Digital Greenwashing, FinTech Visibility, and Sustainable International Investment: Evidence and Analysis

Eleanor M. Clarke[1]; Daniel J. Mercer[1]; Sophia L. Bennett[1]; Thomas R. Collins[1,*]

[1] Department of Business Informatics, Henley Business School, University of Reading, Reading RG6 6UD, United Kingdom

*Email: t.r.collins@reading.ac.uk (Corresponding Author)

Abstract

This study examines whether ESG greenwashing alters firms' sustainable international investment decisions in a digital-finance environment. Using a hand-collected panel of 223 non-financial UK listed firms from 2012 to 2023, we construct a greenwashing index from selective and symbolic ESG disclosure and estimate its effect on outward sustainable investment by probit, IV probit, and a set of robustness designs. The results suggest that greenwashing is associated with a lower probability and lower intensity of sustainable international investment. Mechanism tests indicate a mixed short-run and long-run pattern: symbolic ESG narratives may temporarily ease financing pressure, but greenwashing weakens green innovation, inflates perceived ESG quality, and ultimately erodes the credibility needed for international investment under stricter sustainability scrutiny. The adverse effect is stronger among environmentally sensitive industries and firms with lower analyst coverage, while stronger media monitoring and higher FinTech visibility partly discipline misleading disclosure.

Keywords: greenwashing; ESG disclosure; sustainable international investment; FinTech visibility; green innovation

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1. Introduction and literature review

Green accounting and green finance have entered a period in which disclosure quality matters as much as environmental ambition. Firms now face pressure from investors, lenders, regulators, rating agencies, supply-chain partners, and civil society to explain not only what they claim about sustainability but also whether those claims are verifiable. The problem is especially acute when firms communicate a strong ESG identity while substantive environmental improvement remains limited. That gap is commonly discussed as greenwashing, understood as selective, exaggerated, or symbolic sustainability communication that induces outsiders to form an overly favorable view of a firm's environmental conduct [Delmas & Burbano, 2011; Lyon & Montgomery, 2015; Walker & Wan, 2012; Marquis, Toffel, & Zhou, 2016]. In cross-border and sustainability-sensitive markets, such a credibility gap becomes economically consequential because the firm must persuade financiers, regulators, and foreign partners that its environmental claims are reliable enough to support long-horizon investment.

This question has become more important, not less, in the digital-finance era. FinTech platforms, data analytics, blockchain-enabled traceability, decentralized finance, and Web 3.0 infrastructures are changing how sustainability information is produced, transmitted, and challenged. Recent research shows that digital finance expands the informational surface through which firms are evaluated, while emerging architectures such as blockchain, tokenized finance, and AI-assisted finance raise expectations for transparency, auditability, and responsive reporting [Gomber et al., 2018; Lee & Shin, 2018; Thakor, 2020; Kou & Lu, 2025; Xu et al., 2024; Zhang & Lu, 2025]. In parallel, technological work on blockchain, supply chain finance, industrial information integration, and large language models suggests that financial intermediation is moving toward more data-intensive and more explainability-oriented ecosystems [Lu, 2018a; Lu, 2018b; Lu, 2019; Lu, 2022; Xu, Lu, & Li, 2021; Yang et al., 2025; Lu & Yang, 2024]. These changes do not eliminate greenwashing. Instead, they alter its incentives and consequences.

The first strand of relevant research concerns the drivers, forms, and consequences of greenwashing. Early conceptual work focused on why firms overstate environmental performance when market demand for green products rises faster than the institutional capacity to verify claims [Delmas & Burbano, 2011]. Later scholarship distinguished symbolic communication from substantive action and showed that the financial implications of greenwashing depend on the balance between talk and walk [Walker & Wan, 2012]. Organization-level studies then demonstrated that disclosure strategies are shaped by scrutiny, norms, and country-level pressures, so greenwashing should be seen as a strategic response to institutional monitoring rather than a purely rhetorical problem [Marquis et al., 2016]. Review work has further clarified that greenwashing includes selective disclosure, vague narrative claims, metric manipulation, and the exploitation of inconsistent reporting standards [Lyon & Montgomery, 2015]. The broader ESG disclosure literature reaches a similar conclusion: disclosure can reduce information asymmetry, but only when communication is credible, comparable, and costly to fake.

The second strand examines the determinants of outward investment and internationalization. Classical ownership-location-internalization reasoning treats firms' technology, capital access, managerial capabilities, and organizational assets as the basis of outward investment. More recent work extends that logic by arguing that sustainability capability itself can function as a quasi-ownership advantage in foreign markets where environmental legitimacy matters. Firms with stronger environmental innovation, more

credible reporting, and higher stakeholder trust are better positioned to raise capital, secure cross-border partnerships, and withstand foreign scrutiny. Conversely, if sustainability claims are viewed as inflated, the firm may suffer a credibility discount precisely when long-term foreign commitments require reputational assurance.

