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## THE IMPACT OF SUSTAINABLE DEVELOPMENT AND GREEN BONDS ON FIRM VALUE: EVIDENCE FROM LISTED COMPANIES DURING THE PERIOD 2017–2024

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### ABSTRACT

This study analyzes the impact of sustainable development and green bonds on firm value based on a sample of listed companies issuing green bonds during the period 2017–2024. In the context of the growing emphasis on sustainable finance, green bonds have emerged as an important capital-raising instrument for environmentally friendly projects. Using panel data and regression models, the study examines the direct effects of ESG performance and green bond issuance on firm value, while also investigating the mediating and moderating roles of green bonds in the relationship between ESG and firm value. The results indicate that sustainable development and green bond issuance exert a positive impact on firm value; green bonds serve both as an effective financing channel and as a mechanism that strengthens the relationship between ESG performance and firm value.

**KEYWORDS:** Sustainable development; ESG; Green bonds; Firm value; listed companies.

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### 1.0 INTRODUCTION

In the context of intensifying climate change and environmental degradation, sustainable development has become a strategic orientation for many countries and enterprises. Numerous studies indicate that sustainability is not only a matter of social responsibility but also a “source of long-term competitive advantage for firms” (Porter & Kramer, 2011), while contributing to improved operational performance and long-term market value (Eccles, Ioannou, & Serafeim,

2014). In parallel, green bonds have emerged as a key financing instrument for environmentally friendly projects; this market has experienced rapid growth over the past decade (Climate Bonds Initiative, 2021), and issuance is regarded as a “positive signal to the market regarding a firm’s environmental commitment” (Flammer, 2021), although its effects depend on contextual and firm-specific characteristics. According to the Vietnam Bond Market Association (VBMA), total issuance during 2021–2024 exceeded USD 1.4 billion; in 2024 alone, issuance reached approximately VND 6.9 trillion (around USD 300 million), accounting for nearly 1.5% of newly issued corporate bonds. This suggests substantial remaining potential and underscores the need for further research into the relationship between sustainable development, green bonds, and firm value, particularly for issuing firms over the period 2017–2024, in order to address gaps in both theory and practice. Although a growing body of domestic and international literature has examined the links between sustainable development, green finance, and firm value, studies that directly investigate the simultaneous effects of sustainable development and green bonds on firm value—especially among issuing firms—remain relatively limited.

Therefore, the research topic selected by the authors—“*Examining the impact of sustainable development and green bonds on firm value: Evidence from issuing firms during the period 2017–2024*”—is both necessary and meaningful from theoretical as well as practical perspectives.

## **2.0 RESEARCH OVERVIEW AND RESEARCH HYPOTHESIS**

### **2.1. Literature review**

Several studies have documented a positive relationship between ESG performance, green bond issuance, and firm value. Enhancing ESG performance while employing green bonds as a financing instrument for sustainable development projects contributes to improved information transparency, reduced information asymmetry, and lower cost of capital, thereby facilitating long-term increases in firm value. When firms perform well across environmental, social, and governance dimensions, transparency is enhanced and information risk declines, which in turn reduces the cost of capital and increases market valuation (Fang & Guo, 2025). At the same time, ESG performance reflects firms’ risk management capabilities and long-term strategic orientation, helping to strengthen investor confidence and improve financial performance (Al Hamrani & Al Hamrani, 2025).

Alongside ESG performance, green bond issuance has also been recognized as a factor that can enhance firm value through signaling effects and the expansion of the investor base. Positive market reactions to green bond issuance announcements are reflected in positive abnormal returns around the announcement date (Flammer, 2018), indicating that investors place a high value on strategies that finance sustainable projects. Access to ESG-oriented investor groups further helps improve stock liquidity and enhance firm valuation (Negi et al., 2025). Although the positive relationship between ESG performance and green bond issuance has been well established, the extent to which these advantages translate into higher firm value under different financial conditions remains an issue that warrants more in-depth empirical investigation.

While ESG has been shown to exert a direct influence on firm value, another stream of the literature focuses on the role of ESG as a key determinant of green bond issuance. Firms with high levels of ESG practices typically exhibit transparent governance structures, effective risk control, and a clear

orientation toward sustainable development, thereby enhancing investor trust and reducing financing costs (Fang & Guo, 2025; Ban et al., 2025). A strong ESG foundation improves corporate reputation and creditworthiness, which in turn increases the likelihood of successful issuance and lowers the cost of capital (Al Hamrani & Al Hamrani, 2025). Effective ESG implementation also mitigates perceived risks associated with “green washing,” thereby increasing investor acceptance of green bonds (Fang & Guo, 2025).

