

GREEN INVESTMENT AND FIRM VALUE IN THE REAL ESTATE AND CONSTRUCTION SECTOR: THE ROLE OF AUDITOR INDUSTRY SPECIALIZATION IN VIETNAM

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ABSTRACT

The purpose of this research is to investigate the relationship between green investment and firm value, and most importantly, to analyze the moderating influence of audit firm industry specialization among listed real estate and construction companies in Vietnam, where there are significant concerns regarding information asymmetry and issues of “greenwashing.” Using a panel data set that covers 1,285 firm-year observations from 2015 to 2024, the research utilizes a Fixed Effects Model (FEM) with a variable interaction term and Driscoll-Kraay standard errors, as well as robustness checks (System GMM used to test for endogeneity, and quantile regression to detect heterogeneous effects). From the results, it is shown that the phenomenon of green investment, on its own, has no significant linear effect on firm value and is consistent with market doubt; moreover, it is an inverted U-shape relationship. More importantly, the main result shows that the positive effect of green investment on firm value only achieves statistical significance when the indirect validation of an industry-savvy auditor is “activated”; this effect is largest for undervalued firms. From this study, we find that in information-asymmetric system, the strength of green signals is conditionally attached to credibility of an external validation mechanism. These results add pioneering empirical evidence in Vietnam on the role of auditing quality in validating the worth of green signals. In a practical sense, this means that to create value, managers need to align green investment with a strategic selection of a specialist auditor to ensure that sustainability pledges become commercial entities on a balance sheet-wide footing, and to signal to decision-makers the need to increase transparency in the audit market.

Keywords: Real estate and construction, auditor industry specialist, green investment, firm value, greenwashing, Vietnam

1. INTRODUCTION

The global climate crisis has accelerated the adoption of sustainable economic practices, with ESG (Environmental, Social, and Governance) becoming key within corporate strategy and investments. Vietnamese cities and pollution, energy, water, and other environmental concerns pose an increasing threat to Vietnam and emerging economy cities for such reasons in this sense (Fan et al., 2019; Hoang et al., 2019). As well, the Government announced the net-zero emission objective of 2050 as indicated by COP26 and National Strategy for Green Growth for 2021–2030 (Decision 1658/QĐ-TTg) thus fostering the momentum of sustainability financing. None-

theless there is a regulatory paradox with which this still does not completely clear. In practice, green initiatives are incentivized, but a mechanism for disclosure and verification is underdeveloped. Example – Circular 96/2020/TT-BTC calls for reported environmental impacts of listed companies, but there are no structured standards and guidelines. The lack of a mandatory and guaranteed reporting regime generates a “credibility gap” in which green claims of corporate actors are susceptible to market skepticism. The real estate and construction industry represents a key sector contributing to the attainment of national sustainability objectives, as it encompasses almost 40% of global energy consumption, as well as approximately 30% of greenhouse gas emissions (Global, 2020). More and more firms are funding green-certified buildings, sustainable materials, energy efficiency and so on. Theoretically, such activities may increase firm value by lowering cost of production, contributing to reputation and quality, reducing legality risks, and attracting green capital (Qiu et al., 2016; Antipin et al., 2023; Sanchaniya & Geipele, 2024). Although developed markets record a positive link between green activities and firm value, for emerging economies such as Vietnam, the evidence is small and sporadic. This uncertainty may be enhanced by “greenwashing,” where companies overstate their environmental progress to boost their image (Delmas & Burbano, 2011; Jong et al., 2019; Kim et al., 2020). Therefore, the information asymmetry threatens investor confidence and muddles the line between true and symbolic green behavior. To bridge that gap, this study not only tests whether green investment adds value, but also if the impact of green investment relies on external evidence. We maintain that auditor sector specialization is an essential assurance mechanism. Professional auditors with high sector-specific knowledge are the ones with the most specific experience regarding the respective sector and it grants them a better assurance against the quality of the financial as well as non-financial disclosures (Balsam et al., 2003; Eugénio et al., 2022; Tuo et al., 2023). So, we suggest that this specialization moderates the relationship between green investment and firm value by giving credibility to green signals. Hence, the study concludes: (i) Does green investment enhance the firm value of listed real estate and construction companies in Vietnam? and (ii) Does specialization in audit firm industry strengthen this association? By examining whether external assurance can “translate” green investment from “questionable” signal to “valuable” signal, this study adds to the literature on ESG, governance, and market trust in emerging markets. This paper is structured as follows. Section 2 develops the theoretical background and hypotheses. Section 3 describes the research methodology. Section 4 presents the empirical findings, which are then discussed in Section 5. The final section, Section 6, provides the conclusion, which includes a summary of the findings, implications, limitations, and suggestions for future research.

2. THEORETICAL OVERVIEW AND HYPOTHESIS DEVELOPMENT

2. 1. THEORETICAL BACKGROUND

To study the connection between green investment, audit quality and firm value, this research relies on three complementary theoretical frameworks: Signaling Theory, Stakeholder Theory, and Agency Theory. According to Signaling Theory (Spence, 1973), through costly and observable actions, firms communicate their quality to investors under information asymmetry. To indicate the signal, it should involve enough economic cost to dissuade imitation by low-quality firms (Connelly et al., 2011; Tian et al., 2022). It means that in such a setting, green investment, e.g., through green-certified projects, incorporation of clean construction technologies, needs considerable financial and strategic investment in the long run. It is therefore a potent manifestation of managers believing that cash flows in future, risk management, sustainable development is being achieved and which results in higher average market price (Goh et al., 2019; Xie et al., 2022; Ong et al., 2022; Al Halbusi et al., 2023). Stakeholder Theory (Freeman, 1984) is also consistent with this perspective that firm performances are dependent on the performance

