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Capital Structure, Investment Decisions, and Firm Value under Investment Loan Rate Conditions: Evidence from Indonesian Property and Real Estate Firms

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Abstract

This study examines the associations of capital structure and realized investment intensity with firm value and whether interest rates on investment loans condition those relationships in Indonesian property and real estate firms. Annual data for 2015–2025 are estimated using cross-section fixed effects with firm-clustered robust standard errors. The primary balanced panel consists of 29 firms and 319 firm-year observations. Capital structure, measured by the debt-to-equity ratio, is positively associated with Tobin's Q, whereas realized investment intensity is negatively associated with firm value. The capital-structure interaction with investment loan rates is positive and significant in the primary model, while the investment interaction is positive rather than negative as hypothesized. A 33-firm full-sample sensitivity model preserves the direct effects but renders both interactions nonsignificant, indicating that moderation results are sample-sensitive. For property developers, the findings favor disciplined debt-capacity management and selective staging of capital additions when borrowing costs are high and cash-conversion timing is uncertain. For investors, leverage and realized investment intensity should be evaluated together with project progress, financing capacity, and expected cash conversion rather than as stand-alone valuation signals.

Keywords: capital structure; investment decisions; firm value; investment loan interest rate; Tobin's Q

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INTRODUCTION

Property companies cannot understand firm value simply by examining companies or by looking at the land, buildings, and development assets recorded on their balance sheets. Investors also consider how those assets are financed, how quickly development spending can be converted into cash flow, and how exposed a developer is to changing financing conditions. Indonesia illustrates this tension clearly. MNC Sekuritas (2024) described the sector as trading at average net-asset-value discounts of approximately 55%–70%, while BRI Danareksa Sekuritas (2025) maintained an overweight view even as valuations remained at substantial discounts, supported by improving pre-sales. Both reports also treated the interest-rate environment as relevant to the sector outlook. The combination of large reported asset bases and discounted market valuations makes Indonesian property firms a useful setting for studying how financing and investment decisions are reflected in market value. Property and real estate development is inherently capital intensive. Developers typically commit substantial funds well before units are sold or recurring income is generated, and the period from land acquisition and construction to project completion and cash collection can be long. Debt can support project execution and expand financing capacity, but it also creates fixed financial commitments. Real investment involves a similar trade-off: additions to productive assets and construction in progress may represent future growth, yet they can also lock capital into projects whose returns may not be realized for several years.

These features make financing and investment decisions difficult to separate when considering valuation. A higher debt ratio may indicate that a firm can mobilize outside funding for projects with substantial upfront costs, but it also increases contractual obligations. Likewise, higher realized investment may reflect the execution of development plans, while its valuation effect remains uncertain until construction progress is converted into sales, recurring income, or other cash inflows. Lending rates can change the way both decisions are interpreted. Financing is relatively less costly when rates are low; when rates rise, the hurdle for debt-funded development also rises, and some projects may become less attractive or harder to continue. For this reason, the study treats SBKI as a conditioning variable rather than merely as background macroeconomic information. Empirical findings on leverage and firm value are far from uniform. Bui, Nguyen, and Pham (2023) demonstrate a positive effect of the debt ratio on Tobin's Q, and Wijaya and Setyawan (2025) report a positive relationship between capital structure and firm value among Indonesian energy firms. Other studies point in the opposite direction: Dang and Do (2021) document a negative relationship in the construction and real estate sectors, while Karaca, Mensi, and Gemici (2025) show that the relationship may be nonlinear. Indonesian evidence is also mixed. Using Tobin's Q and DER in food and beverage firms, Tandra and Setyawan (2026) report a negative but statistically insignificant capital-structure coefficient. Taken as a whole, the literature suggests that the valuation effect of leverage is likely to depend on sector characteristics, financing conditions, and the leverage range being observed.

The evidence regarding the relationship between investment and firm value remains mixed. Capital expenditure may be rewarded when investors view it as a credible commitment to profitable growth opportunities (Chung et al., 1998; Juniarti & Toly, 2021; Ullah et al., 2023). At the same time, realized investment can be valued negatively when it increases financing requirements, delays cash conversion, or raises concerns about project quality and overinvestment. In Indonesia, Suteja et al. (2023) report a negative effect of investment decisions on firm value, and Maria and Birawan

(2022) observe the same direction. Satt et al. (2025) further show that capital expenditure can reduce firm value under intense product-market competition. The mixed record implies that the amount invested cannot be separated from its quality, timing, financing burden, and economic setting, which is also consistent with the investment-efficiency literature (Biddle et al., 2009). Interest rates provide a natural boundary condition for both relationships. Lin et al. (2018) show that interest-rate dynamics affect investment, Tobin's q, the user cost of capital, and the value of growth opportunities. Hussain et al. (2020) document a significant relationship between interest rates and corporate capital structure, while Bindra et al. (2024) show that investment responses to interest-rate movements vary across economic states. More directly, Rizka and Jonnardi (2021) demonstrate that the moderating role of interest rates in the capital-structure–firm-value relationship depends on the leverage measure used; for one leverage proxy, higher interest rates strengthen the relationship. These studies suggest that lending rates can influence how financing and investment decisions are valued, rather than functioning only as background macroeconomic conditions.

