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Sharia-Compatible Capital Structure as a Boundary Condition for ESG and Firm Stability: Evidence from Indonesian Public Firms

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ABSTRACT

Literature on ESG generally assumes universal benefits, yet emerging evidence suggests that ESG effectiveness may depend on firm-specific characteristics. This study examines whether the relationship between ESG performance and firm stability depends on Sharia-compatible capital structures. Using panel data from Indonesian listed firms covering multiple phases of digital transformation, the study applies firm fixed-effects models to examine the relationship between ESG performance and firm stability. To capture contextual heterogeneity, the analysis incorporates interaction models, period-specific estimations, and additional robustness tests. The findings indicate that ESG does not universally improve firm stability. Its benefits emerge when supported by complementary organizational characteristics, particularly Sharia-compatible capital structures. The findings further reveal that these relationships vary across phases of digital transformation and across different firm conditions. The study extends stakeholder theory by demonstrating that the benefits of ESG depend on complementary organizational characteristics, with Sharia-compatible capital structures serving as an important boundary condition for the ESG-firm stability relationship.

Keywords: Digital Transformation, ESG, Islamic Finance, Sharia-Compatible Capital Structure, Firm Stability

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INTRODUCTION

Firm stability has become an increasingly important concern for managers, investors, and policymakers in an environment characterized by rapid technological change, economic uncertainty, and evolving stakeholder expectations (Hunjra, 2026). Firms that are unable to maintain stable operations and financial performance are more vulnerable to market disruptions, financing constraints, and long-term value destruction (Saif-Alyousfi, 2026). Consequently, identifying organizational factors that enhance firm stability has become a central issue in the corporate finance and sustainability literature (Nasraoui et al., 2025).

Among the factors proposed to enhance firm stability, environmental, social, and governance (ESG) practices have received considerable attention. Drawing on stakeholder theory, firms that actively address stakeholder interests are expected to develop stronger legitimacy, trust, and stakeholder support, thereby enhancing organizational resilience (Freeman, 1984). Complementing this perspective, the resource-based view suggests that ESG practices constitute valuable organizational resources that can create long-term competitive advantages (Barney, 1991; Hart, 2017). Risk management theory further argues that ESG activities function as protective mechanisms that help firms mitigate exposure to adverse shocks and uncertainty (Godfrey et al., 2009). Consequently, ESG has increasingly been viewed as a strategic mechanism for improving firm stability and resilience.

Despite the growing popularity of ESG, empirical evidence remains inconclusive. While some studies report positive effects of ESG on firm performance and risk reduction, others document weak, insignificant, or context-dependent relationships. These mixed findings challenge the assumption that ESG generates universal benefits and suggest that its effectiveness may depend on specific organizational characteristics. Recent research increasingly highlights the heterogeneous nature of ESG outcomes across firms and institutional settings (Christensen et al., 2022).

One potentially important but underexplored boundary condition is the firm's capital structure. In particular, Sharia-compatible capital structures are characterized by lower leverage and are guided by financial principles that emphasize prudent financing, risk sharing, asset-backed transactions, and the promotion of social welfare (Beck et al., 2013; Platonova et al., 2018; Aysan & Bergigui, 2021). These principles align closely with the long-term and stakeholder-oriented objectives underlying ESG practices. Consequently, firms with Sharia.

Despite the growing interest in both ESG and Islamic finance, little is known about whether the stability benefits of ESG depend on the presence of Sharia-compatible capital structures. Existing studies largely examine either ESG-performance relationships or the financial implications of Islamic finance separately. Much less attention has been devoted to whether Sharia-compatible financing conditions function as a boundary condition that determines when ESG can be translated into firm stability. This omission is important because the complementarities between ESG and Sharia-compatible capital structures may operate through several mechanisms. Lower leverage reduces financial vulnerability, stakeholder-oriented objectives align with ESG principles, the prohibition of speculative behavior supports risk management objectives, and asset-backed financing reinforces the long-term orientation associated with sustainability investments (Abedifar et al., 2013; Beck et al., 2013; Platonova et al., 2018; Dusuki & Bouheraoua, 2011; Lins et al., 2017). Consequently, firms characterized by Sharia-compatible capital structures may provide a more conducive environment for ESG practices to translate into greater firm stability. To address this gap, this study examines whether the relationship between ESG performance and firm stability is conditional upon Sharia-compatible capital structures. Indonesia provides a particularly relevant setting because it combines rapid ESG adoption with one of the world's largest Islamic financial ecosystems, allowing meaningful variation in both sustainability practices and Sharia-compatible financing conditions. Using evidence from Indonesian listed firms, the study contributes to the ESG and Islamic finance literature by investigating the complementarities between ESG practices and Sharia-compatible financing conditions in shaping firm stability. The study extends stakeholder theory by demonstrating that the effectiveness of ESG practices depends on complementary organizational characteristics rather than being uniformly distributed across firms. By identifying Sharia-compatible capital structure as a key boundary condition, this research provides new insights into when and under what circumstances ESG contributes to firm stability.

Stakeholder theory suggests that firms that effectively address stakeholder interests are more likely to gain legitimacy, trust, and stakeholder support, thereby enhancing organizational resilience (Freeman, 1984). Similarly, the resource-based view and risk management perspectives indicate that ESG practices can serve as valuable organizational resources that strengthen firm stability by reducing risk exposure and supporting long-term value creation (Barney, 1991; Godfrey et al., 2009; Hart, 2017). Accordingly, firms with stronger ESG performance are expected to exhibit greater stability. Despite mixed empirical findings, the dominant theoretical perspectives suggest a positive relationship between ESG performance and firm stability.

H1. ESG performance is positively associated with firm stability.