of various stakeholder groups at once - customers, employees, communities and regulatory bodies. Green investment meets such growing stakeholder calls for corporate responsibility, reputation, risks (regulatory and/or legal), community relations, and value creation on a longer time scale (Dhaliwal et al., 2011; Karagiannis et al., 2019; Maharani et al., 2024; Peng, 2024). However, a key limitation is indicated in Agency Theory (Jensen & Meckling, 1976) which proposes information imbalance and managers' conflicts with investors. In an environmental sense, this can express itself as "greenwashing," in which managers exaggerate or distort their environmental performance as part of an effort to present themselves favorably, but not to provide any real value (Delmas & Burbano, 2011; Wang, 2023). This undermines the credibility of green signals and causes investors to discount the green efforts of firms (Xiao, 2020). Thus, external monitoring is compulsory. Independent audits minimize information asymmetry and limit managerial opportunism. We assert that audit firm industry specialization is a superior means for monitoring quality. By contrast, industry-specialist auditors have more in-depth knowledge about the risks faced in sectors, business practices, and complicated accounting regulations prevalent in the field of real estate and construction, which can enhance their ability to identify misstatements and restrict earnings management (Balsam et al., 2003; Krishnan, 2003). Combining Signaling and Agency perspectives, we argue that auditor industry specialization serves as a validation mechanism to enhance green investment signals. If firms have industry experts auditing them, investors are more likely to see the information environment as transparent and trustworthy and be less skeptical of greenwashing and the degree to which market responses to green investment are positive.

2. 2. GREEN INVESTMENT AND FIRM VALUE

Green investment (GI) has been theorized to yield firm value via tangible and intangible factors. First, it enhances cost efficiency by optimizing energy, water, and materials usage to reduce long-term operating costs. Second, green property and project management enhances sustainable branding and draws environmentally friendly consumers and tenants to enhance sale or rental prices (Ambec & Lanoie, 2008). Third, adopting green standards early reduces regulatory and climate-related risks. Last of all, strong commitments on sustainability increase access to preferential finance, including green bonds and ESG-conscious funds, lowering the cost of capital. There is a ton of empirical support for a positive relationship between environmental performance and financial performance. According to large-scale reviews and meta-analyses of approximately 2,200 studies, nearly 90% finds a non-negative association between ESG criteria and firm performance in market-based (e.g., Tobin's Q) and accounting-based measures (Friede et al., 2015; Albertini, 2013; Alshehhi et al., 2018). Indeed, in the real estate sector, green-certified buildings always sell and rent at a premium compared to traditional properties, thus evidence the economic value of sustainable construction (Eichholtz et al., 2010; Mangiavardo et al., 2018; Massimo et al., 2022). In Vietnam's context, which is characterized by rapid urbanization and environmental constraints, these effects are likely to be magnified. The national green growth policy and the growing interest of investors and popular among the general population contribute to a conducive policy and market environment. For listed real estate and construction companies, therefore, green investment is not only a matter of regulatory compliance but a competitive advantage and a source of long-term strategic vision, as well as governance quality. Accordingly, we posit:

H₁: Green investment contributes to the economic value of listed real estate and construction companies in Vietnam.

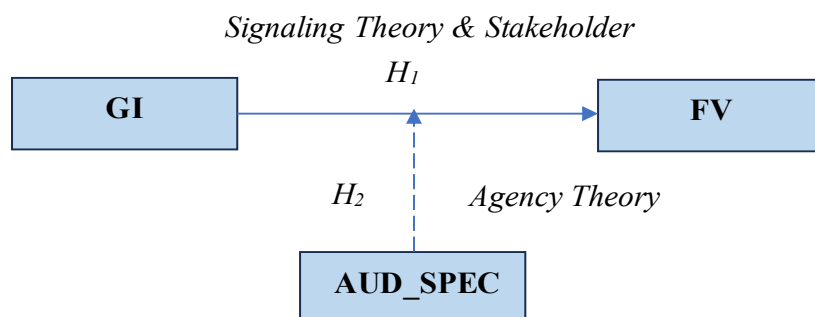
But market valuation of green signals is contingent on their credibility. We argue that industry specialization of audit firm is a central validation mechanism. Audit sector expertise of indus-

try-specialist auditors indicates their extensive information on sector-specific risks, operations and accounting complexities that leads to better audit quality, enhanced disclosures and performance assurance (Balsam et al., 2003; Krishnan, 2003). This competence also spills into non-financial information, bringing to bear a “credibility spillover,” which makes green disclosures more credible and reduces the risk of greenwashing. Previous studies have demonstrated that greater audit quality enhances the reliability and market significance of CSR and sustainability disclosures (Simnett et al., 2009; Rezaee, 2016; Martinez-Ferrero & Garcia-Sanchez, 2017; Mohammadi et al., 2020; Khoiriyah et al., 2022; Wang & Wang, 2023; Chen et al., 2022). Since audit quality acts as a known assurance framework, it acts to convert social and environmental efforts into economic value (Musallam, 2018; Pasko et al., 2024). With the changing ESG regulatory climate in Vietnam and its high-information risk context, the role of the industry-specialist auditors comes to the fore. And as external validators, they help investors distinguish valid initiatives from the most symbolic claims, instilling further confidence in green signals and making it easier for the market to price their worth in full. Accordingly, we propose:

H₂: Industry specialization of audit firms has a significant positive moderating effect on the relationship between green investment and the firm value of listed real estate and construction companies in Vietnam.

From these hypotheses Figure 1 presents the conceptual framework of the study, which shows the direct influence of green investment on firm value (H1) and the moderating effect of auditor industry specialization (H2). Signaling and Stakeholder theories explain the value creation channel and Agency Theory the validation and mitigation of information risk—making the role of industry-specialist auditor.

