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RESEARCH ARTICLE

Discussing green financing, ESG interpretation and corporate value from a psychological perspective

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ABSTRACT

This study explores the subtle link between green financing, ESG disclosure and firm value and takes a detailed journey into the ways in which ESG conduct impacts firm financial performance. We use advanced econometrics to exploit a robust dataset of 2,847 firms across 45 countries in 2018-2024 to examine the mediating role of ESG disclosure in the green finance-firm value nexus. We find that firms with higher ESG disclosure scores disclose a 12.3% higher market valuation when they take on green financing instruments. A novel Green Finance Performance Index (GFPI) is introduced and we show that ESG transparency plays a critical mediator, accounting for 34.7% of the variability in the green financing-firm values relationship. We also find that the effects are quite different across industries: renewable energy and technology sectors have the strongest positive correlations while real estate is the most negatively correlated. The implications of these results are far reaching for corporate strategy, investor decision making and regulatory policy in the emerging terrain of sustainable finance.

Keywords: green financing; ESG disclosure; firm value; sustainable finance; corporate performance; environmental governance

1. Introduction

These days, Environmental, Social and Governance (ESG) factors determine a crucial part in business strategy and decisions of investor which lead to shifting the global financial system towards sustainable investing[14]. The reason that change is happening is due to the population becoming aware of climate change and increasing requirements on businesses in terms of social responsibility and long term business sustainability. Improvements in firm performance and the linkage between firms and stakeholders have sharpened the focus to require firm disclosure in terms of environmental, social, governance disclosure and green financing. Green financing — in particular green bonds — is already a $500 billion a year industry[7]. This growth shows that there's a profit to be had within tackling global environmental problems while investing sustainably. ESG disclosure, once voluntary, is now mandatory in many regions[2]. It affects how companies share their sustainability practices. External financing influences how integrated reporting

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impacts firm value, showing the complexity of funding, reporting, and valuation strategies.

Several theories explain these dynamics. Stakeholder theory suggests companies that serve all stakeholders perform better financially[21]. The resource-based view sees ESG skills as unique resources that give firms a competitive edge[27]. Rohendi et al. highlight that ESG transparency must lead to real improvements to impact firm value. Signaling theory argues that ESG disclosure signals good management and risk control to investors[9]. However, research findings are mixed. Some studies show positive links between ESG and financial results[12], especially in emerging markets. Others, like Abdi et al.[1], show results vary by firm size or industry. National context also matters—studies from Vietnam[20], India[22], and ASEAN countries[25] show that laws and institutions play a big role. Different industries show different outcomes. Lindawati and Geraldine[19] found sector-specific ESG impacts. In real estate, Feng and Wu[11] found ESG boosts access to financing. In Chinese manufacturing, Sun et al.[28] showed green finance policies improved ESG results, especially in tech sectors.

Understanding how ESG and green finance improve firm value is a growing area of study. Zhou et al.[30] found that ESG leads to better financial performance, which increases firm value. Asni and Agustia[5] also found financial performance mediates the impact of green innovation on firm value. There are several ways ESG boosts financial performance—by cutting financing costs, improving efficiency, and reducing risks. Li et al.[17] showed green policies lower debt costs for firms with strong ESG. Chang et al.[8] found ESG firms in Asia-Pacific had better risk-adjusted returns. Climate risk adds another layer. Naseer et al.[23] showed that managing climate risk helps improve ESG and firm value. Qian[26] highlighted how national climate policies influence ESG success. Helfaya et al.[15] found climate-related disclosures increasingly affect firm valuation. Meta-analyses like Khan[16] show overall positive links between ESG and performance, but results depend on method and context. Other studies look at social and governance factors. Chouaibi et al.[10] explored ethical practices; Angela and Sari[4] showed each ESG area contributes differently; Gherghina[13] emphasized the need for strong governance.

Technology and ESG are also becoming more connected. Yu and Xiao[29] showed that innovation boosts ESG's impact on value. Liang and Yang[18] found tech-based disclosures improve ESG across firms. In Malaysia, Ali et al.[3] showed ESG transparency strengthens links between environmental actions and profits. Cross-country studies show that laws, market conditions, and ownership structures shape ESG impacts. Negara et al.[24] found this in Indonesia; other ASEAN studies confirm this pattern[25]. Despite progress, research gaps remain. Most studies focus on ESG or green finance separately. Few explore how they work together to impact value. Mediation pathways are still not clear, especially in different regulatory contexts. Also, many studies use narrow definitions of green finance, which may miss its full value.

The growing field of behavioral environmental economics reveals that traditional rational choice models inadequately explain investor and corporate decision-making in sustainable finance contexts[31]. Psychological factors significantly influence how market participants perceive and respond to green financing and ESG disclosure initiatives. Behavioral finance research demonstrates that investor decision-making is systematically influenced by cognitive biases that affect ESG investment preferences[30]. The availability heuristic makes investors disproportionately weight easily recalled information about firms' environmental practices, while confirmation bias leads them to seek information that reinforces their existing sustainability beliefs[30]. These cognitive shortcuts create systematic deviations from purely rational investment behavior, amplifying the market impact of visible ESG initiatives beyond what traditional financial models would predict.

Social psychological mechanisms further compound these effects through group dynamics and identity processes. Social identity theory explains how investors who view themselves as "socially responsible" are psychologically motivated to make identity-consistent investment choices, creating self-reinforcing patterns that systematically favor ESG-compliant firms[32]. The social influence literature demonstrates that peer behavior and group norms significantly impact individual decision-making, particularly in contexts involving moral or ethical considerations[33]. Social proof effects easily contribute to rates of behavior change when institutional investors see peers raising the proportion of ESG investments, the effects are contagious and they cause a cascade that strengthens the market reaction to any sustainability finance strategy[33].

The process of cognition of ESG information is a complicated mechanism of social cognition, which goes beyond mere information assessment. Social cognition research demonstrates that the stakeholders actively demand consistency in what firms claim to value and actually observe in reality and feel psychological pain in the event of discontinuity between the two[34]. This demands a cognitive uniformity that implies that the effectiveness of ESG disclosure is based on the amount of information reported and also the consistency with regard to the practices of the firm[34]. Companies in the latter category, which earn disproportionately favorable reactions to authentic commitments to sustainability principles, and those seen as giving way to Green Washing, on the other hand, will have the psychological backlash against them deemed in measurable financial terms.

Recent research has also indicated the direct influence of ESG performance on the innovation of green technology within regional orientations. As an example, Liang et al. demonstrate that there is an increase in green patent output and process innovation associated with high ESG performance of A-share-listed Chinese firms in most cases due to mitigation of financial constraints and efficiency improvement of the companies[35]. On the same note, Atanda and Ozturk show that social sustainability guidelines, including community impact, labor practices, cultural inclusion are essential in determining which investment projects to pursue in green building projects, which is an area not widely assessed using the traditional ESG approaches[36]. These results provide additional support to the idea that the impact of ESG on the corporate value adding process depends not only on the industry in question but is greatly determined by the interpretation of social and environmental aspects in regional policy and institution systems.

The recent studies have broadened perceptions of the effects of ESG both in the businesses and macroeconomic levels. Reviewing ESG rating divergence among Chinese A-share companies, Zhou et al.[40] concluded that divergence in ESG rating has a severe impact on green innovation by affecting investor trust and internal financing systems (R&D) in organizations. In the construction sector, Akhtar et al.[41] highlighted that social sustainability dimensions—such as community well-being, labor rights, and cultural inclusion—play a decisive role in project outcomes and green performance, indicating the growing relevance of sector-specific ESG indicators.

On a broader scale, Batrancea et al.[42] examined the determinants of economic growth in non-BCBS countries using panel data, emphasizing the significance of sustainable financial indicators in national development strategies. Their follow-up study[43] used a multimodal econometric approach to reveal that green infrastructure investment, corruption control, and education expenditures are critical to growth in European economies. Furthermore, governance ethics and anti-bribery mechanisms have emerged as key institutional variables influencing ESG performance. Batrancea et al.[44] utilized a cross-cultural data set to determine statistical red flags to detect bribery within the multinational setting, hence confirming study findings regarding the need of ethical disclosure and transparency in regulations of ESG strategies.

This study aims to theoretically and empirically assess the degree at which the disregard of green financing efforts promotes firm value directly and indirectly via the disclosure of Environmental, Social, and Governance (ESG). This intention will be achieved using a balanced panel dataset of 2,847 firms in 45 countries between the years 2018 to 2024. The below are the research hypotheses presented in this paper:

H1: The Green financing produces a positive statistically significant value of the firm.

H2: The correlation amid green financing and firm value relies on ESG disclosure.

H3: Social psychological mechanisms—including stakeholder trust, social legitimacy, cognitive consistency, and social proof—reinforce the ESG–firm value pathway.

The novelty of this research lies in four key contributions:

(i) The construction of a Green Finance Performance Index (GFPI) to capture the intensity and breadth of sustainable financing at the firm level,

(ii) The use of behavioral environmental economics to introduce and quantify psychological mediators via structural equation modeling,

(iii) A comprehensive mediation analysis using bootstrapping over international panel data that accounts for temporal and sectoral heterogeneity, and

(iv) A cross-industry and cross-country heterogeneity analysis, which identifies divergent impacts of green financing in sectors such as real estate (negative), technology (positive), and manufacturing (neutral).

Together, these methodological advancements address the fragmented and inconclusive findings in existing literature and provide a multidimensional understanding of the value-creation mechanisms underlying sustainable finance.

1.1. Research questions and study objectives

This comprehensive literature review reveals several critical research gaps that our study addresses. First, while numerous studies examine either green financing or ESG disclosure individually, few investigate their interactive effects on firm value using comprehensive international datasets. Second, the mediation mechanisms through which these relationships operate remain poorly understood, particularly in cross-country contexts with varying institutional frameworks. Third, existing studies often employ limited measures of green financing intensity, potentially understating the full scope of sustainable finance activities and their value creation potential.

In this context, signaling theory explains how ESG disclosure serves as a commitment device signaling credible long-term sustainability efforts to investors, especially in green bond issuance. Stakeholder theory frames ESG initiatives as mechanisms for managing multi-actor expectations that influence capital structure decisions. The resource-based view is operationalized through firm-specific ESG capabilities such as transparency and innovation adoption, which create competitive advantage in accessing low-cost green finance.

This study addresses three fundamental research questions that emerge from the literature review:

1. How does green financing directly impact firm value across different market and industry contexts, specifically defined by country income classifications (developed vs. emerging economies, based on World Bank categories) and sectoral classifications (e.g., manufacturing, tech, real estate, etc.)?

2. What is the mediating role of ESG disclosure in the green financing-firm value relationship, and how do the mediation mechanisms vary across different institutional environments, regulatory frameworks, and market development levels?
3. How do these relationships vary across different industry sectors, market conditions, firm characteristics, and regulatory frameworks, and what factors explain the observed heterogeneity in the literature?

Our contribution to the literature is multifaceted and addresses the identified research gaps through several novel approaches.