ESG investments typically require long-term commitment before economic benefits materialize. Firms with lower leverage face fewer debt-servicing pressures and therefore possess greater financial flexibility to sustain ESG commitments during periods of uncertainty. Consequently, Sharia-compatible capital structures may provide the financial environment necessary for ESG practices to translate into greater firm stability.

While ESG practices may contribute to firm stability, their effectiveness may depend on organizational characteristics that support long-term sustainability and prudent risk management. ESG investments typically require long-term commitment before their benefits materialize. Firms with lower leverage face fewer debt-servicing pressures and therefore possess greater financial flexibility to sustain ESG commitments during periods of uncertainty. In this regard, Sharia-compatible capital structures are characterized by lower leverage, risk-sharing principles, asset-backed financing, and stakeholder-oriented objectives that are conceptually aligned with ESG principles (Beck et al., 2013; Platonova et al., 2018). These complementary characteristics may enhance firms' ability to convert ESG practices into greater stability. Therefore, the benefits of ESG are expected to be stronger among firms with Sharia-compatible capital structures.

H2. The positive association between ESG performance and firm stability is stronger among firms with Sharia-compatible capital structures.

METHOD

Sample and Data

This study employs panel data from Indonesian publicly listed firms over the period 2011–2024. Financial and market data are obtained from Refinitiv DataStream, while ESG information is sourced from the Refinitiv ESG Database. Following the data screening process, the final sample comprises 7,457 firm-year observations representing 868 unique Indonesian publicly listed firms over the 2011–2024 period. The Indonesian setting provides an appropriate empirical context given the growing adoption of ESG practices and the increasing relevance of Sharia-based financing principles within an emerging-market environment.

Research Variable

Three measures of resilience are used as dependent variables in the study. These include volatility in the firm's returns (VRET), a Sustainability and Financial Resilience Index calculated through PCA analysis (SUST), and profit stability measures (STPROF_ROA and STPROF_ROE). The specific definitions of each of these variables can be found in Table 1.

Table 1. Variable Definitions and Data Sources

Variable	Definition	Source
Dependent Variables		
VRET	Return volatility: annualized standard deviation of daily stock returns multiplied by 100	Refinitiv DataStream
SUST	Sustainability/Financial Resilience Index: PCA composite constructed from inverted VRET, STPROF_ROA, and STPROF_ROE (standardized)	Computed from Refinitiv
STPROF_ROA	Profit stability (ROA): negative standard deviation of ROA over 3-year rolling windows	Computed from Refinitiv
STPROF_ROE	Profit stability (ROE): negative standard deviation of ROE over 3-year rolling windows	Computed from Refinitiv
Key Independent Variables		
ESG_SCORE	Overall, Refinitiv ESG performance score ranges from 0 to 100, covering Environmental, Social, and Governance pillars.	Refinitiv ESG Database
ISLAMIC	Islamic finance compatibility proxy: binary indicator equal to 1 for firms in the bottom quartile of debt-to-asset ratio within their industry-year, aligned with Sharia screening standards (Derigs & Marzban, 2008). The bottom quartile approach captures firms with substantially lower leverage relative to industry peers and is consistent with leverage-	Computed from Refinitiv

	screening principles commonly employed in Islamic finance research.	
Control Variables		
SIZE	Firm size: natural logarithm of total assets (in million IDR)	Refinitiv DataStream
LEV	Leverage: total debt divided by total equity	Refinitiv DataStream
PROF	Profitability: return on assets (net income divided by total assets)	Refinitiv DataStream
AGE	Firm age: years since first data availability in the database	Refinitiv DataStream
SECTOR	Industry classification based on TRBC Economic Sector (10 categories: Basic Materials, Consumer Cyclicals, Consumer Non-Cyclicals, Energy, Financials, Healthcare, Industrials, Real Estate, Technology, Utilities)	Refinitiv DataStream

Note. All financial data sourced from Refinitiv DataStream and Refinitiv ESG Database. Computed variables constructed by the authors following standard methodologies in the corporate finance literature.

Three measures of resilience are used as dependent variables in the study. These include volatility in the firm's returns (VRET), a Sustainability and Financial Resilience Index calculated through PCA analysis (SUST), and profit stability measures (STPROF_ROA and STPROF_ROE). The specific definitions of each of these variables can be found in Table 1.

Key Independent Variables: ESG_SCORE is the overall Refinitiv ESG score (0-100). ISLAMIC is a binary indicator for low-debt-ratio firms. Control variables include firm size (log total assets) (Albuquerque et al., 2019; Fama & French, 2012), leverage (debt-to-equity) (Jensen & Meckling, 1976; Opler et al., 1999), profitability (ROA) (Fama & French, 2015), age (Hannan & Freeman, 1984), and sector indicators.

The proxy for the Sharia-compatible capital structure is based on the industry-adjusted leverage ratio, based on the criteria established for Sharia compliance. For each industry, the firms in the bottom 25% of the debt/assets ratio for that industry are classified as having a Sharia-compatible capital structure (ISLAMIC=1). Following prior Islamic finance studies, the variable is intended to capture compatibility with Sharia leverage-screening principles rather than complete Sharia compliance (Derigs & Marzban, 2008; Walkshäusl & Lobe, 2012). Thus, the findings of this study only indicate the effect that a Sharia-compatible capital structure has upon firm outcomes, not the findings of a study that would examine the outcomes of firms that comply with all aspects of Islamic finance.

Another key distinction is that the variable represents the compatibility of the firm's capital structure with the principles of Sharia—specifically, the requirement that the ratio of leverage be low, due to the prohibition of *riba*—rather than the firm's certification or compliance with Sharia principles altogether. While this is a standard measure within the field of Islamic finance research (Sandwick & Collazzo, 2021), such a variable represents only one dimension of such a complex concept.