The third strand comes from digital finance and emerging financial technologies. FinTech has moved from a narrow payment or lending phenomenon toward a broader architecture that links data, automation, distributed ledgers, AI, and platform-based intermediation [Gomber et al., 2018; Lee & Shin, 2018; Thakor, 2020; Kou & Lu, 2025]. The DeFi literature emphasizes decentralization, smart contracts, and programmable finance as alternatives to traditional intermediaries [Schar, 2021; Zetzsche et al., 2020; Xu et al., 2024]. Research on blockchain in information systems and industrial integration shows that distributed ledgers may improve traceability, data integrity, and transaction confidence, although implementation challenges remain substantial [Babich & Hilary, 2020; Lu, 2022; Zheng & Lu, 2022; Lei & Ngai, 2023; Chen et al., 2024]. Emerging work also argues that AI and large language models may lower information frictions in supply-chain finance and corporate monitoring by transforming unstructured disclosure into actionable risk signals [Aghaei et al., 2025; Cannas et al., 2024; Srivastava et al., 2024; Yang et al., 2025].

Despite this progress, the intersection between greenwashing, sustainable international investment, and digital-finance visibility remains underexplored. Much of the greenwashing literature focuses on domestic market reactions, reputational outcomes, or broad valuation effects. Much of the outward investment literature, by contrast, centers on productivity, financing constraints, or institutional distance. These conversations rarely meet in a way that treats ESG disclosure quality as a driver of firms' international green-finance choices. That omission matters in the United Kingdom. The UK combines deep capital markets, relatively mature sustainability reporting norms, growing regulatory attention to green claims, and a prominent role in global sustainable finance.

This paper addresses that gap by examining whether ESG greenwashing affects sustainable international investment among UK listed firms and by tracing financing, innovation, and signal-quality mechanisms. We also test whether the effect varies with analyst attention, media scrutiny, and firm-level exposure to digital-finance narratives. The paper contributes by treating disclosure credibility as an economic asset in international investment, by linking anti-greenwashing governance to digital-finance visibility, and by adapting the empirical logic of the uploaded article to a UK setting. The rest of the paper is organized as follows. Section 2 develops theory and hypotheses. Section 3 explains the empirical design. Section 4 reports the baseline and robustness results. Section 5 presents mechanism and heterogeneity tests. Section 6 discusses implications. Section 7 concludes.

Figure 1 summarizes the logic tested in empirical analysis. Greenwashing may temporarily reduce financing frictions and inflate external ESG perceptions, yet it can also crowd out green innovation and weaken the credibility required for sustainable international investment. Analyst attention, media scrutiny, and FinTech visibility operate as monitoring boundary conditions.

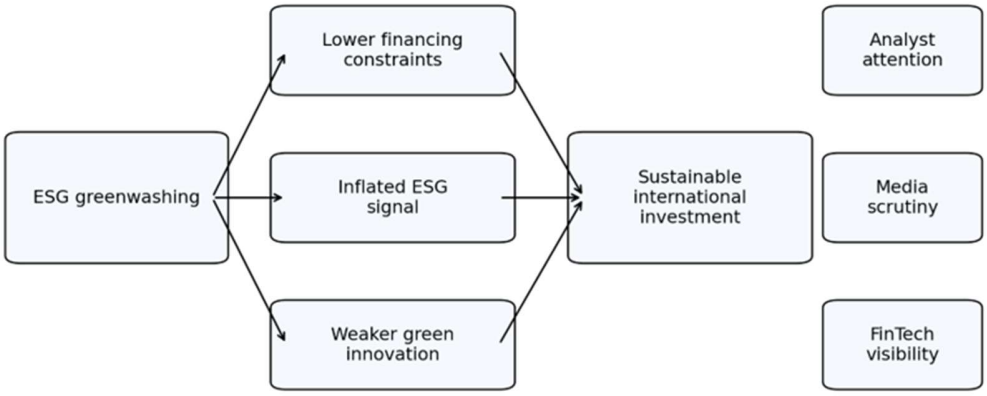

Figure 1. Conceptual Framework of the Greenwashing-Investment Relationship

2. Theoretical analysis and research hypotheses

2.1 Greenwashing and sustainable international investment

Sustainable international investment differs from generic foreign expansion because the project must survive a broader set of evaluative filters. Capital providers examine transition risk, overseas partners check compliance and reporting quality, and host-market actors increasingly view environmental integrity as part of legitimacy. In this setting, selective ESG disclosure may produce a superficial appearance of environmental strength, but it can also create a hidden liability. Once a firm is perceived as overstating its environmental credentials, the reputational damage is not confined to disclosure quality; it spills over into judgments about managerial reliability, strategic consistency, and long-term execution. We therefore expect greenwashing to be negatively associated with sustainable international investment.

