

Firm Size as Moderator in the Innovation, Capital Structure and Profitability Relationship

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Abstract

Under the Resource-Based View (RBV), innovation is a strategic, firm-specific resource that can create sustainable competitive advantage. Because innovation requires substantial investment and financing, it may affect both capital structure and profitability; however, this relationship remains underexplored in Indonesia, particularly with respect to firm size as a moderator. This exploratory study examines the associations between innovation and capital structure and profitability, and the moderating role of firm size, using secondary data from manufacturing companies listed on the Indonesia Stock Exchange (IDX) during 2020–2025. Only 10 of 165 firms had complete audited reports and variable data, producing 60 firm-year observations. Innovation was proxied by R&D intensity, capital structure by debt-to-equity ratio (DER), profitability by return on equity (ROE), and firm size by the natural logarithm of total assets. WarpPLS was used to estimate the structural relationships. Innovation was positively associated with capital structure ($\beta = 0.395$, $p < 0.001$), while its association with profitability was negative but statistically insignificant ($\beta = -0.109$, $p = 0.191$). Capital structure was positively associated with profitability ($\beta = 0.787$, $p < 0.001$), although DER and ROE share equity as a denominator. The interaction terms for innovation, firm size, and capital structure were not statistically significant. Because the sample is small and the model-fit indices SPR and RSCR fall below their thresholds, the findings are preliminary associations, not causal evidence.

Keywords *Innovation; Capital Structure; Firm Size; Profitability; R&D Intensity*

INTRODUCTION

Firm performance is critical to business continuity amid global competition. Innovation can improve products, processes, services, and organizational responses to technological and market change. From the Resource-Based View (RBV), firm-specific resources may support competitive advantage when they are valuable, rare, difficult to imitate, and difficult to substitute (Barney, 1991; Penrose, 2009; Wernerfelt, 1984). Innovation, however, is not costless: research and development (R&D), experimentation, and commercialization may increase current expenditure before producing measurable revenue or efficiency gains.

Innovation also has financing implications. Under Pecking Order Theory, firms generally prioritize internal funds, followed by debt and equity when internal funds are insufficient (Myers & Majluf, 1984). Trade-off Theory suggests that debt can provide tax benefits but also creates financial-distress costs (Myers, 1984). Agency Theory further highlights that debt may discipline managerial use of free cash flow, while innovation projects may intensify information asymmetry

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and disagreements about long-term investment returns (Jensen & Meckling, 1976).

In Indonesia, listed manufacturers do not necessarily disclose R&D expenditure uniformly. Some firms report R&D as a separate expense, whereas others combine it with product development, engineering, technology, or operational innovation. Consequently, R&D intensity is a useful but incomplete input-based proxy: it may omit innovation that is not separately disclosed and may reflect differences in reporting practice as well as actual innovation activity (OECD, 1997).

Previous research has not produced a consistent innovation–capital structure–profitability pattern (Damanpour & Wischnevsky, 2006). Innovation may increase financing needs, but firms with strong internal cash flow may avoid debt. Likewise, R&D expenditure may depress short-term profitability while generating benefits later. Firm size may influence access to finance and organizational resources, yet large firms may also face bureaucracy and agency costs. This exploratory study therefore examines innovation's associations with capital structure and profitability and tests firm size as a moderator of the innovation–profitability and capital structure–profitability relationships in Indonesian manufacturing firms during 2020–2025. Because the sample is very small, the results are interpreted as preliminary associations rather than causal effects.

LITERATURE REVIEW

Theoretical Foundation

RBV frames innovation as a strategic resource whose financial value depends on effective deployment and commercialization (Barney, 1991; Penrose, 2009). Agency Theory explains how investment horizons, managerial discretion, and debt discipline may affect innovation and financing decisions (Jensen & Meckling, 1976). Trade-off Theory predicts that leverage is beneficial until expected distress costs outweigh tax-shield benefits (Myers, 1984). Pecking Order Theory predicts a financing hierarchy driven by information asymmetry and financing costs (Myers & Majluf, 1984).

Firm size is a contingency in these theories: larger firms tend to have greater debt capacity, lower bankruptcy risk, and lower information asymmetry (Myers, 1984; Myers & Majluf, 1984), but also greater complexity and agency costs (Jensen & Meckling, 1976), which may change how innovation and leverage translate into profitability.