From a signaling perspective, ESG is regarded as a mechanism for reducing information asymmetry, enabling investors to better assess firms’ environmental commitments and social responsibility, and consequently increasing the probability of green bond issuance (Ning et al., 2021; Bai, 2025). Firms with high ESG scores also tend to attract long-term, sustainability-oriented investors, creating favorable conditions for the expansion of green financial instruments (Negi et al., 2025). However, the magnitude of ESG’s impact on green bond issuance may vary across industries, levels of capital market development, and national regulatory frameworks, indicating the need for further empirical evidence in specific contexts. In other words, although ESG contributes to enhanced reputation, transparency, and financing conditions, empirical evidence from emerging markets and recent periods remains limited.

In addition to ESG, firms’ internal financial characteristics are also regarded as important factors influencing both firm value and the likelihood of green bond issuance. Firm size, capital structure, profitability, and financial leverage are often found to exert significant effects on market valuation (Tang & Zhang, 2020; Flammer, 2018). Larger firms typically enjoy advantages in terms of reputation, information transparency, and compliance with issuance standards, thereby enhancing firm value and increasing the probability of successful issuance (Ning et al., 2021). High liquidity contributes to financial stability and improved debt-servicing capacity, which strengthens investor confidence; however, excessive liquidity may give rise to agency costs and reduce capital-use efficiency (Meier et al., 2009). Profitability reflects operational efficiency and cash flow-generating capacity, enabling firms to improve their access to the green bond market (Flammer, 2021). By contrast, higher financial leverage can increase risk and financing costs, exerting a negative impact on market value and constraining access to green financing sources (Bauer & Hann, 2019).

Moreover, corporate governance quality, the degree of information transparency, and the institutional environment also affect the ability to issue green bonds and the effectiveness of value creation following issuance (Fang & Guo, 2025; Ban et al., 2025). Macroeconomic factors—such as the level of financial market development, policies promoting green finance, and investors’ awareness of sustainable development—further shape the relationship between green bonds and firm value (Ning et al., 2021; Bai, 2025). However, most existing studies examine these factors in isolation, whereas the interactive roles of ESG, green bonds, and firm-specific characteristics in explaining firm value have yet to be comprehensively analyzed.

## **2.2. Theoretical basis**

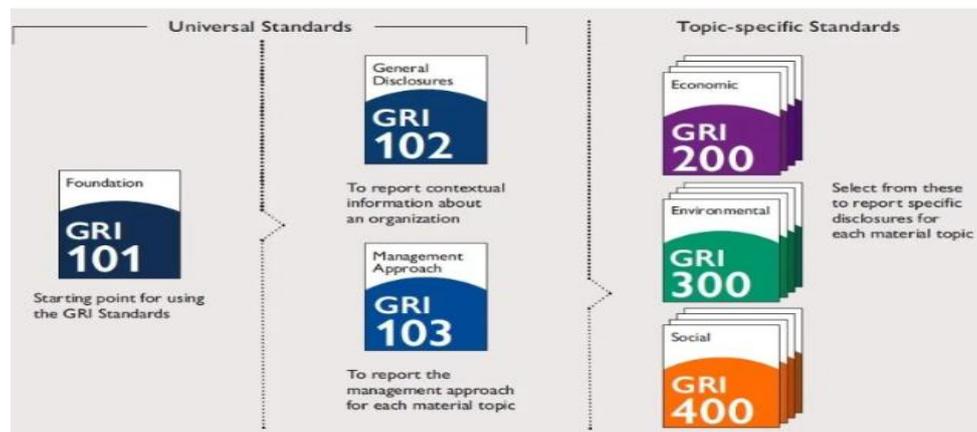
From a theoretical perspective, the relationship between ESG, GB, and firm value can be explained through several key academic frameworks. Stakeholder Theory suggests that firms need to balance the interests of multiple stakeholders to ensure sustainable development; the implementation of

ESG practices helps strengthen trust, reduce conflicts, and enhance corporate reputation, thereby improving financial performance and firm value. Signaling Theory emphasizes the role of ESG as an information transmission mechanism under conditions of information asymmetry, where transparent disclosure of sustainability activities can enhance market confidence and reduce the cost of capital, consequently increasing firm valuation. Legitimacy Theory argues that compliance with social norms through ESG enables firms to maintain legitimacy, reduce legal and reputational risks, and positively influence expected cash flows and firm value. Meanwhile, from the Resource-Based View perspective, ESG and GB can be considered strategic internal resources (such as governance systems, organizational culture, green technologies, and brand reputation) that create sustainable competitive advantages, enhance operational efficiency, and improve profit expectations, thereby increasing Tobin's Q.