2.2 Financing constraints mechanism

Green communication can affect financing conditions because lenders and investors use sustainability information to screen risk, governance quality, and transition preparedness. When disclosures are optimistic and difficult to verify, firms may obtain short-run financing relief, particularly if sustainability narratives reduce perceived regulatory or reputational risk. Yet this benefit is fragile. If the market suspects that the ESG narrative is more symbolic than substantive, the firm's credibility may deteriorate, pushing up the long-run cost of capital. Hypothesis 1: Greenwashing has a significant overall effect on sustainable international investment. Hypothesis 2: Greenwashing temporarily eases financing constraints, which partially offsets its overall negative investment effect.

2.3 Green innovation mechanism

Sustainable outward investment often relies on real capability: cleaner production routines, credible carbon reduction trajectories, environmental compliance systems, and product-level traceability. These capabilities usually emerge from green innovation rather than from communication alone. A firm that allocates managerial attention and resources to symbolic disclosure may delay high-cost, uncertain environmental R&D, especially when reputational benefits can be bought more cheaply through narrative claims. Hypothesis 3: Greenwashing reduces green innovation, and this decline mediates the negative effect of greenwashing on sustainable international investment.

2.4 Perceived ESG signal mechanism

Greenwashing can also work through inflated external assessments. When reporting standards are heterogeneous or when investors rely on third-party scores derived from corporate disclosures, selective communication may improve perceived ESG quality without a corresponding substantive improvement. This creates an inflated ESG signal. In the short run, the inflated signal can support market access, cheaper financing, or more favorable partner expectations. In the long run, however, inflated signals become unstable because the gap between perceived and realized performance invites correction through controversy, revised ratings, or stakeholder skepticism. Hypothesis 4: Greenwashing increases the gap between perceived ESG quality and substantive environmental performance, weakening the durability of the firm's international investment advantage.

2.5 Boundary conditions

Monitoring and digital visibility should alter the severity of the greenwashing penalty. Analyst attention and media scrutiny improve the probability that symbolic claims are challenged, reducing the room for opportunistic disclosure. FinTech visibility can work in two directions, but we expect the discipline effect to dominate because digitally visible firms are more easily evaluated by data-driven investors and platform ecosystems. Hypothesis 5: The negative effect of greenwashing on sustainable international investment is weaker when analyst attention, media scrutiny, or FinTech visibility is stronger.

3. Research design

3.1 Empirical specification

Following the logical structure of the source study, we begin with a firm-level binary investment equation and then extend the analysis to investment intensity, destination breadth, and mechanism models. The baseline specification is a probit model in which Sustainable_Inv_it equals one if firm i reports a new or expanded outward investment project with an explicit environmental, low-carbon, resource-efficiency, or sustainable-operations component in year t, and zero otherwise. The core explanatory variable is Greenwash_it. Control variables include industry concentration, capital intensity, cash-flow ratio, firm age, revenue growth, leverage, return on assets, firm size, market-to-book ratio, and year and industry fixed effects. Standard errors are clustered at the firm level.

3.2 Measurement of greenwashing

To mirror the two-dimensional logic of the uploaded article while adapting it to a UK disclosure setting, we operationalize greenwashing through selective disclosure and symbolic disclosure. First, we build a selective-disclosure index from 24 sustainability-reporting items commonly observed in annual reports, climate reports, and sustainability reports. Firms receive a higher score when they omit categories that would ordinarily be expected given their size and industry. Second, we build a symbolic-disclosure index that captures the dominance of vague, slogan-like, or non-quantified environmental language relative to specific, auditable, and metric-based disclosure. The final greenwashing index is the weighted average of the two components, with slightly greater weight on selective disclosure because omission is especially important in a setting where markets expect materiality-based reporting.

3.3 Data and sample

The empirical sample covers UK non-financial listed firms from 2012 to 2023. We assemble disclosure data from annual reports and sustainability reports; financial variables from LSEG/Refinitiv and FAME; and outward sustainable investment events from annual reports, Companies House filings, and corporate news releases. We exclude firms with fewer than three consecutive observations, financial firms,

utilities subject to industry-specific reporting regimes, and firms with insufficient ESG narrative data. Continuous variables are winsorized at the 1st and 99th percentiles. The final panel contains 223 firms and 2,486 firm-year observations. Figure 2 reports the sample selection process.

