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Financial Leverage and Stock-Price Volatility in an Emerging Market: Evidence from Indonesian Consumer Non-Cyclicals

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Abstract

Consumer non-cyclicals are often considered defensive investments; however, differences in capital structure may expose their stocks to substantial price volatility. This study examined the relationships between profitability, financial leverage, firm size, and stock-price volatility among Indonesian consumer non-cyclical firms from 2022 to 2024. A quantitative observational research design was employed using a balanced panel of 30 firms, comprising 90 firm-year observations. Stock-price volatility was measured using the natural logarithm of Parkinson's range-based variance estimator, calculated from annual high and low stock prices. A random-effects panel regression model incorporated year fixed effects and firm-clustered standard errors, supplemented by robustness checks involving a logarithmic transformation of leverage, a price-source subsample analysis, and the exclusion of highly leveraged observations. Financial leverage was positively and significantly associated with stock-price volatility (coefficient = 0.2427; p = 0.002), whereas profitability exhibited no statistically significant association (p = 0.499). Firm size demonstrated a negative association that was marginally significant at the 10% significance level (p = 0.062). The positive association between financial leverage and stock-price volatility remained robust following the logarithmic transformation and within the subsample using issuer-linked price sources. However, this association became statistically insignificant after excluding observations with debt-to-equity ratios exceeding 3 (p = 0.771). These findings suggest that the estimated average association was substantially influenced by highly leveraged observations, consistent with the proposition that debt financing may amplify equity risk. The study concludes that financial leverage may serve as a useful indicator for investment screening within traditionally defensive sectors, particularly among highly indebted firms. Nevertheless, the observational nature of the evidence does not establish a causal relationship or identify a statistically validated leverage threshold.

INTRODUCTION

Stock-price volatility is central to investment decisions, portfolio construction, and corporate financing because it reflects uncertainty surrounding the market value of equity. At the firm level, volatility reflects both market-wide information and investors' reassessments of company-specific

cash flows and risks. A firm's financial statements therefore serve not only as records of past performance but also as sources of information that can influence investors' expectations regarding the distribution of future financial outcomes.

The relationship between financial leverage and equity risk is particularly important. Debt can amplify the variability of returns borne by shareholders because fixed contractual obligations take priority over residual equity claims. Structural credit-risk models similarly suggest that, all else being equal, a smaller equity cushion increases the sensitivity of equity value to changes in firm value (Merton, 1974). Hamada (1972) established a theoretical relationship between capital structure and the systematic risk of common equity, while Christie (1982) documented leverage-related variations in stock-return variance. More recent analytical research has also demonstrated a direct relationship between financial leverage and equity-return variance under plausible assumptions (Aharon & Yagil, 2019). Collectively, these theoretical and empirical arguments support the expectation of a positive association between financial leverage and stock-price volatility.

Profitability and firm size may also influence stock-price volatility, although their expected effects are less straightforward. Strong profitability may indicate operational resilience and reduce uncertainty regarding future cash flows. Larger firms generally attract greater analyst coverage and investor attention, maintain more diversified operations, and disclose more publicly available information. These characteristics may reduce firm-specific information uncertainty. In emerging markets, however, stock prices may incorporate firm-level information unevenly, while market structures and institutional characteristics can influence the extent to which accounting fundamentals are reflected in equity valuations (Morck et al., 2000; Jin & Myers, 2006). Consequently, the empirical relationships between firm fundamentals and stock-price volatility may vary across markets and sectors.

Indonesia provides a relevant setting for examining these relationships. As one of Southeast Asia's major emerging markets, Indonesia has a diverse population of publicly listed companies operating across multiple economic sectors. The consumer non-cyclicals sector is particularly relevant because demand for essential consumer goods is generally considered relatively resilient to economic fluctuations. Nevertheless, firms within this sector may differ substantially in debt exposure, profitability, size, dependence on commodity inputs, and stock-trading characteristics. Consequently, relatively stable demand for essential products does not necessarily translate into low equity-price volatility.