### 2.3. Disclosure of sustainability information in accordance with the guidelines of the Global Reporting Initiative (GRI)

The authors adopt the Consolidated Set of GRI Sustainability Reporting Standards 2016 as the benchmark for determining firms' ESG scores on an annual basis, using officially published annual reports. This is a widely used global sustainability reporting framework developed by the Global Reporting Initiative, providing comprehensive guidelines for the disclosure of information related to environmental, social, and governance aspects. The standards enable firms to present sustainability information in a systematic manner, ensuring comparability, transparency, and verifiability across reporting periods as well as among firms.

Figure 1. Structure of the GRI Standards



### 2.4. Research hypothesis

Drawing on prior domestic and international literature, this study proposes the following research hypothesis. Sustainable development, as reflected by ESG performance, has increasingly been recognized as a critical indicator of corporate governance quality and long-term strategic orientation. Firms that place greater emphasis on environmental, social, and governance dimensions are better able to manage non-financial risks, including legal, reputational, and operational disruption risks. The mitigation of these risks contributes to more stable cash flows, strengthens corporate credibility, and enhances investor confidence, thereby facilitating improvements in market value.

Empirical evidence provides strong support for this argument. El Ghouli et al. (2011) find that firms with superior environmental performance are generally perceived as less risky and can access capital at lower costs. Eccles, Ioannou, and Serafeim (2014) demonstrate that firms consistently pursuing sustainable development strategies achieve better operating performance and higher market valuations over the long term. Furthermore, a comprehensive meta-analysis by Friede, Busch, and Bassen (2015), covering more than 2,200 empirical studies, reports that the majority of evidence indicates a non-negative—and often positive—relationship between ESG performance and firm value. In the context of the 2017–2024 period, during which ESG has increasingly become a key criterion in investment decisions, sustainable development is therefore expected to exert a positive impact on firm value.

***Hypothesis H1: Sustainable development has an impact on firm value.***

ESG ratings increasingly serve as an important indicator of firms' commitment to sustainable development. Companies with high ESG scores are often perceived as having strong governance systems, high levels of transparency, and clear long-term strategic orientations. These characteristics help strengthen investor confidence and create favorable conditions for capital raising through green financial instruments.

Reboredo (2018) highlights the increasingly close linkage between green bonds and financial markets, while Wang and Wang (2022) show that green bond issuance can enhance investors' perceptions of firms' sustainability performance. More recent studies also document that firms with higher ESG scores are more likely to participate in the green bond market than their industry peers (Al Hamrani & Al Hamrani, 2024). In addition, Bužinskė and Stankevičienė (2023) emphasize the roles of organizational reputation, credit ratings, and positive ESG performance in supporting successful green bond issuance. Taken together, this evidence suggests that sustainable development may serve as an important foundation for promoting firms' green bond issuance activities.

***Hypothesis H2: Sustainable development has an impact on green bond issuance.***

Green bond issuance is not only a financing channel but also a strategic signal that reflects firms' commitment to environmental objectives and sustainable development. According to signaling theory, under conditions of information asymmetry, issuing green bonds enables firms to convey positive information to the market, thereby strengthening investor confidence.

Empirical evidence suggests that this activity can generate tangible financial benefits. Flammer (2021) finds that firms issuing green bonds not only improve their environmental performance but also receive positive reactions from the stock market. Zerbib (2019) and Bachelet, Becchetti, and Manfredonia (2019) document the existence of a “greenium,” indicating that green bonds are often traded at lower yields, which helps firms reduce their cost of capital. Reboredo (2018) further shows that green bonds contribute to greater financial stability and risk diversification. In the context of the growing demand for sustainable investments, green bond issuance is therefore

expected to positively affect firm value through both the cost-of-capital channel and the market signaling channel.

***Hypothesis H3: Green bond issuance has a positive impact on firm value.***

The impact of sustainable development on firm value does not occur solely through direct channels but also operates via financial intermediary mechanisms, among which green bond issuance is regarded as an important transmission channel. A key finding in Bhutta et al. (2022) indicates that firms issuing green bonds tend to exhibit stronger ESG performance while attracting greater capital and reputational benefits, thereby receiving more favorable responses from capital markets. In addition, several prior studies demonstrate that firms can reduce carbon emissions and improve ESG ratings through green bond issuance (Flammer, 2021). Consequently, these firms often achieve higher social and governance (S and G) scores, as green bonds are associated with stronger social responsibility and improved corporate operating performance.

