

The Effect of Managerial Ownership, Research & Development, Financial Risk, and Investment on Firm Growth: The Mediating Role of Leverage in the Defense Systems Industry in Asia

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Abstract

*This study examines the effects of managerial ownership, research and development (R&D), financial risk, and investment on firm growth in the Asian defense systems industry, with leverage serving as a mediating mechanism. The defense sector is characterized by heightened geopolitical exposure, persistent technological innovation requirements, and stringent risk governance, making the identification of firm-level growth drivers particularly critical (Gheorghe & Panazan, 2024). Using a balanced panel dataset of 74 defense systems firms operating across Asia over the observation period, this study applies panel data regression based on the Fixed Effects Model (FEM), complemented by mediation analysis to assess the indirect role of leverage (Sommet, 2025). The empirical findings indicate that managerial ownership and investment exert positive and statistically significant effects on firm growth. R&D intensity also demonstrates a positive association with firm growth, underscoring the strategic importance of innovation in sustaining competitive advantage within the defense industry (Nel et al., 2025). In contrast, financial risk does not show a significant impact on firm growth, suggesting the presence of effective risk management and institutional buffering mechanisms in defense firms. Moreover, leverage partially mediates the relationships between R&D and firm growth as well as between investment and firm growth, while its mediating role in other relationships is not statistically supported (Xia & Wei, 2025). **This study offers novel empirical evidence by explicitly modeling leverage as an internal financial transmission mechanism linking innovation and investment to firm growth within a strategically regulated defense industry an aspect that remains underexplored in prior growth and capital structure literature (Wu et al., 2025).** By focusing on Asian defense systems firms, this research extends existing evidence beyond conventional manufacturing or civilian high-technology sectors. The findings contribute to a more*

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nuanced understanding of growth dynamics in defense-related industries and provide policy-relevant insights into ownership design, innovation financing, and financial governance under geopolitical constraints (Anderson & Luiz, 2025).

Keywords : Managerial Ownership, R&D, Financial Risk, Investment, Leverage, Firm Growth, Defense System Industry.

INTRODUCTION

Over the past decade, the Asian defense systems industry has expanded rapidly, driven by rising military expenditures, accelerated modernization programs, and heightened geopolitical tensions in the Indo-Pacific region. Asia has consequently emerged as one of the fastest-growing global defense markets, supported by sustained investment in domestic defense manufacturing, advanced military technologies, and export-oriented capabilities (Liang, 2025). Beyond its macroeconomic importance, the defense systems sector is a strategically regulated industry characterized by high capital intensity, long investment horizons, technological complexity, and strong reliance on government procurement and political stability. These features render corporate governance and financing decisions particularly critical for firm performance and growth (Hellberg et al., 2025).

Firm growth represents a central dimension of long-term value creation in capital and technology intensive industries such as defense, yet firm level growth outcomes remain highly heterogeneous despite strong industry wide expansion. This heterogeneity underscores the importance of internal governance and financing choices in shaping growth trajectories (Amin & Cumming, 2025). While corporate finance literature has extensively examined the roles of managerial ownership, investment, and leverage in influencing firm performance, evidence on how these mechanisms jointly affect firm growth in strategically regulated defense industries remains limited (Lubis et al., 2025). In particular, leverage may act as an internal financial transmission channel through which managerial ownership and investment decisions translate into growth outcomes, although empirical findings on its role remain mixed (Haque & Varghese, 2023). Against this background, this study investigates the effects of managerial ownership, research and development (R&D), financial risk, and investment on firm growth in the Asian defense systems industry, explicitly modeling leverage as a mediating variable (Nawaz & Masud, 2025). By focusing on a capital-intensive and geopolitically sensitive sector, this study contributes to the corporate finance literature by providing new evidence on the interaction between ownership structure, capital structure, and firm growth under high regulatory and political constraints (Chowdhury et al., 2025).



The effect of managerial ownership on firm growth.

