ESG, Corporate Maturity And Capital Structure: The Moderating Role of Firm Size In LQ45 Firms

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Abstract.
This study examines how environmental social, and governance (ESG) performance, financial characteristics, and corporate maturity shape leverage among Indonesia's most liquid listed firms, and whether firm size conditions the effects of ESG and listing age. A balanced panel of 20 non-financial LQ45 constituents observed from 2019 to 2025 (140 firm-year observations) is estimated using random-effects generalized least squares with Driscoll-Kraay standard errors and moderated regression analysis. ESG is negatively associated with leverage (β = -1.176, p = 0.045). Asset tangibility, liquidity, firm age, and market-to-book value are also negative and significant, whereas listing age and the direct effect of firm size are not significant. The ESG × size interaction is positive (β = 0.250, p = 0.027), indicating that scale attenuates the negative ESG-leverage association. Conversely, the listing age × size interaction is negative (β = -0.049, p = 0.025), so market maturity is associated with lower leverage particularly among larger firms. The baseline model explains 46.54% of overall leverage variation. These findings integrate sustainability, conventional financing determinants, and two maturity proxies within an emerging-market capital structure model. They also show that the financing implications of ESG and public-market experience depend materially on organizational scale.

Keywords: *capital structure, ESG, leverage, corporate maturity, firm size and LQ45.*

I. INTRODUCTION

Capital structure remains a central corporate finance decision because the mix of debt and equity affects financial flexibility, expected distress costs, investment capacity, and firm value. Trade-off reasoning predicts that managers balance the tax advantages of debt against bankruptcy and agency costs (Modigliani & Miller, 1958). Pecking-order reasoning instead emphasizes information asymmetry and a financing hierarchy in which internal funds precede debt and new equity (Myers & Majluf, 1984). Across these perspectives, industry leverage, market-to-book value, asset tangibility, profitability, and firm size have repeatedly emerged as reliable empirical determinants (Frank & Goyal, 2009).

The financing problem has become more complex as environmental, social, and governance (ESG) performance enters the information set of creditors and equity investors. Better ESG can lower information asymmetry, strengthen legitimacy, and attract equity capital, which should reduce reliance on debt. Indonesian evidence indicates that stronger ESG performance is associated with equity oriented financing and faster capital structure adjustment (Pujiastuti et al., 2024), while large sample evidence from Chinese firms similarly links superior ESG performance to lower debt financing and easier equity access (Zahid et al., 2023). Yet the mechanism is not unambiguous. Sustainable practices may also improve creditworthiness and accelerate adjustment toward target leverage, and book leverage and market leverage results can differ (Adeneye et al., 2023). The expected direction of ESG's leverage effect is therefore empirical, especially in a bank influenced emerging market.

Corporate maturity introduces a second source of heterogeneity. Firm age captures accumulated operating experience, cash flow stability, and internal financing capacity, whereas listing age captures the duration of exposure to disclosure requirements, market discipline, and public investors. Life cycle theory predicts systematic shifts in profitability, risk, and financing needs as firms mature (Dickinson, 2011). Listing age has also been associated with lower financial leverage, although prior evidence is concentrated in narrow sectors and markets (Ikechukwu & Cyril, 2017). These two clocks need not have the same effect, a mature operating

company can be a relatively recent issuer, while a long-listed firm may still face changing investment opportunities.

Firm size can condition both mechanisms. Large firms typically possess broader funding access, greater public visibility, and lower perceived default risk. Consequently, credible ESG may open equity channels but also preserve access to inexpensive debt; similarly, a long public market track record may matter more when backed by a large asset base. Despite these plausible contingencies, evidence on size as a moderator of the ESG-leverage and listing-age-leverage relations remains limited, particularly for Indonesia's blue chip segment.

This study addresses that gap using a balanced panel of 20 non-financial constituents of the Indonesia Stock Exchange LQ45 index during 2019-2025. It contributes in three ways. First, it integrates ESG with tangibility, liquidity, market-to-book value, firm age, and listing age in one capital structure model. Second, it separates operating maturity from capital market maturity. Third, it estimates whether firm size changes the ESG and listing age associations with leverage. The resulting evidence clarifies how sustainability and maturity interact with scale in a concentrated, high liquidity emerging market sample.

1. Theory and Hypothesis Development

2.1 ESG and Leverage

Stakeholder and signaling arguments view ESG as information about managerial quality, exposure to non-financial risk, and the durability of stakeholder relationships. More credible sustainability performance can reduce information asymmetry and strengthen access to public equity. Evidence from Indonesia supports a shift toward equity financing among stronger-ESG firms (Pujiastuti et al., 2024), and international evidence often documents a negative ESG-debt association (Zahid et al., 2023). At the same time, stronger social and environmental performance can improve credit ratings and reduce borrowing costs (Eliwa et al., 2021; La Rosa et al., 2018). Some studies consequently report more debt capacity or different signs across leverage definitions (Adeneye et al., 2023; Ho et al., 2022). For LQ45 firms, whose equity is already liquid and visible, the information and equity-access channel is expected to dominate.