Taken together, this evidence suggests a positive linkage between green bond issuance, the level of sustainable development, and firms' market value.

***Hypothesis H4: Green bond issuance mediates the relationship between sustainable development and firm value.***

Finally, the impact of green bond issuance is reflected not only in market value but also in improvements in firms' sustainable development performance. Raising capital through green bonds provides the financial resources necessary for firms to invest in environmentally friendly projects, enhance energy efficiency, reduce emissions, and strengthen governance systems toward greater transparency (Flammer, 2021). When implemented as part of a long-term strategy, green bonds function not merely as a financial instrument but also as a signal of firms' commitment to sustainable development, in line with signaling theory (Spence, 1973), while simultaneously reinforcing legitimacy in the eyes of stakeholders, as argued by legitimacy theory (Dowling & Pfeffer, 1975).

Conversely, if green bond issuance is not accompanied by substantive commitments and effective implementation, its impact on sustainable development value may be limited due to concerns regarding the credibility of environmental commitments (Fatemi et al., 2018). However, when firms allocate proceeds appropriately and integrate green bond financing into their overall development strategies, empirical evidence suggests that they tend to improve environmental performance and attract long-term investors (Tang & Zhang, 2020).

***Hypothesis H5: Green bond issuance enhances the positive impact of sustainable development on firm value.***

### 3. RESEARCH METHODOLOGY

#### 3.1. Sample and Research Data

The research sample is selected using a purposive sampling approach and consists of multi-industry listed companies in the stock market that have complete financial data as well as disclosed sustainability information and that have participated in and issued or obtained certification for green bonds. Information on green bond issuance is collected from the website of the Climate Bonds Initiative. After data collection, the dataset is organized as a balanced panel comprising 43 firms over eight years, corresponding to 344 firm–year observations.

Firms' financial data are primarily obtained from the international financial platform Investing.com, and are cross-checked and verified against audited annual financial statements and disclosures published on firms' official websites. Information on green bond issuance (GB) is collected from firms' bond issuance reports, official disclosure announcements on corporate websites, and publicly available sources via Google searches. A dummy variable is constructed for green bond issuance, taking the value of 1 in years when a firm issues green bonds and 0 otherwise.

The authors employ Stata version 15 for data analysis. Regarding methodology, the study estimates panel data regression models using commonly applied approaches, including Pooled Ordinary Least Squares (Pooled OLS), the Fixed Effects Model (FEM), and the Random Effects Model (REM), in order to select the most appropriate specification. The Breusch–Pagan Lagrange Multiplier (LM) test and the Hausman test are conducted to determine the optimal estimation method. After selecting the suitable model, diagnostic tests for heteroskedasticity, autocorrelation, and multicollinearity are performed, particularly given the inclusion of interaction terms to examine moderating effects. When model deficiencies are detected, the study applies the Feasible Generalized Least Squares (GLS) method to simultaneously address heteroskedasticity and autocorrelation, thereby enhancing the efficiency, robustness, and reliability of the empirical results.

#### 3.2. Model Specification and Variable Measurement

*Measurement of the Dependent Variable: Firm Value (Tobin's Q)*

In this study, firm value is measured using Tobin's Q, a widely employed indicator in corporate finance research to capture the extent of market valuation of a firm. (Tobin, 1969), (Chung & Pruitt, 1994), (Aggarwal & Padhan, 2017)

Tobin's Q is calculated using the following formula:

$$Tobin's\ Q = \frac{\text{Market value of equity} + \text{market value of debt}}{\text{Book value of total assets}}$$

*Measurement of Independent and Control Variables in the Model:*

**Table 1. Measurement of Independent and Control Variables in the Model**

Variable	Variable name	Measurement formula	References
ESG	Sustainable Development	Measured using a set of criteria developed by the authors	Eccles et al., 2014; El Ghouli et al., 2011; Fang & Guo, 2025; Al & Hamrani, 2025
GB	Green bond	Issuance = 1 No issuance = 0	Flammer, 2021; Tang & Zhang, 2020; Zerbib, 2019; Bachelet et al., 2019; Ning et al., 2021; Negi et al., 2025
ROE	Return on equity	Profit/Equity	Fang & Guo, 2025; Meier & Servaes, 2009
SIZE	Firm size	Firm size	Bauer & Hann, 2010; El Ghouli et al., 2011
GROWTH	Firm growth rate	(Revenue t - Revenue t-1)/ Revenue t-1	Eccles et al., 2014; Ning et al., 2021
LEV	Financial leverage	Total liabilities / Total assets	Bauer & Hann, 2010; El Ghouli et al., 2011
AGE	Firm age	Research year - year of establishment	Bachelet et al., 2019; Flammer, 2021
CR	Current Ratio	Current assets / Current liabilities	Meier & Servaes, 2009; Ning et al., 2021