Figure 1. Conceptual Framework



Source: Authors' proposal, 2025

3. RESEARCH METHODOLOGY

3. 1. SAMPLE SELECTION AND DATA COLLECTION

The target population of the study comprises all listed companies in the real estate and construction sectors on the Ho Chi Minh Stock Exchange (HOSE) and the Hanoi Stock Exchange (HNX). The study period is set for 10 years, from 2015 to 2024. This timeframe is strategically significant as it begins just after the post-financial crisis economic recovery period and covers important milestones: (i) the advent of the Paris Agreement on climate change (2015), which created a global wave of awareness, and (ii) Vietnam's commitment to achieve net-zero emissions by 2050 at COP26 in 2021, which strongly promoted domestic ESG activities. This period allows us to capture changes in firms' green investment behavior and market reactions over time.

Data were collected from multiple reliable sources to ensure comprehensiveness and accuracy. Financial data, stock prices, and governance information were extracted from the FiinPro da-

tabase, a leading professional and reputable financial data source in Vietnam. Data on green investment and audit firms were manually collected through a content analysis of the audited annual reports and sustainable development reports of each company for each year.

The final sample selection process was conducted systematically. The initial sample consisted of 271 companies in the real estate and construction industries listed on HOSE and HNX as of the end of 2024. We then applied the following exclusion criteria: (i) Companies lacking the necessary financial data to calculate the variables in the research model for at least three consecutive years; (ii) Companies with negative EBITDA, as the EV/EBITDA ratio loses its economic meaning in such cases.

After the screening process, the final sample comprises 172 companies, forming an unbalanced panel data with 1,285 firm-year observations. To mitigate the influence of outliers and potential biases in the estimates, all continuous variables in the model were treated using winsorization at the 1st and 99th percentiles.

3. 2. VARIABLE MEASUREMENT

Dependent Variable: Firm Value (FV)

The dependent variable (Firm Value) is calculated as the proportion of Enterprise Value to Earnings Before Interest, Taxes, Depreciation and Amortization (EV/EBITDA). In theory, EV/EBITDA is perceived as being better than book-value-based ratios (such as ROA, ROE) or stock-price-based ratios (such as P/E), as EV/EBITDA reflects the value of the entire firm (both its total equity value and the total amount of debt) and is less affected by the capital structure and the tax policy. Methodologically, using a forward-looking and market-based proxy EV/EBITDA is congruent with Signaling Theory, since it serves to demonstrate the investors' expectations on the potential cash flow coming out of the firm. This scale has been extensively used in international studies on firm value (Kim & Ouimet, 2014; Coles et al., 2008).

Finally, in Vietnam, EV/EBITDA is one of the standard indicators in M&A; analysts and investors value it as an indicator of the core operational value of a company substantially. FV is defined as the ratio of EV to EBITDA. EV is the value of market capitalization and total debt less cash & cash equivalents. On one hand, EBITDA is determined by computing EBIT by adding depreciation and amortization expenses to earnings before interest and taxes.

Independent Variable: Green Investment (GI)

Given the lack of a mandatory and uniform green disclosure standard available in Vietnam, we create a Green Disclosure Index (GDI) to evaluate the degree of commitment and green investment activities of companies. This index is constructed by content analysis of annual and sustainability reports. The construction of this index is a necessary approach in the context of Vietnam, a country that does not currently have a standardized and publicly available ESG (Environmental, Social, and Governance) rating dataset for listed companies like more developed markets currently do. Based on several other studies (e.g., Clarkson et al., 2008) and specific industry details, we prepared a 10-item list of items specifically related to green investment and activities in the real estate and construction sector.

The coding process was as follows: a dummy variable was assigned to each item, taking a value of 1 if the company disclosed information on that item (whether qualitative or quantitative), and 0 otherwise. The GDI for company i in year t is calculated as the sum of the scores of the 10 items:

$$GDI_{it} = \sum_{k=1}^{10} Item_{kit}$$

We have Item kit as the dummy variable for the k-th disclosure item of company i in year t. The ten items used for coding are: (1) Disclosure of projects with green building certification (LEED, LOTUS, etc.); (2) Disclosure of the use of sustainable building materials; (3) Disclosure of energy efficiency initiatives; (4) Disclosure of water-saving and recycling initiatives; (5) Disclosure of construction waste management; (6) Disclosure of R&D for green technology/materials; (7) Disclosure of access to green finance; (8) Disclosure of environmental management certification (ISO 14001); (9) Disclosure of quantitative environmental targets; and (10) Disclosure of an overall strategy for climate change. A random sample of 10% of the reports was coded by two independent researchers to ensure objectivity and consistency of the coding process. Inter-coder reliability was evaluated by measuring Cohen's Kappa coefficient where the level was 0.81, indicating high agreement.

Moderating Variable: Auditor Industry Specialization (AUD_SPEC)

Following studies in the auditing field (Balsam et al., 2003; Krishnan, 2003), we measure the Auditor Industry Specialization (AUD_SPEC) variable as a dummy variable based on market share. Specifically, the market share of each audit firm in the real estate and construction industry is calculated annually, based on the ratio of the total assets of their client firms to the total assets of the entire industry. The audit firm with the largest market share each year is identified as the industry specialist for that year. Accordingly, the AUD_SPEC variable takes a value of 1 if the firm is audited by this industry specialist, and 0 otherwise.