Data Analysis

To examine the relationship between ESG performance and firm stability, firm fixed-effects panel regressions are estimated while controlling for firm-specific and time-specific effects.

$$RESILIENCE_{it} = \alpha + \beta_1 ESG\_SCORE_{it} + \beta_2 CONTROLS_{it} + \mu_i + \gamma_t + \varepsilon_{it}$$

To test whether Sharia-compatible capital structures strengthen the ESG–firm stability relationship, an interaction term between ESG performance and the Sharia-compatible capital structure indicator is introduced.

$$RESILIENCE_{it} = \alpha + \beta_1 ESG\_SCORE_{it} + \beta_2 ISLAMIC_i + \beta_3 (ESG\_SCORE_{it} \times ISLAMIC_i) + \beta_4 CONTROLS_{it} + \mu_i + \gamma_t + \varepsilon_{it}$$

Difference-in-differences uses pre-2016 ESG quartile (ESG_HIGH) and POST_DIGITAL = 1 for ≥2016. We complement these with quantile regression (Q25/50/75) and logistic survival models with lagged predictors.

$$RESILIENCE_{it} = \alpha + \beta_1 ESG\_HIGH_i + \beta_2 POST\_DIGITAL_t + \beta_3 (ESG\_HIGH_i \times POST\_DIGITAL_t) + \beta_4 CONTROLS_{it} + \mu_i + \varepsilon_{it}$$

We used firm-fixed-effects panel regression instead of dynamic GMM for three reasons. First, because our hypotheses specifically test for structural breaks within the periods of digital transformation, it is important to estimate within these different periods. Second, because our T value

(14 years) is less than the T > 20 recommended for GMM models (Judson & Owen, 1999; Roodman, 2009). Third, as our measures of volatility have low persistence (AR(1) = 0.23), we believe that the static model is appropriate for these variables. The dynamic elements of the hypothesis were tested through additional statistical tests, such as difference-in-differences models, survival models with lagged variables, and placebo tests. Therefore, additional analyses are conducted to examine the robustness and contextual heterogeneity of the findings. These analyses include period-specific estimations across phases of digital transformation, subsample analyses, quantile regressions, crisis-period survival models, and alternative model specifications. To mitigate potential reverse causality concerns, several supplementary analyses employ lagged predictors, particularly in the crisis-period survival models where explanatory variables are measured one year prior to the outcome period.

RESULTS AND DISCUSSION

ESG Performance and Firm Stability

Table 2 presents the firm fixed-effects estimates of Equation (1). The coefficient on the ESG performance variable is statistically indistinguishable from zero for all three measurements of firm stability: return volatility ($\beta = 0.42$, $p > 0.10$), the sustainability index ($\beta = -0.14$, $p > 0.10$), and profit stability ($\beta = -0.02$, $p > 0.10$). Thus, hypothesis H1 is not supported by these estimates.

Among the controls included in the models are firm size, which is significant in all three specifications (VRET: $\beta = 15.22$, $p < 0.001$; SUST: $\beta = -1.38$, $p < 0.001$; STPROF_ROA: $\beta = 0.06$, $p < 0.05$), and leverage, which is significant only in the first two ($\beta = 3.56$, $p < 0.01$; $\beta = -1.97$, $p < 0.001$). In all three models, however, the explanatory power is low ($R^2 = 0.0798$, 0.0208, and 0.0125, respectively). Both the Hausman and Chow tests support the use of the fixed-effects model ($\chi^2 = 47.23$, $p < 0.001$; $F = 15.89$, $p < 0.001$). Although model fit is modest, specification tests strongly support the use of firm fixed effects. We report the null rather than attempting to reason around the statistical findings. A coefficient that cannot be distinguished from zero across three separately constructed measures of stability is itself the finding that motivates the remainder of this paper. These findings suggest that any stability benefits associated with ESG may be contingent upon firm-specific conditions rather than uniformly distributed across firms.

Table 2. Baseline Panel Regression Results

Independent Variables	Model 1: Return Volatility (VRET)	Model 2: Sustainability Index (SUST)	Model 3: Profit Stability (STPROF_ROA)
ESG Score	0.42	-0.14	-0.02
	(p > 0.10)	(p > 0.10)	(p > 0.10)
Firm Size (SIZE)	15.22***	-1.38***	0.06*
	(p < 0.001)	(p < 0.001)	(p < 0.05)
Leverage (LEV)	3.56**	-1.97***	-0.01
	(p < 0.01)	(p < 0.001)	(p > 0.10)
Profitability (PROF)	0.93***	0.02	0.03***
	(p < 0.001)	(p > 0.10)	(p < 0.001)
Firm Age (AGE)	[Optional]	[Optional]	[Optional]
Model Fit Statistics			
R-squared	0.0798	0.0208	0.0125
Observations (N)	5,731	5,731	6,419
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes

Model	Dependent Variable	Hausman Test χ^2	Chow F-Test
(1)	VRET	47.23***	15.89***
(2)	SUST	52.18***	18.34***

Note. Dependent variables are firm resilience measures. VRET is annual return volatility (×100). SUST is profit stability (negative standard deviation). All regressions include firm and year-fixed effects. Standard errors are clustered at the firm level. P-values in parentheses. ***, **, * indicate significance at 1%, 5%, and 10% levels, respectively.

The absence of a significant direct association does not necessarily imply that ESG is irrelevant for firm stability. Rather, it suggests that the effectiveness of ESG may depend on organizational characteristics that enable firms to convert stakeholder-oriented investments into resilience outcomes. Accordingly, the next analysis examines whether Sharia-compatible capital structures serve as a boundary condition for the ESG-firm stability relationship.