Despite the existing literature, a significant research gap remains regarding Indonesian property developers. Previous studies have yet to clarify how capital structure and realized investment jointly influence firm market value in an industry characterized by lengthy development cycles, substantial initial capital requirements, and delayed revenue generation from projects. Research in Indonesia has predominantly focused on leverage in other industries, employed broader or market-oriented measures of investment opportunities, or investigated interest rates in relation to specific financing arrangements. As a result, it remains uncertain whether actual investments in productive assets and construction in progress have valuation effects distinct from those of leverage and whether these effects vary according to the investment lending conditions faced by Indonesian property firms. To address this gap, the present study incorporates three key components into a single empirical framework: firm-level capital structure, realized investment intensity measured through additions to property, plant, and equipment (PPE) and construction in progress (CIP), and the annual commercial bank investment loan rate as a moderating variable. The 2015–2025 observation period encompasses substantial variations in lending rates for investments, while the use of realized asset additions enables the study to distinguish actual investment implementation from market expectations regarding future growth opportunities. Accordingly, this study examines whether capital structure and realized investment intensity are associated with firm value in Indonesian property and real estate firms and whether these relationships vary with the annual commercial-bank investment loan rate over the 2015–2025 period.

LITERATURE REVIEW

Capital structure and firm value.

Trade-off theory does not imply a universally positive effect of debt on firm value. Conceptually, the relationship can be nonlinear because the marginal benefits of debt may dominate at relatively manageable leverage levels, whereas expected financial distress and bankruptcy costs can dominate after leverage becomes excessive (Kraus & Litzenberger, 1973). A positive marginal relationship is therefore theoretically consistent with trade-off theory when firms are observed predominantly on the upward-sloping portion of that trade-off, where additional financing capacity remains more valuable than the incremental distress costs. This study does not estimate an optimal leverage threshold or claim that firm value rises monotonically with debt. Instead, H1 is a directional

prediction about the average leverage–value association within the observed DER range of Indonesian property firms. For capital-intensive developers, debt can expand financing capacity, support land acquisition and construction, and allow projects to progress before sales proceeds are collected. Consistent with this interpretation, Bui, Nguyen, and Pham (2023) report a positive debt-ratio effect on Tobin's Q, while Wijaya and Setyawan (2025) demonstrate a positive capital-structure effect on firm value. At the same time, the negative evidence of Dang and Do (2021) and the inverted U-shaped relationship documented by Karaca, Mensi, and Gemici (2025) remain consistent with Trade-Off Theory because the sign of the marginal leverage effect can change when leverage moves beyond a sustainable range. H1 therefore tests whether firms in the present sample exhibit a positive average slope within their observed leverage range, rather than whether debt is universally value-enhancing.

H1: Capital structure is positively associated with firm value in property and real estate firms.

Investment decisions and firm value.

From a signaling perspective, observable managerial actions can convey information when managers know more than outside investors about project quality and expected cash flows (Spence, 1973). Investment, however, is not necessarily interpreted as a favorable signal. Large realized additions may be viewed negatively when they increase funding requirements, lengthen the period before cash is recovered, or raise concerns about overinvestment and project quality. Investment-efficiency research likewise distinguishes the amount invested from the economic quality of that investment, implying that high investment does not automatically create value when firms move away from efficient investment levels (Biddle et al., 2009). This concern is particularly relevant in property development, where projects can remain under construction for years before producing cash inflows. Suteja et al. (2023) demonstrate a negative effect of investment decisions on firm value in Indonesian non-financial firms, and Maria and Birawan (2022) report the same direction. Satt et al. (2025) also show that capital expenditure can reduce firm value under demanding competitive conditions. Based on these findings, the study anticipates that a higher realized investment intensity will correlate with a lower firm value. An important distinction here is the difference between investment opportunities and investment that has already been carried out. The KI measure captures additions recorded in PPE or CIP, not a market-based measure of future growth opportunities. A high KI value therefore shows that resources have been committed, but it does not establish that the underlying projects will earn returns above their financing and execution costs. This interpretation is consistent with Biddle, Hilary, and Verdi (2009), who distinguish the quantity of investment from its economic efficiency. The issue is especially relevant for property developers because the gap between expenditure and monetization can be long. H2 therefore concerns the contemporaneous association between realized investment intensity and Tobin's Q; it should not be interpreted as saying that productive investment is inherently undesirable.

H2: Investment decisions are negatively associated with firm value in property and real estate firms.

Investment loan rates serve as a moderator of capital structure.

Higher lending rates increase the cost of debt and can also make external credit more selective. In a tighter credit environment, firms that remain able to obtain debt may be perceived as more creditworthy, better able to finance projects, or capable of supporting a higher financing cost.

If leverage is positively valued within the observed range, this selection effect could make the positive leverage-value association more pronounced when investment lending rates are higher. Rizka and Jonnardi (2021) provide evidence that the capital-structure-firm-value relationship can depend on interest rates: higher interest rates strengthened the relationship when leverage was measured as long-term debt to fixed assets, although the direction differed under another leverage measure. Hussain et al. (2020) also show that interest rates are materially related to firms' capital structures. Together, these findings provide a basis for expecting a strengthening moderating effect while recognizing that its direction may depend on the leverage measure.

H3: Investment loan interest rates strengthen the positive association between capital structure and firm value.

Investment loan rates serve as a moderator in investment decisions.

If realized investment is already valued negatively because of financing requirements, long payback periods, or project risk, higher borrowing rates may deepen those concerns. Lin et al. (2018) show that interest rates affect investment, Tobin's Q, the user cost of capital, and growth opportunities. Bindra et al. (2024) further show that investment responses to interest-rate changes differ across economic states. For property developers, higher investment lending rates raise project hurdle rates and increase the financing burden carried during long construction periods. The study therefore expects higher investment loan rates to strengthen the negative relationship between realized investment intensity and firm value.

H4: Investment loan interest rates strengthen the negative association between investment decisions and firm value.