Table 1. Definition and Measurement of Variables

Variable Type	Symbol	Variable Name	Definition and Measurement	Source(s)
Dependent Variable	FV	Firm Value	The ratio of Enterprise Value to EBITDA (EV/EBITDA), where EV = Market Capitalization + Total Debt - Cash & Cash Equivalents.	Kim & Ouimet (2014)
Independent Variable	GDI	Green Disclosure Index	Total score (from 0-10) based on 10 green disclosure items in annual/sustainability reports.	Botosan (1997); Clarkson et al. (2008)
Moderating Variable	AUD_SPEC	Auditor Industry Specialization	Dummy variable, equals 1 if audited by the audit firm with the largest industry-year market share, and 0 otherwise.	Balsam et al. (2003); Krishnan (2003)
Control Variables	SIZE	Firm Size	Natural logarithm of total assets.	Dang et al. (2018)
	LEV	Financial Leverage	Total debt divided by total assets.	Fama & French (1992)
	AGE	Firm Age	Natural logarithm of the number of years since listing.	Pástor & Veronesi (2003)
	BIG4	Big 4 Auditor	Dummy variable, equals 1 if audited by one of the Big 4 firms (PwC, Deloitte, E&Y, KPMG), and 0 otherwise.	DeAngelo (1981)
	FWB	Female Board Representation	The percentage of female directors on the Board of Directors.	Adams & Ferreira (2009)

Source: Author's compilation

3. 3. RESEARCH MODEL

To test hypotheses H1 and H2, we construct a panel data regression model with an interaction term, which allows for the evaluation of both the direct impact of green investment and the moderating role of audit firm industry specialization. The model is specified as follows:

$$FV_{it} = \beta_0 + \beta_1 GDI_{it} + \beta_2 AUD_SPEC_{it} + \beta_3 (GDI_{it} * AUD_SPEC_{it}) + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 AGE_{it} + \beta_7 BIG4_{it} + \beta_8 FWB_{it} + \eta_t + \mu_i + \varepsilon_{it}$$

Where: i and t denote the firm and year, respectively; FV is firm value; GDI is the green disclosure index; AUD_SPEC is the dummy variable for the industry-specialist auditor; $GDI \times AUD_SPEC$ is the interaction term to test the moderating role; $Control$ is the vector of control variables; η_t are year dummies to control for time-varying macroeconomic shocks; μ_i are firm-fixed effects; ε_{it} is the random error term.

3. 4. ANALYTICAL METHODS AND ROBUSTNESS CHECKS

First, we conduct descriptive statistics and correlation matrix analysis. The Variance Inflation Factor (VIF) is computed to check for potential multicollinearity among the independent variables. Then, we apply panel data regression. A Hausman test will be conducted to select between the Fixed Effects Model (FEM) and the Random Effects Model (REM). We believe that the most appropriate model is FEM as it provides the ability to adjust for unobserved and time-invariant characteristics of each firm (e.g., corporate culture, intrinsic competitive advantages), thereby minimizing the risk of bias introduced by omitted variables. One of the problems regarding panel data analysis at the industry level may include cross-sectional dependence, where macroeconomic shocks (i.e. COVID-19) affect all the firms at the same time. To really deal with this in conjunction with heteroskedasticity and autocorrelation, we will calibrate the model with Driscoll - Kraay (1998) standard errors.

This approach affords robust standard errors even for very general types of cross-sectional dependence and enables more accurate statistical inferences. Concurrently, to secure high robustness of the findings, a set of robustness tests will be performed. The data is processed with Stata 17.0 software.

4. EMPIRICAL RESULTS

4. 1. DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Table 2 below provides descriptive statistics for all variables in the model, including the mean, median, standard deviation, minimum, and maximum values. These parameters offer an initial overview of the characteristics of the research sample, which consists of 1,285 firm-year observations.

Table 2. Descriptive statistics of research variables

Variable	Symbol	N	Mean	Median	Std. Dev.	Min	Max
Firm Value	FV	1,285	9.541	8.216	5.882	0.890	35.720
Green Disclosure Index	GDI	1,285	2.350	2.000	1.864	0.000	9.000
Auditor Industry Specialization	AUD_SPEC	1,285	0.221	0.000	0.415	0.000	1.000
Firm Size	SIZE	1,285	28.103	28.015	1.650	25.330	31.442
Financial Leverage	LEV	1,285	0.583	0.591	0.198	0.052	0.913
Firm Age	AGE	1,285	2.408	2.398	0.617	0.693	3.258
Big 4 Auditor	BIG4	1,285	0.560	1.000	0.497	0.000	1.000
Female Board Representation	FWB	1,285	0.155	0.143	0.101	0.000	0.500

Source: Author's calculation, 2025.

After examining the individual characteristics of each variable, we conduct a Pearson correlation matrix analysis to explore the relationships between them. This analysis not only provides initial indications for the research hypotheses but also helps to check for multicollinearity through Variance Inflation Factors (VIF). The results are detailed in Table 3.

Table 3. Pearson Correlation Matrix and Variance Inflation Factor (VIF)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) FV	(1.45)							
(2) GDI	0.145***	(1.81)						
(3) AUD_SPEC	0.081**	0.112***	(1.23)					
(4) SIZE	0.092**	0.354***	0.167***	(2.84)				
(5) LEV	-0.211***	0.045	0.031	0.288***	(1.52)			
(6) AGE	0.063*	0.129***	0.059*	0.195***	0.024	(1.19)		
(7) BIG4	0.152***	0.298***	0.201***	0.453***	0.117***	0.140***	(2.56)	
(8) FWB	0.072**	0.105***	0.048	0.133***	-0.019	0.035	0.099**	(1.15)

*Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses on the main diagonal are the Variance Inflation Factors (VIF).

Source: Author's calculation, 2025.

From Table 2, the main characteristics of the sample can be observed. Notably, the green disclosure index (GDI) has a mean value of only 2.350 on a 10-point scale, indicating that the level of green investment by firms in the sample is still in its early stages, affirming the timeliness of the research. Regarding the audit environment, 22.1% of observations are audited by an industry specialist (AUD_SPEC) and 56% by a Big 4 firm (BIG4), which is consistent with the reality of the Vietnamese market.

Meanwhile, Table 3 provides preliminary evidence of the relationships between variables. The results show that the correlation coefficient between green investment (GDI) and firm value (FV) is positive and statistically significant ($r = 0.145$, $p < 0.01$), which is an initial sign supporting hypothesis H_1 . The VIF coefficients on the main diagonal are all less than 3, significantly lower than the critical threshold of 10 and even the stricter threshold of 5 (O'Brien, 2007; Rogerson, 2001), indicating that multicollinearity is not a significant concern in the model.