Empirical Review and Hypotheses

Wijayanto and Nuzula (2025) report a positive relationship between innovation capabilities and financial performance, whereas Octavia et al. (2024) emphasize that R&D and digital transformation may not translate into performance immediately. These differences are consistent with a realization lag. Accordingly, H1 is stated as a directional expectation based on RBV:

H1: Innovation is positively associated with profitability

Faria et al. (2024) find that innovation and strategic resources are related to capital-structure decisions. R&D-intensive firms may require external financing when internal funds are insufficient, although Caroline and Wahyudi (2023) show that financing preferences can differ under varying constraints. Consistent with Pecking Order Theory, H2 is:

H2: Innovation is positively associated with capital structure

Meutya and Suriono (2026) report a positive capital structure–profitability relationship,

while [Putri and Wicaksari \(2026\)](#) discuss conditions under which distress costs may dominate. Based on Trade-off Theory, H3 is:

H3: Capital structure is positively associated with profitability

Firm size may provide assets, reputation, financing access, and economies of scale, but it may also increase organizational complexity. Prior studies, from [Kijkasiwat and Phuensane \(2020\)](#) to [Schrank and Kijkasiwat \(2025\)](#), indicate that firm size positively moderates the impact of innovation on firm performance, although [Octavia et al. \(2024\)](#) show that the potential benefits of R&D activities remain insufficiently reflected in the financial results of large-scale companies. [Suttipun and Insee \(2024\)](#) found that the larger the company, the lower the impact on innovation performance, which may mean R&D intensity in large companies has a more negative effect on performance than in smaller companies.

H4: Firm size positively moderates the innovation–profitability association.

[Putri and Wicaksari \(2026\)](#) and [Ahmed et al. \(2023\)](#) find that firm size moderates only the negative effect of profitability, indicating that larger firms can better manage debt and reduce operational profitability risks, whereas [Fauziah and Mauludi \(2026\)](#) find that firm size is unable to moderate the effect of long-term debt on financial performance.

H5: Firm size positively moderates the capital structure–profitability association

Moderation may also fail to appear: interaction effects need larger samples to detect than direct effects, benefits may already be captured by the direct paths, and reporting practices or R&D lags may obscure size-related contingencies ([Octavia et al., 2024](#); [Fauziah & Mauludi, 2026](#); [Suttipun & Insee, 2024](#)). H4 and H5 are therefore exploratory tests.

RESEARCH METHOD

Population and Sample

The population consisted of 165 manufacturing companies listed on the IDX from 2020 to 2025. The selection mechanism was purposive: firms had to publish complete audited annual reports and provide data for all variables throughout the six-year period. Thirty firms were excluded for incomplete annual reports and 125 for incomplete variable data, leaving 10 firms and 60 firm-year observations. In total, 155 of 165 firms (93.9%) were excluded, so the final sample is a small and highly selective subset of listed manufacturers, and selection bias cannot be ruled out. Purposive sampling does not remove outliers, and Table 3 shows extreme DER and ROE values.

Table 1. Sample Selection Procedure

Selection criterion	Firms	Remaining
Manufacturing firms listed on IDX, 2020–2025	165	165
Incomplete audited annual reports	30	135
Incomplete research-variable data	125	10
Final sample	10	10
Firm-year observations	60	60

Source: Secondary data, processed 2026

Operational Definition of Variables

The study measures innovation using R&D intensity, capital structure using DER, profitability using ROE, and firm size using the natural logarithm of total assets. DER and ROE both reflect funding decisions and the returns to capital owners, but they share total equity as a denominator, so a mechanical association between them is possible (see the discussion section). The use of firm size as a moderator has been standardized by using the natural logarithm of total assets.

Table 2. Operational Definition of Variables

Variable	Formula	Measurement Scale	Source
Innovation (R&D Intensity)	$\text{R\&D Expenditure} / \text{Total Sales} \times 100\%$	Ratio	Firm annual report
Capital Structure (DER)	$\text{Total Debt} / \text{Total Equity} \times 100\%$	Ratio	Firm annual report
Profitability (ROE)	$\text{Net Profit After Tax} / \text{Total Equity} \times 100\%$	Ratio	Firm annual report
Firm Size	Ln (Total Assets)	Ratio	Firm annual report

Source: Secondary data, processed 2026

Data Analysis Method

This exploratory study uses descriptive and inferential analysis with WarpPLS to test direct and moderating effects on 60 firm-year observations from 10 firms over 2020–2025. WarpPLS suits this design because each construct is measured by a single formula-based indicator, so conventional outer-model reliability and validity measures such as composite reliability, Cronbach's alpha, and AVE do not apply. Model evaluation therefore focuses on the inner structural model, including path significance and strength (Solimun et al., 2017).