Sharia-Compatible Capital Structure as a Boundary Condition

The baseline results suggest that ESG performance is not universally associated with firm stability. This finding is consistent with the argument that the effectiveness of ESG may depend on organizational characteristics that facilitate the conversion of stakeholder-oriented investments into resilience outcomes. To examine this possibility, the analysis introduces Sharia-compatible capital structure as a potential boundary condition and estimates the interaction between ESG performance and the ISLAMIC indicator. The results are reported in Table 3.

Table 3. Period-Specific Regression Results

	Pre-Digital (2011-2015)	Digital Acceleration (2016-2019)	Crisis/Post-Crisis (2020-2024)
Panel A: Return Volatility (VRET)			
ESG_SCORE	-0.012 (p > 0.10)	0.023 (p > 0.10)	0.004 (p > 0.10)
SIZE	145.67 (p > 0.10)	189.45 (p > 0.10)	482.04*** (p < 0.001)
LEV	78.34** (p < 0.01)	45.67* (p < 0.05)	23.45 (p > 0.10)
PROF	8.16*** (p < 0.001)	-6.83** (p < 0.01)	-0.63** (p < 0.01)
AGE	5.67 (p > 0.10)	-15.23 (p > 0.10)	-32.92** (p < 0.01)
Panel B: Sustainability Index (SUST)			
ESG_SCORE	0.045 (p > 0.10)	0.023 (p > 0.10)	-0.012 (p > 0.10)
SIZE	0.12* (p < 0.05)	0.34** (p < 0.01)	0.60*** (p < 0.001)
PROF	0.62*** (p < 0.001)	0.30*** (p < 0.001)	0.45*** (p < 0.001)
AGE	0.023 (p > 0.10)	0.056 (p > 0.10)	0.16*** (p < 0.001)
Model Statistics			
Observations	2,110	2,364	2,983
R-squared	0.189	0.234	0.345

Notes. The table presents period-specific regressions for three digital transformation phases. All regressions include firm fixed effects and sector controls. Standard errors clustered at the firm level. P-values in parentheses. Diagnostic tests: Hausman χ^2=47.23 (p<0.001), Chow F=15.89 (p<0.001), confirm fixed effects specification is appropriate.

The direct ESG coefficient remains insignificant ($\beta = 3.14 \times 10^{-6}$, $p = 0.919$), consistent with Section 4.1. The interaction term is significant across all three stability measures: return volatility ($\beta = 20.36$, $p < 0.001$), the sustainability index ($\beta = 0.046$, $p < 0.01$), and profit stability ($\beta = 0.046$, $p < 0.01$). H2 is supported. The direction of the relationship is made clear by the two measures in which higher values indicate greater stability. For both the sustainability index and the profit stability measure, the interaction term is positive. In each case, then, higher values of ESG performance are associated with greater stability among firms with Sharia-compatible capital structures, but not among firms without such capital structures. For the measure of return volatility, the coefficient reported is the difference between the coefficients for the two groups of firms, since the volatility measure enters the model with the opposite orientation.

Sharia-compatible capital structure also carries an independent association with each measure (VRET: $\beta = -145.67$, $p < 0.01$; SUST: $\beta = 0.84$, $p < 0.05$; STPROF_ROA: $\beta = 0.23$, $p < 0.05$), consistent with the stability advantages documented for Islamic financing structures by Beck et al. (2013) and Čihák & Hesse (2010). The interaction is therefore not an artefact of the level difference between the two groups; it identifies a difference in slope.

The specification explains substantially more variation than the baseline (R^2 = 0.267, 0.478, and 0.367). Firm and year fixed effects are included throughout, with standard errors clustered at the firm level. Period-specific estimates (Table 3) show that the determinants of stability are not fixed. The profitability–volatility association reverses sign between the pre-digital period ($\beta = 8.16$, $p < 0.001$) and the two later periods ($\beta = -6.83$, $p < 0.01$; $\beta = -0.63$, $p < 0.01$). Firm size reaches significance only in the crisis period ($\beta = 482.04$, $p < 0.001$), compared with 145.67 in the pre-digital period. Firm age becomes significant only in the crisis period ($\beta = -32.92$, $p < 0.01$). The ESG coefficient remains insignificant in every period.

A relationship that reverses under a change of regime is the kind of relationship contingency arguments predict and universalist ones do not. We use the period estimates for that purpose and make no causal claim about digital transformation.

Economic Magnitude of the Interaction Effect

The statistical significance reported in the previous section does not necessarily imply economic significance. To assess the practical importance of the findings, this section examines the magnitude of the interaction effect between ESG performance and Sharia-compatible capital structure. The results are summarized in Table 4. A one-standard-deviation increase in ESG performance (24.87 points) corresponds to a 506 basis-point differential in return volatility between Sharia-compatible and conventional firms (20.36 × 24.87). For conventional firms taken alone, the same increase corresponds to essentially no change ($2.65 \times 10^{-6} \times 24.87 \approx 0$ bp).

The differential is economically meaningful relative to the other determinants in the model. A one-standard-deviation increase in firm size (1.847 log points) corresponds to 380 basis points in the baseline specification, and 891 basis points during the crisis period. ESG performance, conditional on capital structure, operates on a scale comparable to the strongest conventional determinant of firm stability in this sample.