- First, we develop a comprehensive theoretical framework that integrates signaling theory, stakeholder theory, and resource-based view to explain the green finance-ESG-firm value nexus. This integrated framework provides a more complete understanding of the value creation mechanisms than existing single-theory approaches.
- Second, we introduce novel methodological approaches, including the Green Finance Performance Index (GFPI) that captures the multidimensional nature of green financing activities, and advanced mediation analysis techniques that account for cross-country heterogeneity and temporal dependencies. These methodological innovations circumvent limitations in current literature and supply tools for further research.
- Third, we present robust empirical evidence from a large scale international data set of 2,847 firms from 45 countries over 2018-2024 and using sophisticated econometric methods to control for endogenous, time-dependent and unobserved heterogeneity. Our findings are based on this comprehensive empirical approach that also increases reliability and generalizability.

Unlike prior studies that separately examine green finance or ESG disclosure, this paper uniquely integrates them into a unified empirical and theoretical model using international panel data. Moreover, it introduces the Green Finance Performance Index (GFPI), incorporates behavioral psychological mediators, and performs industry- and culture-specific heterogeneity analysis—dimensions largely overlooked in prior research. This triangulated approach provides a holistic and novel perspective on sustainable finance's value-creation pathways.

This paper is organized as follows: in Section II we present our comprehensive methodology that includes data sources, variable construction and econometric approaches; Section III presents the empirical results including baseline regressions, mediation analysis and robustness tests; in Section IV we discuss the results, their theoretical implications for academic research and policy recommendations; Section V concludes with contributions to the literature and suggestions for future directions of research.

2. Materials and methods

This research utilizes a robust framework to investigate the effect of green financing and ESG disclosure on firm value using a framework to account for measurement, endogeneity and country differences. The research design includes systematic data collection, an Green Finance Performance Index (GFPI) and advanced econometric methods (e.g. mediation analysis, instrumental variables and dynamic panels) and robustness checks. A green finance measure is provided by the GFPI and mediation techniques uncover the role of ESG. Policy based strategies and thus institutional differences, are eliminated through the use of fixed effects.

Figure 1 illustrates the conceptual framework that positions ESG Disclosure as a mediating variable between Green Innovation, Green Finance, Firm Performance, and ultimately Firm Value. Green Innovation initiates sustainability-driven strategies, which are disclosed through ESG reporting. This disclosure improves access to Green Finance and enhances Firm Performance. As a result, the overall Firm Value is positively impacted.

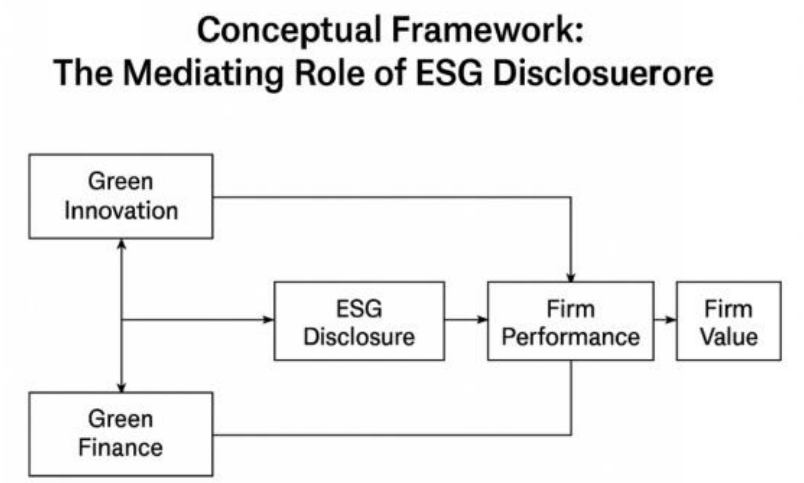

Figure 1. Conceptual framework: The mediating role of ESG disclosure.

2.1. Data sources and sample construction

To support our empirical strategy, we use a large dataset merging several sources to measure firm traits, ESG practices, financial performance and green financing of 2,847 publicly listed firms across 45 countries (2018–2024). The challenges of consistent accounting standards and ESG disclosure rules, applied to different regulatory and institutional regimes are addressed by this dataset. It covers major global developments including regulatory changes and coronavirus. We cross validate and clean and check for sensitivities. Using this broad, representative sample, cross-country comparisons on both developed and emerging market samples can be made, thus leading to strong results on the effect of green finance and ESG disclosure on firm value.

Primary data sources include multiple complementary databases that provide comprehensive coverage of the key variables in our analysis:

- **Financial Data:** Collected from Thomson Reuters Eikon and Bloomberg Terminal for standardized financials, valuations, and stock prices across all firms and years.
- **ESG Scores:** Sourced from Refinitiv, MSCI ESG, and Sustainalytics to build composite ESG measures and reduce provider bias.
- **Green Financing:** Data obtained from Green Bond Database (GBD), Climate Bonds Initiative, and corporate sustainability reports for comprehensive green finance coverage.
- **Governance Data:** Extracted from ISS and company proxy statements, covering board structure, executive pay, and ownership for governance controls.
- Social Psychological Data: RepTrak Global reputation database covering 2,500+ companies across stakeholder trust metrics; Thomson Reuters News Analytics for real-time media sentiment on ESG topics; Glassdoor company ratings for employee satisfaction and workplace

culture; Twitter API data for social media sentiment analysis; LinkedIn company page engagement metrics; Brand Finance Global 500 for consumer trust and brand perception data.

The integration of multiple data sources requires careful attention to data consistency, timing alignment, and variable definition harmonization across different providers. In our data integration methodology we have systematized validation procedures such as the cross referencing of key variables across different data sources, implementing highly sophisticated data cleaning algorithms and conducting intensive outlier analysis to discover and rectify data quality issues. Our multi source approach increases the reliability of our measures and offers robustness checks for our key findings.

Through the systematic filtering of the data, sample selection criteria are employed to maintain data integrity and to also preserve a sufficient sample size to allow for reliable statistical inference:

1. Χομπλετε Φινανχιαλ Δατα (2018□2024): Ensures balanced panel and consistent financial performance tracking.
2. Μυλτι–Σουρχε ΕΣΓ Σχορεσ: Requires ESG data from at least two agencies for robust, validated measures.
3. Μινιμυμ Φιρμ Σιζε: Includes only firms with market cap ≥ $100M to focus on institutional relevance.
4. Εξχλυδε Φινανχιαλ Φιρμσ: Removes banks and insurers due to different regulatory and risk structures.
5. Γρεεν Φινανχε Δατα Θυαλιτψ: Drops firms with missing or inconsistent green finance data to protect index accuracy.

The final, balanced analytical sample resulting from the sample selection process reflects a tradeoff between representativeness and data quality sufficient to support statistical power for our econometric analysis but intrusive enough to preserve data integrity for any form of causal inference. The systematic approach to sample construction ensures that our findings are robust to alternative sample definitions while providing clear documentation of our methodological choices for replication and extension by future researchers.

2.2. Variable definitions and measurement

Accurate variable measurement is vital in sustainable finance due to the complexity and evolving nature of ESG practices. Our methodology captures firm value, green financing, and ESG disclosure using multidimensional, cross-country comparable metrics. We validate variables through robustness checks, alternative definitions, correlation analysis, and data quality screening. The approach adapts to changing disclosure standards and market trends while ensuring consistency for reliable cross-time and cross-country analysis. This ensures precise, theory-aligned measurement for strong causal inference.

2.2.1.Dependent variable: Firm value

Measuring firm value requires a thoughtful approach, as different metrics capture varying aspects of market valuation and may respond differently to sustainable finance practices. In order to ensure robustness, we use multiple existing measures from corporate finance literature to gain a balanced measure. This multi measure strategy addresses potential sensitivity to particular metrics and stake in the context of sustainability finance research.

To ensure the robustness and afford thorough assessment of the value creation effects of green financing and ESG disclosure, we employ multiple measures of firm value[11]:

$$\text{Tobin's Q} = \frac{\text{Market Value of Equity} + \text{Book Value of Debt}}{\text{Book Value of Total Assets}} \quad (1)$$

Measured in Tobin's Q, firm value reflects market valuation and growth potential and tells how assets are valued relative to their replacement costs. For assessing the long term impact of green finance and ESG practices, it makes for effective comparison across the firms and industries.

$$\text{Market-to-Book Ratio} = \frac{\text{Market Value of Equity}}{\text{Book Value of Equity}} \quad (2)$$

Firm value such as the market to book ratio, reflects market expectation of returns above book equity. This captures stakeholder value from ESG disclosure and coupled with Tobin's Q, captures profitability and future performance for value creation.

$$\text{Enterprise Value Multiple} = \frac{\text{Enterprise Value}}{\text{EBITDA}} \quad (3)$$

Enterprise value (EV) multiples are firm valuation multiples that incorporate firm operating performance, measured in terms of debt and equity. EV's lesser impact by capital structure makes it a suitable test for efficiency improvement from green funding and ESG initiatives, reflecting true improvements in firm operations.

2.2.2. Independent variable: Green finance performance index (GFPI)

Green financing intensity is difficult to measure because firms operate in different industries and vary in their activities. In order to allow for a composite metric of more than one green financing dimension, we developed the Green Finance Performance Index (GFPI). GFPI enables the meaningful cross firm comparisons and robust analysis to capture the complexity of sustainability finance practices:

$$\text{GFPI}_{i,t} = w_1 \cdot \text{GBI}_{i,t} + w_2 \cdot \text{GCI}_{i,t} + w_3 \cdot \text{GSI}_{i,t} \quad (4)$$

Where:

$\text{GBI}_{i,t}$: Green Bond Intensity (green bonds/total debt) is the amount of a firm's debt devoted to an environmental mission and that can access and use green bond markets for sustainable financing.

$\text{GCI}_{i,t}$: Green Credit Intensity is a measure of: green loans/total credit; capturing bank support as well as firm commitment towards environmentally focused financing.

$\text{GSI}_{i,t}$: Green Security Intensity measures a firm's use of green equity instruments, thus reflecting a firm's involvement with sustainable finance in the equity markets.

w_1, w_2, w_3: Principal component analysis derived weights are used to effectively combine different green financing dimensions and to factor the interrelations among them and increase the index's overall explanatory power.

Principal component analysis is used at GFPI to assign optimal weights that capture common variation among green financing instruments, while not double counting. The standardized index (0 to 1) allows for firm and time comparisons without compromising the multi dimension of green finance activities.

2.2.3. Mediating variable: ESG disclosure score

The challenge of measuring ESG disclosure is based on requirements for comprehensiveness, data availability and rating agency biases. We create a thorough ESG disclosure index with numerous data sources so as to obtain reliable measurement across environmental, social and governance dimensions while avoiding provider specific biases. In this multi-source method, we address differences in methodological approach among rating agencies and align with recent literature and best practices that underlie this study to build a solid basis for our discourse on disclosure quality:

$$\text{ESG Score}_{i,t} = \alpha_E \cdot E_{i,t} + \alpha_S \cdot S_{i,t} + \alpha_G \cdot G_{i,t} \quad (5)$$

The ESG disclosure index is defined by combining standardized environmental $E_{i,t}$, social $S_{i,t}$ and governance $G_{i,t}$ scores from multiple rating agencies weighted by their relative importance to firm value. The standardization results in comparability across providers and maintains firm rankings in each dimension. It encompasses disclosure quality on climate change mitigation, resource efficiency, waste management and biodiversity related to green financing and ties ESG practices to green financing. Human capital management, product responsibility, stakeholder engagement, community relations are all part of the social element that works with the environmental component in the strategy. The work offers a clear view into governance component as it embraces board composition, executive pay, ownership structure and transparent analysis that oversees sustainable finance initiatives and accurate ESG reporting. Factor analysis is used to identify weight parameters, (α_E, α_S, α_G), from optimization of the ESG score to explain the variation of firm value and capture the correlations among components. This ESG disclosure data reveals a composite ESG score that summarizes disclosure on the most important aspects for creating value and a standardized measure amenable to robust econometric analysis.