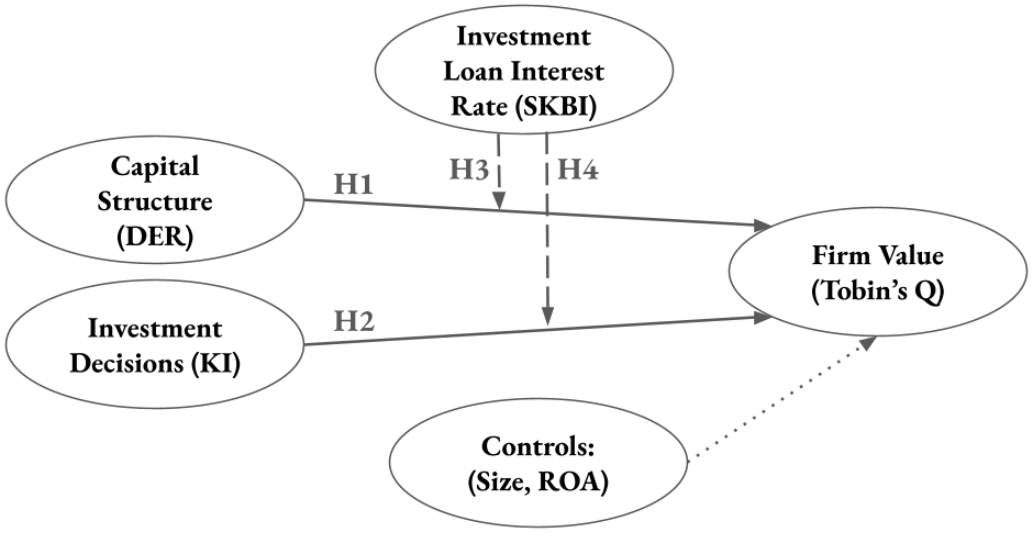


Figure 1. Conceptual Model

H1 predicts a positive capital structure–firm value association, whereas H2 predicts a negative investment–firm value association. H3 predicts that investment loan interest rates strengthen the positive capital structure–firm value relationship, while H4 predicts that investment loan interest rates strengthen the negative investment–firm value relationship. SIZE and ROA are included as control variables. The SBKI main effect is included in the empirical specification as a lower-order term but is not separately hypothesized.

METHODS

Research Design and Sample.

This study adopts an explanatory panel-data design using annual secondary data from property and real estate companies listed on the Indonesia Stock Exchange (IDX) over the 2015–2025 period. As of December 31, 2025, the sampling frame consisted of 92 issuers classified within the property and real estate sector (Indonesia Stock Exchange [IDX], 2025). Of these, 45 companies were excluded because they were listed after 2015 and consequently did not have a complete observation history covering the entire study period. An additional 14 companies were removed due to inconsistencies or gaps in the availability of financial statements and market data required to operationalize the research variables throughout 2015–2025. Following these exclusions, a balanced panel comprising 33 firms was established.

The resulting 33-firm panel was subsequently examined for extreme observations using externally studentized residuals obtained from a least-squares dummy-variable (LSDV) specification equivalent to the cross-section fixed-effects model. Using an absolute residual threshold exceeding 3 ($|RStudent| > 3$), eight extreme firm-year observations were identified, originating from four companies: BCIP, FMII, MKPI, and RODA. For the primary analysis, these four companies were excluded from the sample, resulting in a balanced panel of 29 firms observed over 11 years, yielding 319 firm-year observations. Excluding the firms at the company level ensures that all observations in the primary sample cover the same 2015–2025 period. This procedure represents a sampling decision intended to maintain a consistent observation window rather than a statistical prerequisite for fixed-effects estimation. Meanwhile, the original balanced panel of 33 firms, comprising 363 firm-year observations, was retained for sensitivity analysis to evaluate whether the findings remain consistent when all firms with complete data are included.

The two samples serve distinct analytical purposes. The 29-firm panel constitutes the primary estimation sample following the specified outlier-screening procedure, whereas the 33-firm panel serves as an alternative specification for assessing the robustness of the substantive findings to the sample selection decision. This approach provides transparency regarding the exclusion process and avoids presenting the sampling decision because of the observed regression results. Although the screening procedure identifies extreme observations at the firm-year level, the primary analysis excludes the corresponding firms entirely to preserve a uniform eleven-year observation period across all included companies. Since fixed-effects estimation does not inherently require a balanced panel, the balanced structure is adopted as a design preference for the primary analysis rather than a methodological necessity. Estimating the model using the complete 33-firm panel alongside the primary specification therefore enables a direct assessment of how the exclusion of the four firms affects the empirical conclusions.

Table 1. Sample Selection

Stage	Number of firms
Property and real estate sector population frame as of December 31, 2025	92
Listed after 2015 / no full 2015–2025 history	(45)
Incomplete data required for variable construction	(14)

Initial complete-data balanced panel	33
Firms containing one or more extreme firm-year observations (|RStudent| > 3)	(4)
Primary final sample	29
Years / firm-year observations	11 years / 319

The population frame is based on the *IDX Equity Market Yearly Statistics 2025* (Indonesia Stock Exchange, 2025). Eight extreme firm-year observations were identified across four firms. The primary sample is the resulting 29-firm balanced panel. The complete 33-firm balanced panel is retained as a full-sample sensitivity specification.

Data Sources and Variable Measurement.