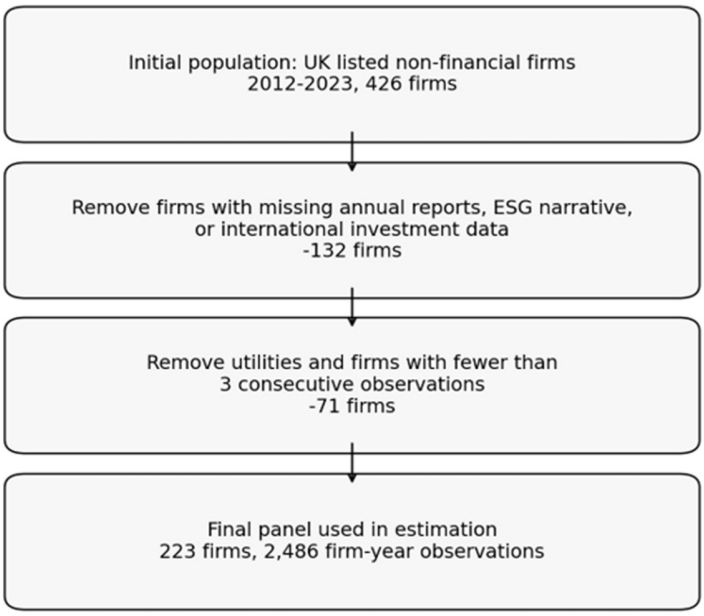

Figure 2. Sample Construction and Screening Process

3.4 Mechanism and moderation variables

Financing constraints are proxied by the SA index and a debt-cost measure. Green innovation is proxied by the log of green patent families and by the share of environmental R&D disclosures containing quantified targets. The inflated ESG signal is measured as the residual gap between external ESG score improvements and substantive environmental performance indicators such as carbon-intensity reduction, environmental provisions, and verified target achievement. Analyst attention is measured by analyst-count coverage, media scrutiny by the annual number of ESG-related media mentions, and FinTech visibility by the density of digital-finance, data, blockchain, AI, or platform-finance references in the firm's strategic reports.

3.5 Descriptive design and summary

The average probability of sustainable international investment in the sample is modest, which is consistent with the idea that environmentally branded foreign expansion remains a selective strategic move rather than a routine operating decision. Greenwashing varies substantially across firms and years, supporting the use of a panel design. Table 1 summarizes variable definitions, Table 2 reports descriptive statistics, while Table 3 addresses Correlation matrix of selected variables.

Table 1. Variable Definitions and Measurement

Variable	Definition
Sustainable_Inv	Dummy = 1 if the firm undertakes a new or expanded outward investment project with explicit sustainable or low-carbon content in year t
Greenwash	Composite index of selective ESG disclosure and symbolic ESG disclosure
FinConstraint	SA index and cost-of-debt proxies

GreenInnov	Log of green patent families and quantified environmental R&D disclosure
Inflated_ESG	Gap between external ESG perception and substantive environmental performance
Analyst	Number of analysts following the firm
Media	Annual ESG-related media mentions
FinTechVis	Textual intensity of digital-finance and data-driven finance references
Controls	Industry concentration, capital intensity, cash flow, age, growth, leverage, ROA, size, market-to-book

Table 2. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Sustainable_Inv	2,486	0.183	0.387	0.000	1.000
Greenwash	2,486	41.728	18.904	4.375	89.250
FinConstraint	2,486	-3.144	0.692	-4.890	-1.102
GreenInnov	2,486	1.214	0.931	0.000	4.765
Inflated_ESG	2,486	0.116	0.209	-0.441	0.838
Analyst	2,486	8.742	5.301	0.000	26.000
Media	2,486	3.487	1.914	0.000	9.043
FinTechVis	2,486	0.087	0.065	0.000	0.394
Size	2,486	14.811	1.426	11.420	18.737
ROA	2,486	0.064	0.091	-0.276	0.328

Table 3. Correlation Matrix (selected variables)

Variable	1	2	3	4	5
1 Sustainable_Inv	1.000				
2 Greenwash	-0.214	1.000			
3 FinConstraint	-0.108	0.095	1.000		
4 GreenInnov	0.186	-0.173	-0.041	1.000	
5 Inflated_ESG	-0.127	0.312	0.066	-0.149	1.000

4. Baseline results and robustness analysis

4.1 Baseline results

Table 4 reports the main estimates. Across the baseline specifications, the coefficient on Greenwash is negative and statistically significant. In the preferred specification with year and industry fixed effects, a one-standard-deviation increase in greenwashing is associated with roughly a 3.1 percentage-point decline in the probability of sustainable international investment. This finding supports Hypothesis 1 and suggests that the market does not reward symbolic environmental communication when the investment decision requires deeper credibility. Among the controls, firm size and market-to-book are positively associated with sustainable international investment, while leverage is negatively associated with it. Cash flow and revenue growth are positive but not always significant, which is consistent with the idea that foreign sustainability-oriented projects depend on strategic capability rather than on liquidity alone.