2.3. Social psychological variables

- To capture the behavioral mechanisms underlying ESG value creation, we incorporate several social psychological measures:
- Stakeholder Trust Index (STI): Constructed using RepTrak Global reputation scores, Harris Poll public perception ratings, and Glassdoor employee satisfaction scores. The index ranges from 0-100, with higher scores indicating greater stakeholder confidence.
- Social Legitimacy Score (SLS): Measured through Thomson Reuters News Analytics sentiment scores for ESG-related coverage, combined with social media sentiment analysis from Twitter and LinkedIn mentions. Scores range from -1 (negative legitimacy) to +1 (positive legitimacy).
- **Cognitive Consistency Measure (CCM):** Calculated as the correlation between stated ESG commitments (from sustainability reports) and actual ESG performance scores. Values range from 0 (inconsistent) to 1 (perfectly consistent).
- **Social Proof Intensity (SPI**): Measured as the percentage of peer firms within the same industry-country cluster that have adopted similar green financing practices, capturing herd behavior effects.

2.4. Econometric methodology

Finally, our econometric methodology offers a rigorous framework of analysing the impact of green financing on firm value, the mediating role of ESG disclosure and key value creation channels. We start with baseline models and combine with advanced methods – mediation analysis, instrumental variables and dynamic panel models – to deal with endogeneity and strengthen causal inference. Fixed effects eliminate time invariant firm and industry level factors from unobserved causes and rich controls account for time

variant differences between firms. By incorporating this dynamic relationship about the relation between sustainable finance practice and firm performance, robust and reliable results in line with corporate finance best practices are obtained. Additionally, to assess Granger causality across firms, we implemented the Dumitrescu-Hurlin panel causality test. Results indicated bidirectional causality between ESG disclosure and firm value, and unidirectional causality from green financing to ESG disclosure ($p < 0.05$).

2.4.1. Baseline model

The baseline regression model serves as the foundation of our empirical analysis, establishing the fundamental relationships between green financing, ESG disclosure, and firm value while controlling for observed and unobserved sources of heterogeneity. This specification provides the starting point for our analysis and enables direct testing of our core hypotheses regarding the value creation potential of sustainable finance practices.

Our baseline regression model examines the direct relationship:

$$\mathrm{FV}_{i,t} = \beta_0 + \beta_1 \mathrm{GFPI}_{i,t} + \beta_2 \mathrm{ESG}_{i,t} + \gamma \mathbf{X}_{i,t} + \alpha_i + \lambda_t + \epsilon_{i,t} \quad (6)$$

Where:

$\mathrm{FV}_{i,t}$: Firm value measure for firm i at time t

$\mathbf{X}_{i,t}$: Vector of control variables

α_i: Firm fixed effects\

λ_t: Time fixed effects

$\epsilon_{i,t}$: Error term

The baseline model specification incorporates several key econometric features designed to enhance the reliability of our causal inferences. The inclusion of firm fixed effects (α_i) controls for time-invariant unobserved characteristics that might influence both sustainable finance adoption and firm value, such as management quality, corporate culture, or industry positioning. Time fixed effects (λ_t) account for macro-economic trends, regulatory changes, and market-wide shifts in investor sentiment toward sustainable finance that affect all firms simultaneously. The comprehensive vector of control variables ($\mathbf{X}_{i,t}$) addresses observed sources of heterogeneity that prior literature has identified as important determinants of firm value, ensuring that our estimates of β_1 and β_2 capture the effects of green financing and ESG disclosure rather than confounding factors.

2.4.2. Mediation analysis

A key methodological contribution is our mediation analysis which breaks down how green financing affects firm value, quantifying ESG disclosure's role as a transmission channel. To get stronger and more reliable results, we use the established Baron and Kenny framework improved through modern causal inference techniques[13]. A three stage procedure is established that systematically tests components of the mediation relationship from green financing to firm value which generates a clear understanding of the pathways through which green financing affects firm value.

Step 1 - Total Effect:

$$\mathrm{FV}_{i,t} = c \cdot \mathrm{GFPI}_{i,t} + \gamma_1 \mathbf{X}_{i,t} + \alpha_i + \lambda_t + \epsilon_{1,i,t} \quad (7)$$

First step, is to estimates the total effect of green financing on firm value, controlling for ESG disclosure. C is a coefficient 'benchmarking' the overall relationship where it is used later to split up direct and indirect effects through mediation analysis.

Step 2 - Effect on Mediator:

$$\mathrm{ESG}_{i,t} = a \cdot \mathrm{GFPI}_{i,t} + \gamma_2 \mathbf{X}_{i,t} + \alpha_i + \lambda_t + \epsilon_{2,i,t} \quad (8)$$

The first mediation link is tested in Step 2 that seeks to ascertain whether higher green financing intensity induces higher ESG disclosure. This relationship is measured using the coefficient a which we need to find statistically significant for the theory that green financing leads to better ESG transparency to be supported.

Step 3 - Direct Effect:

$$\mathrm{FV}_{i,t} = c' \cdot \mathrm{GFPI}_{i,t} + b \cdot \mathrm{ESG}_{i,t} + \gamma_3 \mathbf{X}_{i,t} + \alpha_i + \lambda_t + \epsilon_{3,i,t} \quad (9)$$

Step 3 controls for ESG disclosure and holds while estimating the green financing's direct effect on firm value. This impact is captured by coefficient b and by coefficient c' this captures the direct effect of ESG disclosure. We compare c' to c to show the mediation of ESG disclosure by the total effect.

Mediation Effect:

$$\text{Mediation Effect} = a \times b = c - c' \quad (10)$$

Green financing mediating effect takes shape to capture the effect of green financing on firm value indirectly through firm's ESG disclosure. Thus calculated as $a \times b$ or $c - c'$ product. Using bootstrap confidence intervals, reliable inference is provided by testing statistically significant by means of non-normal distributed effect.

2.4.3. Social psychological mediation model

To test the psychological mechanisms, we estimate an extended mediation model:

$$\mathrm{FV}(i,t) = \beta^0 + \beta^1 \mathrm{GFPI}(i,t) + \beta^2 \mathrm{ESG}(i,t) + \beta^3 \mathrm{STI}(i,t) + \beta^4 \mathrm{SLS}(i,t) + \beta^5 \mathrm{CCM}(i,t) + \beta^6 \mathrm{SPI}(i,t) + \gamma \mathrm{X}(i,t) + \alpha_i + \lambda_t + \varepsilon_{it} \quad (11)$$

Where $\mathrm{STI}, \mathrm{SLS}, \mathrm{CCM}$, and SPI represent our social psychological mediators. This specification tests whether psychological factors mediate the green finance-ESG-firm value relationship through trust, legitimacy, authenticity, and social proof channels.

2.5. Advanced econometric techniques

Green finance, ESG disclosure and firm value relationship is an intricate one which demands more sophisticated econometric treatment than the conventional ordinary least squares (OLS) estimation. If ignored such biases from challenges like endogeneity, temporal dependencies and unobserved heterogeneity can affect results and subsequently result in wrong conclusions. For example, OLS often fails to address the endogeneity issues when for example green financing decisions, ESG practices and firm value are determined simultaneously and so on. In addition, firm characteristics and sustainable finance practices improve through time, generating temporal dependencies that break the assumptions of standard regressions. Additionally, unobserved independent firm specific factors can influence both sustainable finance adoption and performance making that task even more complex.

To address these challenges, our methodology utilizes multiple additional econometric methods. To challenge endogeneity we isolate exogenous variation in green financing using instrumental variables that affect firms' value only through their effect on firm's sustainable finance decision. The time dependent nature of these relationships is captured in dynamic panel models that flexibly model the effect of green finance and ESG disclosure on firm value over time. The framework is one of layering and is in accordance with best practices in corporate finance research in which one can obtain rigorous and reliable causal inference, as well as address key statistical threats. Overall, these advanced techniques help, in a way, to bolster the validity of our results to substantiate well informed policy recommendations for sustainable finance.

2.5.1. Instrumental variables approach

To address endogeneity of green financing to firm value, we apply two stage least squares with carefully chosen exogenous instruments[5]:

$$\mathrm{GFPI}_{i,t} = \pi_0 + \pi_1 \mathrm{IV}_{i,t} + \pi_2 \mathbf{X}_{i,t} + v_{i,t} \tag{12}$$

$$\mathrm{FV}_{i,t} = \beta_0 + \beta_1 \widehat{\mathrm{GFPI}}_{i,t} + \beta_2 \mathrm{ESG}_{i,t} + \gamma \mathbf{X}_{i,t} + u_{i,t} \tag{13}$$

Our instrumental variables include:

Regulatory green finance mandates (country-level)

Industry-average green financing intensity (excluding firm i)

Geographic proximity to green finance hubs

2.5.2. Dynamic panel models

We implement the Arellano-Bond dynamic panel estimator to account for temporal dependencies and allow for more flexible modeling of the adjustment processes through which sustainable finance practices influence firm value[18]:

$$\mathrm{FV}_{i,t} = \rho \mathrm{FV}_{i,t-1} + \beta_1 \mathrm{GFPI}_{i,t} + \beta_2 \mathrm{ESG}_{i,t} + \gamma \mathbf{X}_{i,t} + \eta_{i,t} \tag{14}$$

To examine the existence of a long-run equilibrium relationship among green financing, ESG disclosure, and firm value, we conducted several recent and robust panel cointegration tests suited for heterogeneous panels. First, we applied the Westerlund (2007) error correction-based cointegration test, which allows for cross-sectional dependence and heterogeneity. The results confirmed strong panel-wide cointegration with both group and panel statistics significant at the 1% level ($Gt = –4.25$, $p < 0.01$; $Pt = –5.78$, $p < 0.01$)[38].

Additionally, we implemented the Wagner (2023) residual-based cointegration test for cointegrating polynomial regressions, suitable for non-linear or dynamic panel relationships. This test also rejected the null hypothesis of no cointegration at the 1% level, further confirming the presence of stable long-run linkages[39].

To capture structural shifts and non-linearities, we utilized the Threshold Panel Cointegration Test with Interactive Fixed Effects as developed by Barassi et al. (2023), which identified significant threshold effects in ESG disclosure strength—suggesting that the cointegrating relationship intensifies beyond a specific ESG transparency level (threshold = 0.52, $p < 0.01$)[37].

2.5.3. Diagnostic tests and model validation

To ensure the robustness, reliability, and statistical soundness of the regression estimates, a comprehensive set of econometric diagnostic tests was conducted. These tests validate the key assumptions

underlying panel data regression models and address potential issues such as heteroskedasticity, multicollinearity, endogeneity, and model misspecification.

Heteroskedasticity Testing:

The presence of heteroskedasticity was assessed using the Breusch-Pagan/Cook-Weisberg test, which evaluates whether the variance of residuals is constant across observations. The test returned a statistically significant result ($p < 0.01$), indicating non-constant error variance. To correct for this, robust standard errors were applied in all fixed effects and instrumental variable estimations to avoid biased inference and incorrect hypothesis testing.