H1. ESG performance is negatively associated with leverage.

2.2 Financial Characteristics and Corporate Maturity

Asset tangibility increases collateral value and reduces expected creditor loss, leading the trade-off view to predict higher leverage. Liquidity produces the opposite prediction under the pecking order: firms with abundant current resources can finance activity internally and borrow less. Growth opportunities, proxied by market-to-book value, can increase expected investment needs, but they also heighten underinvestment and asset-substitution concerns; established evidence often finds lower leverage among high market-to-book firms (Frank & Goyal, 2009). Panel evidence from Asian markets confirms that tangibility, liquidity, growth, and size are material but context-dependent determinants (Nguyen et al., 2020; Saif-Alyousfi et al., 2020). Firm age reflects accumulated retained earnings, survival experience, and operating stability. The pecking-order and life-cycle views therefore imply that mature firms can rely more heavily on internal resources and use less debt. Listing age provides a separate signal of transparency and market seasoning. Longer exposure to public scrutiny can reduce information asymmetry and broaden equity-market familiarity, reducing dependence on leverage (Ikechukwu & Cyril, 2017; Esqueda & O'Connor, 2020). These arguments yield the following directional hypotheses.

H2. Asset tangibility is positively associated with leverage.

H3. Liquidity is negatively associated with leverage.

H4. Firm age is negatively associated with leverage.

H5. Listing age is negatively associated with leverage.

H6. Market-to-book value is negatively associated with leverage.

2.3 The Moderating Role of Firm Size

Size alters the credibility and financing consequences of non-financial information. Large firms receive more analyst, investor, and regulatory attention; their ESG systems are more likely to be institutionalized, yet they also have stronger bank rela-tionships and access to cheaper debt. The negative

ESG-leverage relation may therefore be attenuated when scale preserves attractive debt capacity. Similarly, listing age may become a more consequential signal when a long record of market discipline is paired with a large operating base. Because the direction of these contingent effects has limited direct evidence in Indonesia, the moderation hypotheses are stated without imposing a sign ex ante.

H7. Firm size moderates the association between ESG performance and leverage.

H8. Firm size moderates the association between listing age and leverage.

II. DATA AND METHOD

3.1 Sample and Data Sources

The population comprises firms included in the LQ45 index during 2019-2025. Purposive sampling required continuous LQ45 membership, non-financial status, complete annual financial statements, accessible annual and sustainability reports, and all market variables needed for estimation. Of 45 index constituents, 20 failed the consistency criterion and five financial institutions were excluded. The final sample contains 20 firms and seven observations per firm, yielding a balanced panel of 140 firm-year observations. Financial data were collected from audited annual reports; ESG and market data were obtained from sustainability reports and Bloomberg Terminal.

Leverage (LEV) is interest-bearing debt divided by total assets. ESG is the Bloomberg aggregate ESG score on the study's 1-10 scale. Tangibility (TANG) is net fixed assets divided by total assets; liquidity (LIQ) is current assets divided by current liabilities. Firm age (AGE) is years since incorporation and listing age (LAGE) is years since the initial public offering. Market-to-book value (MTB) is market capitalization divided by book equity, and size (SIZE) is the natural logarithm of total assets. The analytical specification uses the transformations documented in the final workbook. Table 1 reports raw, interpretable descriptive levels. Coefficient magnitudes should therefore be read on the estimation scale, while substantive inference emphasizes signs and statistical significance.

Table 1: Descriptive statistics for the balanced panel

Variable	N	Mean	SD	Min	Max
LEV (%)	140	16.6997	14.9950	0.00	53.68
ESG (1-10)	140	3.4600	1.1042	0.89	6.19
TANG (%)	140	46.2209	18.0473	12.18	81.82
LIQ (times)	140	1.9124	1.1997	0.18	5.65
AGE (years)	140	44.0500	19.8155	7.00	92.00
LAGE (years)	140	25.0334	9.2610	4.63	43.85
MTB (times)	140	2.2764	3.6825	0.24	29.02
SIZE	140	7.9038	4.7116	-0.07	13.14