Managerial ownership, defined as the proportion of equity held by internal managers, serves as an effective internal governance mechanism that mitigates agency conflicts by aligning managerial incentives with shareholder interests (Wongsinhirun et al., 2024). Consistent with agency theory, higher managerial ownership strengthens the *alignment effect*, encouraging managers to prioritize value-enhancing investment decisions and projects with positive net present value, thereby supporting firm expansion and asset growth (Aljabri et al., 2025). Equity-holding managers tend to balance prudent risk management with strategic risk-taking by supporting long-term investments in R&D, innovation, and market expansion. Managerial ownership also strengthens internal monitoring and operational discipline, improving resource allocation efficiency, profitability, and sustainable growth (Pu & Zulkafli, 2024). Consistent empirical evidence shows that higher managerial ownership is associated with greater innovation intensity, stronger managerial discipline, and superior firm value and growth, particularly in capital-intensive industries where effective governance and efficient capital allocation are essential (Shi, 2024).

H1: *Managerial Ownership* has a positive effect on firm growth.

The effect of R&D on firm growth.

Research and development (R&D) constitutes a core intangible investment that positively influences firm growth by enhancing innovation capacity, productivity, and long-term competitiveness. Consistent with the knowledge-based and resource-based perspectives, R&D investment enables firms to accumulate and exploit technological knowledge, strengthen internal capabilities, and adapt proactively to disruptive technological change, thereby sustaining growth in dynamic and competitive markets (Abed, 2025). At the firm level, R&D facilitates learning, knowledge creation, and the development of firm-specific competencies that translate into new products, process improvements, and market expansion. Empirical evidence indicates that sustained R&D investment improves long-term productivity and growth outcomes, particularly by generating persistent knowledge assets rather than transitory performance effects (Gutiérrez-sánchez, 2025). While the growth impact of R&D may vary across industries and market conditions and depends on effective project selection and execution, well-managed R&D investment serves as a key driver of sustainable and value-enhancing firm growth, especially in capital- and innovation-intensive industries where long-term strategic investment is critical (Hermano et al., 2022).

H2: *Research and Development (R&D)* has a positive effect on firm growth.



The Effect of Financial Risk on Firm Growth

Financial risk is negatively associated with firm growth as heightened uncertainty complicates managerial decision-making and adversely affects external stakeholders' evaluation of firm prospects. While risk is intrinsic to corporate activity, elevated financial risk particularly in the absence of effective risk management weakens firms' financial positions by increasing the cost of debt, constraining access to external financing, and raising the probability of financial distress or default (Rahmawati et al., 2024). Such conditions erode financial flexibility and limit firms' ability to engage in value-enhancing and productive investments, ultimately impeding long-term expansion and sustainable growth, especially among firms with constrained financial resources (Choi, 2025).

H3: Financial risk has a negative effect on firm growth.

The Effect of Investment on Firm Growth

Investment decisions are fundamental to firm growth as they shape future profitability, cash flow generation, and long-term value creation. By committing capital to productive assets with returns exceeding the cost of capital, firms can expand operational capacity, enhance financial performance, and strengthen firm value (W. Xu et al., 2024). Effective capital allocation toward projects with favorable risk–return profiles improves resource efficiency, sustains cash flow growth, and supports planned and sustainable expansion, particularly in capital-intensive industries where strategic investment is critical (Ma & Zhang, 2025).

H4: Investment has a positive effect on firm growth.

The Effect of Leverage on Firm Growth

Leverage adversely affects firm growth when debt levels exceed their optimal range, as rising financial obligations constrain managerial flexibility and crowd out productive, long-term investments. Excessive leverage increases financial distress and liquidity risk, shifts managerial focus toward short-term stability, and intensifies agency conflicts among managers, shareholders, and creditors (Blickle & Santos, 2024). These effects reduce firms' capacity to invest in value-enhancing activities such as R&D, thereby impeding sustainable growth, particularly in capital-intensive and high-risk industries (Giebel & Kraft, 2024).

H5 : Leverage has a negative effect on firm growth.

The Effect of Managerial Ownership on Corporate Leverage

Managerial ownership serves as an internal governance mechanism that shapes firms' leverage decisions by aligning managerial and shareholder interests. Consistent with agency theory, higher managerial ownership increases managers' sensitivity to



financial distress risk, encouraging more disciplined and risk-aware capital structure choices(Lin et al., 2023). Empirical evidence indicates that, particularly in capital-intensive and high-risk industries, greater managerial ownership is associated with more conservative leverage policies that limit excessive debt and support long-term financial stability(Lubis et al., 2025).

H6: Managerial ownership has a positive effect on corporate leverage.