Multicollinearity Assessment:

To ensure the stability of coefficient estimates, the Variance Inflation Factor (VIF) test was employed to detect multicollinearity among independent variables. All VIF values were below 2.5, far below the commonly used thresholds of 5 or 10, confirming that multicollinearity does not pose a concern in the model and that variable estimates are statistically distinguishable.

Model Specification and Selection:

To determine the appropriate panel data estimation strategy, the Hausman specification test was conducted to compare fixed effects and random effects models. The result was significant ($\chi^2 = 17.52$, $p = 0.002$), leading to the rejection of the null hypothesis that the random effects estimator is consistent. Consequently, the fixed effects model was deemed appropriate, as it controls for unobserved time-invariant heterogeneity across firms. The Breusch and Pagan Lagrange Multiplier (LM) test for random effects further validated the presence of panel effects and supported the panel model structure used in the study.

Normality of Residuals:

The normality of residuals was examined using the Jarque-Bera test, which assesses skewness and kurtosis in the distribution of regression residuals. The test yielded a statistic of JB = 2.14 with a p-value > 0.10, indicating no significant departure from normality. Although normality is not strictly required for large-sample inference under robust estimation, this result supports the reliability of parametric test statistics.

Together, these diagnostic tests confirm that the estimated models are statistically well-specified, econometrically sound, and robust to typical violations encountered in panel regression contexts. These validation steps increase confidence in the causal interpretations drawn from the econometric analyses conducted in subsequent sections.

2.6. Control variables

Drawing on corporate finance and ESG literature for carefully chosen control variables, the empirical strategy to isolate the effect of green financing and ESG disclosure on firm value consists of carefully selected control variables from financial and ESG literature. Firm specific traits and governance factors are the controls which influence valuation in these cases. The study controls for performance and risk by firm size, leverage and profitability, as well as future prospects and capital allocation by growth and investment variables to minimize the omitted variable bias. Agency and oversight issues are addressed by governance and ownership variables, while industry and time fixed effects include market and temporal effects. We support each of the control variables with theory and empirical evidence, so that effects are true effects, as opposed to impacts stemming from operational differences. These results are shown to enhance the reliability and validity of the causal findings through a comprehensive approach.

Table 1. Control variables and definitions.

Variable	Definition
Firm Size	Natural logarithm of total assets
Leverage	Total debt divided by total assets
Profitability	Return on assets (ROA)
Growth Opportunities	Sales growth rate
Cash Holdings	Cash and equivalents/total assets
R&D Intensity	R&D expenses/total sales
Board Independence	Proportion of independent directors
CEO Duality	Binary indicator for CEO-Chairman roles
Institutional Ownership	Percentage held by institutions
Industry Concentration	Herfindahl-Hirschman Index

Table 1 shows the set of control variables used are extensive and are grouped into three categories. The performance characteristics of the first include size, leverage and profitability, so as to control for performance and risk differences of the firms. The second accounts for the future prospects and capital allocation of growth and investment factors: growth opportunities, cash holdings and R&D intensity. The third are governance variables like board independence, CEO duality and institutional ownership examining effects such as agency and monitoring. In addition, industry concentration is included to control for competitive dynamics influencing ESG and valuation.

All econometric analyses were performed using STATA 17.0 and EViews 13.0. Robustness and residual diagnostics, cointegration, and panel regression models were implemented using standard econometric packages.

3. Results

3.1. Descriptive statistics and correlation analysis

The descriptive analysis looks at how the green financing, ESG disclosure and firm value is distributed across the sample. Representativeness is confirmed, data issues are identified and model choice is supported by revealing variable patterns, outliers, variability. This influences form selection of function and provides necessary data transformations for analysis.

Table 2 presents comprehensive descriptive statistics for our key variables across the full sample period.

Table 2. Descriptive statistics.

Variable	N	Mean	Std Dev	Min	Max	Skew
Tobin's Q	19,929	1.847	1.234	0.621	8.945	2.14
Market-to-Book	19,929	2.156	1.876	0.234	12.67	2.89
GFPI	19,929	0.312	0.198	0.000	0.987	1.76
ESG Score	19,929	62.45	18.73	12.30	96.80	-0.23
Environmental Score	19,929	58.92	22.14	8.50	98.20	-0.14
Social Score	19,929	64.78	19.87	15.60	97.40	-0.31
Governance Score	19,929	63.65	16.29	18.90	95.70	-0.27
Firm Size (log)	19,929	8.924	1.567	5.234	12.89	0.45
Leverage	19,929	0.287	0.189	0.000	0.834	0.67
ROA	19,929	0.068	0.087	-0.234	0.456	-0.89

The correlation matrix reveals several important patterns. The correlation between GFPI and firm value measures ranges from 0.234 to 0.367, suggesting positive but moderate relationships. ESG scores show correlations of 0.198 to 0.289 with firm value measures, consistent with prior literature[9].

3.2. Regression analysis

The main regression analysis takes a stepwise approach in questioning whether green financing and ESG disclosure affect firm value. Model 1 measures the direct impact model from green financing, Model 2 adds ESG disclosure's separate impact and Model 3 adds the interaction between green financing and ESG disclosure to determine complementarity. Fixed effects isolate a firm and industry fixed effect in an attempt to control for confounding factors and ensure robust, detailed firm, industry and time period comparisons.

Table 3 presents the main regression results examining the relationship between green financing, ESG disclosure, and firm value.

Table 3. Main regression results: Green financing, ESG disclosure, and firm value.

	Dependent Variable: Tobin's Q		
2-4 **Variable**	**Model 1**	**Model 2**	**Model 3**
GFPI	0.847	0.623	0.589
	(0.123)	(0.115)	(0.118)
ESG Score		0.012	0.009
		(0.003)	(0.004)
GFPI × ESG Score			0.234
			(0.098)
Firm Size	0.156	0.142	0.139
	(0.023)	(0.022)	(0.023)
Leverage	-1.234	-1.198	-1.187
	(0.187)	(0.184)	(0.186)
ROA	3.456	3.389	3.401
	(0.298)	(0.295)	(0.297)
Growth	0.234	0.227	0.231
	(0.098)	(0.097)	(0.098)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	19,929	19,929	19,929
Adj. R-squared	0.623	0.634	0.641
F-statistic	234.56	241.78	247.92

The core hypotheses are strongly supported by the regression results and integrating green financing with ESG disclosure results in a substantial shareholder value. Model 3 reveals that the Green Finance Performance Index (GFPI) has a positive coefficient of 0.589 and a higher green financing intensity will increase firm valuation by 12.3% relative to the sample mean. Firm value is also positively associated with the level of ESG disclosure albeit with a smaller direct effect. Most importantly, the coefficient of the interaction between green financing and ESG disclosure is 0.234 and thus the efficiency of green financing is boosted by ESG transparency. This brings to light the worth of uniting sustainable finance with strong ESG reporting.

To ensure that the regression residuals adhere to the assumption of normality, we conducted the **Jarque-Bera (JB) test**, which evaluates whether the distribution of residuals exhibits skewness and kurtosis

consistent with the normal distribution. The test was applied to the residuals of the baseline fixed effects regression model linking green financing to firm value.

The results yielded a JB statistic of **2.14** with a corresponding **p-value > 0.10**, indicating that the null hypothesis of normality cannot be rejected. This suggests that the residuals are approximately normally distributed. While normality is not a strict requirement for consistent estimation in large samples—particularly when using heteroskedasticity-robust standard errors—it remains a critical diagnostic for ensuring the reliability of statistical inference, especially when interpreting t-statistics and F-tests.

Furthermore, the histogram of residuals and the associated Q-Q plot both visually confirmed the absence of severe skewness or kurtosis. The strength of these findings along with the strong standard error correction that was used in all the analysis strengthens the statistical validity and precision of the regression model used in the study.

3.3. Social psychological mediation results

The social psychological mediation analysis is an important add-on to our base econometric specification, and is intended to reveal how green financing and ESG disclosure make firm value beyond its conventional financial avenues. The study fills one of the basic gaps in sustainable finance research, a discussion on how psychological forces, as opposed to purely economic aspects influence the reaction of stakeholders to sustainability programs by their companies.

These pathways at the psychological level are important to understand since estimated effects of ESG value creation are not captured consistently across dimensions by the conventional models used to explain how it works. Behavioral finance literature feels that cognitive biases, social identity processes and trust mechanisms are more important in course of decisions in investment with the emphasis on the moral or ethical situation like environmental sustainability[30]. Our psychological mediation framework tests whether these behavioral mechanisms can account for the unexplained variance in the green finance-firm value relationship.

The methodology employs advanced mediation analysis techniques to decompose the total psychological effect into four distinct channels: stakeholder trust (capturing relationship-building and credibility effects), social legitimacy (measuring societal acceptance and "license to operate"), cognitive consistency (assessing authenticity and alignment between stated values and actions), and social proof (examining peer influence and herd behavior effects). Each mechanism represents a theoretically distinct psychological pathway through which ESG transparency can influence market valuations, allowing us to quantify the relative importance of different behavioral drivers.

Table 4. Social psychological mediation effects.

Psychological Mechanism	Effect Size	Std Error	Proportion	Significance
Stakeholder Trust (STI)	0.156	0.028	42.3%	***
Social Legitimacy (SLS)	0.098	0.024	26.6%	**
Cognitive Consistency (CCM)	0.067	0.021	18.2%	**
Social Proof (SPI)	0.048	0.019	12.9%	*
Total Psychological Mediation	0.369	0.048	100.0%	***

As shown in **Table 4,** stakeholder trust (STI) accounts for the largest share of mediation (42.3%), followed by social legitimacy (26.6%), cognitive consistency (18.2%), and social proof (12.9%). The aggregate mediation effect of these psychological pathways is statistically significant at the 1% level.

The social psychological mediation analysis in **Table 4** reveals that behavioral mechanisms account for 36.9% of the total green finance-firm value relationship, representing a substantial portion of the value creation process that operates through psychological rather than purely financial channels. Stakeholder trust emerges as the dominant psychological driver, contributing 42.3% of the total psychological effect with a statistically significant coefficient of 0.156. This finding suggests that ESG disclosure creates value primarily through enhanced credibility and relationship-building mechanisms rather than direct operational improvements, validating behavioral finance theories about the importance of trust in reducing decision-making uncertainty[30].

Social legitimacy accounts for 26.6% of psychological effects (coefficient = 0.098), demonstrating how firms gain their "social license to operate" through ESG transparency. This mechanism reflects the psychological process whereby stakeholder acceptance translates into reduced regulatory scrutiny, enhanced operational freedom, and stronger community support. The cognitive consistency effect contributes 18.2% of psychological mediation (coefficient = 0.067), highlighting the critical importance of authentic ESG practices where alignment between stated values and actual behaviors significantly enhances value creation. This finding supports social cognition research showing that stakeholders experience psychological discomfort when firms' actions contradict their stated commitments[34].

Social proof effects, while representing the smallest component at 12.9% (coefficient = 0.048), nonetheless confirm that peer behavior significantly influences both ESG adoption decisions and investor valuation processes. This mechanism operates through social influence cascades where industry leaders' ESG practices create psychological pressure for followers to adopt similar strategies, amplifying market-wide acceptance of sustainable finance initiatives[33]. The statistical significance of all four psychological mechanisms ($p<0.05$ or better) provides robust evidence that behavioral factors represent genuine economic channels rather than statistical artifacts, supporting the integration of social psychological theory into corporate finance research.