Accounting information for the 2015–2025 period is collected from audited consolidated financial statements and annual reports published by the Indonesia Stock Exchange (IDX) and the respective companies through their official disclosure channels (Indonesia Stock Exchange, 2015–2025). Closing share prices at year-end and the number of shares outstanding at year-end, which are required to determine the market value of equity, are extracted from the share-price and share-capital information reported in the companies' annual reports and audited financial statements. The investment loan interest rate (SBKI) is sourced from the statistical table on rupiah lending rates by bank group published by Statistics Indonesia (Badan Pusat Statistik [BPS], 2026). Specifically, the commercial-bank investment lending-rate series for 2015–2025 is used. Monthly interest rates are aggregated by calculating the annual average and subsequently converted from percentages into decimal values for estimation (e.g., 9.78% is expressed as 0.0978). As SBKI represents a national-level annual indicator, its value is identical for all firms in the same year.

Firm value is operationalised using Tobin's Q, calculated as the sum of the market value of equity and total liabilities divided by total assets. Capital structure is represented by the debt-to-equity ratio (DER), computed as total liabilities divided by total equity. Investment decisions are measured through realised investment intensity (KI), defined as the sum of additions to property, plant, and equipment (PPE) and additions to construction in progress (CIP), scaled by lagged total assets. The use of lagged total assets as the scaling denominator is consistent with the investment-efficiency literature (Biddle et al., 2009), whereas the numerator is tailored to the property and real estate sector by incorporating reported additions to PPE and CIP. Profitability, measured by return on assets (ROA), is calculated as consolidated net income divided by total assets. Firm size (SIZE) is measured as the natural logarithm of total assets.

The selected measures are intended to maintain comparability across firms and years while capturing the underlying economic characteristics of each construct. Tobin's Q relates the market value of equity, together with balance-sheet liabilities, to the firm's recorded asset base, thereby reflecting market valuation relative to accounting assets. DER represents the firm's financing structure by expressing total liabilities in relation to shareholders' equity. KI captures realised investment relative to the asset base preceding the investment period, with lagged total assets providing a reference point for evaluating current asset additions. SBKI reflects the prevailing national commercial-bank investment lending-rate environment, which is common to all firms in a given year. Meanwhile, ROA and SIZE are included as firm-level control variables to account for differences in profitability and organisational scale. All variable definitions and measurement

procedures remain consistent between the primary and sensitivity analyses. However, when the estimation sample changes, the sample-specific means used to centre the focal variables are recalculated.

Table 2. Variable Definitions and Measurement

Variable	Role	Measurement
Tobin's Q	Dependent	(Market value of equity + total liabilities) / total assets
DER	Independent	Total liabilities / total equity
KI	Independent	(PPE additions + CIP additions) / lagged total assets
SBKI	Moderator	Annual arithmetic mean of monthly commercial-bank investment lending rates
DER_C × SBKI_C	Interaction	DER_C × SBKI_C
KI_C × SBKI_C	Interaction	KI_C × SBKI_C
ROA	Control	Consolidated net income / total assets
SIZE	Control	ln(total assets)

Moderation Specification.

The variables representing capital structure (DER), realized investment intensity (KI), and the investment loan interest rate (SBKI) are mean-centered before the interaction terms are generated. This procedure facilitates the interpretation of the main-effect coefficients by expressing them at the average level of the moderator while recognizing that centering does not inherently improve statistical significance. Dawson (2014) suggests centering continuous predictors and moderators when a zero value lacks meaningful substantive interpretation. Accordingly, the interaction terms are constructed by multiplying the centered variables, namely DER_C × SBKI_C and KI_C × SBKI_C, using the same centered measures incorporated into the regression model. The dependent variable, Tobin's Q, and all control variables are retained in their original forms without centering.

The empirical model is specified as follows,

$$TQ_{it} = \alpha_i + \beta_1 DER_C_{it} + \beta_2 KI_C_{it} + \beta_3 SBKI_C_t + \beta_4 (DER_C_{it} \times SBKI_C_t) + \beta_5 (KI_C_{it} \times SBKI_C_t) + \beta_6 ROA_{it} + \beta_7 SIZE_{it} + \varepsilon_{it}$$

where TQit denotes Tobin's Q for firm i in year t; i is the firm-specific intercept captured by cross-section fixed effects; DER_Cit, KI_Cit, and SBKI_Ct denote the mean-centered capital structure, realized investment intensity, and interest rate on investment loans, respectively; DER_Cit, SBKI_Ct, and KI_Cit are the interaction terms; ROAit and SIZEit are control variables; and it is the idiosyncratic error term. Because SBKI varies only by year and is identical across firms within a year, a complete set of year fixed effects would be perfectly collinear with the SBKI main effect. The specification therefore includes firm fixed effects but not a full set of year dummies. H1 is supported when $\beta_1 > 0$ and statistically significant; H2 when $\beta_2 < 0$ and significant; H3 when $\beta_4 > 0$ and significant; and H4 when $\beta_5 < 0$ and significant. Significant interactions are probed using conditional slopes at SBKI one standard deviation below the mean, at the mean, and one standard deviation above the mean (Dawson, 2014).

Panel estimation and inference.

Panel-model selection is carried out by comparing pooled, fixed-effects, and random-effects specifications in sequence. The redundant cross-section fixed-effects (Chow) test compares pooled estimation with fixed effects, while the Hausman specification test compares fixed and random effects (Hausman, 1978). Multicollinearity is evaluated using centered variance inflation factors (VIFs). Residual diagnostics include the Jarque–Bera normality test (Jarque & Bera, 1980), a Wooldridge-type test for first-order serial correlation (Drukker, 2003), and cross-sectional-dependence diagnostics based on the Breusch–Pagan LM test (Breusch & Pagan, 1980) and the Pesaran CD test (Pesaran, 2015). Both the Chow and Hausman tests favor cross-section fixed effects. The Wooldridge-type diagnostic—a test of whether regression errors for the same firm remain correlated from one year to the next—rejects the absence of first-order serial correlation. This means that conventional fixed-effects standard errors could understate or misstate the uncertainty around the estimated coefficients. Coefficient inference, therefore, uses EViews White-period covariance with clustering by firm/cross-section. In practical terms, this procedure leaves the fixed-effects coefficient estimates unchanged but adjusts their standard errors and p-values to remain more reliable when errors within the same developer are correlated over time or have unequal variances.