4. 2. MAIN REGRESSION RESULTS

Before analyzing the results, we performed model selection tests. The F-test result is statistically significant at the 1% level, indicating that the FEM model is more appropriate than Pooled OLS. More importantly, the Hausman test result is also highly statistically significant ($p\text{-value} < 0.01$), indicating that the FEM is a more suitable and efficient choice than the REM. Therefore, all main regression results presented below use the FEM with Driscoll-Kraay robust standard errors to address issues of heteroskedasticity, autocorrelation, and cross-sectional dependence.

Table 4 presents the main regression results for testing hypotheses H_1 and H_2 . Column (1) includes only the control variables. Column (2) introduces the independent variable GDI to test hypothesis H_1 . Column (3) is the full model, including the moderating variable AUD_SPEC and the interaction term GDI * AUD_SPEC to test hypothesis H_2 .

Table 4. The Impact of Green Investment on Firm Value: The Moderating Role of Auditor Industry Specialization

Variable	(1)	(2)	(3)
Independent and moderating variables			
GDI		0.115 (0.140)	0.089 (0.152)
AUD_SPEC			0.550 (0.480)
GDI * AUD_SPEC			0.452*** (0.165)
Control Variables			
SIZE	0.481*** (0.155)	0.455*** (0.160)	0.432*** (0.158)
LEV	-3.872*** (0.850)	-3.915*** (0.844)	-3.980*** (0.835)
AGE	0.311* (0.182)	0.298 (0.185)	0.285 (0.181)
BIG4	1.054*** (0.380)	0.998** (0.391)	0.921** (0.395)
FWB	1.886** (0.795)	1.850** (0.791)	1.812** (0.782)
Constant	-4.215* (2.250)	-3.992* (2.281)	-3.855 (2.310)
Test Statistics			
R-squared (within)	0.125	0.138	0.152
Observations	1,285	1,285	1,285
Number of groups (firms)	172	172	172
F-statistic	15.42***	16.11***	17.05***
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Hausman Test (Chi2)			45.21***

*Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Driscoll-Kraay standard errors are reported in parentheses. The Fixed Effects Model (FEM) is selected based on a statistically significant Hausman test ($p < 0.01$).

Source: Author's calculation, 2025.

Hypothesis H₁ Test: Hypothesis H₁ posits that green investment has a positive impact on firm value. The test results are presented in Column (2) of Table 4. The coefficient of the GDI variable is positive ($\beta_1 = 0.115$) but not statistically significant ($p > 0.10$). This suggests that, when considered independently, enhancing green disclosure and investment does not seem to create any significant increase in firm value in the eyes of investors. This result does not support hypothesis H1; in other words, there is no evidence of a linear relationship between green investment and the value of real estate and construction firms. It suggests a market context of skepticism, where green signals by themselves are not persuasive enough and may be perceived as “noise” or cosmetic activities, consistent with concerns about “greenwashing” in an emerging market like Vietnam.

Hypothesis H₂ Test: Hypothesis H₂ predicts that audit firm industry specialization will positively moderate the relationship between green investment and firm value. The results in Column (3) provide strong evidence for this hypothesis. The coefficient of the interaction term GDI * AUD_SPEC is positive ($\beta_3 = 0.452$) and highly statistically significant at the 1% level. This is the core result of the study, revealing a profound “conditional effect” scenario:

(i) For firms not audited by an industry specialist (AUD_SPEC = 0), the marginal effect of green investment (GDI) on firm value (FV) is only β_1 , corresponding to a coefficient of 0.089,

which is not statistically significant. This confirms that the market does not recognize or positively value green signals when they are not accompanied by a credible validation mechanism.

(ii) However, for firms audited by an industry specialist ($AUD_SPEC = 1$), the total effect of green investment on firm value is $(\beta_1 + \beta_3) = 0.089 + 0.452 = 0.541$. This combined effect is not only positive but also highly statistically significant.

The research reveals the industry-specialist auditor's role is not merely for improving an established relationship, but more crucially, it plays a role in "activating" the value of green investment. In a world of information asymmetry, where there is significant risk of "greenwashing," the financial significance of a green investment signal will only be realized if and only if it is indirectly validated by the superior reputation and monitoring capabilities of an industry-specialist auditor.

4. 3. ROBUSTNESS CHECKS

To evaluate the robustness of the key findings, we perform several further tests (summarized in Tables 5 and 6).

To address possible endogeneity induced by reverse causality, omitted variables (i.e., unobserved managerial ability), and measurement error, the System Generalized Method of Moments (System GMM) estimator, which was introduced by Arellano & Bover (1995) and Blundell & Bond (1998), is used.

- The first differencing removes time-invariant firm-specific effects and controls for dynamic endogeneity by using internal instruments: lagged levels for the differenced equation and lagged differences for the level equation. This system of equations improves instrument relevance and alleviates the weak instrument issue, providing consistent and unbiased estimates. Table 5 reports column (1) of System GMM results. Model integrity is confirmed with specification tests. The Arellano-Bond AR (2) test gives a p-value of 0.254, corresponding to no second-order serial correlation and Hansen test of overidentifying restrictions yields a p-value of 0.188, supporting instrument validity. As expected, considering the baseline model, the coefficient on GDI (0.138) remains statistically insignificant, whereas the interaction term $GDI \times AUD_SPEC$ (0.505) is shown to be positive and significant at the 5% level. In the end, this shows that the moderating effect of auditor specialization is not biased by endogeneity.
- Second, we check for sensitivity by substituting the Enterprise Value-to-Sales (EV/Sales) ratio for EV/EBITDA, which is less sensitive to depreciation policies and applies to negative EBITDA. GDI (0.031) is in the column as Table 5 (Column (2)), and however, $GDI \times AUD_SPEC$ (0.148) remains positive and significant at the 5% level meaning that results are not determined by a valuation factor.
- Finally, we use an accounting-based performance metric, Return on Assets (ROA), to evaluate whether the impact goes further than market-based assessment to operational capacity. Column (3) in Table 5 shows that GDI is still not significant, but $GDI \times AUD_SPEC$ (0.015) again occurs to be positively significant at the 5% level. This coherence of market- and accounting-dependent variables supports the finding that auditor industry specialization constitutes a strong tool to substantiate the performance consequences of green investment.