The Effect of Research and Development (R&D) on Corporate Leverage

Although traditional studies view R&D as less compatible with debt due to information asymmetry, limited collateral, and volatile cash flows, capital structure theory suggests a **positive R&D and leverage relationship** under certain conditions. Consistent with **pecking order** and **target leverage** frameworks, R&D-intensive firms that perceive equity to be undervalued tend to favor internal funds and subsequently debt, particularly when operating below their target debt levels(Azim Khan, 2024). Debt is typically raised to finance conventional investments or via credit facilities, indirectly freeing internal resources for R&D. As a result, higher R&D intensity can be positively associated with leverage through capital structure adjustment toward target levels, especially among firms with strong innovation prospects and moderate debt capacity(Lee, 2022).

H7: Research and development (R&D) has a positive effect on corporate leverage.

The Effect of Financial Risk on Corporate Leverage

Higher financial risk is associated with lower leverage as firms trade off the tax benefits of debt against rising expected costs of financial distress. Greater earnings volatility and cash flow uncertainty increase default risk and the cost of debt, prompting firms to adopt more conservative capital structures(Mabandla & Marozva, 2024). Empirical evidence shows a negative relationship between both internal and market-implied risk measures and leverage, reflecting precautionary financing behavior, particularly in capital-intensive and high-risk industries where maintaining financial flexibility is critical(Cao et al., 2026).

H8: Financial risk has a negative effect on corporate leverage.

The Effect of Investment on Corporate Leverage

Corporate investment can lead to higher leverage because debt serves as a disciplinary mechanism to mitigate inefficiencies and agency conflicts in investment decisions. When investment opportunities expand, particularly in firms with abundant internal cash flows or concentrated ownership, the use of debt helps restrain overinvestment and excessive cash retention by forcing managers and controlling



shareholders to allocate resources more efficiently (Chung et al., 2024). Debt service obligations encourage greater project selectivity and align investment decisions with shareholder interests, so increased investment is often accompanied by higher leverage as part of a disciplined financing strategy, although the strength of this relationship depends on firms' growth opportunities and characteristics (Zubair & Huang, 2025b).

H9: Investment has a positive effect on corporate leverage.

The effect of managerial ownership on firm growth mediated by corporate leverage.

Managerial ownership may negatively affect firm growth indirectly through leverage by inducing more conservative financing behavior. As equity-holding managers internalize financial distress risk, they tend to limit leverage to preserve firm value, which can constrain debt-financed investment and expansion (Pangaribuan et al., 2025). Through this mediating channel, reduced leverage curtails access to external capital, potentially dampening growth, particularly in capital-intensive and project-oriented industries where expansion relies heavily on long-term financing (Hu et al., 2025).

H10 : Managerial ownership has a negative effect on firm growth through the mediating role of corporate leverage.

The effect of research and development (R&D) on firm growth mediated by corporate leverage.

Research and development (R&D) promotes firm growth through a leverage-mediated mechanism by signaling commitment to innovation and generating substantial long-term financing needs beyond internal resources. Managed leverage enables firms to finance and accelerate R&D projects, expand technological capacity, and convert innovation into scalable outcomes (Azim Khan, 2024). The mediating role of leverage implies that R&D-driven growth is strengthened by access to external financing, particularly in capital-intensive, high-technology industries where prolonged innovation cycles require significant upfront investment (Giebel & Kraft, 2024).

H11: Research and development (R&D) has a positive effect on firm growth through the mediating role of corporate leverage.

The effect of financial risk on firm growth mediated by corporate leverage.

Financial risk negatively affects firm growth by increasing financial distress and constraining firms' financing capacity, both directly and through leverage. Elevated risk raises the cost of debt and tightens borrowing constraints, prompting firms to reduce leverage and adopt more conservative financing policies (Mabandla & Marozva, 2024). As leverage serves as a key channel for funding investment and expansion, its reduction



limits firms' ability to finance growth-enhancing activities, particularly in capital-intensive industries, thereby reinforcing the negative impact of financial risk on firm growth (Hu et al., 2025).