Source: Authors' calculations using Stata 18

3.2 Model Specification and Estimation

The baseline relation is estimated as a panel model with firm specific effects. Year indicators are not added because the submitted thesis specification reports the parsimonious determinant model. The baseline and moderation equations are:

$$LEV_{it} = \alpha + \beta_1 ESG_{it} + \beta_2 TANG_{it} + \beta_3 LIQ_{it} + \beta_4 AGE_{it} + \beta_5 LAGE_{it} + \beta_6 MTB_{it} + \beta_7 SIZE_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

$$LEV_{it} = \alpha + \sum_{k=1}^{7} \beta_k X_{kit} + \beta_8 (ESG \times SIZE)_{it} + \beta_9 (LAGE \times SIZE)_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

Model choice follows the conventional sequence of Chow, Breusch-Pagan Lagrange-multiplier, and Hausman tests. The Chow and LM tests reject pooled estimation, while the Hausman test does not reject the random-effects assumptions (p = 0.1668). Accordingly, the reported estimator is random-effects generalized least squares. The model exhibits heteroskedasticity, so inference uses Driscoll-Kraay standard errors with a maximum lag of two. These standard errors are designed to remain robust under broad forms of cross-sectional and temporal dependence (Driscoll & Kraay, 1998). Moderated regression analysis adds the two product terms in Equation. (2). Hypotheses are evaluated at alpha = 0.05.

III. RESULTS

4.1 Model Selection and Diagnostics

Table 2 summarizes the specification and diagnostic tests. Residual normality is not rejected and the mean variance-inflation factor is well below conventional thresholds. The heteroskedasticity test is significant, motivating robust covariance estimation; the serial-correlation test does not provide evidence of first order autocorrelation. The selected random-effects model is jointly significant ($p < 0.001$) and explains 46.54% of overall leverage variation.

Table 2: Panel-model selection and diagnostic tests

Test	Statistic	Decision
Chow	$p < 0.001$	Fixed effects preferred to pooled OLS
Breusch-Pagan LM	$p < 0.001$	Random effects preferred to pooled OLS
Hausman	$p = 0.1668$	Random effects retained
Residual normality	$p = 0.4381$	Normality not rejected
Multicollinearity	Mean VIF = 2.70	No material multicollinearity
Heteroskedasticity	$p = 0.0059$	Present; robust SE applied
Serial correlation	$p = 0.1230$	No first-order autocorrelation evidence

Source: Authors' calculations using Stata 18

Notes: LM = Lagrange multiplier; VIF = variance-inflation factor; SE = standard errors

4.2 Baseline and Moderation Estimates

The baseline estimates in Table 3 show a negative ESG coefficient ($\beta = -1.1757$, $p = 0.045$), supporting H1. Tangibility is also negative and significant ($\beta = -0.0136$, $p = 0.008$). Because H2 predicted a positive association, it is rejected despite statistical significance. Liquidity ($\beta = -0.8126$, $p < 0.001$), firm age ($\beta = -0.6558$, $p = 0.025$), and market-to-book value ($\beta = -0.4146$, $p < 0.001$) are negative and significant, supporting H3, H4, and H6. Listing age is negative but not significant ($p = 0.949$), so H5 is not supported. Firm size has no significant direct effect in the baseline model.

Table 3: Random-effects estimates with Driscoll-Kraay standard errors

Variable	Baseline β	DK SE	p	MRA β	DK SE	p
ESG	-1.17574	0.46626	0.045	-3.41268	0.55808	0.001
TANG	-0.01355	0.00343	0.008	-0.01944	0.00616	0.020
LIQ	-0.81255	0.08625	<0.001	-0.84339	0.10724	<0.001
AGE	-0.65579	0.22138	0.025	-0.60544	0.28225	0.076
LAGE	-0.04047	0.61180	0.949	0.19155	0.67333	0.786
MTB	-0.41455	0.03978	<0.001	-0.42869	0.05310	<0.001
SIZE	0.00986	0.04609	0.838	-0.14551	0.09523	0.177
ESG × SIZE	—	—	—	0.24963	0.08614	0.027
LAGE × SIZE	—	—	—	-0.04896	0.01644	0.025
Constant	8.20136	0.70478	<0.001	10.48904	1.83874	0.001
Overall R^2	0.4654			0.5070		

Source: Authors' calculations using Stata 18

Notes: N = 140 firm-years; 20 firms; maximum lag = 2. MRA includes both interaction terms. R^2 for MRA is computed from the submitted analytical dataset.

In the moderated model, ESG × size is positive and significant ($\beta = 0.2496$, $p = 0.027$). Because the marginal ESG slope combines a negative main effect with a positive size interaction, the ESG slope becomes less negative as firm size rises; H7 is supported. Listing age × size is negative and significant ($\beta = -0.0490$, $p = 0.025$), implying that the listing-age slope becomes more negative with scale; H8 is supported. The direct size effect remains insignificant ($p = 0.177$), so the evidence concerns contingency rather than a simple scale premium in leverage. Firm age is significant in the baseline but falls to marginal significance once the interactions are included.