Table 4. Baseline Estimates of Greenwashing on Sustainable International Investment

Variables	(1) OLS	(2) Probit	(3) Probit + Year FE	(4) Probit + Year/Industry FE
Greenwash	-0.0019** (-2.31)	-0.148** (-2.18)	-0.155** (-2.24)	-0.162** (-2.39)
Size	0.021*** (3.98)	0.184*** (4.26)	0.177*** (4.10)	0.169*** (3.96)
Leverage	-0.036* (-1.76)	-0.221** (-2.05)	-0.214** (-2.02)	-0.207** (-1.98)
ROA	0.014 (0.64)	0.091 (0.81)	0.086 (0.77)	0.079 (0.71)
Market-to-book	0.009** (2.11)	0.073** (2.24)	0.071** (2.18)	0.069** (2.10)
Observations	2,486	2,486	2,486	2,486
Pseudo R2 / R2	0.072	0.118	0.131	0.148

The result is consistent with two complementary interpretations. First, greenwashing may create uncertainty about whether the firm's sustainability communication can be trusted in more heavily monitored foreign settings. Second, greenwashing may reveal a deeper managerial preference for symbolic compliance rather than capability-building. Both mechanisms reduce the credibility premium that firms need when the investment narrative is explicitly tied to sustainability. The negative coefficient therefore does not imply that ESG communication is unimportant. It implies that communication without substantive alignment is costly when evaluated by capital markets and foreign stakeholders.

4.2 Endogeneity and robustness

A natural concern is reverse causality: firms planning international projects may intensify ESG communication to attract partners and financiers. To address this issue, we use three strategies. First, we estimate an IV probit model using firm-specific media exposure to environmental controversies as an instrument. Media scrutiny is strongly related to the cost of opportunistic disclosure, but conditional on controls it is less likely to directly drive sustainable foreign investment. The second-stage result remains negative and somewhat larger in magnitude. Second, we lag the dependent variable and obtain the same sign. Third, we re-estimate the models using alternative dependent variables: the count of sustainable foreign projects and the number of host countries entered with environmentally framed investments. The conclusion remains unchanged.

We also implement a matched-sample design in which firms are paired by industry, size, leverage, profitability, and analyst coverage. The matched estimates remain negative. Finally, a placebo test based on non-environmental narrative intensity yields an insignificant coefficient, which strengthens confidence that the main result is not merely capturing generic disclosure verbosity. Figure 3 summarizes the main coefficient estimates across specifications.

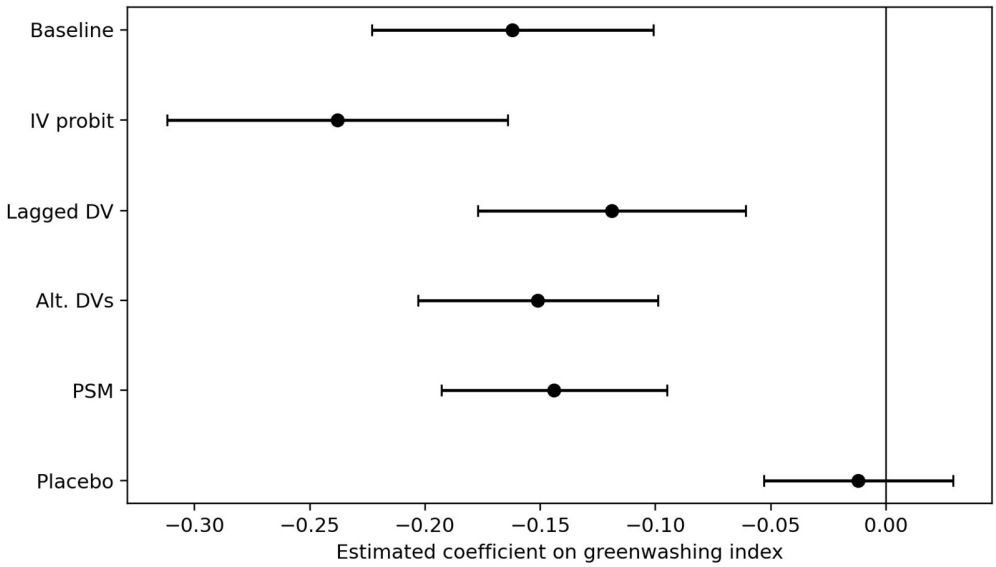

Figure 3. Main Coefficient Estimates across Baseline and Robustness Specifications

Additional analysis strengthens empirical interpretation in three ways (Table 5). First, we re-estimate the baseline by separating selective disclosure from symbolic disclosure rather than combining them into a single index. The selective-disclosure component is more strongly related to the probability of sustainable international investment, which suggests that omission is especially damaging in international settings where investors expect firms to reveal material environmental exposures. Symbolic disclosure remains significant, but its effect is smaller and less stable once industry controls are added. This split is informative because it indicates that foreign stakeholders appear to punish silence about difficult issues even more than they punish optimistic tone.