This approach is consistent with cluster-robust panel inference discussed by Wooldridge (2020), while White (1980) provides the foundation for heteroskedasticity-consistent covariance estimation. Evidence on cross-sectional dependence is mixed, so the primary covariance choice is driven mainly by the clearly detected within-firm serial dependence. EViews also reports a reduced-rank warning for the clustered coefficient covariance matrix. Because the warning concerns covariance-based inference rather than the fixed-effects point estimates, interaction p-values close to the 5% threshold are interpreted cautiously and assessed together with the sensitivity analyses. As an additional inference robustness check, the primary 29-firm specification is also evaluated using EViews White two-way cluster covariance, which allows the estimated uncertainty to reflect clustering along both the firm and time dimensions. In plain terms, this verification allows for repeated disturbances within the same developer as well as common disturbances affecting firms in the same year. Because the panel contains only 11 annual time clusters and EViews again reports a reduced-rank covariance warning, the two-way result is treated as supporting evidence rather than as a replacement for the firm-clustered primary inference.

The estimation procedure explicitly distinguishes panel model selection from the determination of the appropriate covariance estimator. The Chow and Hausman tests are employed to identify the most suitable specification among pooled ordinary least squares, fixed effects, and random effects. Meanwhile, residual diagnostic tests are conducted to assess whether conventional standard errors are appropriate for statistical inference under the selected fixed-effects model. Accordingly, the presence of within-firm serial correlation is addressed by adjusting the covariance estimator rather than replacing the selected fixed-effects specification. Similarly, evidence of non-normal residuals is documented as a diagnostic finding but is not considered sufficient justification for modifying the coefficient specification solely to achieve normally distributed residuals. The application of White-period covariance estimation adjusts the estimated standard errors and associated statistical inference without altering the fixed-effects coefficient estimates. This methodological distinction is particularly important when evaluating the reduced-rank warning and interpreting interaction-term p-values that lie close to the conventional 5% significance threshold.

RESULT

Descriptive statistics.

The primary panel contains 319 firm-year observations from 29 firms. Average Tobin's Q is 0.794, average DER is 0.736, mean realized investment intensity is 0.0102, and the annual investment loan rate averages 0.0978. KI varies considerably relative to its mean, which is consistent with differences across developers in the timing and scale of realized capital additions.

Table 3. Descriptive Statistics - Primary Sample

Variable	Mean	Median	Min	Max	Std. dev.
Tobin's Q	0.7936	0.7346	0.1147	2.0202	0.3307
DER	0.7365	0.5860	0.0075	4.1650	0.6052
KI	0.0102	0.0036	0.0000	0.1662	0.0204
SBKI	0.0978	0.0931	0.0828	0.1224	0.0130
SIZE	29.4585	29.6563	25.5903	32.0039	1.4802
ROA	0.0305	0.0295	-0.2090	0.4283	0.0678

N = 319 firm-year observations.

Panel selection and model diagnostics.

The largest centered VIF is 1.824, suggesting that multicollinearity is not a material concern among the centered main effects, interaction terms, and controls. The cross-section fixed-effects (Chow) test rejects pooled estimation in favor of fixed effects ($F = 20.460$, $p < .001$), and the Hausman test rejects random effects in favor of fixed effects ($\chi^2 = 43.475$, $p < .001$). The Jarque-Bera statistic rejects residual normality, while the Wooldridge-type test provides strong evidence of first-order serial correlation within firms ($F = 56.526$, $p < .001$). Evidence on cross-sectional dependence is mixed: the Breusch-Pagan LM statistic is significant, but the Pesaran CD statistic is not ($CD = 0.063$, $p = .950$). These diagnostics support the use of robust rather than conventional fixed-effects standard errors and call for caution when interpreting coefficients with marginal p-values. The diagnostics point to a clear distinction between model specification and statistical inference. Low-centered VIFs indicate that the centered main effects and interactions do not create a meaningful multicollinearity problem. The serial-correlation test, however, shows that conventional fixed-effects standard errors would be inappropriate, providing a direct reason for firm-clustered inference. Because the cross-sectional-dependence tests do not agree, the manuscript reports that evidence is mixed rather than allowing either the significant LM statistic or the nonsignificant Pesaran CD statistic to dominate the interpretation. This diagnostic reading is carried through to the regression results.

Table 4. Panel Selection and Key Diagnostics

Diagnostic	Statistic	p-value / result	Interpretation
Maximum centered VIF	1.8239	-	No material multicollinearity
Chow cross-section F	20.4596	< .001	Fixed effects preferred to pooled
Hausman χ^2	43.4750	< .001	Fixed effects preferred to random

Jarque-Bera	224.4375	< .001	Residual normality rejected
Wooldridge-type serial-correlation F	56.5265	< .001	Within-firm serial correlation indicated
Breusch-Pagan LM dependence	917.3373	< .001	Dependence indicated by LM
Pesaran CD	0.0626	.950	No rejection by CD; overall evidence mixed

The Jarque-Bera statistic is reported as a diagnostic. Final coefficient inference uses firm-clustered robust covariance because within-firm serial correlation is detected.

Primary hypothesis tests.