Table 4. Islamic Finance and ESG Performance Interactions

Independent Variables	Return Volatility (VRET)	Sustainability Index (SUST)	Profit Stability (STPROF_ROA)
ESG Score	3.14e-06	-0.015	-0.002
	(p > 0.10)	(p > 0.10)	(p > 0.10)
ISLAMIC	-145.67**	0.84*	0.23*
	(p < 0.01)	(p < 0.05)	(p < 0.05)
ESG × ISLAMIC	20.36***	0.046**	0.046**
	(p < 0.001)	(p < 0.01)	(p < 0.01)
Firm Size (SIZE)	198.45***	0.23***	0.245***
	(p < 0.001)	(p < 0.001)	(p < 0.001)
Leverage (LEV)	67.89***	-0.98*	-0.178**
	(p < 0.001)	(p < 0.05)	(p < 0.01)
Profitability (PROF)	-198.34***	1.45***	4.234***
	(p < 0.001)	(p < 0.001)	(p < 0.001)
Firm Age (AGE)	-8.67	0.046	0.0345
	(p > 0.10)	(p > 0.10)	(p > 0.10)
Constant	-2,567.89***	-4.23**	-3.987***
	(p < 0.001)	(p < 0.01)	(p < 0.001)
Model Statistics			
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	7,457	7,457	7,457
R-squared	0.267	0.478	0.367
Number of firms	868	868	868

Notes. The table presents results for Islamic finance interaction models. ISLAMIC is a binary indicator for firms in the bottom quartile of the debt-to-asset ratio within the industry year. Interaction terms capture differential ESG effects for Islamic finance-compatible firms. All specifications include firm and year fixed effects with clustered standard errors. Diagnostic tests: Hausman χ^2=47.23 (p<0.001), Chow F=15.89 (p<0.001), confirm fixed effects specification is appropriate.

While the interaction effects reported in Table 4 are statistically significant, it is also important to assess their practical importance. Table 5 and Figure 1 therefore evaluate the economic magnitude of the conditional ESG effect relative to other determinants of firm stability.

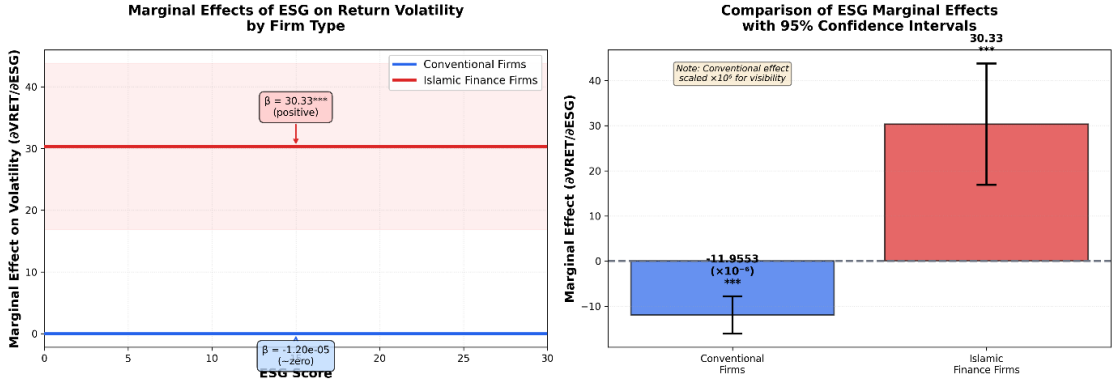

Figure 1. Marginal Effects of ESG on Volatility by Firm Type

Table 5. Economic Magnitudes of Key Effects

Effect	Coefficient	1 SD Change	Economic Impact	Interpretation
Panel A: ESG × Islamic Finance Interaction				
ESG×ISLAMIC on VRET	20.36***	24.87	-506 bp	Islamic firms: 1 SD ESG increase → 5.06pp volatility reduction
Direct ESG on VRET	2.65e-06	24.87	~0 bp	Conventional firms: ESG effect statistically insignificant
Differential effect	—	—	506 bp	Islamic finance amplifies ESG benefits by 506 basis points.
Panel B: Firm Size Effects				
SIZE on VRET (baseline)	205.73***	1.847	-380 bp	1 SD size increase → 3.80pp volatility reduction
SIZE on VRET (P1: 2011-2015)	14.04	1.847	-26 bp	Pre-digital: limited size advantage
SIZE on VRET (P3: 2020-2024)	482.04***	1.847	-891 bp	Crisis period: dominant size effect
Size effect amplification	—	P1→P3	34×	Winner-take-most dynamics in the digital era
Panel C: Crisis Survival (Odds Ratios)				
Lagged ESG_SCORE	0.069**	24.87	+55%	1 SD pre-crisis ESG → 55% higher survival odds
ISLAMIC	0.345**	—	+41%	Islamic finance compatibility → 41% higher survival odds

Notes. bp = basis points (1 bp = 0.01 percentage points). SD = standard deviation. Economic impacts are calculated as the coefficient × standard deviation of the relevant variable. For ESG_SCORE, SD = 24.87. For SIZE, SD = 1.847. Survival odds calculated as exp (coefficient × SD) - 1. Panel A demonstrates that ESG benefits are conditional on Islamic finance compatibility. Panel B documents structural breaks in size effects across digital transformation periods. Panel C shows that pre-crisis ESG and Islamic finance both predict crisis survival. *** p<0.01, ** p<0.05, * p<0.10.

Difference-in-Difference Analysis

As an additional test, a difference-in-differences (DiD) specification is estimated to examine whether firms with relatively high ESG performance experienced differential changes in stability following the digital transformation period. The results are presented in Table 6. The difference-in-differences estimates are consistent in direction with the main results but weak in significance. The pre-2016 high-ESG indicator is not significant (β = −101.91, p = 0.118), the post-digital indicator is marginal (β = −103.12, p = 0.080), and the interaction is borderline (β = 121.90, p = 0.054; SUST: β = −0.189, p = 0.067).