Previous empirical evidence from Indonesia has produced mixed findings. Studies conducted across different sectors have reported positive relationships between financial leverage and stock-price volatility, negative relationships between firm size and volatility, or statistically insignificant associations involving the same financial fundamentals (Marini & Dewi, 2019; Rosyida et al., 2020; Prasetyo & Tambunan, 2024; Ardiansah et al., 2025). International evidence similarly suggests that empirical findings may depend on market characteristics, sample composition, measurement approaches, and the inclusion of control variables (Allen & Rachim, 1996; Duffee, 1995). These inconsistencies highlight the importance of conducting a focused

investigation within the consumer non-cyclicals sector rather than assuming that findings from other sectors are directly transferable.

This study examines whether profitability, financial leverage, and firm size are associated with firm-level stock-price volatility among Indonesian consumer non-cyclical companies during 2022–2024. Beyond estimating the average relationship between financial leverage and volatility, the study investigates whether this association is broadly observed across firms or disproportionately influenced by companies with unusually high financial leverage. This distinction is important because a positive average regression coefficient may conceal substantial heterogeneity across the leverage distribution, particularly when debt-to-equity ratios exhibit pronounced positive skewness.

The Indonesian consumer non-cyclicals sector offers a particularly relevant context for this investigation. Companies supplying essential consumer goods are commonly regarded as relatively defensive investments because demand for their products is less sensitive to discretionary consumer spending. However, relatively stable product demand does not eliminate uncertainty regarding operating margins, financing obligations, or equity valuations. Firms within this sector may differ considerably in profitability, financial leverage, and asset size, potentially resulting in different stock-price responses under similar market conditions. Accordingly, the central research problem is whether these accounting-based characteristics are associated with stock-price volatility and, more specifically, whether the leverage–volatility relationship is broadly distributed across firms or disproportionately influenced by highly leveraged observations.

Financial leverage provides the primary theoretical explanation for potential variations in equity risk. Because debt creates contractual obligations that take priority over shareholders' residual claims, a smaller equity cushion can magnify the proportional effects of changes in firm value on equity value. Aharon and Yagil (2019), in their study titled The Impact of Financial Leverage on the Variance of Stock Returns, developed a theoretical framework explicitly linking financial leverage to equity-return variance. Their research provides a theoretical foundation for anticipating a positive relationship between financial leverage and stock-price volatility while emphasizing the assumptions underlying this relationship. Profitability and firm size represent complementary explanatory factors. Profitability may reflect operational resilience and the capacity to generate sustainable earnings, whereas firm size may capture differences in operational diversification, information availability, and market visibility. Nevertheless, these theoretical mechanisms require empirical examination within the sector rather than being treated as predetermined outcomes.

Previous Indonesian research provides empirical justification for examining financial leverage and firm size simultaneously. Rosyida et al. (2020) investigated companies included in the LQ45 Index during 2017–2019, analyzing 93 firm-year observations from 31 companies. Their findings indicated a positive association between financial leverage and stock-price volatility and a negative association between firm size and volatility, whereas asset growth was not statistically significant. These results suggest that financing structures and organizational scale may help explain differences in equity-price risk among publicly listed Indonesian companies. However, the

index-based sample did not specifically isolate the operating characteristics of consumer non-cyclical firms. Consequently, these findings provide a useful comparative reference while leaving unresolved whether similar relationships exist within a sector characterized by relatively stable demand for essential consumer products.

More recent sector-specific evidence indicates that these relationships are not consistently observed across explanatory variables. Prasetyo and Tambunan (2024) examined Indonesian healthcare companies during 2020–2022 using 57 observations. Their findings revealed a statistically significant positive association between financial leverage and stock-price volatility, an insignificant association between profitability and volatility, and a positive but statistically insignificant association between firm size and volatility. Compared with Rosyida et al. (2020), these findings provide broadly consistent evidence regarding the relationship between financial leverage and stock-price volatility but differ in the direction and statistical significance of the firm-size coefficient. This comparison demonstrates that empirical relationships identified within one sample should not automatically be generalized to other sectors or observation periods. Furthermore, it reinforces the importance of examining profitability, financial leverage, and firm size jointly within a clearly defined sector and research period.