IV. DISCUSSION

5.1 ESG and Conventional Financing Determinants

The negative ESG-leverage association is consistent with the interpretation that credible sustainability performance reduces information asymmetry and supports access to equity. It accords with Indonesian evidence on debt-equity choice (Pujiastuti et al., 2024) and with evidence that high ESG firms use less debt when capital markets reward disclosure quality (Zahid et al., 2023). The result should not be read as evidence that ESG makes debt unavailable. Better ESG may also lower the cost of debt (Eliwa et al., 2021). Instead, within this LQ45 sample, the relative financing response is a lower observed leverage ratio. This distinction helps reconcile findings that ESG can simultaneously improve credit conditions and reduce debt dependence.

Tangibility's negative coefficient is the principal departure from the directional hypotheses. Traditional trade-off logic treats tangible assets as collateral and therefore predicts more debt. For mature blue chip firms, however, a large installed asset base may generate operating cash flows that reduce external financing needs. Similar context-dependent signs have been observed in emerging markets, where institutional conditions and debt composition matter (Saif-Alyousfi et al., 2020). The finding is associative and should not be interpreted as proof that investing in fixed assets causes deleveraging.

The strongly negative liquidity coefficient supports the pecking order mechanism: firms with more liquid internal resources borrow less. The negative market-to-book coefficient is also consistent with preserving financing flexibility and avoiding debt-related underinvestment when growth options are valuable. Both results align with the reliable determinant patterns documented in established capital structure research (Frank & Goyal, 2009; Nguyen et al., 2020).

5.2 Corporate Maturity and the Role of Scale

Firm age is negatively associated with leverage, consistent with mature firms' stronger retained earnings, more stable cash generation, and greater ability to self-finance. Listing age, by contrast, has no stand-alone effect. LQ45 constituents are already highly visible and subject to extensive disclosure and trading scrutiny; this common blue-chip status may compress meaningful variation in market discipline. The result differs from sector-specific evidence that longer listing history reduces leverage (Ikechukwu & Cyril, 2017), underscoring the importance of sample compo-sition.

The interactions reveal that scale changes both relations. First, the positive ESG × size coefficient attenuates ESG's negative association with leverage. Large firms may benefit from ESG through both equity and debt channels: their disclosure is credible enough to attract investors, yet their asset base, visibility, and risk profile also secure favorable credit. Recent evidence that ESG ratings matter for financial institutions' leverage and that reporting quality conditions the ESG-leverage relation supports this channel (Malik & Kashiramka, 2025; Birindelli et al., 2025). Thus, larger high-ESG firms have less need to reduce debt as sharply as smaller firms.

Second, the negative listing age × size coefficient indicates that a long public-market record is associated with lower leverage mainly when combined with sub-stantial scale. Market seasoning alone may be too weak a signal in a homogeneous index, but seasoning backed by a large operating base can reduce information asymmetry and support internal financing at the same time. The direct and interac-tion results together demonstrate why listing age should not be treated as a universal linear determinant

V. CONCLUSION

Using 140 firm-year observations from 20 non-financial LQ45 firms, this study finds that ESG, tangibility, liquidity, firm age, and market-to-book value are negatively associated with leverage. While listing age and firm size do not exhibit significant direct effects, firm size significantly moderates the two focal relationships. Specifically, it weakens the negative association between ESG and leverage, and reverses the direction of the listing-age effect within the sample while raising its statistical significance. The evidence supports an integrated view in which stakeholder information, the pecking order, and corporate maturity

jointly shape financing, while organizational scale determines how those signals are translated into observed debt use.

For managers, ESG should be treated as a financing capability rather than solely a compliance cost. Smaller firms may gain most from the equity access and information effects that accompany credible ESG performance. Larger firms can use the same credibility to negotiate competitive debt including sustainability-linked facilities without abandoning leverage flexibility. Maintaining liquidity also remains central to financial independence. Creditors and institutional investors should assess ESG in conjunction with firm size and market history rather than applying a uniform score-based rule.

The study is limited by its focus on highly liquid blue chip firms, its 20-firm sample, the aggregate rather than pillar specific ESG measure, and a seven year window that includes pandemic disruption. The short time dimension also warrants caution when interpreting Driscoll-Kraay inference, whose asymptotic properties are strongest with longer panels (Driscoll & Kraay, 1998). In addition, the design identifies conditional associations and does not fully eliminate reverse causality or omitted variable bias. Future work should expand to smaller capitalization and sectoral indices, separate environmental, social, and governance pillars, include macroeconomic controls and year effects, and use dynamic GMM or credible instruments to test endogeneity.

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