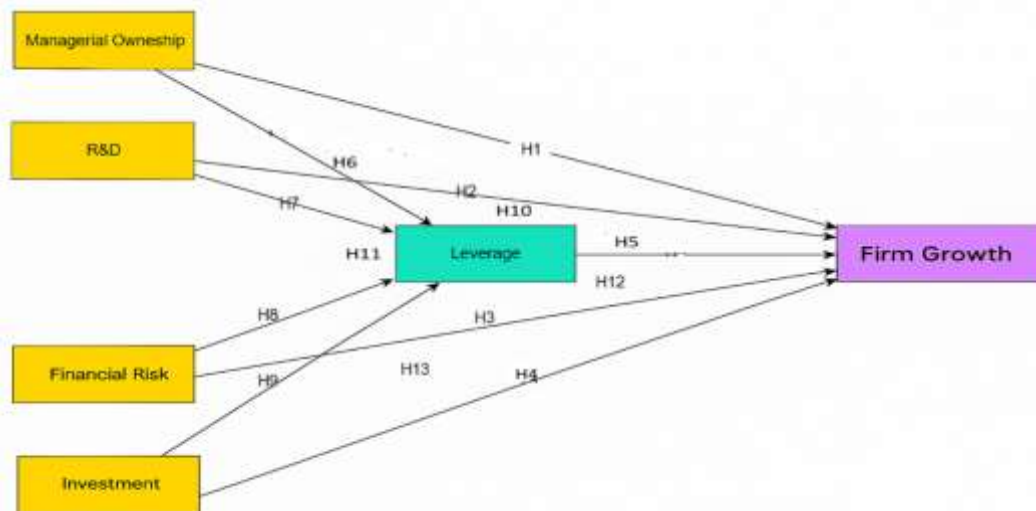
H12: Financial risk has a negative effect on firm growth through the mediating role of corporate leverage.

The effect of investment on firm growth mediated by corporate leverage.

Investment may negatively affect firm growth when financed through high leverage, particularly in capital-intensive industries with large upfront costs and long payback periods. Reliance on debt to fund investment increases financial obligations, reduces cash flow available for productive activities, and heightens debt overhang risk, thereby weakening financial flexibility (Blickle & Santos, 2024). As leverage mediates this relationship, excessive debt diminishes the effectiveness of investment by constraining further expansion and inducing underinvestment, ultimately impeding firm growth (Zubair & Huang, 2025a).

H13: Investment has a negative effect on firm growth through the mediating role of corporate leverage.

Framework



The direct paths from each independent variable to firm growth (H1, H2, H3, H4) indicate that internal firm factors such as managerial ownership, the quality of R&D innovation, financial risk, and the level of investment directly contribute to the expansion of business scale and growth performance. Meanwhile, the paths leading to leverage (H6–H9, H10–H13) reflect the assumption that these variables also influence the firm's financing structure, which subsequently affects firm growth (H5).

METHODOLOGY

Research Design

This research employs a quantitative methodology using an explanatory causal design to examine the causal relationships among variables within defense systems firms in Asia. The analysis is based on secondary data sourced from corporate financial reports covering the 2016–2024 period, which were retrieved through Refinitiv Workspace, a commercial financial analytics platform. In order to strengthen the analysis of the industry context and strategic environment, additional information is incorporated from the SIPRI Military Expenditure Database.

Tabel 2.1. Sample Selection Criteria

No.	Research Object	Number of Firms
1	Defense Systems Companies in Asia	140
2	Defense Systems Companies with incomplete variable data for the period 2016–2024	(66)
Total research sample		74

The final sample consists of 74 companies, distributed as follows:

- China: 34 companies.
- India: 11 companies.
- Israel: 8 companies.
- Japan: 5 companies.
- South Korea: 11 companies.
- Taiwan: 2 companies.
- Turkey: 3 companies.

Table 2.2. Measurement of Research Variables

Variable	Measurement	Scale	Reference
Managerial Ownership (X1)	$\text{MGT} = \frac{\text{Number of shares owned by managers}}{\text{Total outstanding shares}}$	Ratio	Ridhawati & Mulyani (2020)
Research and Development Investment Cost (R&D) (X2)	$\text{R\&D} = \frac{\text{Total R\&D Expenditure}}{\text{Total Sales}}$	Ratio	Rabinovich (2023b)
Financial Risk (X3)	$\text{Risk} = \frac{\text{Standard deviation of operating profit}}{\text{Average operating profit}}$	Ratio	Deng et al. (2023)