(Source: Compiled by the author)

Based on prior studies and the development of research hypotheses, the authors propose the following research model:

*Model 1:*  $Tobin's Q_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 SIZE_{it} + \beta_3 CR_{it} + \beta_4 LEV_{it} + \beta_5 GROWTH_{it} + \beta_6 ROE_{it} + \beta_7 AGE_{it}$ .

*Model 2:*  $GB_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 SIZE_{it} + \beta_3 CR_{it} + \beta_4 LEV_{it} + \beta_5 GROWTH_{it} + \beta_6 ROE_{it} + \beta_7 AGE_{it}$ .

*Model 3:*  $Tobin's Q_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 GB_{it} + \beta_3 SIZE_{it} + \beta_4 CR_{it} + \beta_5 LEV_{it} + \beta_6 GROWTH_{it} + \beta_7 ROE_{it} + \beta_8 AGE_{it}$

*Model 4:*  $Tobin's Q_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 GB_{it} + \beta_3 GB \times ESG_{it} + \beta_4 SIZE_{it} + \beta_5 CR_{it} + \beta_6 LEV_{it} + \beta_7 GROWTH_{it} + \beta_8 ROE_{it} + \beta_9 AGE_{it}$ .

## 4.0 RESEARCH RESULTS AND DISCUSSION

### 4.1. Descriptive Statistics Results

**Table 2. Descriptive Statistics**

Variable	Number of observations	Mean	Standard deviation	Min	Max
GB	344	0.4273256	0.4954108	0.000	1.000
ESG	344	0.626686	0.1921387	0.260	1.000
SIZE	344	23.72662	1.966928	19.20012	28.27325
LEV	344	1.118847	3.252101	0.0111116	22.10625
GROWTH	344	0.0702512	0.2333845	-0.6918514	1.902901
ROE	344	8.846143	3.064628	0.010	18.000
CR	344	1.76776	0.5892421	0.010	3.57
Tobin's Q	344	1.938124	2.680904	0.318905	19.68905

(Source: Analysis results obtained using Stata 15)

The descriptive statistics table shows that the research sample consists of 344 observations, with variables exhibiting different levels of dispersion. The GB variable has a mean value of 0.427, indicating that approximately 42.7% of firms in the sample issued green bonds, suggesting that participation in the green finance market is still not widespread. ESG has an average value of 0.627 with a standard deviation of 0.192, implying that firms' ESG performance is at a moderately high level, although notable variation exists across companies. SIZE has a mean of 23.73 and a standard deviation of 1.97, reflecting considerable differences in firm scale within the sample.

LEV has an average value of 1.12 with a relatively high standard deviation (3.25) and a maximum of 22.11, indicating substantial heterogeneity in capital structures, with some firms using extremely high levels of debt. Growth (GROWTH) shows a positive mean (0.070) but a large dispersion, suggesting uneven growth performance among firms. ROE averages 8.85%, ranging from 0.01 to 18, reflecting differences in operating efficiency across companies. CR has a mean of 1.77, indicating that most firms maintain an acceptable level of short-term liquidity.

Notably, firm value measured by Tobin's Q has a mean of 1.94 with a relatively high standard deviation (2.68) and a maximum of nearly 19.69, revealing significant variation in market valuation among firms in the sample. This suggests that factors such as ESG performance and green bond issuance may play an important role in explaining differences in firm value, providing an appropriate basis for subsequent regression analyses.