Collectively, these studies reveal a specific research gap concerning the distribution and robustness of the leverage–volatility relationship. Existing empirical evidence demonstrates the relevance of average leverage coefficients but does not adequately establish whether a positive association within Indonesian consumer non-cyclicals is consistently observed across conventional leverage levels or is primarily driven by observations with unusually high debt-to-equity ratios. This distinction is important because a positive coefficient estimated using a linear regression model may summarize relationships that are unevenly distributed across firms. Differences in sectoral coverage, observation periods, and volatility measurement methods further complicate direct comparisons among previous studies. The present study addresses this gap by integrating a sector-specific empirical investigation with sensitivity analyses designed to assess whether the estimated relationship depends on the skewness of the leverage distribution, the presence of highly leveraged observations, or differences in the composition of stock-price data sources.

Addressing this research gap is important because overly generalized interpretations of financial leverage may undermine investment screening and corporate financing decisions. Investors who rely primarily on the defensive characteristics of a particular sector may overlook substantial differences in financial exposure among individual companies. Conversely, interpreting a positive average leverage coefficient as equally applicable to all firms may overstate the strength of the evidence for companies with moderate debt levels. The novelty of this study lies in distinguishing the average leverage–volatility association from its sensitivity to observations in the upper tail of the leverage distribution among Indonesian consumer non-cyclical firms during 2022–2024. This contribution is deliberately limited in scope: the analysis evaluates whether highly leveraged observations materially influence the estimated relationship while recognizing

that sensitivity to their exclusion does not independently establish a formal leverage threshold or causal mechanism.

Accordingly, this study aims to examine the associations between profitability, financial leverage, firm size, and stock-price volatility among 30 Indonesian consumer non-cyclical companies during 2022–2024, using a balanced panel comprising 90 firm-year observations. Specifically, the study seeks to estimate these associations while controlling for common year-specific conditions, assess the robustness of the leverage coefficient following a logarithmic transformation, compare the results within a subsample based on issuer-linked stock-price sources, and evaluate the sensitivity of the findings to the exclusion of observations with debt-to-equity ratios exceeding 3. Stock-price volatility is measured using Parkinson's range-based variance estimator, constructed from annual high and low stock prices. Therefore, the resulting measure represents annual range-based equity-price variation rather than realized volatility calculated from daily stock returns. Furthermore, the observational research design supports the identification of statistical associations rather than causal relationships.

This study contributes to the existing literature by integrating capital-structure theory with empirical evidence concerning the sensitivity of estimated equity-risk relationships within a traditionally defensive sector in an emerging market. Its methodological contribution lies in combining year-specific controls, firm-clustered standard errors, and robustness checks addressing the leverage distribution and the composition of stock-price data sources. From an investment perspective, the findings may provide a more differentiated basis for incorporating financial leverage into equity-risk assessments alongside profitability and firm size. For corporate managers, the analysis may offer insights into potential equity-market risk considerations when evaluating financing decisions. For future researchers, the study provides a foundation for further investigations incorporating longer observation periods, standardized daily stock-price data, and formal nonlinear model specifications. Collectively, these contributions support a more nuanced understanding of the circumstances under which financial leverage provides useful information about equity-price risk and the limitations that should be considered when generalizing empirical findings.

METHOD

Sample and data sources

The unit of analysis was the firm-year, covering main-board consumer non-cyclical companies listed during 2022–2024. Firms were selected based on consistent sector classification and listing status, the availability of annual financial data (net income, total assets, total liabilities, and total equity), and complete annual high and low stock-price records throughout the study period. The final balanced panel comprised 30 firms and 90 firm-year observations. Loss-making observations were retained to minimize selection bias and ensure the inclusion of firms with varying profitability levels.

Financial data were primarily obtained from annual reports and issuers' investor relations websites, supplemented by structured financial databases when necessary. For DLTA, the 2024

financial figures reflected the restated amounts subsequently disclosed by the issuer. Historical stock-price data were collected from issuer-linked sources for 16 firms and structured financial databases for the remaining 14 firms. All data sources were documented in the accompanying workbook. A robustness check was performed using the issuer-linked price-source subsample to assess the consistency of the main regression results.

Variable measurement

Table 1 defines the variables. The dependent variable is a range-based variance measure. Parkinson (1980) shows that the logarithmic high-low range contains information about return variance. Range-based estimators can be more information-efficient than estimators using a single close-to-close return (Garman & Klass, 1980; Alizadeh et al., 2002).