Small Sample, Panel Structure, and Control Variables

Because every construct has a single indicator, the WarpPLS model is effectively a path analysis with interaction terms. The small sample (60 observations from 10 firms) lowers statistical power and was not justified a priori. The six annual observations per firm are likely correlated, yet the estimation treats the 60 rows as independent, which may understate standard errors, and no controls (e.g., firm age, sales growth) are included. The results are therefore exploratory.

FINDINGS AND DISCUSSION

Descriptive Statistics

The descriptive statistics show substantial variation in the financial variables. Innovation has a mean R&D intensity of 0.2093, while DER averages 105.7917 with a high standard deviation of 127.62215. ROE averages 41.1285 and also shows substantial dispersion (SD 96.92597). Firm size is comparatively stable, with a mean of 30.2978 and an SD of 1.88465. These patterns indicate considerable heterogeneity among the sampled manufacturing firms, particularly in leverage and profitability. The maxima of DER (646.60) and ROE (621.00) indicate extreme observations that may influence the estimates.

Table 3. Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Innovation (R&D Intensity)	60	0.2093	0.21808	0.00	0.98
Capital Structure (DER)	60	105.7917	127.62215	0.16	646.60
Profitability (ROE)	60	41.1285	96.92597	0.00	621.00
Firm Size	60	30.2978	1.88465	26.99	33.73

Source: Secondary data, processed 2026

Model Fit and Quality Indices of the WarpPLS Model

Most model-fit indices meet the reported criteria: APC is significant (0.318, $P=0.002$), ARS and AARS are acceptable, AVIF and AFVIF are ideal, GoF is large (0.582), and SSR and NLBCDR are acceptable, though SPR (0.400) and RSCR (0.865) do not meet the stated thresholds. Following [Solimun et al. \(2017\)](#), a model may be tolerated when one or two indicators fail. However, SPR and RSCR both fall below their thresholds, which points to problems in the model itself (Subsection Model Diagnostics and Simpson's Paradox Ratio), so the model is not treated as validated, and the results are read as exploratory.

Table 4. Model Fit and Quality Indices

No	Model Fit and Quality Indices	Fit Criteria	Value	Result
1	Average Path Coefficient (APC)	$p < 0.05$	0.318, $P = 0.002$	Good
2	Average R-squared (ARS)	$p < 0.05$	0.339, $P = 0.001$	Acceptable
3	Average Adjusted R-squared (AARS)	$p < 0.05$	0.314, $P = 0.002$	Acceptable
4	Average Block VIF (AVIF)	acceptable if < 5 , ideally < 3.3	1.718	Ideal
5	Average Full Collinearity VIF (AFVIF)	acceptable if < 5 , ideally < 3.3	2.586	Ideal
6	Tenenhaus GoF (GoF)	small > 0.1 , medium > 0.25 , large > 0.36	0.582	Large
7	Simpson's Paradox Ratio (SPR)	acceptable if > 0.7 , ideally 1	0.400	Unacceptable
8	R-squared Contribution Ratio (RSCR)	Acceptable if > 0.9 , ideally 1	0.865	Unacceptable
9	Statistical Suppression Ratio (SSR)	Acceptable if > 0.7	1.000	Acceptable
10	Nonlinear Bivariate Causality Direction Ratio (NLBCDR)	Acceptable if > 0.7	1.000	Acceptable

Source: Secondary data, processed 2026

Structural Model: R^2 , f^2 , and Q^2

The model explains 15.6% of the variance in capital structure ($R^2=0.156$) and 52.1% of the variance in profitability ($R^2=0.521$). Q^2 values of 0.211 and 0.663 indicate predictive relevance for the endogenous variables. The f^2 values reported are 0.156 for capital structure and 0.039 for profitability.