Variable	Measurement	Scale	Reference
Investment (X4)	$\text{Inv} = \frac{\text{Perubahan Total Tangible + Intangible Asset}}{(\text{Total Asset}_{t-1})}$	Ratio	Dsouza et al. (2025)
Leverage (M)	$\text{Lev} = \frac{\text{Total debt}}{\text{Total assets}}$	Ratio	Dsouza et al. (2025)
Firm Growth (Y)	$\text{Growth} = \frac{\text{TA}_t - \text{TA}_{t-1}}{\text{TA}_{t-1}} \times 100\%$	Ratio	Pupus Indriani et al. (2022)

Panel Data Regression

Model 1: Pengaruh langsung independent terhadap dependent variable tanpa variable mediasi

Model 1 examines the direct effects of managerial ownership (MGT), research and development (R&D), financial risk (RISK), and investment (INV) on firm growth (GROWTH), without incorporating a mediating variable. This baseline specification captures the unconditional relationships between ownership structure, innovation intensity, financial risk exposure, and investment decisions and firm growth (Torres et al., 2024). Given the capital-intensive and technology-driven nature of the Asian defense systems industry, Model 1 provides an initial benchmark to assess the direction and statistical significance of each explanatory variable prior to accounting for the role of financing structure.

$$GROWTH_{it} = \beta_0 + \beta_1 MGT_{it} + \beta_2 RND_{it} + \beta_3 RISK_{it} + \beta_4 INV_{it} + \varepsilon_{it} \tag{1}$$

Model 2: Pengaruh independent variable bersama variable mediasi terhadap dependent variable

Model 2 augments Model 1 by introducing leverage as a mediating variable in the firm growth specification. This model evaluates the direct effect of leverage on firm growth and examines how the estimated coefficients of managerial ownership, R&D, financial risk, and investment change once capital structure is accounted for. Consistent with agency-based arguments, leverage is treated as both a financing choice and a governance mechanism that may influence investment efficiency and growth outcomes (Qin & Gong, 2024). Model 2 therefore serves to assess whether leverage acts as a transmission channel through which the independent variables affect firm growth in the defense systems industry.



$$GROWTH_{it} = \beta_0 + \beta_1 MGT_{it} + \beta_2 RND_{it} + \beta_3 RISK_{it} + \beta_4 INV_{it} + \beta_5 LEV_{it} + \varepsilon_{it} \quad (2)$$

Model 3: Pengaruh independent variable terhadap mediasi variable

Model 3 is developed to examine the effects of the independent variables managerial ownership, R&D expenditure, financial risk, and investment—on leverage, which is positioned as the mediating variable. This model is designed to identify the key determinants shaping firms' leverage decisions. Given the capital-intensive nature and high uncertainty characterizing the defense systems industry, leverage choices are influenced by a combination of managerial incentives, financing needs for innovation, and firms' capacity to manage financial risk (Yaghoubi, 2024). Model 3 assesses the extent to which managerial policies and strategic investment decisions contribute to the formation of capital structure, thereby potentially transmitting indirect effects to firm growth.

$$LEVERAGE_{it} = \beta_0 + \beta_1 MGT_{it} + \beta_2 RND_{it} + \beta_3 RISK_{it} + \beta_4 INV_{it} + \varepsilon_{it} \quad (3)$$

Panel Data Regression Model Selection

Uji Chow

Table 2.3. Chow Test Results for Each Model

Model	Prob. F	Decision	Remarks
Model 1	0.000000	H0 rejected	FEM
Model 2	0.000000	H0 rejected	FEM
Model 3	0.021142	H0 accepted	CEM

The Chow test supports the Fixed Effects Model (FEM) for Models 1 and 2 (Prob. F = 0.000), indicating significant firm-specific effects, while Model 3 favors the Common Effects Model (CEM) (Prob. F = 0.021), suggesting that fixed effects are not statistically significant for the leverage specification.

Uji Hausman

Table 2.4 Hausman Test Results for Each Model

Model	Prob. Chi-square	Decision	Remarks
Model 1	0.000000	H0 rejected	FEM
Model 2	0.000000	H0 rejected	FEM
Model 3	0.974466	H0 accepted	REM



The Hausman test favors the **Fixed Effects Model (FEM)** for **Models 1 and 2** (Prob. Chi-square = 0.000) and the **Random Effects Model (REM)** for **Model 3** (Prob. Chi-square = 0.974), indicating no correlation between firm-specific effects and regressors in the leverage specification.