In the fixed-effects model with firm-clustered robust inference, DER_C is positive and statistically significant (β = 0.2279, robust SE = 0.0433, p < .001). This supports H1 in the primary specification: at the sample mean of SBKI, higher leverage is associated with higher Tobin's Q. KI_C is negative and significant (β = -2.8588, robust SE = 0.8474, p = .0022), supporting H2. The centered SBKI main effect is also positive and significant (β = 7.0587, p < .001), although the study does not state a separate directional hypothesis for that coefficient. The DER_C SBKI_C interaction is positive and significant (β = 5.5270, robust SE = 2.5936, p = .0420), giving primary-specification support to H3: the positive leverage-value slope becomes steeper as investment loan rates rise. The KI_C SBKI_C interaction is also positive and significant (β = 203.2859, robust SE = 98.7703, p = .0490), but H4 predicts a negative interaction. H4 is therefore not supported. In the primary model, higher SBKI weakens the negative investment-value association rather than intensifying it. The model as a whole is statistically significant (F = 26.182, p < .001), with R^2 = 0.764 and adjusted R^2 = 0.735.

Table 5. Primary Fixed-Effects Estimates and Hypothesis Assessment

Variable	Coefficient	Robust SE	p-value	Hypothesis implication
DER_C	0.227948	0.043293	< .001	H1 supported (+)
KI_C	-2.858764	0.847444	.0022	H2 supported (-)
SBKI_C	7.058661	1.322174	< .001	Main effect; not separately hypothesized
DER_C × SBKI_C	5.527007	2.593571	.0420	H3 supported in primary model (+)
KI_C × SBKI_C	203.2859	98.77030	.0490	H4 not supported; sign is opposite
ROA	0.097037	0.210472	.6483	Control
SIZE	-0.155752	0.107247	.1575	Control

Cross-section fixed effects with EViews White-period covariance (standard errors clustered by firm/cross-section; d.f. corrected). R^2 = 0.764041; adjusted R^2 = 0.734859; F = 26.18181, p < .001. EViews reports a reduced-rank coefficient covariance warning; therefore, interaction p-values are interpreted cautiously and considered together with the full-sample sensitivity specification reported in Table 7.

Conditional effects.

The simple slopes show more directly how the interaction terms behave. The DER slope rises from 0.156 at low SBKI (-1 SD) to 0.228 at the mean and to 0.300 at high SBKI (+1 SD); each slope is statistically significant. For KI, the slope is -5.507 at low SBKI (p = .0105), -2.859 at the mean (p = .0022), and -0.210 at high SBKI (p = .8053). The DER pattern is therefore consistent with H3, while the KI pattern runs against H4: as lending rates increase, the negative investment slope becomes progressively weaker and is statistically indistinguishable from zero at high SBKI.

Table 6. Conditional Effects at Low, Mean, and High SBKI

Predictor	Low SBKI (-1 SD)	Mean SBKI	High SBKI (+1 SD)
DER slope	0.155937 (SE 0.034908), p < .001	0.227948 (SE 0.043293), p < .001	0.299959 (SE 0.069382), p < .001
KI slope	-5.507377 (SE 2.008846), p = .0105	-2.858764 (SE 0.847444), p = .0022	-0.210152 (SE 0.844376), p = .8053

Entries are conditional slopes with standard errors derived from the firm-clustered covariance matrix. Reported p-values use 28 cluster degrees of freedom (29 firm clusters minus one). Low and high SBKI correspond to one standard deviation below and above the sample mean, respectively.

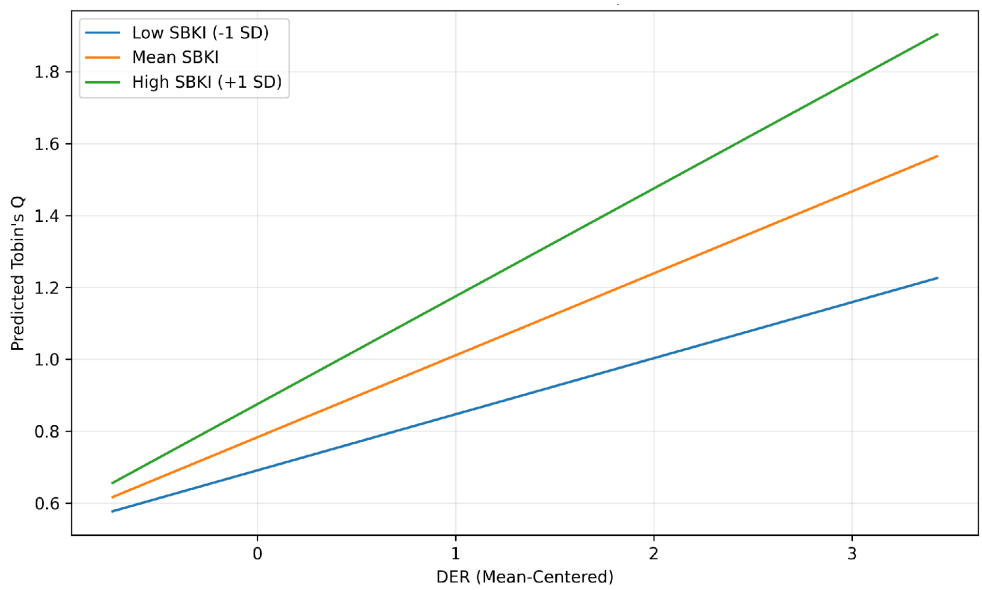


Figure 2. Conditional DER-Firm Value Relationship across SBKI Levels

Source: Authors' calculations.