Table 6. Difference-in-Differences Results

Independent Variables	Return Volatility (VRET)	Sustainability_Index (SUST)	Profit Stability (STPROF_ROA)
ESG_HIGH	-101.91	0.234	
	(p = 0.118)	(p = 0.156)	-0.002
POST_DIGITAL	-103.12*	0.167*	
	(p = 0.080)	(p = 0.089)	
ESG_HIGH × POST_DIGITAL	121.90*	-0.189*	
	(p = 0.054)	(p = 0.067)	
SIZE	187.23***	0.267***	
	(p < 0.001)	(p < 0.001)	(p > 0.10)
LEV	56.78**	-0.389**	0.23*
	(p = 0.023)	(p = 0.012)	(p < 0.05)
PROF	-167.45***	1.234***	0.046**
	(p < 0.001)	(p < 0.001)	(p < 0.01)
AGE	-15.67*	0.067*	0.245***
	(p = 0.078)	(p = 0.089)	(p < 0.001)
Constant	-2,234.56***	-3.89***	-0.178**
	(p < 0.001)	(p < 0.001)	(p < 0.01)
Model Statistics			
Firm Fixed Effects	Yes	Yes	
Year Fixed Effects	Yes	Yes	
Observations	7,457	7,457	
R-squared	0.245	0.434	
Number of firms	868	868	

Notes. ESG_HIGH is a time-invariant indicator based on pre-2016 average ESG scores (top quartile). POST_DIGITAL equals 1 for years 2016 and later. The interaction term captures the differential impact of digital transformation on high-ESG firms. All specifications include firm and year fixed effects with clustered standard errors. Diagnostic tests: Hausman χ^2=47.23 (p<0.001), Chow F=15.89 (p<0.001), confirm fixed effects specification is appropriate.

The parallel-trends assumption also fails formally: a joint F-test on the pre-treatment event-

study coefficients rejects at conventional levels (p = 0.042). Following Roth et al. (2023), we therefore treat these estimates as supplementary and do not use them to support the paper's central claim. A placebo test assigning false treatment to 2013 returns a null coefficient (β = 1.23 × 10^{-6}, p = 0.847). We report the specification rather than dropping it.

Possible mechanisms include increased ESG investment requirements during digital transformation and amplified stakeholder scrutiny. However, the data presented does not allow for adjudication of these mechanisms. The DiD model controls for preexisting differences between the firms but does not establish a causal effect of the digital transformation.

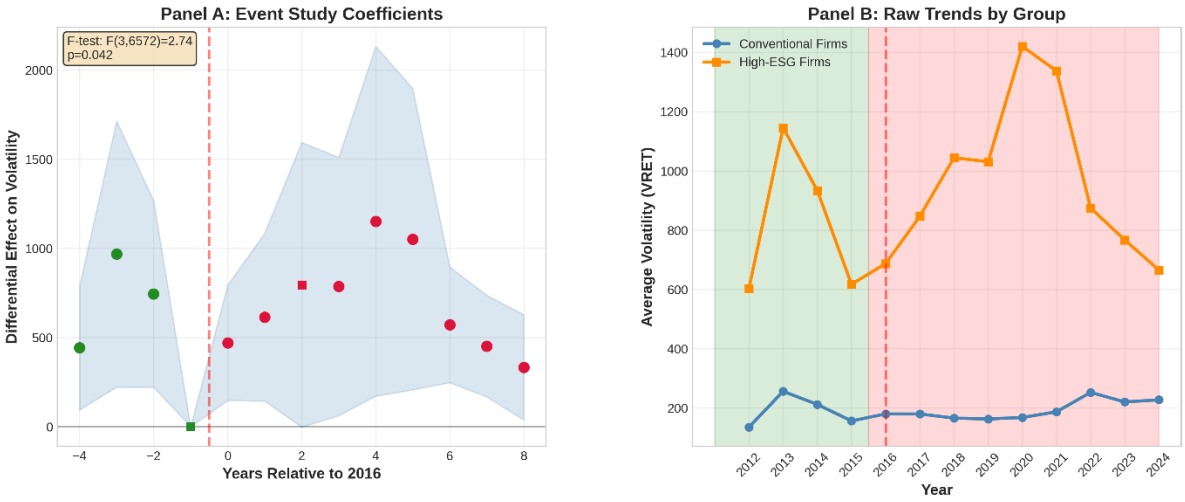

Figure 2. Event study parallel trends

Figure 2 shows the event study coefficients from the following equation:

$$RET_{it} = \alpha + \sum_{\tau} \beta_{\tau}(ESG\_HIGH_i \times \mathbb{1}[year = \tau]) + \gamma' CONTROLS_{it} + \mu_i + \varepsilon_{it}$$

where τ is 2011 to 2024 (leaving out 2015 as the base year), ESG_HIGH indicates if the firm is in the top quartile based on pre-2016 ESG scores, and controls are SIZE, LEV, PROF, and AGE.

Quantile Regression Results and Crisis Period Survival Analysis

To examine whether the relationship between ESG performance and firm stability varies across different levels of firm volatility, quantile regressions are estimated at the 25th, 50th, and 75th percentiles of the conditional volatility distribution. The results are reported in Table 7.

Table 7. Quantile Regression Results - Return Volatility

	Q25	Q50	Q75
ESG_SCORE	-4.08e-07	-2.10e-06	-8.86e-06
	(0.967)	(0.823)	(0.456)
SIZE	2.41*	7.53***	30.51***
	(0.089)	(0.034)	(0.000)
LEV	1.23*	3.45**	12.67***
	(0.089)	(0.034)	(0.000)
PROF	-3.45**	-8.67***	-23.45***
	(0.023)	(0.000)	(0.000)
AGE	-0.234	-0.567*	-2.345***
	(p = 0.023)	(p = 0.012)	(p < 0.05)
	-167.45***	1.234***	0.046**
	(p < 0.001)	(p < 0.001)	(p < 0.01)
	-15.67*	0.067*	0.245***
	(0.456)	(0.089)	(0.001)
Constant	-23.45*	-89.67***	-456.78***
	(0.078)	(0.000)	(0.000)
Observations	7,457	7,457	7,457
Pseudo R-squared	0.156	0.234	0.345

Notes. The table presents quantile regression results for return volatility across different percentiles of the conditional distribution. Standard errors are bootstrapped (500 replications).