Table 5. Robustness Checks Results

Variable	(1)	(2)	(3)
Model	System GMM	FEM	FEM
Dependent Variable	FV (EV/EBITDA)	FV (EV/Sales)	ROA
L.Dependent Var	0.215***		
	(0.071)		
GDI	0.138	0.031	-0.002
	(0.185)	(0.051)	(0.006)
AUD_SPEC	0.610	0.185	0.018
	(0.550)	(0.162)	(0.015)
GDI * AUD_SPEC	0.505**	0.148**	0.015**
	(0.224)	(0.066)	(0.007)
Control Variables	Included	Included	Included
Constant	-2.881	-1.055*	-0.140
	(1.995)	(0.614)	(0.087)
Test Statistics			
Observations	1,113	1,285	1,285
Number of groups (firms)	172	172	172
Number of instruments	88		
AR(1) test (p-value)	0.045		
AR(2) test (p-value)	0.254		
Hansen test (p-value)	0.188		
R-squared (within)		0.118	0.112
F-statistic		14.95***	14.51***

*Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are reported in parentheses. Both models include the full set of control variables (SIZE, LEV, AGE, BIG4, FWB) and year dummies, which are not reported for brevity. Column (1) presents the results from the two-step System GMM model to control for endogeneity; the number of observations is lower due to the use of lagged variables as instruments. Column (2) presents the results from the Fixed Effects Model (FEM) using EV/Sales as an alternative dependent variable. Column (3) uses a FEM model with an accounting-based proxy for Return on Assets (ROA).

Source: Author's calculation, 2025.

The primary regression findings reject H1 with no statistically significant direct association between green investment and firm value. This lack indicates a more complex non-linear relationship, consistent with diminishing marginal returns theory. Thus, the gains derived initially from green investment will decrease and may be negative at the point when the marginal cost exceeds the marginal benefit. This gives us the **inverted U-shaped relationship** hypothesis. We then apply the squared term of the green investment index (GDI^2) to this assumption in the overall regression equation. We show that the positive and statistically significant coefficient of GDI is at the 5% level ($\beta = 0.385$) and the negative and statistically significant coefficient of GDI^2 occurs at the 5% level ($\beta = -0.054$) (Table 6). These findings provide some evidence in favor of the existence of an inverted U-shaped relationship between green investment and firm value.

Based on the estimated coefficients, we calculate the turning point of the curve, where the marginal benefit of green investment begins to turn negative, to be:

$$GDI^* = -\beta_1 / (2 * \beta_2) = -0.385 / (2 * -0.054) \approx 3.56$$

Compared to the average GDI value in the sample of 2.350, we find that most of the real estate and construction firms in Vietnam are still operating on the upward-sloping portion of the curve, where increasing green investment still benefits firm value. Notably, the coefficient of the interaction term $GDI * AUD_SPEC$ (0.430) remains positive and highly statistically significant, indicating that the presence of an industry-specialist auditor continues to play an “activating” and amplifying role for the benefits of these green investments across the entire curve.

Table 6. Testing for a Non-linear Relationship

Variable	(1)
Model	FEM (Non-linear)
Dependent Variable	FV (EV/EBITDA)
GDI	0.385**
	(0.171)
GDI ²	-0.054**
	(0.025)
AUD_SPEC	0.515
	(0.475)
GDI * AUD_SPEC	0.430***
	(0.168)
Control Variables	Included
Constant	-3.790
	(2.305)
Test Statistics	
Observations	1,285
Number of groups (firms)	172
R-squared (within)	0.161
F-statistic	16.88***
Year fixed effects	Yes
Firm fixed effects	Yes

*Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Driscoll-Kraay robust standard errors are reported in parentheses. The model is estimated using the Fixed Effects Model (FEM). The model includes the full set of control variables (SIZE, LEV, AGE, BIG4, FWB) and year dummies, which are not reported for brevity.

Source: Author’s calculation, 2025.

4. 4. HETEROGENEOUS EFFECTS ACROSS FIRM VALUE QUANTILES

The FEM assumes a homogeneous effect; however, we argue that the value of a green signal and auditor validation depends on the firm’s position. In the low-value quantiles; those areas where market skepticism is highest; endorsement from a reputable auditor is an important mechanism for building trust. In practice, on the other hand, firms ranked high on the market are already very trusted with their reputation, and the impact from an auditor-validated green signal is essentially negligible.

To investigate this, we adopt a Quantile Regression for Panel Data model; it can estimate the magnitude of the influence of different variables on various quantiles of the dependent variable (FV). We choose the 25th, 50th (median), 75th, and 90th quantiles for impact analysis on this distribution. We present these results (summarized in Table 7, plotted in Figure 2).

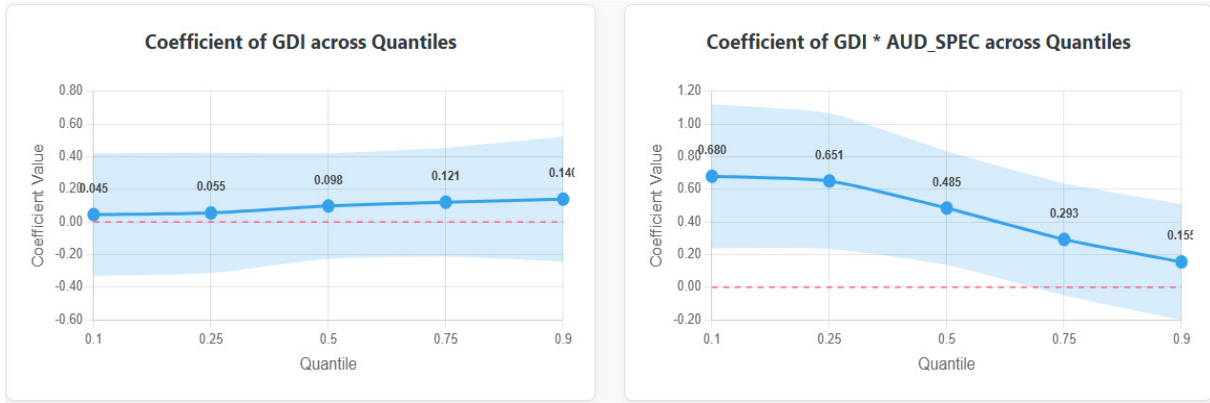
Table 7. Panel Quantile Regression Results