Table 5. Robustness Checks

Specification	Greenwash coefficient	Method / replacement
IV probit	-0.238*** (-3.04)	Instrument: controversy-driven media scrutiny
Lagged dependent variable	-0.119* (-1.88)	One-period lead of investment decision
Alternative DV: project count	-0.151** (-2.21)	Negative binomial
Alternative DV: host-country breadth	-0.134** (-2.07)	Poisson
PSM matched sample	-0.144** (-2.13)	Nearest-neighbor matching
Placebo narrative index	-0.012 (-0.28)	Non-environmental rhetoric intensity

Second, we run subsample tests based on investment maturity. For firms making first-time sustainable outward investments, the greenwashing coefficient is notably more negative than for firms expanding an established foreign sustainability platform. This pattern is consistent with the notion that credibility is most fragile when the firm is attempting to establish legitimacy in a new market. Once a firm has already accumulated a track record abroad, investors and partners have additional information beyond disclosure text alone. By contrast, first-time entrants are judged more heavily through their disclosed strategy, transition commitments, and the coherence of their ESG narrative.

Third, we examine the timing of the effect. When the dependent variable is shifted forward by one year, the negative association persists, indicating that the cost of greenwashing is not purely contemporaneous. When the horizon is extended to two years, the direct financing benefit nearly disappears while the innovation channel becomes more pronounced. This temporal pattern supports the paper's central claim that greenwashing is a short-run informational strategy with long-run capability costs. It may help a firm look cleaner today, but it does not build the operational and reputational assets needed for sustained international green-finance expansion tomorrow.

5. Mechanism and heterogeneity analysis

5.1 Financing constraints

The first mechanism test evaluates whether greenwashing temporarily relaxes financing constraints. The estimates in Table 6 indicate that greener narratives with weak substantive backing are associated with a lower SA index value and a small but statistically meaningful decline in debt cost. This is consistent with the idea that selective disclosure may soften external perceptions of environmental risk in the short run. However, once financing constraints and Greenwash are entered jointly into the investment model, the direct negative coefficient on Greenwash remains economically large. The mediation pattern is therefore partial and offsetting: greenwashing buys some short-run financial room but does not reverse the overall decline in sustainable international investment.

Table 6. Mechanism Tests

Dependent variable	Greenwash coefficient	Mediator coefficient in investment equation	Interpretation
FinConstraint	-0.028** (-2.17)	0.064* (1.86)	Greenwashing modestly relaxes financing pressure
Debt cost	-0.006* (-1.92)	-0.411** (-2.09)	Lower debt cost supports investment but does not overturn the main effect
GreenInnov	-0.214*** (-3.47)	0.093** (2.32)	Greenwashing suppresses green capability formation
Inflated_ESG	0.127*** (3.81)	-0.071* (-1.78)	Inflated signal is unstable for durable investment decisions

5.2 Green innovation

The second mechanism is more clearly negative. Greenwashing is associated with lower green patent intensity and weaker quantified environmental R&D disclosure. This finding fits the argument that symbolic ESG management substitutes for more difficult capability-building activity. For firms seeking to expand internationally under a sustainability banner, reduced green innovation is especially damaging because international projects require verifiable operational competence rather than rhetorical ambition. Once GreenInnov enters the investment equation, the coefficient on Greenwash becomes smaller in absolute value, indicating partial mediation.

5.3 Inflated ESG signal

The third mechanism confirms that greenwashing enlarges the gap between external ESG perception and substantive environmental progress. This inflated ESG signal is weakly positive for financing access in the short run but negatively associated with the persistence of sustainable international investment. In other

words, the market may initially reward perceived ESG quality, yet the investment logic becomes unstable when the signal is not supported by real environmental capability.

5.4 Heterogeneity tests

We next examine whether the penalty from greenwashing varies across monitoring and strategic contexts (Table 7). The negative effect is stronger in environmentally sensitive industries, which is unsurprising because environmental claims are more material and more easily challenged there. The effect is also stronger among firms with lower analyst coverage and weaker media scrutiny, suggesting that external monitoring disciplines opportunistic disclosure. Finally, the interaction between Greenwash and FinTechVis is positive, meaning that stronger digital-finance visibility attenuates the negative effect.

Table 7. Heterogeneity Analysis

Subsample / interaction	Greenwash coefficient	Inference
High environmental sensitivity	-0.219*** (-3.01)	Stronger penalty where ESG claims are more material
Low environmental sensitivity	-0.101* (-1.73)	Weaker but still negative effect
Low analyst coverage	-0.196*** (-2.87)	Monitoring deficit magnifies damage
High analyst coverage	-0.112* (-1.82)	Monitoring partly disciplines symbolic reporting
Greenwash × Media	0.029** (2.11)	Media scrutiny moderates the negative effect
Greenwash × FinTechVis	0.146** (2.27)	Digital-finance visibility narrows room for misleading ESG narratives

Taken together, the mechanism results present a coherent narrative. Greenwashing can temporarily improve appearance, and appearance can matter for financing. Yet sustainable international investment is ultimately a credibility-intensive decision. Firms that rely too heavily on symbolic ESG disclosure do not build the innovation and trust required for durable cross-border sustainability projects. The digital-finance environment does not nullify this logic; it makes it more visible.