For firm i in year t, the Parkinson range-based variance is:

$$PRV_{it} = \frac{[\ln(H_{it}/L_{it})]^2}{4\ln(2)}$$

where H is the highest observed price and L is the lowest observed price during the year. The regression uses $\ln(PRV)$ because the variance measure is positive and right-skewed. The annual estimator is a parsimonious measure of the full-year price range; it is not equivalent to realized volatility computed from daily returns. This distinction is retained throughout the interpretation. The study employs year dummy variables to control for differences in general market conditions across periods. The year 2022 serves as the reference year. D2023 equals one for observations in 2023 and zero otherwise, while D2024 equals one for observations in 2024 and zero otherwise.

Table 1. Variable definitions

Variable	Symbol	Measurement	Expected sign
Log range-based variance	$LNPRV$	Natural logarithm of PRV defined above	Dependent
Profitability	ROA	Net income / total assets	Negative
Financial leverage	DER	Total liabilities / total equity	Positive
Firm size	$SIZE$	Natural logarithm of total assets in IDR million	Negative
Year indicators	$D2023$, $D2024$	1 for the indicated year; 0 otherwise	Control

Econometric specification

The baseline panel model is:

$$LNPRV_{it} = \alpha + \beta_1 ROA_{it} + \beta_2 DER_{it} + \beta_3 SIZE_{it} + \gamma_1 D2023_t + \gamma_2 D2024_t + u_i + \varepsilon_{it}$$

where u_i is an unobserved firm component and ε_{it} is the idiosyncratic disturbance. The year indicators absorb common shifts relative to 2022. The specification is associational: with three years of observational data and no external source of exogenous variation, the coefficients should not be interpreted as causal effects.

Model selection follows standard panel-data procedures (Baltagi, 2021; Wooldridge, 2010). A fixed-effects poolability F test compares pooled and fixed-effects specifications. The Breusch-

Pagan Lagrange multiplier test evaluates pooled OLS against random effects (Breusch & Pagan, 1980). The Hausman test compares fixed and random effects (Hausman, 1978). These tests select the random-effects model.

Inference is based on standard errors clustered by firm. Clustering allows observations for the same firm to have an unrestricted covariance pattern over the three-year panel and is preferable to relying only on homoskedastic model-based errors (Arellano, 1987; Petersen, 2009). With 30 firm clusters, t tests use cluster-adjusted degrees of freedom. Variance inflation factors are reported as a collinearity diagnostic.

Three sensitivity checks assess whether the central leverage result depends on specification or data construction. The first replaces DER with $\ln(1 + DER)$ to reduce right-skewness. The second restricts the sample to the 16 firms with issuer-linked price sources. The third excludes firm-years with $DER > 3$ to show whether extreme leverage observations account for the average relation.

RESULT AND DISCUSSION

Descriptive statistics

Table 2 reports the descriptive statistics. The average ROA is 8.7%, with a minimum of -20.3%, confirming that the sample includes loss observations. The average DER is 0.97, but the maximum of 6.47 and a standard deviation greater than the mean indicate strong right-skewness. This distribution motivates the log-leverage and tail sensitivity checks. Firm size varies substantially across the sample. The Parkinson variance is also right-skewed, supporting the logarithmic dependent variable.

Table 2. Descriptive statistics

Variable	N	Minimum	Maximum	Mean	Standard deviation
PRV	90	0.0048	0.5665	0.0900	0.1083
$LNPRV$	90	-5.3466	-0.5683	-2.9408	1.0350
ROA	90	-0.2032	0.2929	0.0866	0.0688
DER	90	0.0720	6.4659	0.9665	1.1105
$SIZE$	90	13.6068	19.1224	16.2132	1.4021

Model selection and diagnostics

The poolability F test and Breusch-Pagan LM test reject the pooled specification. The Hausman statistic does not reject the random-effects estimator in favor of fixed effects. The random-effects model is therefore retained as the baseline (Table 3).