Table 5. Coefficient of Determination (R^2)

Endogenous Variable	R^2
C-Structure	0.156
Profitability	0.521

Source: Secondary data, processed 2026

Table 6. Effect Size of Path Coefficient (f^2)

	Innovation	C_Structure	F_Size
C-Structure	0.156		
Profitability	-0.039	0.646	0.52

Source: Secondary data, processed 2026

Table 7. Predictive Relevance (Q^2)

Endogenous Variable	Q^2
C-Structure	0.211
Profitability	0.663

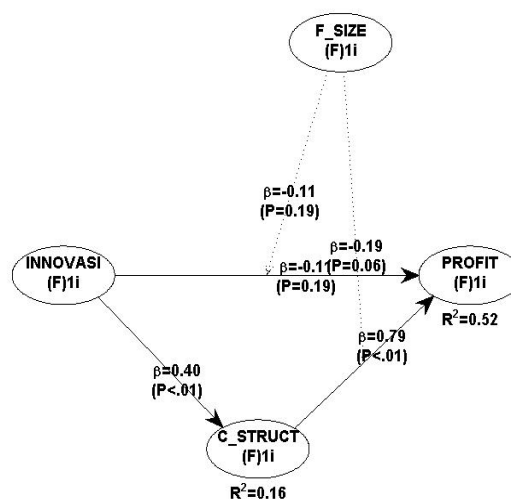
Source: Secondary data, processed 2026

Hypothesis Testing

Table 8. Hypothesis Testing of Direct and Moderating Effects Using WarpPLS

Hypothesis	Effect Between Variables	Coefficient	p-value	Description
H1	Innovation → Profitability	-0.109	0.191	Not Significant
H2	Innovation → Capital Structure	0.395	<0.001	Significant
H3	Capital Structure → Profitability	0.787	<0.001	Significant
H4	Innovation × Firm Size → Profitability	0.109	0.192	Not Significant (No Moderation)
H5	Capital Structure × Firm Size → Profitability	-0.187	0.064	Not Significant (No Moderation)

Source: Secondary data, processed 2026

**Figure 1.** Hypothesis Testing Diagram

Discussion

Innovation is significantly and positively associated with capital structure. Under Pecking Order Theory, R&D and new-product development require funding that may exceed retained earnings, encouraging firms to use debt before issuing equity, and information asymmetry surrounding innovation can also make equity financing costlier. RBV similarly recognizes innovation as a valuable, difficult-to-imitate resource whose development requires substantial investment, while Trade-off Theory suggests that innovative firms may accept greater leverage when debt's tax-shield benefits exceed expected financial-distress costs. The result is consistent with [Faria et al. \(2024\)](#), who report greater debt reliance among R&D-intensive firms, but contrasts with [Caroline and Wahyudi \(2023\)](#), potentially reflecting differences in financing constraints and Indonesia's equity-market characteristics.

Innovation is not significantly associated with profitability. The negative coefficient (-0.109) suggests a weak negative direction, but it is statistically insignificant. From an RBV perspective, innovation generates competitive advantage only after resources are effectively exploited, so benefits may take time to materialize, and R&D expenditure can reduce short-term profitability before producing revenue-generating outcomes. Agency Theory adds that managers may overinvest in innovation or pursue reputation-enhancing rather than value-maximizing projects, causing innovation costs to exceed immediate returns. This finding is consistent with [Octavia et al. \(2024\)](#) on realization lag but differs from [Wijayanto and Nuzula \(2025\)](#), whose positive result may reflect a longer observation period.

Capital structure is strongly and positively associated with profitability ($\beta=0.787, p<0.001$). Trade-off Theory supports this because debt provides tax-shield benefits when leverage remains below the level at which financial-distress costs dominate, while Agency Theory suggests that debt disciplines managers by reducing free cash flow available for inefficient use. From Pecking Order Theory, financially healthy and profitable firms may have greater creditor confidence and access to debt at lower cost. The finding is consistent with [Meutya and Suriono \(2026\)](#) but contrasts with [Putri and Wicaksari \(2026\)](#), who report a negative relationship when firms are closer to financial distress. The sampled firms therefore appear, on average, to remain on the favorable side of the trade-off.