Variable	FEM (Mean)	Q25	Q50	Q75	Q90
Dependent Variable	FV (EV/EBITDA)	FV (EV/EBITDA)	FV (EV/EBITDA)	FV (EV/EBITDA)	FV (EV/EBITDA)
GDI	0.089	0.055	0.098	0.121	0.140
	(0.152)	(0.188)	(0.165)	(0.170)	(0.195)
GDI * AUD_SPEC	0.452***	0.651***	0.485***	0.293*	0.155
	(0.165)	(0.212)	(0.178)	(0.175)	(0.181)
Observations	1,285	1,285	1,285	1,285	1,285
Pseudo R ²		0.085	0.151	0.138	0.122

*Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Robust standard errors are reported in parentheses. All quantile regression models include the full set of control variables (SIZE, LEV, AGE, BIG4, FWB) and firm-fixed effects, which are not reported for brevity.

Source: Author's calculation, 2025.

Figure 2. Percentile Regression Coefficient Plot of GDI and GDI * AUD_SPEC



Source: Authors' calculation from Stata software

The results from Table 7 and Figure 2 reveal interesting findings.

First, the coefficient of GDI (left plot), as for most of the regression results, fluctuates around zero and is not significant in most of the quantiles. This again provides confirmation that, across the length of the value-creation curve of firms, the green investment signal itself is not dominant enough to produce value independently. However, the model yields a significant coefficient for the interaction term GDI * AUD_SPEC (right chart). The moderating effect of the industry-specialist auditor has a clear downward trend with firm value:

At the low quantile (Q25): the interaction coefficient reaches its maximum value (0.651), which is significant at the 1% level. This means that for undervalued firms by the market, the specialist auditor as “value-activator” acts at its highest value. The validation of them is the determining factor to convert a potentially suspect green signal into a significantly preferred investment by investors.

At the median quantile (Q50): this is still highly significant as evidenced by the value with a significant and very strong effect at (Q50) (0.485, $p < 0.01$) near the average outcome of the FEM model revealing that this role is still very important for a “typical” firm in the industry.

At the high quantiles (Q75 and Q90): the effect of the interaction term is greatly reduced. The coefficient decreases to 0.293 at Q75 and is found to be significant only at the 10% level. This coefficient (0.155) is found to be statistically insignificant by Q90.

5. DISCUSSION OF RESEARCH RESULTS

5. 1. THE LATENT VALUE OF GREEN SIGNALS AND MARKET SKEPTICISM

The first core result of the study is the rejection of hypothesis H1, which shows no linear, direct, and statistically significant relationship between green investment (GDI) and firm value (FV). This finding challenges the simple assumption of Signaling Theory and Stakeholder Theory that all positive actions will be automatically recognized by the market. Instead, it provides empirical evidence for the warnings from Agency Theory. Specifically, in the unique information-asymmetric environment of Vietnam's real estate and construction industry, investor skepticism about the risk of "greenwashing" has become a tangible barrier, diminishing or neutralizing the inherent value of green signals.

Our results contrast with many studies in developed markets, where a positive link between environmental activities and financial performance has been firmly established (Friede et al., 2015; Eichholtz et al., 2010; Mangialardo et al., 2018; Massimo et al., 2022). However, it strongly aligns with studies that emphasize information risk and lack of transparency in emerging markets (Xiao, 2020). This difference is attributed to the specific context of Vietnam's real estate and construction industry, which, despite its large growth potential, still has transparency issues. Terms like "green project" or "eco-construction" are sometimes overused as marketing tools rather than genuine strategic commitments. Investors, with experience and caution, tend to view standalone green claims as information noise until they are validated. Therefore, the market's failure to positively reflect green signals in firm valuation does not imply indifference to sustainability. Instead, it indicates that investors demand stronger validation for such commitments.

5. 2. THE "VALUE-ACTIVATING" ROLE OF INDUSTRY-SPECIALIST AUDITORS

Our study's main contribution is the robust evidence for H2, indicating that audit firm industry specialization (AUD_SPEC) does have a positive moderating effect on the association between green investment and firm value.

The positive, highly significant coefficient of the interaction term for $GDI \times AUD_SPEC$ shows that green investment is perceived to be positively valued by the market mostly when indirectly certified by industry-specialist auditors. This discovery gives empirical support to the synthesis of Signaling Theory and Agency Theory, stating that specialist auditors work as a robust external monitoring mechanism, reducing agency risk and greenwashing and increasing the credibility of green signals (Wang & Wang, 2023; Martinez-Ferrero & Garcia-Sanchez, 2017).

Quantile regression statistics also indicate heterogeneity in this moderating effect. The decreasing interaction coefficient from the lowest (Q25) to the highest (Q90) quantiles suggests that the role of expertise of auditor could differ across the firm value distribution. For low-value companies (Q25), characterized by the most information asymmetry and market skepticism, auditor specialization exerts the greatest influence and constitutes an essential route for achieving greater investor confidence and a means for distinguishing the firms from their competitors. On the other hand, for high-value firms (Q90), the impact is no longer significant, as their established reputation already serves as a robust assurance mechanism, and so it can lower the marginal informational benefit of auditor validation.