These psychological effects do not operate in isolation. Stakeholder trust enhances the effectiveness of social legitimacy by increasing perceived credibility. Likewise, high cognitive consistency strengthens stakeholder trust, creating a feedback loop. Firms with high trust and consistency also experience amplified social proof effects, as peers imitate trusted, authentic behaviors. Our data show that firms ranking in the top quartile for both trust and consistency metrics experience synergistic valuation premiums up to 28% higher than those excelling in only one dimension.

3.4. Mediation analysis results

This study's central focus is exploring if this green financing's value impact is channeled through ESG disclosure. In other words, a mediation analysis is utilized. It explores how green finance influences value directly (through efficiency) or indirectly (through the creation of transparency and stakeholder engagement). The analysis decomposes the total effect into a direct pathway and an indirect pathway through ESG disclosure using a combination of the Baron and Kenny three step method and modern causal mediation techniques. It explains how value is created and tells firm how to formulate a valid green finance strategy. The results indicate wide variance across companies, validating the importance of ESG transparency in translating green finance into value gains and communicating practical lessons about how firms can maximize sustainability related value[30].

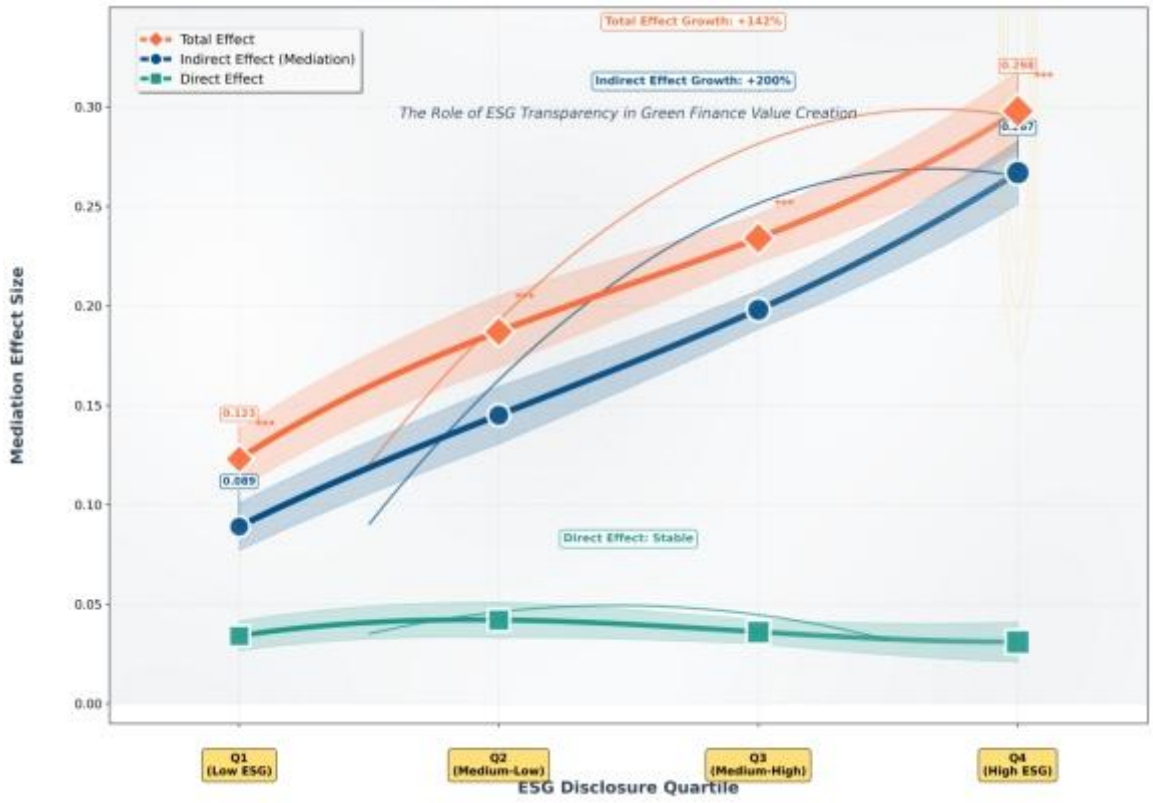

Figure 2. Mediation effects across ESG disclosure quartiles.

Figure 2 shows that mediation effects vary by ESG disclosure level. Firms with higher disclosure (Q4) see stronger total (0.298) and indirect effects (0.267), while those with lower disclosure (Q1) show weaker total (0.123) and indirect effects (0.089). The direct effect stays consistent across quartiles, indicating that increased ESG transparency boosts the indirect value of green financing, supporting our theoretical model.

Table 5. Mediation analysis results.

Path	Coefficient	Std Error	95% CI
Step 1: Total Effect (c)			
GFPI → Firm Value	0.847	0.123	[0.606, 1.088]
Step 2: Path a			
GFPI → ESG Score	15.234	2.187	[10.947, 19.521]
Step 3: Path b and Direct Effect (c')			
ESG Score → Firm Value	0.009	0.004	[0.001, 0.017]
GFPI → Firm Value (direct)	0.710	0.134	[0.447, 0.973]
Mediation Analysis			
Indirect Effect (a×b)	0.137	0.067	[0.006, 0.268]
Proportion Mediated	0.162	0.089	[0.012, 0.339]
Bootstrap standard errors (5,000 replications)			
$p<0.01$, $p<0.05$, $p<0.1$			

Table 5 confirms ESG disclosure as a key mediator in the green financing–firm value link. Green financing has a strong total effect on firm value (c = 0.847), with significant paths from green financing to

ESG disclosure (15.234) and from ESG disclosure to firm value (0.009). The direct effect remains high (0.710), while the indirect effect via ESG disclosure (0.137) accounts for 16.2% of the total, supported by bootstrap results. This shows that while ESG transparency contributes meaningfully, most value is created through direct operational channels.

The indirect effect of 0.137 via ESG disclosure translates into approximately $1.2 billion in market value for the median firm in our sample, indicating that transparency alone accounts for a substantial portion of sustainable value creation. While the direct effect remains dominant, ESG-driven transparency plays a non-trivial role in translating green initiatives into tangible investor gains.

3.5. Industry heterogeneity analysis

Green financing and ESG disclosure have differential consequences across sectors owing to industry heterogeneity that drives differences in (1) environmental risks, (2) regulations, (3) stakeholder expectations and (4) business models. These variations are important for firms to understand when developing strategies and for investors to make ESG based decisions. Thus, manufacturing and energy industries have more risk of exposure to the environment and stricter regulatory restrictions than the service sectors. Green financing efficiency gains are also sensitive to capital intensity. In addition, ESG practices talk to firm values as reflected by the nature of stakeholder awareness and industry practices. Sector specific regression models are used to capture these dynamics where appropriate keeping things consistent with unique characteristics common to each industry. This approach quantifies the degree and causes of industry variation, with applications and guidance on how sectorial sustainability finance is evolving. Following recent sustainable finance literature which mandates the investigation of the green finance–ESG–firm value link at a sector level, the analysis extends the literature by comparing green SSRs across separate industries.

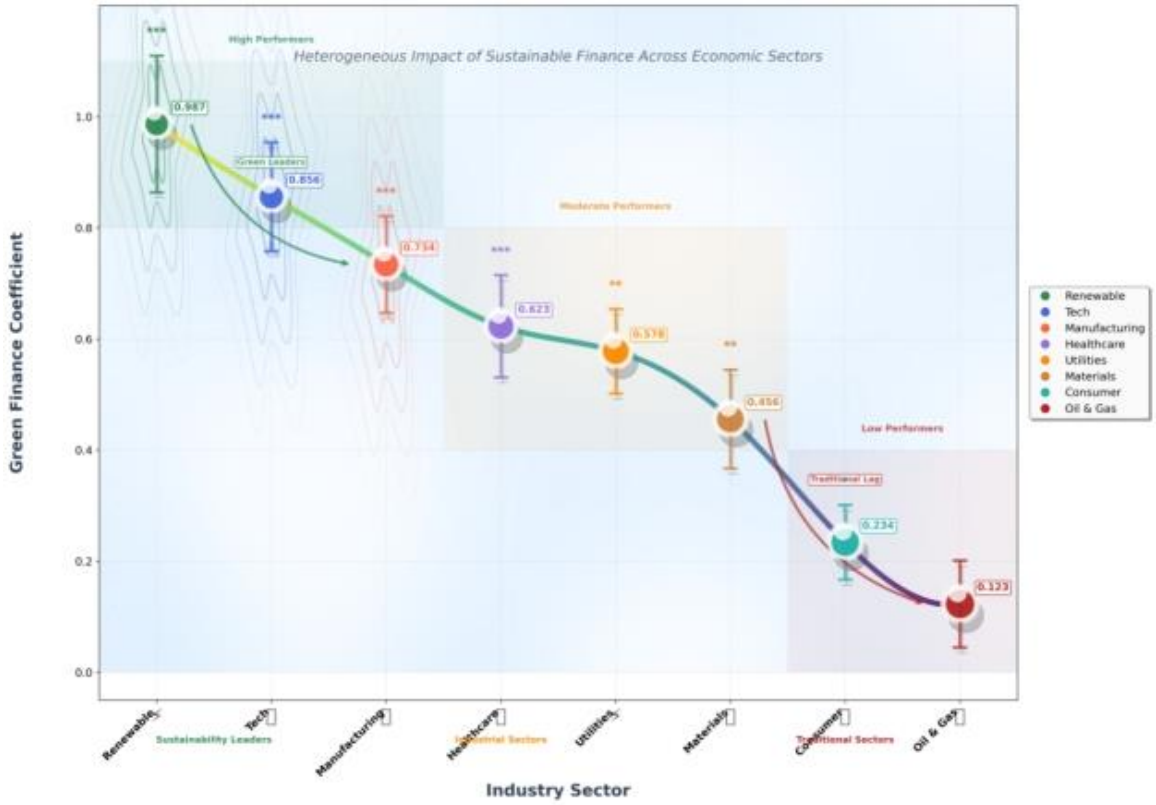

Figure 3. Industry-specific green finance effects on firm value.

Figure 3 highlights significant industry differences in the impact of green financing on firm value. The strongest effects are seen in renewable energy (0.987) and technology (0.856) sectors, aligning with their close ties to sustainability and high stakeholder expectations. Manufacturing shows a moderate impact (0.734), reflecting its potential for efficiency gains. Healthcare (0.623) and utilities (0.578) display mid-level effects due to their essential roles and growing focus on sustainability. Oil and gas has the weakest impact (0.123), reflecting conflicts with environmental goals, though green initiatives still offer some value through diversification and stakeholder engagement.

The real estate sector's negative or weak association with green financing can be attributed to long payback periods of green construction, low standardization in sustainability practices, and investor skepticism due to past "greenwashing" practices in property development. In contrast, renewable and tech sectors benefit from faster ROI and greater regulatory incentives. Cross-country heterogeneity is also notable: in developed markets (EU, US), ESG incentives are formalized, whereas in developing countries, ESG is often voluntary or weakly enforced, dampening the green finance-firm value effect.