### 4.2. Correlation Analysis and Multicollinearity Diagnostics among Variables

**Table 3. Correlation Matrix and Multicollinearity Diagnostics among Variables**

Variable	GB	ESG	SIZE	LEV	GROWTH	GB×ESG	ROE	CR	Tobin's Q	Variance Inflation Factor (VIF)
<b>GB</b>	1.000	0.382***	-	0.072	0.024	0.961***	0.201***	0.144***	0.428***	1.23

			0.095*							
<b>ESG</b>		1.000	0.024	0.039	0.096*	0.514***	0.249***	0.045	0.447***	1.23
<b>SIZE</b>			1.000	- 0.117**	0.097*	-0.057	-0.008	-0.075	-0.025	1.04
<b>LEV</b>				1.000	-0.002	0.050	0.009	-0.001	0.001	1.02
<b>GROWTH</b>					1.000	0.047	0.007	0.096*	0.124**	1.03
<b>GB×ESG</b>						1.000	0.251***	0.148***	0.535***	-
<b>ROE</b>							1.000	0.055	0.426***	1.08
<b>CR</b>								1.000	0.218***	1.04
<b>Tobin's Q</b>									1.000	-

(Source: Analysis results obtained using Stata 15)

The correlation matrix shows that relationships among variables are generally low to moderate, with VIF values below 2, indicating no serious multicollinearity and supporting the suitability of the data for regression analysis.

GB and ESG are both positively and significantly correlated with Tobin's Q, suggesting that green bond issuance and stronger ESG performance are associated with higher firm value. The interaction term (GB×ESG) also exhibits a relatively strong positive correlation with Tobin's Q, providing preliminary evidence that green bonds may enhance the positive effect of ESG on firm value. Among the control variables, ROE and CR show positive and significant correlations with Tobin's Q, while SIZE and LEV are not significantly related. Additionally, ESG is positively correlated with GB, indicating that firms with better ESG performance are more likely to issue green bonds. Overall, the results are consistent with theoretical expectations and provide initial support for the research hypotheses.

#### 4.3. Regression model results

**Table 4. OLS Regression Results for Model 1**

Variable	Coefficient	Standard error	t	p-value
ESG	5.184***	0.629	8.240	0.000
SIZE	-0.074	0.060	-1.220	0.222
AGE	0.013***	0.003	3.980	0.000
CR	0.750***	0.199	3.770	0.000
LEV	-0.003	0.036	-0.080	0.933
GROWTH	1.095***	0.506	2.160	0.031
ROE	0.286***	0.039	7.330	0.000
_cons	-4.140***	1.549	-2.670	0.008

(Source: Analysis results obtained using Stata 15)

The regression results show that ESG has a positive coefficient and is statistically significant at the 1% level ( $\beta = 5.184$ ;  $p < 0.01$ ), implying that an increase in ESG performance is associated with a significant improvement in firm value (Tobin's Q), holding other factors constant. This finding suggests that firms with stronger commitments to sustainable development tend to be more positively valued by the market, as ESG practices enhance reputation, reduce long-term risks, and strengthen investor confidence.

Regarding the control variables, both ROE and CR have positive effects and are statistically significant at the 1% level, indicating that higher profitability and better liquidity contribute to improved firm value. AGE also shows a positive coefficient with significance at the 1% level, implying that more established firms are generally valued more favorably by the market due to accumulated experience and reputation. GROWTH has a positive effect and is significant at the 5% level, suggesting that higher revenue growth is associated with higher firm valuation. In contrast, SIZE and LEV are not statistically significant, indicating no clear evidence of a relationship between firm size, financial leverage, and firm value in this sample. Therefore, hypothesis H1 is supported.

**Table 5. OLS Regression Results for Model 2**

Variable	Coefficient	Standard error	T	p-value
ESG	0.9088882***	0.132752	6.85	0.000
SIZE	-0.0219865**	0.012764	-1.72	0.086
AGE	0,0000511	0,0006724	0,08	0.939
CR	0.0982743***	0.0419301	2.34	0.020
LEV	0.0072061	0.0075949	0.95	0.343
GROWTH	-0.0270037	0.106919	-0.25	0.801
ROE	0.0171189***	0.0082352	2.08	0.038
_cons	0.0454392	0.3270686	0.14	0.890

(Source: Analysis results obtained using Stata 15)

The regression results indicate that ESG has a positive coefficient and is statistically significant at the 1% level ( $\beta = 0.909$ ;  $p < 0.01$ ), implying that higher ESG performance increases the likelihood of firms issuing green bonds, holding other factors constant. This finding suggests that sustainable development is not only a strategic orientation but is also translated into concrete financing activities through green financial instruments.

Regarding the control variables, both ROE and CR have positive effects and are statistically significant (at the 5% level), indicating that firms with higher profitability and better liquidity are more likely to participate in the green bond market due to stronger financial foundations. SIZE has a negative coefficient and is significant at the 10% level, suggesting that firm size is not a clear driving factor for green bond issuance in this sample. Meanwhile, AGE, LEV, and GROWTH are not statistically significant, indicating no clear evidence regarding the roles of firm age, financial leverage, and revenue growth in influencing green bond issuance decisions. Therefore, hypothesis H2 is supported.