The results emphasize a structural disparity in the Vietnamese real estate and construction industry; external assurance systems are most valuable for firms when trying to build their reputation and market confidence, not for their own existing industry leaders.

5. 3. THE NON-LINEAR RELATIONSHIP AND THE “OPTIMAL GREEN INVESTMENT” THRESHOLD

Another primary finding is that the green investment to firm value relationship is inverted U-shape, where the turning point is reached at $GDI \approx 3.56$. This non-linear relationship explains the previous linear regression results: by averaging the positive effects at lower investment levels with diminishing or negative effects at higher levels, the linear model provides an insignificant net coefficient. Therefore, the evidence is not that green investments don't have value, but that the value of green investments is a function of their investment level and is consistent with the principle of diminishing marginal returns.

On the upward-sloping side of the curve ($GDI < 3.56$), the initial green investments (initial green certification or the introduction of basic energy-saving technology) derive large value (cost efficiency, reputation, signaling, etc.) and the market favors cost-effectiveness. Beyond the turning point ($GDI > 3.56$), further investments become increasingly complex and less cost-efficient, with diminishing returns and potentially being perceived as inefficient resource allocation, particularly in a capital-intensive category such as real estate.

Importantly, the mean GDI for the sample (2.350) is on the upward-sloping part of the curve, indicating that most Vietnamese real estate and construction firms still have scope to enhance value through green investment. Simultaneously, this finding emphasizes the need for a directed and deliberate approach to sustainability investments rather than scattered and unfocused efforts.

5. 4. CONTRIBUTIONS OF THE STUDY

Our study makes multi-layered and significant contributions. Theoretically, it not only applies but also innovatively integrates Signaling Theory and Agency Theory, clarifying the mechanism by which an external governance mechanism (audit quality) can validate and “activate” the value of a corporate signal (green investment) in an information-asymmetric environment. Empirically, this is pioneering research in Vietnam that provides quantitative evidence of the moderating role of industry-specialist auditors on the value of green investment. More importantly, by identifying the inverted U-shaped relationship and heterogeneous effects, the study has illuminated the multifaceted and realistic nature of this relationship, thereby explaining why green signals can be met with market skepticism and when validation becomes most critical.

6. CONCLUSION AND IMPLICATIONS

6. 1. CONCLUSION

This study puts forward a key insight for emerging markets: the economic value of green investment is contingent, not intrinsic. In Vietnam's real estate and construction market, green signals do not automatically lead to increased firm value; rather, value is “unlocked” through credible validation by industry-specialist auditors. Two extra nuances amplify this determination. First, the relation follows an inverted U-shape, showing an optimal level of green investment beyond which the marginal return diminishes. Second, the auditor's validation effect is heterogeneous, exerting the strongest influence on relatively low-valued firms facing greater market skepticism and becoming negligible for established industry leaders. In turn, these results indicate that the green investment - firm value nexus is neither linear nor automatic. In doing so, firms need to design a strategic framework integrating strategically calibrated investments with credible external assurance to translate sustainability initiatives into profitability, laying the groundwork for the potential policy and managerial implications.

6. 2. RESEARCH IMPLICATIONS

Considering the key findings, this study presents some practical implications for the stakeholders, who need to be able to translate sustainability efforts into the economic profit-generating activity.

For agents of publicly listed real estate and construction companies. Green investment and the choice of auditors should be considered as strategic value-creation measures, rather than compliance issues. The managers should develop an investment strategy focusing on green, specifically with an inverted U-shaped relationship focus on value-adding green investments and allocate funds to the high-impact and cost-effective initiatives that lie on the upward-sloping portion of the value curve. For instance, instead of trying to seek expensive international certifications that can reach above the maximum investment that is considered optimal, they should go for some local green certifications and realistic measures for energy efficiency.

The audit selection should be taken as strategic for financing and communication: a “who is in the room”. For companies looking to raise green capital (i.e., through green bonds), involvement of an industry-specialist auditor can elevate the credibility of a firm’s sustainability assertion, mitigate the risk from information, improve the potential reduction of the cost of capital, a key aspect of the method used, especially among undervalued or less established companies. For audit firms. Results reveal that there is potential for moving industry specialization away from a market value-for-money assurance function and towards a value-added service offering. Such role of industry-specific auditors can be highlighted in building credibility and financial performance of clients’ ESG and green investment strategies and further build its profile as value partner.

For investors and financial analysts. The results may serve as a useful addition to the existing valuation and due diligence systems. Green claims are evaluated alongside those of the auditor’s industry expertise because this aspect enhances the credibility of the sustainability disclosure. That would also help differentiate between serious green commitments and potential greenwashing. For policymakers. There’s a two-pronged effort needed to encourage green investment. (1) Regulators need to strengthen the validation ecosystem by increasing transparency and quality in the audit market, such as creating incentives to specialize in the performance audit field and to publish the criteria for auditing quality indicators. (2) The introduction and enforcement of the harmonized, institutionalized mandatory green disclosure frameworks can reduce information noise, level markets, and make environmental sustainability work in the market relatively more effectively at price.

6. 3. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

While this study meets its aims, we recognize some limitations that can pave the way for further research. First, the evaluation of green investment is based upon a disclosure index (GDI), rather than on a standard ESG score or actual spending. This was due to the lack of a single, authoritative, third-party ESG rating scheme covering a broad range of firms in Vietnam. Although our GDI is developed using traditional approaches, this instrument largely measures the extent of disclosure, not the depth or nature of green investments. Further research, as the data becomes more abundant, could bring more exact information with quantitative data of green capital expenditures or with the future standardized ESG database for Vietnam. Second, while our results highly hint at a validation mechanism, the research does not directly observe investor cognitive processes. Future research could use qualitative methods, such as interviews with fund managers and analysts, to gain a deeper comprehension of precise ways in which they interpret the common signal of green investment and auditor specialization.

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