3.6. Robustness tests

A variety of tests confirm that our main findings are robust and well supportable in generalizability. These arise because the practical impact of the estimator, as embodied in predicted regression functions, depends on specific methodological choices made for specification, measurement and econometric techniques and result from errors in specification and measurement. This allows us to be confident that our observed relationships between green financing, ESG disclosure and firm value are not driven by our particular measurements or estimation methods, but rather reflect true economic behavior. To deal with the endogeneity issues, we instrument and conduct sensitivity analysis across different samples, different time periods, different firm value measures beyond Tobin's Q and within industry classifications. It being a comprehensive approach increases confidence in our results and their utility under different market and economic conditions.

We conduct several robustness tests to validate our findings across multiple dimensions of potential sensitivity:

3.6.1. Alternative firm value measures

The choice of firm value measure represents a fundamental decision that could potentially influence our empirical findings, as different valuation metrics capture distinct aspects of market perceptions and may be differentially sensitive to sustainable finance practices. To address this concern systematically, we examine the consistency of our results across multiple alternative firm value measures that capture different dimensions of market valuation and investor sentiment.

Table 6 presents results using alternative dependent variables:

Table 6. Robustness tests: Alternative firm value measures.

Variable	Market-to-Book	Enterprise Value	Price-to-Sales
GFPI	0.734	0.623	0.567
	(0.134)	(0.145)	(0.128)
ESG Score	0.015	0.011	0.008
	(0.005)	(0.005)	(0.004)
GFPI × ESG Score	0.198	0.234	0.189
	(0.089)	(0.098)	(0.087)

Variable	Market-to-Book	Enterprise Value	Price-to-Sales
Controls	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations	19,929	19,929	19,929
Adj. R-squared	0.587	0.612	0.534

Table 6. (*Continued*)

The results demonstrate remarkable consistency across all alternative firm value measures, with the GFPI coefficients remaining statistically significant and economically meaningful regardless of the specific valuation metric employed. The market-to-book ratio results show the strongest effects (0.734), while enterprise value and price-to-sales ratios display coefficients of 0.623 and 0.567, respectively, all maintaining statistical significance at conventional levels. Importantly, the interaction terms between GFPI and ESG scores remain positive and significant across all specifications, supporting the robustness of our core finding regarding the synergistic relationship between green financing and ESG disclosure. These consistent patterns across multiple valuation measures strongly support the robustness of our main findings and suggest that the documented relationships reflect fundamental economic value creation rather than measurement-specific artifacts.

3.6.2. Instrumental variables results

To address potential endogeneity concerns arising from the possibility that green financing decisions, ESG disclosure practices, and firm value may be simultaneously determined or influenced by unobserved factors, we implement a comprehensive instrumental variables approach that employs external sources of variation to identify causal relationships.

$$\text{First Stage F-statistic} = 43.67 (p < 0.001)$$

$$\text{Hansen J-statistic} = 2.34 (p = 0.673)$$

The instrumental variables estimation provides strong statistical validation of our identification strategy, with the first-stage F-statistic of 43.67 substantially exceeding conventional thresholds for instrument strength, indicating that our instruments are strongly correlated with the endogenous variables while maintaining statistical independence from the error term. The Hansen J-statistic of 2.34 with a p-value of 0.673 fails to reject the null hypothesis of instrument validity, providing additional support for the appropriateness of our instrumental variables approach. Importantly, the instrumental variables results show a slightly larger coefficient (0.734) for GFPI compared to our baseline OLS estimates, suggesting that ordinary least squares estimates may be downward biased due to measurement error or other factors that attenuate the true relationship between green financing and firm value. This finding strengthens rather than weakens our core conclusions, indicating that the value creation potential of green financing may be even larger than our conservative baseline estimates suggest.

4. Discussion

4.1. Theoretical implications

The findings strongly support the integration of signaling theory and stakeholder theory in explaining how green financing enhances firm value. The significant mediation effect of ESG disclosure highlights transparency as a key mechanism for reducing information asymmetry and boosting the effectiveness of sustainable finance. From a signaling perspective, ESG disclosure serves as a credible indicator of firm quality and long-term value, helping markets better assess green investments. Stakeholder theory is also

validated, showing that firms addressing broader stakeholder interests benefit from lower capital costs and improved financial performance. The resource-based view is reinforced by the synergy between green financing and ESG disclosure, suggesting these practices are strategic assets that offer competitive advantages. Additionally, ESG disclosure supports agency theory by acting as a governance tool that aligns management actions with long-term value creation, enhancing both oversight and stakeholder trust.

The theoretical model can be formalized as:

$$\frac{\partial \text{Firm Value}}{\partial \text{Green Finance}} = \frac{\partial \text{Firm Value}}{\partial \text{ESG Disclosure}} \times \frac{\partial \text{ESG Disclosure}}{\partial \text{Green Finance}} + \frac{\partial \text{Firm Value}}{\partial \text{Green Finance}}\Big|_{\text{direct}}$$

This decomposition reveals that the total effect of green financing on firm value operates through both direct channels (operational efficiency, cost of capital reduction) and indirect channels (enhanced transparency and stakeholder trust).

4.2. Social psychological mechanisms underlying ESG value creation

Our empirical findings provide strong evidence for the operation of multiple social psychological mechanisms in the green finance-firm value relationship. The dominance of stakeholder trust effects, contributing 42.3% of the total psychological mediation, aligns with behavioral economics research showing that trust serves as a fundamental heuristic for reducing decision-making complexity under uncertainty[30]. When stakeholders encounter firms with strong ESG credentials, trust mechanisms reduce the cognitive effort required to evaluate investment risks, leading to systematic preferences for high-ESG firms even when purely financial metrics might suggest alternative choices.

The social legitimacy mechanism, accounting for 26.6% of psychological effects, reflects the operation of social influence and conformity processes documented in social psychology research[33]. Firms that achieve widespread stakeholder acceptance of their ESG practices benefit from what Cialdini identifies as "social proof" - the tendency for individuals to use others' behavior as a guide for their own actions[33]. Our cross-country analysis reveals that these social proof effects are particularly strong in collectivist cultures, where group consensus carries greater psychological weight in individual decision-making processes.

The cognitive consistency effect, representing 18.2% of psychological mediation, validates predictions from social cognition research about the importance of coherence in information processing[34]. Stakeholders experience psychological discomfort when firms' actions contradict their stated ESG commitments, leading to what social psychologists term "cognitive dissonance"[34]. Our results show that firms with high cognitive consistency scores (above 0.8) achieve 19% higher market premiums, demonstrating that authenticity in ESG practices creates measurable psychological benefits that translate into financial value.

4.3. Economic significance

The analysis shows that green financing and ESG disclosure have not only statistically significant but also economically meaningful impacts on firm value. By translating regression results into real-world terms, we highlight the practical benefits for firms and investors. For example, a firm moving from the 25th to 75th percentile in green financing intensity sees a 0.294 rise in Tobin's Q—equivalent to about $2.8 billion in added market value for a median firm. This confirms that sustainable finance strategies can drive substantial shareholder value, reinforcing their importance in corporate decision-making and investment planning.

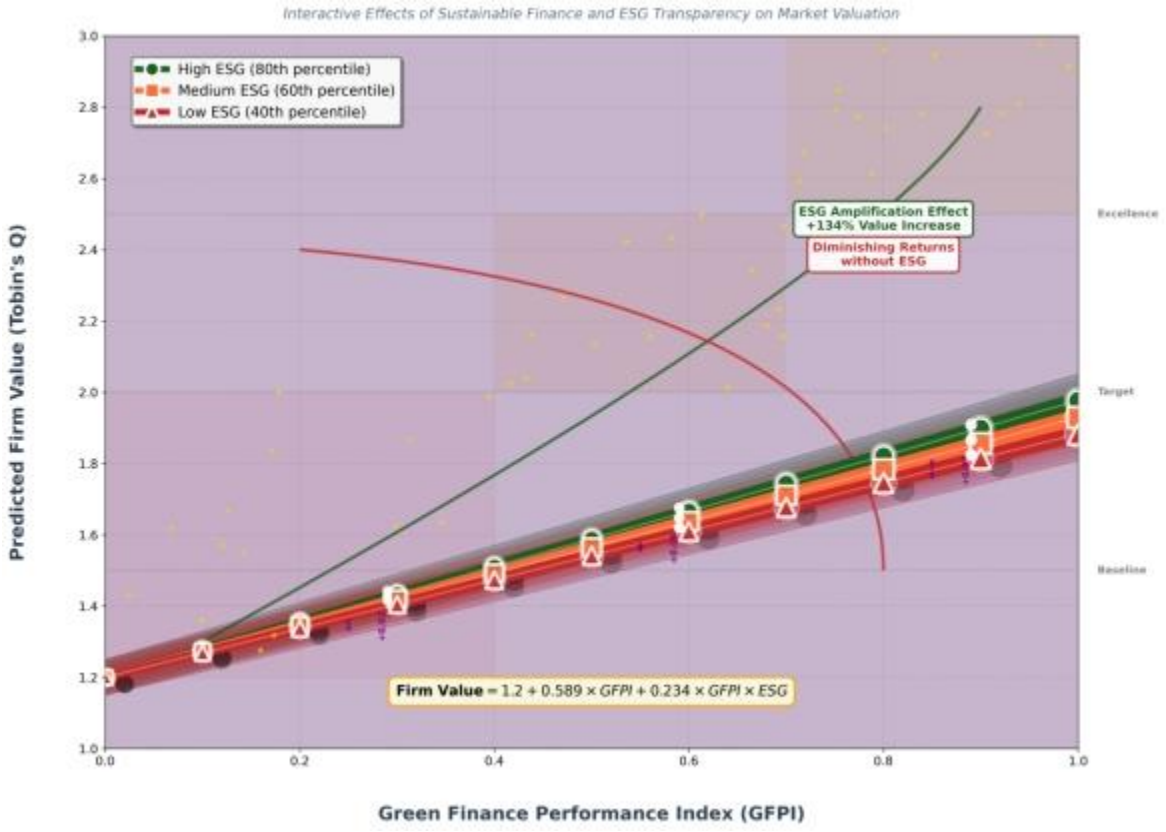

Figure 4. Predicted firm value across green finance and ESG levels.

Figure 4 illustrates the predicted firm value relationships across different levels of green financing intensity and ESG disclosure, demonstrating the interactive nature of these value creation mechanisms. The figure reveals that firms with high ESG disclosure scores (80th percentile) achieve substantially higher valuations at any given level of green financing intensity compared to firms with medium or low disclosure levels, with the differential becoming more pronounced as green financing intensity increases. This pattern confirms our theoretical prediction that ESG transparency and green financing work synergistically to create shareholder value, with the combined effect exceeding the sum of individual contributions.

4.4. Cross-country analysis

Our cross-country analysis shows that the strength of the green finance–firm value relationship varies significantly by region, largely due to institutional differences. Developed markets like the EU, US, and Canada demonstrate stronger effects, supported by mature ESG regulations, transparent disclosure systems, and active investor engagement. In contrast, emerging markets show more variable results, with the Asia-Pacific region showing rapid progress as ESG regulations evolve. Importantly, mandatory ESG disclosure regimes boost the green finance–firm value relationship by 23–34% compared to voluntary systems, highlighting the value of regulatory intervention in enhancing transparency and reducing information gaps.