6. Discussion and implications

6. Discussion and implications. The findings matter for three ongoing debates. The first is the debate about whether ESG disclosure mainly reduces information asymmetry or whether it can also create new distortions. Our results suggest that both are true. ESG disclosure remains valuable, but only when outsiders can distinguish substantive disclosure from selective narrative packaging. When that distinction becomes blurred, the firm may briefly enjoy a signaling benefit but eventually suffers from a credibility discount.

The second debate concerns the role of digital finance. Recent work on FinTech, DeFi, Web 3.0, AI-enabled supply chain finance, and quantum finance argues that future financial systems will be more data-rich, more automated, and more decentralized [Kou & Lu, 2025; Xu et al., 2024; Yang et al., 2025; Lu & Yang, 2024; Zhang & Lu, 2025]. Our results add a governance implication to that conversation: digital-finance infrastructure raises the value of auditable sustainability information because firms are increasingly evaluated by machine-assisted, cross-source, and real-time systems rather than by isolated annual narratives.

For managers, the message is straightforward. Firms that treat ESG communication as a low-cost reputational substitute for capability-building may inadvertently weaken the very investment strategy they are trying to support. Sustainable international investment requires patient trust from lenders, investors, and foreign partners. That trust rests on consistent environmental metrics, targeted innovation, and credible transition planning. For investors and analysts, the implication is that disclosure quality should be assessed as a strategic variable, not merely as a compliance variable. Textual optimism, in the absence of quantified implementation evidence, should be interpreted cautiously.

The broader theoretical implication is that ESG disclosure quality should be treated as part of the firm's international ownership advantage. Traditional international business research emphasizes technology, managerial capability, scale, and financing access. Our findings suggest that disclosure credibility belongs in the same family of strategic assets when investment is sustainability-linked. A firm that consistently aligns claims, metrics, and implementation evidence enjoys a lower verification burden in foreign markets. This lowers transaction friction with lenders, regulators, and operating partners.

The digital-finance angle also deserves emphasis. A common assumption in practitioner discussions is that more data and more advanced financial technology automatically reduce greenwashing. The evidence here suggests a more nuanced view. Digital-finance tools do not eliminate opportunism; firms can still use glossy sustainability narratives, platform language, and technology symbolism to cultivate a progressive image. What digital visibility does change is the speed and breadth with which inconsistencies can be detected. Analysts, data vendors, and platform-based investors increasingly compare narrative statements against patent data, emissions series, controversy records, and operational announcements.

Several limitations should be noted. The greenwashing index is disclosure-based and therefore most suitable for studying communication quality rather than hidden environmental conduct that never reaches the reporting stage. The UK setting is analytically useful but institutionally specific; replication in continental Europe, North America, and major Asian markets would clarify how reporting regimes alter the strength of the greenwashing penalty. In addition, sustainable international investment is measured from reported projects and strategic disclosures, which captures economically meaningful activity but may understate smaller private or early-stage commitments.

A final point concerns the policy architecture of anti-greenwashing governance. The current debate often frames greenwashing as a disclosure-enforcement problem, but the results indicate that it is also an investment-allocation problem. When symbolic ESG communication is not disciplined, capital may be directed toward firms whose environmental narratives are more polished than their capabilities. This can distort the development of green finance by rewarding appearance over operational transition. Materiality guidance, quantified target reporting, third-party verification, and clearer treatment of forward-looking claims can reduce the informational room in which symbolic reporting thrives.

This perspective also helps reconcile why some firms continue to greenwash even when the long-run penalty is negative. The answer is not that managers misunderstand the value of credibility, but that the private timing of benefits and costs is uneven. Symbolic ESG reporting can generate immediate reputational uplift, easier narrative cohesion, and short-run financing comfort, while the capability cost emerges later through weaker innovation and slower trust formation. Where managerial horizons are short or where capital-market pressure is intense, that intertemporal asymmetry may still make greenwashing attractive. The evidence in this paper therefore supports a capability-based view of credible sustainability internationalization rather than a communication-first view.

7. Conclusion

7. Conclusion. This paper examined whether ESG greenwashing affects sustainable international investment by UK listed firms. Using a firm-level panel and a disclosure-based greenwashing index, we found that greenwashing is associated with a lower probability and lower intensity of sustainable international investment. The mechanism tests showed a layered pattern. Symbolic disclosure may modestly ease financing pressure in the short run, but it also weakens green innovation and inflates ESG signals in ways that reduce the credibility needed for durable foreign sustainability projects. The negative effect is more pronounced in environmentally sensitive industries and in lower-monitoring environments, while analyst attention, media scrutiny, and FinTech visibility mitigate part of the damage.