**Table 6. GLS Regression Results for Model 3**

Variable	Coefficient	Standard error	t	p-value
ESG	2.437	0.380	6.40	0.000
GB	0.475	0.110	4.31	0.000
CR	0.066	0.068	0.98	0.330
LEV	-0.007	0.020	-0.38	0.705
AGE	0.003	0.002	1.71	0.088
GROWTH	0.125	0.167	0.75	0.452
ROE	0.019	0.015	1.30	0.194
SIZE	-0.088	0.037	-2.37	0.018
_cons	1.378	0.911	1.51	0.130

(Source: Analysis results obtained using Stata 15)

The regression results show that green bond issuance (GB) has a positive and statistically significant effect at the 1% level ( $\beta = 0.475$ ;  $p < 0.01$ ), indicating that firms issuing green bonds tend to have higher Tobin's Q values, holding other factors constant. This suggests that participation in the green finance market not only provides financing but also signals firms' commitment to sustainable development, thereby enhancing investor confidence and market valuation. ESG also remains positive and significant at the 1% level, confirming that sustainable development continues to play an important role in firm value even after controlling for GB.

Regarding the control variables, most are not statistically significant. LEV, GROWTH, CR, and ROE show no significant effects, while SIZE is negative and significant at the 5% level, and AGE is positive and significant at the 10% level. Therefore, hypothesis H3 is supported.

To examine the mediating role of green bond issuance (GB) in the relationship between ESG and firm value, this study compares the ESG coefficient across Model 1 and Model 3. The results show that ESG has a positive and significant effect on Tobin's Q in Model 1. However, after including the mediating variable GB in Model 3, the ESG coefficient decreases in magnitude while remaining statistically significant. Combined with the findings that ESG significantly affects GB (H2) and GB significantly affects Tobin's Q (H3), this evidence indicates that GB partially mediates the relationship between ESG and firm value. In other words, part of the positive impact of ESG on firm value is transmitted through firms' participation in the green bond market. Therefore, hypothesis H4 is supported.

**Table 7. GLS Regression Results for Model 4**

Variable	Coefficient	Standard error	t	p-value
GB	-1.000**	0.521	-1.92	0.055
ESG	2.078***	0.408	5.09	0.000

GB×ESG	2.345***	0.814	2.88	0.004
SIZE	-0.634**	0.034	-1.87	0.061
LEV	-0.001	0.021	-0.07	0.946
AGE	0.004***	0.002	2.12	0.034
GROWTH	0.174*	0.164	1.06	0.290
ROE	0.024	0.016	1.54	0.124
CR	0.069*	0.069	1.00	0.316
_cons	0.875	0.841	1.04	0.299

(Source: Analysis results obtained using Stata 15)

The GLS regression results of the moderating model indicate that the interaction term between green bond issuance and ESG (GB×ESG) is positive and highly statistically significant at the 1% level ( $\beta = 2.345$ ;  $p = 0.004$ ). This provides evidence that green bond issuance plays a positive moderating role in the relationship between ESG and firm value, meaning that when firms participate in the green bond market, the positive impact of ESG on Tobin's Q is further strengthened. The findings imply that the combination of sustainable development strategies and green financial instruments enables firms to achieve higher market valuation compared to implementing ESG practices alone.

The ESG variable continues to exhibit a positive and statistically significant effect at the 1% level ( $\beta = 2.078$ ;  $p < 0.01$ ), reaffirming the important role of sustainability performance in enhancing firm value. Considering green bond issuance (GB) separately, the coefficient is negative ( $\beta = -1.000$ ) and significant at the 10% level. In the presence of the interaction term, this coefficient reflects the effect of GB when ESG equals zero (or remains at a very low level). This suggests that, without a sufficiently strong sustainability foundation, green bond issuance may not produce a clearly positive impact on firm value; conversely, this effect becomes more positive as the level of ESG increases.

Regarding the control variables, AGE has a positive and statistically significant effect at the 5% level, indicating that more established firms tend to be valued more highly by the market. SIZE shows a negative coefficient and is significant at the 10% level, while CR has a positive effect and is significant at the 10% level. The variables LEV, GROWTH, and ROE are not statistically significant in this model. Therefore, hypothesis H5 is supported.