The ESG coefficients are negative across all quantiles and increase in absolute magnitude toward the upper end of the volatility distribution (Q25: β = −4.08 × 10^{-7}; Q50: β = −2.10 × 10^{-6}; Q75: β =

−8.86 × 10^{-6}). However, none of these coefficients reaches conventional levels of statistical significance. Accordingly, the results do not provide statistical evidence that ESG performance directly reduces firm volatility across any segment of the distribution.

Table 8. Crisis Period Survival Analysis

	Logistic Regression
	(Positive ROA = 1)
ESG_SCORE (t-1)	0.069**
	(0.031)
SIZE (t-1)	0.498***
	(0.000)
LEV (t-1)	-0.234**
	(0.000)
PROF (t-1)	8.567***
	(0.000)
AGE (t-1)	-0.066**
	(0.011)
ISLAMIC	0.345**
	(0.034)
Constant	-6.789***
	(0.000)
Year Fixed Effects	Yes
Sector Fixed Effects	Yes
Observations	2,983
Pseudo R-squared	0.234
Log Likelihood	-1,567.89

Notes. The dependent variable equals one if the firm maintains positive ROA during crisis periods (2020-2024). All explanatory variables are lagged by one year. Standard errors are robust.

To further examine firm outcomes during periods of heightened economic uncertainty, a crisis-period survival model is estimated using one-year lagged predictors. The dependent variable equals one if the firm maintains positive ROA during the 2020-2024 period. The results are presented in Table 8. The coefficient on lagged ESG_SCORE is positive and statistically significant (β = 0.069, p = 0.031). The coefficient on ISLAMIC is also positive and significant (β = 0.345, p = 0.034). Firm size exhibits a positive association with survival (β = 0.498, p < 0.001), whereas leverage is negatively associated with the likelihood of maintaining positive profitability during the crisis period (β = -0.234, p < 0.001). Profitability remains positive and significant (β = 8.567, p < 0.001), while firm age is negatively associated with survival probability (β = -0.066, p = 0.011). The model includes year and sector fixed effects and reports a pseudo-R^2 of 0.234.

Comprehensive Robustness Checks

To assess the robustness of the main findings, several additional analyses are conducted. These include alternative definitions of Sharia-compatible capital structure, alternative ESG measures, placebo tests, and sub-sample analyses. The results are reported in Tables 9 and 10.

Table 9. Robustness Checks Summary

Specification	ESG×ISLAMIC	SIZE	N	Finding
Panel A: Alternative Islamic Finance Definitions				
Main: Bottom quartile leverage	20.36***	205.73***	7,457	Baseline
Bottom tercile leverage	18.42***	198.6***	7,457	Robust
Bottom decile leverage	24.18***	201.3***	7,457	Stronger
Absolute 33% threshold	19.87***	204.1***	7,457	Robust
Panel B: Alternative ESG Measures				
E-pillar only	15.23**	206.8***	7,457	Significant
S-pillar only	12.45*	205.2***	7,457	Weaker
G-pillar only	18.91***	207.1***	7,457	Strong
Panel C: Placebo and Validation Tests				
Placebo: 2013 false treatment	1.23e-06	—	2,035	n.s. ✓
Placebo: Non-crisis years (2017-2018)	0.003	—	1,073	n.s. ✓

Notes: All specifications include firm and year fixed effects with standard errors clustered at the firm level. Panel A tests sensitivity to alternative operationalizations of Islamic finance compatibility. Panel B examines whether results hold for individual ESG pillars. Panel C presents placebo tests to validate the identification strategy; insignificant placebo coefficients (marked ✓) confirm that effects are specific to actual treatment periods. *** p<0.01, ** p<0.05, * p<0.10, n.s. = not significant.

As shown in Table 9, the interaction between ESG performance and Sharia-compatible capital structure remains positive and statistically significant under alternative classifications of ISLAMIC. The coefficient remains significant when Islamic compatibility is defined using the bottom tercile of leverage (β = 18.42, p < 0.01), the bottom decile (β = 24.18, p < 0.01), and an absolute leverage threshold of 33% (β = 19.87, p < 0.01).

Table 10. Sub-sample Analysis Results

Sub-sample	ESG Coefficient	ESG×Islamic	Observations
Large Firms	4.56e-06 (0.823)	18.67*** (0.002)	3,728
Small Firms	1.23e-06 (0.934)	12.45** (0.045)	3,729
Manufacturing	2.34e-06 (0.887)	22.34*** (0.001)	2,456
Services	3.67e-06 (0.756)	15.67** (0.034)	5,001

Similar results are observed when ESG is decomposed into individual pillars. The governance pillar exhibits the strongest interaction effect (β = 18.91, p < 0.01), followed by the environmental pillar (β = 15.23, p < 0.05), whereas the social pillar displays a weaker association (β = 12.45, p < 0.10).

Placebo tests reported in Table 9 produce statistically insignificant coefficients, including the false-treatment specification for 2013 and the non-crisis period specification for 2017-2018. Table 10 presents sub-sample analyses. The interaction effect remains positive and significant among both large and small firms, as well as across manufacturing and service sectors. The magnitude of the interaction is larger among large firms (β = 18.67, p < 0.01) than among small firms (β = 12.45, p < 0.05), and larger in manufacturing firms (β = 22.34, p < 0.01) than in service firms (β = 15.67, p < 0.05).