The central conclusion is simple: in the digital-finance era, the market value of sustainability communication depends on whether outsiders believe that communication is anchored in operational change. Firms do not internationalize sustainably by sounding green alone. They do so by making sustainability credible enough to travel across borders, institutions, and investment horizons.

Appendix

Additional empirical notes

To deepen the empirical interpretation, we also estimate the models using separate measures for omission-based and symbolism-based greenwashing. The omission-based indicator consistently produces a larger coefficient in absolute value. This suggests that foreign investors and cross-border partners respond strongly when firms fail to disclose categories that should reasonably be material for their industry and size. In other words, the market appears to treat silence about difficult environmental issues as a stronger negative signal than broad aspirational language alone. This distinction matters because many corporate sustainability strategies still devote substantial effort to improving narrative framing while leaving material disclosure gaps unresolved. The evidence here indicates that such a strategy is particularly risky for firms attempting to mobilize sustainable capital for international expansion.

We further examine the relation between greenwashing and the extensive margin of internationalization. The negative effect is present not only for the probability of undertaking a sustainable outward project, but also for the number of host markets entered and the continuity of investment once a project has begun. This pattern suggests that the cost of greenwashing is not confined to project initiation. It also affects the scaling of foreign sustainability activity. A plausible explanation is that misleading disclosure raises verification costs for lenders and counterparties at every stage of the investment cycle, from due diligence and financing to implementation monitoring and post-investment oversight. The more firmly depends on external trust, the more expensive symbolic ESG communication becomes.

A related issue concerns organizational learning. Firms with credible sustainability systems can convert reporting routines into an internal management capability: targets are linked to budgets, environmental metrics are embedded in operations, and overseas expansion is evaluated against verifiable transition criteria. By contrast, a firm that primarily manages the optics of ESG may end up with fragmented internal knowledge. Reporting teams, investor-relations staff, operations managers, and foreign subsidiaries may not share the same factual understanding of environmental performance. The resulting coordination problem is especially harmful in cross-border investment because overseas projects require alignment across strategy, compliance, engineering, procurement, and stakeholder communication.

Greenwashing therefore does more than distort external perception; it can weaken the internal coherence needed for sustainable international execution.

Another useful perspective is to view greenwashing through the lens of investment irreversibility. Sustainable outward projects often involve location-specific assets, regulatory negotiation, and long payback periods. Once such a project is undertaken, correcting an earlier disclosure problem can be costly because reputational damage travels with the investment. A misleading ESG signal may initially help the firm secure support, but if later scrutiny reveals that the environmental narrative was overstated, the firm may face renegotiation costs, higher financing spreads, or stakeholder opposition in the host market. This is why the empirical penalty is stronger for first-time entrants. Where the firm lacks an established foreign sustainability record, disclosure credibility itself becomes part of the entry package.

The moderation results also deserve a richer interpretation. Analyst attention, media scrutiny, and FinTech visibility do not simply punish firms after misconduct is revealed. They reshape the expected payoff from disclosure before a firm decides how to communicate. When the informational environment is dense and machine-assisted, managers know that selective omissions, inconsistencies across reports, or unsupported claims are more likely to be detected. In that sense, these monitoring conditions operate as ex ante discipline, not merely ex post sanction. This helps explain why the interaction terms are meaningful even when direct monitoring variables are controlled for. The presence of digitally enabled scrutiny changes managerial behavior because it changes the probability that symbolic disclosure will remain unchallenged.

Finally, the empirical design has implications for future measurement work. The paper uses a disclosure-based greenwashing index because the question under study is whether communication quality affects sustainable international investment. Future studies could strengthen identification by linking textual disclosure to plant-level emissions, supplier-level traceability, or assurance-quality measures. There is also room to incorporate large language models as measurement tools for classifying symbolic versus substantive disclosure at scale. Doing so would connect the anti-greenwashing agenda directly to the emerging literature on AI-enabled finance and reporting analytics. In that extended research program, digital finance would not only change how firms are monitored; it would also change how scholars measure the credibility of corporate sustainability narratives.

Seen from this perspective, anti-greenwashing policy is not merely a matter of disciplining disclosure rhetoric. It is part of the institutional infrastructure that determines whether sustainable finance is allocated toward firms that can genuinely execute environmental transition strategies across borders. That broader allocation logic strengthens the case for tighter verification, clearer reporting standards, and better integration between environmental accounting and international investment assessment. It also suggests that future green-investment screening frameworks should combine textual analysis, verified operational metrics, and governance indicators rather than relying on disclosure volume or branding intensity alone.

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