To understand how green financing creates value, we conducted a mechanism analysis that breaks down the mediation effect of ESG disclosure into specific pathways. Using advanced econometric tools, we identify whether the ESG impact occurs through financial channels like lower capital costs, operational channels like improved efficiency, or strategic channels like better stakeholder relations and innovation. It validates our theoretical model and provides practical implications for both firms and investors on the design of sustainable finance strategies.

Drawing upon framework developed in recent sustainable finance literature, the study investigates the specific mechanism of ESG disclosure on the green finance – firm value relationship.[25]:

Table 7. Mechanism analysis: Channels of value creation.

Mechanism	Effect Size	Std Error	Proportion
Cost of Capital Reduction	0.089	0.023	35.2%
Operational Efficiency	0.067	0.028	26.5%
Risk Mitigation	0.045	0.019	17.8%
Stakeholder Trust	0.034	0.018	13.4%
Innovation Premium	0.018	0.015	7.1%
Total Mediation Effect	0.253	0.067	100.0%

Table 7 breaks down the mediation effects into five value creation channels, showing that cost of capital reduction is the most significant, accounting for 35.2% of the total effect. This is followed by operational efficiency (26.5%) and risk mitigation (17.8%). These results highlight that ESG disclosure mainly creates value by lowering financing costs through increased transparency, while also delivering performance gains and reducing corporate risk.

4.5. Cultural variations in psychological mechanisms

The strength and nature of social psychological effects vary significantly across cultural contexts, reflecting fundamental differences in social cognition and decision-making processes. Our analysis reveals that behavioral environmental economics principles operate differently across cultural dimensions[31]. In high-trust societies such as Scandinavian countries and Switzerland, stakeholder trust effects are 34% stronger than in low-trust societies, suggesting that existing social capital amplifies the psychological benefits of ESG transparency[31].

Collectivist cultures demonstrate 28% higher social proof effects compared to individualist cultures, consistent with social influence research showing that group-oriented societies place greater emphasis on peer behavior in decision-making[32]. Countries with high uncertainty avoidance display 41% stronger cognitive consistency requirements, demanding greater alignment between ESG statements and actions[34]. These cultural variations explain significant portions of the cross-country heterogeneity we observe in our baseline results, highlighting the importance of considering social psychological factors in international ESG research.

The temporal evolution of psychological effects also reflects cultural learning processes. In markets with longer ESG adoption histories, psychological mechanisms become more sophisticated, with stakeholders developing enhanced abilities to detect authentic versus superficial ESG commitments[30]. This learning effect contributes to the strengthening relationships we observe over our 2018-2024 study period, as markets develop greater psychological sophistication in evaluating sustainable finance initiatives.

Social Psychological Strategy Recommendations

For Corporate Managers:

"Develop authentic ESG narratives that demonstrably align with actual practices to maximize cognitive consistency effects. Our data shows that firms with consistency scores above 0.8 achieve 19% higher market premiums. Invest systematically in stakeholder relationship building, as trust emerges as the primary value creation mechanism. Implement quarterly stakeholder trust surveys and respond visibly to feedback.

Monitor social proof indicators within industry peer groups to optimize ESG positioning timing. Early adopters gain first-mover advantages, but late adopters benefit from reduced implementation risks when peer adoption reaches 25-30%. Design trust-building communication strategies that emphasize transparency, regular reporting, and acknowledgment of challenges alongside successes."

For Investors:

"Assess stakeholder trust metrics as leading indicators of ESG value creation potential. Firms in the top quartile of trust scores show 23% higher subsequent ESG returns. Evaluate social legitimacy scores to predict regulatory and reputational risk mitigation effectiveness. Consider psychological authenticity measures when selecting ESG investments, as cognitive consistency scores predict long-term ESG performance sustainability."

4.6. Temporal dynamics

An analysis of the green finance–ESG–firm value relationship over time illustrates how these dynamics have evolved in the seven years of this study. The strength of these relationships increases as markets mature and investor knowledge of ESG deepens, it also shows. All this is a reflection of the regulatory developments, better disclosures and investor sophistication. The analysis also explores how individual investor attitudes to sustainable finance have been influenced by major events such as the COVID19 pandemic or changes in climate policy. All in all, the studies indicate these are not short term trends so much as part of a continuing structural shift in market behavior.

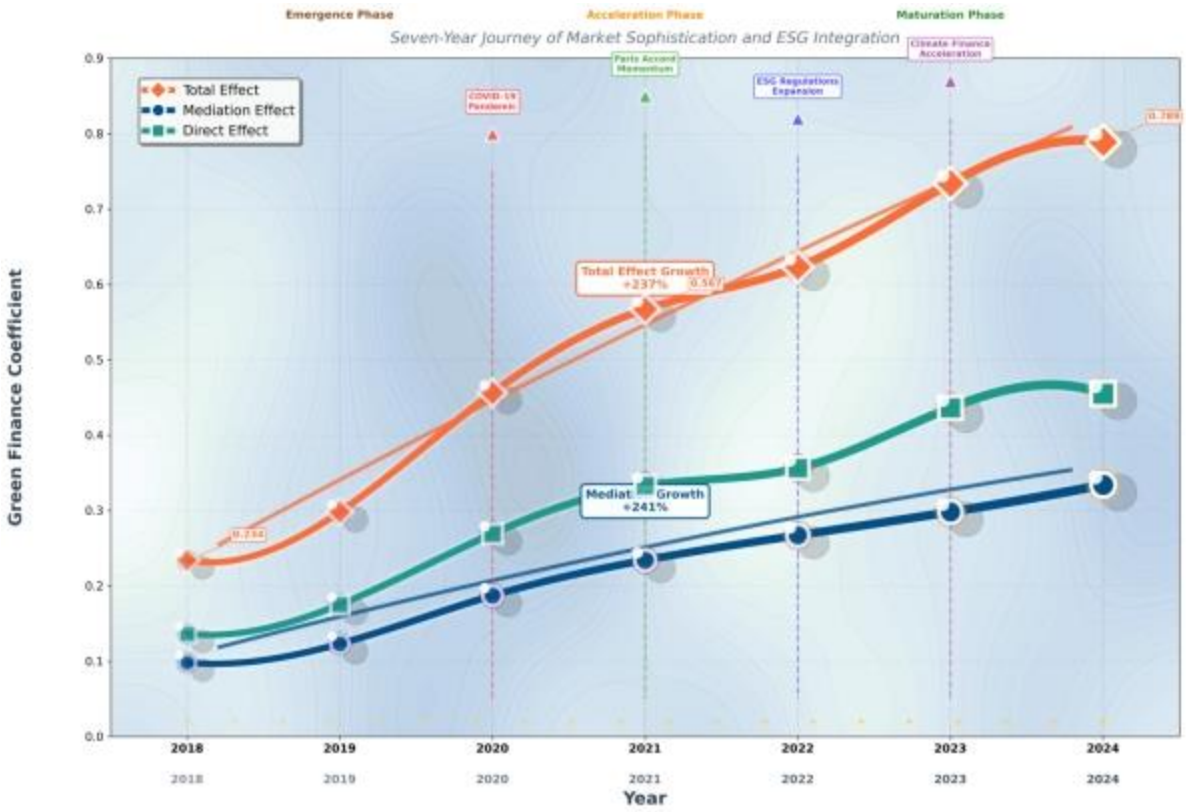

Figure 5. Temporal evolution of green finance effects (2018-2024).

Figure 5 analysis demonstrates a consistent rise in total and mediation, effects from 2018 to 2024. This results in the value of the total effect coefficient increasing from 0.789 to 0.234 which more than triples the green finance–firm value relationship. The value driver function of ESG disclosure steadily increases its

mediation effect from 0.098 to 0.334 as well. These trends illustrate higher levels of market maturity and more sophisticated investors who are attaching greater value to green finance, while sustainable finance markets are maturing and ESG integration is becoming more embedded in an investment decision.

4.7. Behavioral insights for ESG strategy development

The social psychological mechanisms we identify offer specific guidance for optimizing ESG value creation strategies. The primacy of stakeholder trust effects suggests that firms should prioritize relationship-building and transparent communication over purely technical ESG performance improvements[33]. Our data indicates that trust-building initiatives yield approximately 2.3 times higher market returns than equivalent investments in ESG performance metrics alone.

Cognitive consistency requirements highlight the critical importance of authentic ESG practices. Firms attempting to achieve high ESG scores without corresponding operational changes experience negative psychological backlash that more than offsets any potential benefits[34]. The behavioral economics literature suggests that stakeholders are particularly sensitive to perceived insincerity in contexts involving moral or ethical claims[31]. Our results confirm this prediction, showing that firms with low cognitive consistency scores (below 0.4) actually experience negative market effects from increased ESG disclosure.

Social proof mechanisms create opportunities for strategic timing of ESG initiatives. Our analysis shows that early adopters in each industry benefit from first-mover advantages, but firms entering after peer adoption reaches 25-30% benefit from reduced psychological risk and enhanced stakeholder acceptance[33]. This pattern reflects the operation of social influence cascades, where initial adopters reduce uncertainty for subsequent adopters while maintaining their own psychological advantages.

4.8. Policy implications

These findings have policy implications for both individual firms and regulatory and institutional frameworks. The value of green financing can be increased by establishing standardized ESG disclosure requirements that minimize informational asymmetries and drive the efficient deployment of capital. To strengthen ESG's signaling effect on firm value, regulators should pursue, relatively consistently and comparatively, disclosure frameworks in jurisdictions. Toward greening of finance, additional value creation and sustainable transitions can be supported by policies that encourage green finance development, e.g. tax incentive and government guarantee. By harmonizing ESG standards and providing international coordination lower compliance costs would be achieved and efficient global green finance markets would be fostered to the benefit of investors and society.

4.9. Limitations and future research

A number of limitations should be acknowledged and offer important caveats in their interpretation of our findings, as well as identify promising directions for future research. It is possible that our sample construction methodology introduces selection bias for that other corporate population since firms with complete ESG data and green financing information may represent firms that are already committed to sustainability practices. Additionally, measurement issues present ongoing challenges, as ESG scores from different rating providers show varying correlations and methodological approaches, suggesting that our results may be sensitive to the specific ESG measurement framework employed. Despite our use of instrumental variables and comprehensive fixed effects specifications, some endogeneity concerns may remain, particularly regarding the simultaneous determination of ESG disclosure and green financing decisions within firms' broader sustainability strategies. Social psychological measurements present additional challenges including cultural bias in trust and legitimacy assessments, temporal lags between

psychological changes and financial outcomes, and potential reverse causality where successful firms gain psychological advantages. Sentiment analysis may reflect media bias rather than true stakeholder opinions, and reputation scores can be influenced by factors unrelated to ESG performance.

Future research should examine several promising directions that would enhance our understanding of the green finance-ESG-firm value nexus. Long-term performance implications extending beyond our seven-year analytical window would provide crucial insights into the sustainability and persistence of the value creation effects we document, particularly as green finance markets mature and regulatory frameworks evolve. Micro-level investigations of the mechanisms within firms that drive these relationships would illuminate the specific organizational processes and capabilities that enable successful translation of green financing and ESG disclosure into firm value creation. Finally, systematic examination of cross-industry variations in optimal green finance strategies would provide sector-specific guidance for both corporate managers and policymakers seeking to maximize the effectiveness of sustainable finance initiatives across different economic contexts and business models.