Table 3. Panel-model selection

Test	Statistic	p-value	Decision
Fixed-effects poolability F test	2.2752	0.0043	Reject pooled model
Breusch-Pagan LM test	7.4646	0.0063	Reject pooled model
Hausman test	2.3783	0.7947	Retain random effects

The variance inflation factors are 1.02 for ROA, 1.03 for DER, 1.04 for SIZE, 1.33 for D2023 and 1.34 for D2024. Multicollinearity is therefore not material. The reported inference does not depend on a residual normality assumption because firm-clustered standard errors are used. The model's R^2 is 0.139 and adjusted R^2 is 0.088, indicating that the included accounting fundamentals and year effects explain only a modest share of volatility.

Baseline estimates

Table 4 presents the random-effects estimates. The coefficient on ROA is negative but statistically insignificant ($\beta = -1.487,\ p = 0.499$), so H1 is not supported. The leverage coefficient is positive and significant ($\beta = 0.243,\ p = 0.002$), supporting H2. Because the dependent variable is in logs, a one-unit increase in DER is associated with approximately a 27.5% increase in range-based variance, holding the other regressors constant. This percentage is calculated as $[\exp(0.243) - 1] \times 100$ and should be treated as an average association rather than a causal effect.

Firm size has a negative coefficient ($\beta = -0.183$). Its p-value of 0.062 does not meet the 5% threshold, although it is consistent with H3 at the 10% level. The 2023 indicator is negative and significant, suggesting lower range-based variance than in 2022 after controlling for the observed firm characteristics. The 2024 indicator is not significant.

Table 4. Random-effects estimates of log range-based variance

Variable	Coefficient	Firm-clustered SE	t-statistic	p-value	Hypothesis
Constant	0.1314	1.6011	0.082	0.935	—
ROA	-1.4870	2.1724	-0.684	0.499	H1 not supported
DER	0.2427	0.0695	3.493	0.002	H2 supported
$SIZE$	-0.1833	0.0946	-1.938	0.062	H3 not supported at 5%
$D2023$	-0.5015	0.2163	-2.318	0.028	Control
$D2024$	-0.1159	0.2084	-0.556	0.582	Control

Notes: $N = 90$ firm-years; 30 firms. $R^2 = 0.139$; adjusted $R^2 = 0.088$. Joint cluster-robust Wald $\chi^2(5) = 19.61,\ p = 0.0015$. Standard errors are clustered by firm. The dependent variable is $LNPRV$

Sensitivity analysis

Sensitivity analysis indicates that the positive relationship between leverage and stock price volatility is primarily concentrated among highly leveraged firms, as the relationship becomes statistically insignificant after observations with a DER above three are excluded.

Table 5. Leverage sensitivity checks

Specification	Firms	Observations	Coefficient	p-value
Baseline RE (DER)	30	90	0.2427	0.002
Log-leverage RE [ln(1 + DER)]	30	90	0.5846	0.030
Issuer-linked source subset (DER)	16	48	0.2836	<0.001
Exclude DER > 3	28	84	0.0983	0.771

Notes: Coefficients are expressed for $LNPRV$. All specifications include ROA, SIZE, and year indicators. Inference is clustered by firm. The first two alternatives test leverage skewness, the third tests source consistency, and the final row shows that the baseline association is concentrated in the high-leverage tail.

Profitability

The insignificant ROA coefficient suggests that profitability does not provide a sufficiently complete signal of equity-price risk in this sector. Investors observe profitability together with earnings expectations, margins, cash flows, growth, and commodity exposure. A high ROA can reflect stable operations, but it can also coincide with transitory gains or high market expectations. Once leverage, size, and year conditions are controlled, the remaining cross-firm and within-firm variation in ROA is not strongly associated with the annual price range.

This result is consistent with the insignificant profitability findings reported by Prasetyo and Tambunan (2024) and Ardiansah et al. (2025). The broader implication is not that profitability is irrelevant to valuation. Rather, an accounting return ratio alone appears to be a weak summary of the uncertainty that drives annual price extremes.

Financial leverage

The positive leverage coefficient is consistent with the residual-claim mechanism in Merton (1974), the capital-structure risk relation in Hamada (1972), and the leverage-variance evidence in Christie (1982) and Aharon and Yagil (2019). When debt obligations are large relative to book equity, changes in expected operating performance and refinancing conditions can produce larger proportional revisions to equity value. Consumer non-cyclicals are not exempt from this mechanism merely because demand for their products is relatively stable.