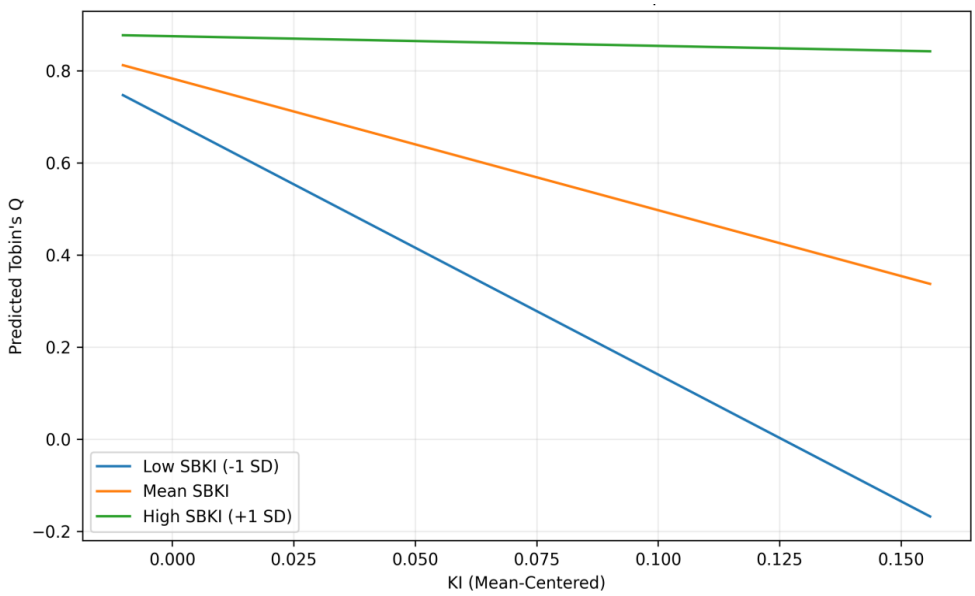


Figure 3. Conditional Investment-Firm Value Relationship across SBKI Levels

Source: Authors' calculations.

Full-sample sensitivity.

The fixed-effects model is re-estimated with the complete balanced panel of 33 firms (363 firm-year observations) to examine whether the main conclusions depend on the treatment of extreme observations. The positive capital-structure effect and the negative investment effect remain statistically significant. Both interaction coefficients keep positive signs, but neither remains statistically significant. The direct effects are therefore more stable across the two sample specifications than the moderation effects. H3 is supported in the primary model but not in the full-sample model, while H4 remains unsupported in both.

Table 7. Full-Sample Sensitivity Analysis

Variable	Primary: 29 firms / 319 obs	Full sample: 33 firms / 363 obs
DER_C	0.227948*** (0.043293)	0.214500*** (0.058381)
KI_C	-2.858764*** (0.847444)	-2.268190** (0.837983)
SBKI_C	7.058661*** (1.322174)	8.535458*** (2.038063)
DER_C × SBKI_C	5.527007** (2.593571)	4.249005 (3.902888)
KI_C × SBKI_C	203.2859** (98.77030)	126.4139 (101.7000)
ROA	0.097037 (0.210472)	0.480478 (0.352809)
SIZE	-0.155752 (0.107247)	-0.175886 (0.142406)
R^2	0.764041	0.802258
Adjusted R^2	0.734859	0.778382
F-statistic	26.18181***	33.60114***

Entries are coefficients with firm-clustered robust standard errors in parentheses. Focal variables are mean-centered separately within each estimation sample before the interaction terms are constructed. Both specifications use cross-section fixed effects and EViews White-period covariance. ** $p < .05$; *** $p < .01$.

Alternative covariance robustness.

As a second robustness check, the primary 29-firm fixed-effects model is evaluated using White two-way cluster covariance. The coefficient estimates remain unchanged because the covariance estimator changes inference rather than the fixed-effects point estimates. The direct effects remain statistically significant, and both interaction terms remain statistically significant within the primary sample under the alternative covariance specification. However, this result does not eliminate the sample sensitivity documented in the 33-firm model because the two interaction terms remain nonsignificant when the four screened firms are restored. The two-way clustering exercise therefore supports the inferential stability of the primary-sample estimates under an alternative covariance treatment, but it does not justify treating the moderation effects as sample-robust.

Table 8. Alternative Covariance Robustness – Primary Sample

Variable	Coefficient	White-period p-value	White two-way p-value
DER_C	0.227948	< 0.001	0.0001
KI_C	-2.858764	0.0022	0.0100
SBKI_C	7.058661	< 0.001	0.0001
DER_C × SBKI_C	5.527007	0.0420	0.0235
KI_C × SBKI_C	203.2859	0.0490	0.0242
ROA	0.097037	0.6483	0.6177
SIZE	-0.155752	0.1575	0.1180

Both columns are based on the same 29-firm cross-section fixed-effects coefficient estimates. Only the covariance estimator changes. EViews reports a reduced-rank covariance warning under the two-way specification; the results are therefore treated as supporting robustness evidence rather than as the primary inference.

DISCUSSION

Capital structure and firm value.

The positive DER coefficient is consistent with Bui, Nguyen, and Pham (2023) and Wijaya and Setyawan (2025), although it differs from studies reporting negative or nonlinear leverage-value relationships. In property development, a positive association is economically plausible because debt can provide the financing capacity needed to acquire land, build, and complete projects before sales proceeds are collected. The market may interpret continued access to external finance within a sustainable leverage range as a sign of creditworthiness and project viability. This does not mean that additional debt always increases firm value. Trade-off theory explicitly allows expected distress costs to overtake the benefits of leverage once debt becomes sufficiently high (Kraus & Litzenberger, 1973). The contrasting results reported by Tandra and Setyawan (2026), Dang and Do (2021), and Karaca, Mensi, and Gemici (2025) underscore how much the leverage-value relationship can depend on sector context and leverage range.