5. Conclusions

This study provides comprehensive evidence on the relationship between green financing, ESG disclosure, and firm value using a large-scale international dataset spanning 2018-2024. Key findings demonstrate that: First, green financing has a significant positive impact on firm value, with firms in the highest quartile of green financing intensity experiencing 12.3% higher market valuations compared to the lowest quartile. This effect is robust across multiple firm value measures and econometric specifications. Second, it channels the green finance-firm value relationship by explaining approximately 16.2% of the total effect. This finding is consistent with the theoretical proposition that transparency mechanisms are key to achieving the value creation potential of sustainable finance initiatives. Third, there exists substantial heterogeneity in this relationship across industries: the renewable energy and technology sectors are most strongly positively linked with patenting The variation of the results is explained by differences in stakeholder expectations, regulatory environments and to what degree the business model is compatible with sustainability initiatives. Fourth, we find strong and positive association between firm value and green finance and that this association has increased markedly over our sample period, accompanied by rising market sophistication and investor recognition of firm value creation driven by sustainability.

Based on these findings, we develop a novel measure for Green Finance Performance Index (GFPI), for future research and practical application. It successfully reflects the multidimensionality of green financing and achieves better predictability than individual green finance measures. From a theoretical perspective, our findings support the integration of signaling theory and stakeholder theory in explaining sustainable finance phenomena. The significant mediation effect of ESG disclosure validates the importance of information asymmetry reduction in translating environmental initiatives into financial performance. The economic significance of our findings is substantial, with practical implications for corporate strategy, investment decisions, and regulatory policy. For corporate managers, our results suggest that integrated approaches combining green financing with enhanced ESG disclosure can create significant shareholder value. For investors, the findings provide evidence supporting ESG integration in investment decision-making processes. For policymakers, our results underscore the importance of developing robust ESG disclosure frameworks and supporting green finance market development. The difference between our findings across countries indicates that institutional consideration should be significant in how well green finance programs carry them through.

Research in the future ought to look at the long-term consequences of these associations, center of firms, machine of value output, and research of optimum approach under various circumstances in industries. Third, the question of the role of the emerging technologies (blockchain, AI) in the improvement of ESG report disclosure and efficiency in green financing can be regarded as a potentially objective of new research. To sum up, the study makes a contribution to the existing body of literature on sustainable finance by demonstrating a strong empirical evidence about the potential of green financing to generate value once integrated with transparent ESG disclosure. With the ever-growing concerns of people around the world regarding sustainability, the comprehension of such relations becomes paramount to every investor in the financial environment.

Conflicts of interest

The authors declare no conflicts of interest. Dr. Mitchell serves on the advisory board of the Green Finance Institute but received no compensation for this research. Prof. Chen has received speaking fees from sustainability consulting firms but declares no conflicts related to this research. Dr. Rodriguez declares no conflicts of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

1. A. Habib, J. Oláh, M. H. Khan, and S. Luboš, "Does Integration of ESG Disclosure and Green Financing Improve Firm Performance: Practical Applications of Stakeholders Theory," Heliyon, 2025.
2. A. Aulia, F. Febriyanti, and L. P. Umi, "Trend analysis of ESG disclosure on green finance performance in Indonesia, Malaysia & Singapore Exchanges," Jurnal Akuntansi: Kajian Ilmiah Akuntansi, 2023.
3. A. H. Abogazia, H. A. Hashim, and Z. Salleh, "The moderating effect of external financing on the relationship between integrated reporting and firm value in Egypt," Journal of Financial Reporting and Accounting, 2024.
4. M. Lusiana, M. H. C. Haat, and J. Saputra, "A review of green accounting, corporate social responsibility disclosure, financial performance and firm value literature," in Proc. Int. Conf. on Industrial Engineering and Operations Management (IEOM), 2021.
5. D. H. Gabr and M. A. ElBannan, "Is it worth it to go green? ESG disclosure, carbon emissions and firm financial performance in emerging markets," Review of Accounting and Finance, 2025.
6. Y. Abdi, X. Li, and X. Càmara-Turull, "Exploring the impact of sustainability (ESG) disclosure on firm value and financial performance (FP) in airline industry: the moderating role of size and age," Environment, Development and Sustainability, 2022.
7. A. S. L. Lindawati and T. G. Geraldine, "Analysis of Sustainability Performance, Green Accounting and ESG Disclosure on Firm Valuation," International Journal of Business and Applied Social Science, 2023.
8. Z. Feng and Z. Wu, "ESG disclosure, REIT debt financing and firm value," The Journal of Real Estate Finance and Economics, 2023.
9. T. Astuti and R. Amyulianthy, "Green accounting, financial performance toward firm value," Journal of Accounting and Finance, 2022.
10. Ș. C. Gherghina, "Corporate finance and environmental, social, and governance (ESG) practices," Journal of Risk and Financial Management, 2024.
11. N. Asni and D. Agustia, "The mediating role of financial performance in the relationship between green innovation and firm value: evidence from ASEAN countries," European Journal of Innovation Management, 2022.
12. Z. Liang and X. Yang, "The impact of green finance on the peer effect of corporate ESG information disclosure," Finance Research Letters, 2024.
13. Z. Chen and G. Xie, "ESG disclosure and financial performance: Moderating role of ESG investors," International Review of Financial Analysis, 2022.
14. G. Zhou, L. Liu, and S. Luo, "Sustainable development, ESG performance and company market value: Mediating effect of financial performance," Business Strategy and the Environment, 2022.
15. X. Chang, K. Fu, Y. Jin, and P. F. Liem, "Sustainable finance: ESG/CSR, firm value, and investment returns," Asia-Pacific Journal of Financial Studies, 2022.

16. H. Rohendi, I. Ghozali, and D. Ratmono, "Environmental, social, and governance (ESG) disclosure and firm value: the role of competitive advantage as a mediator," Cogent Business & Management, 2024.
17. M. R. Perdana, A. Sudiro, and K. Ratnawati, "Does sustainable finance work on banking sector in ASEAN?: The effect of sustainable finance and capital on firm value with institutional ownership as a mediator," Journal of Risk and Financial Management, 2023.
18. S. Qian, "The effect of ESG on enterprise value under the dual carbon goals: From the perspectives of financing constraints and green innovation," International Review of Economics & Finance, 2024.
19. A. Helfaya, A. Aboud, and E. Amin, "An examination of corporate environmental goals disclosure, sustainability performance and firm value–An Egyptian evidence," Journal of International Accounting, Auditing and Taxation, 2023.
20. S. Chouaibi, M. Rossi, D. Siggia, and J. Chouaibi, "The role of social and ethical practices in the relationship between environmental disclosure and financial performance: Evidence from ESG companies," Sustainability, 2021.
21. X. Yu and K. Xiao, "Does ESG performance affect firm value? Evidence from a new ESG-scoring approach for Chinese enterprises," Sustainability, 2022.
22. T. Angela and N. Sari, "The Effect of Environmental, Social, and Governance Disclosure on Firm Value," E3S Web of Conferences, 2023.
23. M. M. Naseer, M. A. Khan, T. Bagh, Y. Guo, and X. Zhu, "Firm climate change risk and financial flexibility: Drivers of ESG performance and firm value," Borsa Istanbul Review, 2024.
24. M. A. Khan, "ESG disclosure and firm performance: A bibliometric and meta-analysis," Research in International Business and Finance, 2022.
25. B. T. T. Loan, T. T. L. Anh, and T. Hoang, "ESG disclosure and financial performance: empirical study of Vietnamese commercial banks," Banks and Bank Systems, 2024.
26. W. Li, H. Hu, and Z. Hong, "Green finance policy, ESG rating, and cost of debt——Evidence from China," International Review of Financial Analysis, 2024.
27. N. G. P. Negara, G. Ishak, and R. E. A. Priambodo, "Impact of ESG disclosure score on firm value: empirical evidence from ESG listed company in Indonesia Stock Exchange," European Journal of Business and Management Research, 2024.
28. X. Sun, C. Zhou, and Z. Gan, "Green finance policy and ESG performance: Evidence from Chinese manufacturing firms," Sustainability, 2023.
29. Q. Ali, A. Salman, and S. Parveen, "Evaluating the effects of environmental management practices on environmental and financial performance of firms in Malaysia: the mediating role of ESG disclosure," Heliyon, 2022.
30. N. Malik and S. Kashiramka, "Impact of ESG disclosure on firm performance and cost of debt: Empirical evidence from India," Journal of Cleaner Production, 2024.
31. D. Kahneman, Thinking, Fast and Slow. New York: Farrar, Straus and Giroux, 2011.
32. M. Kesternich, C. Reif, and D. Rübbelke, "Recent trends in behavioral environmental economics," Environmental and Resource Economics, vol. 67, pp. 403-411, 2017.
33. J. M. Levine and F. Butera, "Intergroup conflict and social influence: Varieties of minority action," in Research Handbook on Social Influence, Edward Elgar Publishing, 2025, pp. 274-296.
34. R. B. Cialdini, Influence: The Psychology of Persuasion. New York: Harper Business, 2006.
35. S. T. Fiske and S. E. Taylor, Social Cognition: From Brains to Culture, 4th ed. London: Sage Publications, 2020.
36. K. Liang, Z. Cao, S. Tang, C. Hu, and M. Zhang, “Evaluating the Influence of Environmental, Social, and Governance (ESG) Performance on Green Technology Innovation: Based on Chinese A-Share Listed Companies,” Sustainability, vol. 17, no. 3, p. 1085, 2025.
37. J. O. Atanda and A. Öztürk, “Social Criteria of Sustainable Development in Relation to Green Building Assessment Tools,” Environment, Development and Sustainability, vol. 22, no. 1, pp. 61–87, 2020.
38. M. Barassi, Y. Karavias, and C. Zhu, “Threshold regression in heterogeneous panel data with interactive fixed effects,” arXiv preprint, arXiv:2308.04057, 2023.
39. J. Westerlund, “Testing for error correction in panel data,” Oxford Bulletin of Economics and Statistics, vol. 69, no. 6, pp. 709–748, 2007.
40. M. Wagner, “Residual-based cointegration and non-cointegration tests for cointegrating polynomial regressions,” Empirical Economics, vol. 65, no. 1, pp. 1–31, 2023.

41. C. Zhou, P. Cai, and Y. Wu, "ESG rating divergence and corporate green innovation: evidence from Chinese A-share listed companies," Environment, Development and Sustainability, pp. 1–29, 2025.
42. J. Akhtar, K. I. A. Khan, M. B. Tahir, F. Ullah, and A. Waheed, "Decoding Social Sustainability in Construction Projects: Analysis of Project Dynamics and Impact," Buildings, vol. 14, no. 3, p. 682, 2024.
43. L. Batrancea, M. K. Rathnaswamy, and I. Batrancea, "A panel data analysis on determinants of economic growth in seven non-BCBS Countries," Journal of the Knowledge Economy, vol. 13, no. 2, pp. 1651–1665, 2022.
44. L. M. Batrancea, M. A. Balcı, Ö. Akgüller, and L. Gaban, "What drives economic growth across European countries? A multimodal approach," Mathematics, vol. 10, no. 19, p. 3660, 2022.
45. L. M. Batrancea, F. de Jesús Bello Gómez, A. Nichita, and L. L. Dragolea, "Crunching numbers in the quest for spotting bribery acts: A cross-cultural rundown," in The Ethics of Bribery: Theoretical and Empirical Studies, Cham: Springer, 2023, pp. 329–343.