The positive DER–ROE association is consistent with tax-shield and debt-discipline explanations, but it requires particular caution. Both ratios share total equity as a denominator, so low or shrinking equity can mechanically raise them together, and the extreme maxima in Table 3 make this plausible; $\beta = 0.787$ should not be read as evidence that leverage raises profitability. Firm size does not significantly moderate the innovation–profitability relationship. RBV suggests that competitive advantage depends more on resource characteristics than organizational scale: smaller firms may exploit innovation effectively through greater agility, while larger firms may face bureaucratic complexity. Agency Theory further suggests that organizational complexity and the separation of ownership and control in large firms can offset expected economies of scale, so firm size does not emerge as a relevant contingency variable. Low statistical power is also possible: interaction effects require larger samples than direct effects, so 60 observations from 10 firms may not detect a non-significant interaction even if firm size is irrelevant. The result is consistent with [Octavia et al. \(2024\)](#) and [Suttipun and Insee \(2024\)](#) but contrasts with [Kijkasiwat and Phuensane \(2020\)](#) and [Schränk and Kijkasiwat \(2025\)](#)

Firm size also does not significantly moderate the capital structure–profitability relationship, although the coefficient is negative (-0.187) and marginal at $p=0.064$. Trade-off Theory would predict that larger firms benefit more from debt given greater debt capacity, lower bankruptcy risk, and collateral; the negative direction may instead indicate diminishing marginal benefits of additional debt when larger firms are already near an optimal capital structure. Agency

Theory suggests debt's disciplinary function may also be weaker in large firms, whose managers have greater access to slack resources and internal controls. The result is consistent with [Fauziah and Mauludi \(2026\)](#) but contrasts with [Putri and Wicaksari \(2026\)](#) and [Ahmed et al. \(2023\)](#), whose multinational-firm sample showed stronger economies-of-scale effects. Given $p = 0.064$ and the small sample, low statistical power may also contribute to this result.

Model Diagnostics and Simpson's Paradox Ratio

The SPR of 0.400 is below the acceptable threshold of 0.7. SPR is the proportion of paths free from Simpson's paradox instances, in which a path coefficient and the corresponding bivariate correlation have opposite signs; 0.400 implies that roughly 60% of paths are affected, so the sign of some estimated relationships depends on which other variables are included. Path directions therefore cannot be treated as confirmed causal relationships. The RSCR of 0.865 (threshold 0.9) indicates negative R-squared contributions from some paths, consistent with the negative innovation–profitability path. Both problems may partly reflect the small sample and the interaction terms.

Novelty

This study's exploratory contribution is the simultaneous examination of innovation, capital structure, profitability, and firm size in one model focused on Indonesian listed manufacturers. It does not assume that firm size necessarily strengthens the financial translation of innovation or leverage; instead, it empirically tests those contingencies. The results also motivate future formal testing of capital structure as a possible mediator, although this study did not estimate mediation.

CONCLUSIONS

The study finds a positive association between innovation and capital structure and a positive, statistically significant association between capital structure and ROE, while the direct innovation–ROE association and both firm-size interaction terms are statistically insignificant. The findings contribute to RBV and capital-structure discussions by suggesting that innovation may be more immediately reflected in financing requirements than in reported profitability. The findings are exploratory: given the small sample (60 observations from 10 firms), the SPR and RSCR shortfalls, and the possible overlap between DER and ROE, they should not be read as causal. Practical implications are limited to manufacturers that disclose R&D-related information and should not be generalized to all Indonesian firms. Managers should evaluate innovation financing alongside commercialization timing and financial risk, while investors should avoid interpreting firm size alone as evidence of superior innovation payoffs. The apparent financing channel should be tested formally through mediation analysis, longer panels, and firm-clustered inference.

LIMITATIONS & FURTHER RESEARCH

This study has several limitations. First, the sample is very small (10 firms; 60 firm-year observations) and highly selective (155 of 165 firms excluded, mainly for incomplete data, including undisclosed innovation data), limiting power and generalisability and allowing selection bias. Second, the sample covers only manufacturing firms listed on the IDX, limiting generalisability to other sectors. Third, R&D intensity captures innovation input and excludes unreported or non-R&D innovation; future research could add output-based measures such as patents or new-product revenue. Fourth, the six-year observation window is relatively short given the lag between innovation investment and realized returns, so longer panels could better capture delayed effects. Fifth, the model omits control variables such as firm age and sales growth, which may confound the

estimated relationships, and it does not model repeated observations per firm with clustered standard errors or fixed effects. Sixth, DER and ROE share equity as a denominator, which may inflate their association. Finally, the SPR of 0.400 and the RSCR of 0.865 indicate that causal-direction inference should be interpreted cautiously; longitudinal designs and additional robustness checks could strengthen future causal claims.

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