#### 4.4. Discussion of Research Findings

The study aims to clarify the relationship between green bond issuance and sustainable development in shaping firm value among listed companies over the period 2017–2024. The empirical results indicate that sustainable development (ESG) exerts a positive and statistically significant effect on firm value, fully supporting the research hypothesis and aligning with prior evidence reported by Flammer (2021) and Lalin Fang and Xuemeng Guo (2025). These findings suggest that transparent disclosure and consistent implementation of sustainability practices can generate tangible benefits for firms by enhancing market valuation.

In addition, green bond issuance (GB) also exerts a positive and statistically significant effect on firm value, which is consistent with signaling theory. Sustainability-related financial decisions help reduce information asymmetry between firms and investors, thereby enhancing corporate credibility and transparency. As a result, the market tends to respond favorably to firms that issue green bonds through higher market valuation (Tang & Zhang, 2020). Notably, GB not only has a direct impact on firm value but also plays both a mediating and a moderating role in the relationship between ESG and firm value. In its mediating role, ESG indirectly affects firm value through the decision to issue green bonds, enabling firms to access green capital and strengthen their market reputation. In its moderating role, GB alters the strength of the impact of ESG on firm value through a signaling mechanism that conveys firms' commitment to sustainable development.

Regarding the control variables, the results show that return on equity (ROE) has a positive effect on firm value, indicating that firms with higher profitability tend to possess stronger financial capacity to undertake long-term and high-risk environmental projects, thereby enhancing investor confidence (Flammer, 2021). Similarly, liquidity (CR) also exerts a positive influence on firm value, suggesting that firms maintaining financial stability are better positioned to access long-term financing, including green bonds (IAENG, 2023). With respect to firm age (AGE), the results indicate that AGE has a positive and statistically significant effect on firm value, suggesting that firms with a longer operating history tend to be more highly valued by the market. This finding is consistent with prior studies by Chay, Kim, and Suh (2015) and Leite and Carvalhal (2016), which argue that more mature firms generally benefit from stronger market reputation, accumulated managerial experience, and lower levels of uncertainty, thereby contributing to higher firm value.

In contrast, several control variables do not exhibit statistically significant effects on firm value. Specifically, financial leverage (LEV) does not have a significant impact, which may be explained by the debt covenant hypothesis, whereby high leverage increases the risk of violating contractual constraints, forcing firms to adjust their financial behavior and restrain investment activities, thus failing to generate clear value enhancement. Firm growth (GROWTH) is also statistically insignificant, despite being supported by prior studies, possibly because excessively rapid growth can heighten financial risk and cash flow pressure, thereby adversely affecting long-term firm value (Coad, 2010; Higgins, 1977). Similarly, firm size (SIZE) does not show a significant effect, suggesting that expansion in scale does not necessarily translate into superior governance efficiency; larger size may increase agency costs and reduce organizational flexibility, ultimately weakening value creation capacity (Jensen, 1986).

## 5.0 CONCLUSION AND RECOMMENDATIONS

The empirical results indicate that financial leverage (LEV), firm size (SIZE), and growth (GROWTH) do not exert a statistically significant impact on firm value, whereas ESG performance, green bond issuance (GB), profitability (ROE), liquidity (CR), and firm age (AGE) exhibit strong and positive effects. Based on these findings, the study proposes several recommendations for listed firms in developing a long-term strategic roadmap.

*First*, firms should proactively integrate environmental, social, and governance (ESG) criteria into their long-term corporate strategies, with particular emphasis on enhancing information

transparency, strengthening risk management systems, and improving social responsibility practices. Such integration can help reinforce investor confidence and mitigate information asymmetry in capital markets.

*Second*, firms should not confine ESG implementation to internal strategic planning; instead, sustainability commitments should be translated into concrete financial actions, among which green bond issuance represents a key instrument. By doing so, firms can credibly signal their long-term sustainability orientation to the market.

*Third*, firms need to maintain stable financial performance as a foundational condition for the effective implementation of sustainability strategies. Sound profitability and liquidity provide the necessary financial capacity to undertake long-term green investments and support access to sustainable finance.

*Fourth*, firms are encouraged to develop a pipeline of eligible green projects in advance, enabling them to promptly participate in the green bond market when market conditions and regulatory frameworks become favorable.

*Finally*, firms should simultaneously design ESG development roadmaps and green financing strategies, rather than implementing these initiatives in a fragmented manner. A coordinated approach allows green bonds to function not only as a funding mechanism but also as a strategic complement that amplifies the value-enhancing effects of ESG practices.

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