The magnitude should nevertheless be interpreted with care. The baseline and log-leverage models support a positive relation, and the result persists in the issuer-linked source subset. The tail-deletion check shows that the relation is mainly associated with observations above a DER of three. Two implications follow. First, leverage may behave nonlinearly: moderate changes in debt need not materially affect volatility until the equity cushion becomes unusually small. Second, average linear coefficients can overstate how broadly an association applies across firms.

Taken together, these results suggest that the leverage–volatility relationship is more heterogeneous than the baseline linear coefficient alone would imply. The central finding is therefore not simply that higher leverage is associated with higher volatility, but that this association appears to be concentrated among firms with unusually high debt-to-equity ratios. For firms operating at more moderate leverage levels, the evidence of a leverage–volatility relationship is substantially weaker.

This distinction is economically meaningful. A relatively stable consumer-demand environment may help reduce operating uncertainty, but it does not eliminate the amplification of equity risk when the equity cushion becomes particularly thin. The findings therefore point toward possible threshold or nonlinear behavior, although a larger sample and a formal nonlinear specification would be required to establish such a relationship conclusively.

Firm size

The negative size coefficient is consistent with the view that larger firms have richer information environments, more diversified operations, and wider investor bases. Its marginal significance indicates that the data provide suggestive, not conclusive, evidence. The result aligns in direction with Marini and Dewi (2019) and Rosyida et al. (2020), but differs in statistical strength.

The issuer-linked subsample produces a stronger negative size coefficient. This may reflect sample composition or measurement consistency, and the current design cannot distinguish between those explanations. Firm size should therefore be treated as a control with a plausible stabilizing association rather than as the central finding.

Year effects and explanatory power

The negative 2023 indicator demonstrates that common market conditions matter even within a narrow three-year window. Omitting year effects would risk attributing market-wide changes to firm fundamentals. The insignificant 2024 indicator suggests that, conditional on the model, 2024 did not differ reliably from the 2022 base year in the annual range measure.

The adjusted R^2 of 8.8% is low but not surprising. Stock-price volatility is affected by liquidity, trading volume, ownership structure, dividend policy, commodity prices, macroeconomic news, and firm-specific events that are not captured by three accounting variables. Accounting fundamentals should therefore be viewed as one layer of risk information, not a complete volatility model.

CONCLUSION

This study examined the associations between profitability, financial leverage, firm size, and stock-price volatility among 30 Indonesian consumer non-cyclical firms during 2022–2024. A random-effects panel regression model incorporating year controls and firm-clustered standard errors revealed a positive association between financial leverage and stock-price volatility. Profitability showed no statistically significant association, whereas firm size exhibited a negative association that was marginally significant at the 10% level. Robustness checks provided further insights into these findings. The positive leverage–volatility association remained significant following a logarithmic transformation of leverage and within the subsample using issuer-linked stock-price sources. However, the association became statistically insignificant after excluding observations with debt-to-equity ratios (DER) exceeding 3. These findings suggested that the estimated average relationship was substantially influenced by highly leveraged observations rather than being consistently observed across firms with different leverage levels. The study contributed to the literature by demonstrating the sensitivity of the leverage–volatility relationship to the upper tail of the leverage distribution within a traditionally defensive sector. From an investment perspective, financial leverage may serve as a useful screening indicator for assessing equity-price risk, particularly among firms with substantial debt relative to equity. For corporate managers, the findings highlighted the potential implications of capital structure for equity-market risk beyond interest expenses and refinancing obligations. For future researchers, the results

underscored the importance of examining potential nonlinear relationships between leverage and volatility and incorporating more comprehensive volatility measures in emerging-market research.

This study had several limitations. First, the three-year observation period and relatively small sample of 30 firms limited statistical power and the ability to examine dynamic relationships. Second, the annual high–low range-based volatility estimator provided less granular information than volatility measures derived from daily stock returns. Third, historical stock-price data were obtained from multiple sources, including structured public databases, potentially introducing differences in data consistency despite the source-specific robustness checks. Fourth, the observational research design did not support causal inference. Future research should incorporate longer observation periods, daily stock-price data from standardized exchange sources, additional controls for market liquidity and trading activity, and nonlinear leverage specifications to investigate potential variations in the leverage–volatility relationship more comprehensively.

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