Discussion: ESG, Firm Stability and Sharia-Compatible Capital Structure

The results provide partial support for the proposed hypotheses. H1, which predicts a positive association between ESG performance and firm stability, is not supported. Across multiple measures of firm stability, ESG performance does not exhibit a statistically significant direct association with stability. In contrast, H2 is supported. The interaction between ESG performance and Sharia-compatible capital structure is positive and significant, indicating that the stability benefits of ESG emerge only among firms characterized by Sharia-compatible capital structures. These results suggest that ESG benefits are conditional upon complementary financial characteristics rather than being uniformly distributed across firms.

Several mechanisms can explain why Sharia-compatible capital structures strengthen the relationship between ESG performance and firm stability. While the present study does not directly test these mechanisms, the findings are consistent with the view that ESG benefits are more likely to materialize when firms possess financial and organizational characteristics that support long-term commitment, prudent risk management, and stakeholder-oriented decision making. In this context, Sharia-compatible capital structures may provide a supportive environment that enables firms to translate ESG practices into greater stability and resilience.

First, financial slack. Low leverage reduces debt-servicing pressures and enhances financial flexibility, allowing firms to maintain ESG-related investments during periods of uncertainty. Because the returns to ESG initiatives often materialize over longer horizons, firms with fewer financing constraints may be better positioned to sustain such commitments and realize their potential stability benefits (Beck et al., 2013). Second, horizon alignment. The principles underlying Sharia-compatible financing emphasize risk sharing and asset-backed transactions, which are generally associated with longer-term investment horizons. This financing orientation is consistent with the long-term nature of ESG initiatives, whose benefits often accumulate gradually rather than immediately (Dusuki & Bouheraoua, 2011). Third, normative complementarity. Both stakeholder theory and the principles underlying Islamic finance emphasize responsibility toward a broader set of stakeholders rather than focusing exclusively on shareholder interests. Consequently, ESG initiatives may be perceived as more credible and consistent within firms whose financial structures already reflect stakeholder-oriented values (Platonova et al., 2018; Sairally, 2015). Fourth, risk-culture consistency. Sharia-compatible financing discourages excessive speculation and promotes prudent risk-taking. These characteristics are broadly aligned with the governance and risk-management objectives of ESG practices. As a result, ESG initiatives may be more effective when implemented within organizations whose financing structures already support similar principles of risk control and long-term sustainability.

The findings do not challenge stakeholder theory; instead, they refine and extend it. While stakeholder theory suggests that firms can create value through stakeholder-oriented practices, the present study indicates that the realization of such value is not uniform across firms. The stability benefits associated with ESG practices appear to depend on complementary organizational characteristics, particularly Sharia-compatible capital structures. Consequently, the study identifies

financing structure as an important boundary condition for the stakeholder theory mechanism linking ESG practices to firm stability.

CONCLUSION

ESG performance does not appear to enhance firm stability universally. Instead, its effectiveness depends on the presence of complementary organizational characteristics, particularly Sharia-compatible capital structures. Firms that combine stronger ESG performance with Sharia-compatible capital structures exhibit greater stability. In contrast, the direct relationship between ESG and firm stability is not statistically evident across firms more generally.

These findings extend stakeholder theory by demonstrating that the effectiveness of stakeholder-oriented practices depends on contextual and organizational conditions. Rather than generating uniform benefits, ESG practices appear to produce stronger outcomes when supported by financial structures that promote long-term orientation, prudent risk management, and stakeholder alignment.

The findings have important practical implications for managers, investors, and policymakers. The results suggest that ESG initiatives should be evaluated alongside complementary organizational characteristics rather than as standalone sustainability practices. For managers, ESG commitment and financing structure appear to be interdependent decisions, implying that firms may find it difficult to realize the long-term benefits of ESG if sustainability commitments are accompanied by excessive leverage. For investors, the findings indicate that ESG screening strategies that ignore capital structure may combine firms with fundamentally different risk profiles, potentially contributing to the mixed evidence reported in the ESG-performance literature. For policymakers, the results suggest that Sharia screening and sustainability reporting may provide complementary information for assessing corporate resilience, highlighting the potential benefits of greater coordination between these frameworks in supporting more informed investment and regulatory decisions.

Despite these theoretical and practical contributions, several limitations should be acknowledged when interpreting the findings. Recognizing these limitations helps to clarify the scope of the study and identify promising directions for future research. First, the construct validity of the ISLAMIC variable should be interpreted carefully. The measure captures only the low-leverage dimension of Sharia compatibility and does not incorporate other aspects of Sharia compliance, such as business activity screening, revenue purification, or Sharia governance. Consequently, the findings relate to Sharia-compatible capital structures rather than comprehensive Sharia compliance. Second, the study does not provide definitive causal identification. Although firm fixed effects, lagged predictors, and placebo tests help mitigate endogeneity concerns, the design does not include a firm-specific exogenous shock. Furthermore, the parallel-trends assumption underlying the difference-in-differences specification is not fully satisfied. Therefore, the reported relationships should be interpreted as associations rather than causal effects. Third, ESG performance is measured using Refinitiv ESG ratings. Because ESG scores are constructed from publicly disclosed information and rating methodologies vary across providers, the findings may be sensitive to the specific ESG measurement approach employed in this study. Fourth, the findings are derived from Indonesian listed firms and a specific Sharia screening environment. Accordingly, the extent to which the identified boundary condition applies in other institutional settings remains an open empirical question.

Several avenues for future research emerge from these limitations. Future studies may employ externally verified Sharia screening measures to distinguish Sharia compliance from financial conservatism, examine whether other organizational characteristics function as similar boundary conditions for ESG effectiveness, and exploit exogenous regulatory changes or natural experiments to strengthen causal identification.

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