Investment decisions and firm value.

The negative KI coefficient is in line with Suteja et al. (2023), Maria and Birawan (2022), and evidence that capital expenditure may be penalized under difficult competitive or informational

conditions (Satt et al., 2025). In property development, investment spending often occurs years before the related cash is realized. A year with significant PPE and CIP additions can thus lead to increased funding requirements, execution risk, and uncertainty regarding the monetization timeline of projects. The finding should not be read as evidence that investment itself destroys value. A more measured interpretation is that the market appears to distinguish the amount invested from project quality, timing, and expected return, which is consistent with the investment-efficiency perspective in Biddle, Hilary, and Verdi (2009).

Moderating role of investment loan rates.

In the primary panel, the positive DER SBKI interaction means that the leverage-value association becomes more positive as investment lending rates rise. One possible explanation is greater selectivity in access to credit. When borrowing becomes pricier, firms that can still obtain and service external financing may be viewed as financially stronger or as having projects capable of carrying a higher financing cost. Rizka and Jonnardi (2021) report related evidence that interest rates can strengthen a capital-structure-firm-value relationship under one leverage measure, although their findings also show that the direction depends on the proxy used. The result in this study is therefore best viewed as related evidence in a different setting rather than as a direct replication.

The investment interaction is more surprising. H4 predicts that higher rates should make the negative investment-value relationship stronger by increasing the user cost of capital and the cost of project financing. The estimated interaction points the other way: the negative KI slope weakens and moves toward zero at high SBKI. A possible explanation is stricter project selection. When financing becomes more expensive, marginal projects may be postponed or cancelled, leaving a larger share of observed investment concentrated in projects with stronger expected returns or greater strategic priority. This possibility is consistent with evidence that investment responses to interest rates vary across economic states (Bindra et al., 2024). It remains, however, an ex post interpretation of the observed pattern and should not be treated as confirmation of H4. The full-sample results put an important limit on the moderation findings. When all 33 eligible firms are included, both interaction coefficients remain positive, but neither is statistically significant. The study therefore does not treat investment loan rates as a robust moderator across sample treatments. What is more stable are the direct relationships: the positive DER coefficient and negative KI coefficient remain statistically significant in both the primary and full-sample models. The moderation results are accordingly interpreted as conditional evidence, not as universal relationships.

The alternative two-way cluster assessment reinforces this distinction. Within the 29-firm primary sample, the main signs and interaction significance remain under a different treatment of the covariance structure. Nevertheless, restoring all 33 complete-data firms removes the statistical significance of both interactions. The moderation evidence is therefore sensitive primarily to sample composition rather than solely to the choice between one-way and two-way clustered inference. This contrast between the direct and interaction effects also helps define the strength of the study's conclusions. In the complete 33-firm panel, the signs of DER and KI do not change, and both direct coefficients remain significant. The two interaction coefficients also keep their positive signs, but they lose significance. The primary-panel moderation results therefore remain informative, yet their generality is narrower than the direct effects. Substantively, the data provide more consistent evidence about the direction of the leverage-value and realized-investment-value relationships than about whether SBKI changes those relationships in the same way across all eligible firms. From a

managerial perspective, positive leverage effects do not justify maximizing debt. Developers should align borrowing with debt-service capacity, financing maturity, presales, and realistic project cash flows. Given the sample-sensitive DER–SBKI interaction, rising lending rates warrant greater financial stress testing rather than increased leverage. The negative and more robust KI relationship also supports selective investment pacing, prioritizing viable projects with strong returns, secured financing, or advanced presales while reconsidering expansions with uncertain cash flows. Investors and lenders should evaluate leverage and investment intensity alongside construction progress, funding structure, presales, and expected cash-conversion timelines.

CONCLUSION

This study examines the relationships between capital structure, realized investment intensity, and firm value in Indonesian property and real estate firms, considering investment loan rates as a moderator. The primary 29-firm fixed-effects model supports H1, H2, and H3, showing a positive association between DER and Tobin's Q, a negative association between realized investment intensity and firm value, and a positive DER–SBKI interaction. H4 is not supported, as the positive KI–SBKI interaction indicates that higher lending rates weaken the negative investment–value relationship. In the 33-firm sensitivity model, both direct relationships remain significant, while neither interaction is statistically significant. Thus, the direct effects are more robust than the moderation results. These findings highlight the distinct valuation implications of leverage and realized investment, while suggesting that lending-rate moderation may depend on sample specification. Practically, property developers should align financing and investment decisions with debt-service capacity and project cash-conversion timelines. Regulators and industry associations could improve project-level disclosure of construction progress, capital expenditure, debt maturity, presales, and expected cash flows to help investors distinguish productive investment from financing-intensive asset accumulation.

LIMITATION

This study has several limitations. First, incomplete historical disclosures restrict the sample to firms with consistent data for 2015–2025, potentially limiting generalizability to later-listed firms and issuers with less complete disclosures. Second, the BPS investment lending rate represents general banking conditions rather than firm-specific borrowing costs; therefore, moderation effects reflect common lending-rate conditions. Third, firm fixed effects do not fully address endogeneity arising from reverse causality or time-varying omitted variables. Consequently, the results ought to be regarded as conditional associations rather than causal effects. Future research could employ instrumental variables, dynamic-panel methods, or appropriate lag structures, extend the observation period, incorporate firm-level financing data, and examine project-level outcomes such as completion, presales, and sales conversion. Replication in other capital-intensive industries could further assess the generalizability of the findings.

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