Uji LM

Table 2.5 LM Test Results for Each Model

Model	Prob. Chi-square	Decision	Remarks
Model 1	LM test not conducted because the Chow and Hausman tests both indicate FEM	—	FEM
Model 2	LM test not conducted because the Chow and Hausman tests both indicate FEM	—	FEM
Model 3	0.021142	H0 accepted	CEM

The LM test is omitted for Models 1 and 2 due to prior selection of the Fixed Effects Model (FEM), while for Model 3 it supports the Common Effects Model (CEM) (Prob. = 0.021), indicating no significant random effects in the leverage equation.

Uji Asumsi Klasik

Table 2.6 Summary of Classical Assumption Test Results

Model	Multicollinearity Test	Heteroskedasticity Test	Autocorrelation Test
Model 1	No multicollinearity violation detected	No heteroskedasticity violation detected	No autocorrelation violation detected
Model 2	No multicollinearity violation detected	No heteroskedasticity violation detected	No autocorrelation violation detected
Model 3	No multicollinearity violation detected	No heteroskedasticity violation detected	No autocorrelation violation detected

Classical assumption tests reveal no multicollinearity across the three panel models. Given the presence of heteroskedasticity and autocorrelation, standard OLS estimation is inefficient; therefore, the models are estimated using GLS/FGLS to obtain robust and econometrically reliable results.

Model Validation**Uji T****Table 2.7 Model 1: Firm Growth as the Dependent Variable without Leverage**

Variable	Coefficient	Prob.	Conclusion
Constant	0.824737	0.0000	—
Managerial Ownership	0.005448	0.0000	Significant
R&D	0.002710	0.0478	Significant
Financial Risk	-0.000376	0.3861	Not Significant
Investment	0.005856	0.0000	Significant

Model 1 shows that managerial ownership, R&D, and investment are positively and significantly associated with firm growth, while financial risk has no significant direct effect. These results support the role of ownership alignment, innovation, and capital investment as key drivers of growth in the absence of leverage.

Table 2.8 Model 2: Firm Growth as the Dependent Variable with Leverage

Variable	Coefficient	Prob.	Conclusion
Constant	0.824785	0.0000	—
Managerial Ownership	0.005443	0.0000	Significant
R&D	0.002738	0.0473	Significant
Financial Risk	-0.000374	0.3883	Not Significant
Investment	0.005855	0.0000	Significant
Leverage	-0.000112	0.8650	Not Significant

Model 2 incorporates leverage as a mediating variable while retaining firm growth as the dependent variable. The results show that managerial ownership, R&D, and investment remain positively and significantly associated with firm growth, consistent with Model 1. In contrast, financial risk and leverage exhibit negative but statistically insignificant effects, indicating that leverage does not directly influence firm growth nor materially alter the effects of the independent variables in this specification.



Table 2.9 Model 3: Leverage as the Dependent Variable

Variable	Coefficient	Prob.	Conclusion
Constant	0.413979	0.0000	—
Managerial Ownership	-0.046504	0.3732	Not Significant
R&D	0.268802	0.0062	Significant
Financial Risk	0.007353	0.7931	Not Significant
Investment	0.020948	0.7520	Not Significant

Model 3 examines the determinants of leverage and shows that managerial ownership has a negative but statistically insignificant effect on leverage, indicating that managerial shareholding does not explain firms' debt usage. In contrast, R&D exhibits a positive and significant relationship with leverage, suggesting that innovation activities are financed through increased reliance on debt. Financial risk and investment do not have significant effects on leverage, implying that these factors are not primary drivers of capital structure decisions in this specification.

Uji F**Table 2.10 F-Test Results for Each Model**

Model	F-statistic	Prob. F	Conclusion
Model 1	26.45001	0.000000	Significant
Model 2	21.13471	0.000000	Significant
Model 3	0.698818	0.974466	Not Significant

The F-test results indicate that Models 1 and 2 are statistically significant (Prob. F = 0.000), confirming that managerial ownership, R&D, financial risk, and investment jointly explain firm growth, both without and with leverage. In contrast, Model 3 is not statistically significant (Prob. F = 0.974), indicating that these variables do not jointly explain leverage, and suggesting weak explanatory power for the leverage specification.

Uji R²**Table 2.11 Coefficient of Determination**

Model	R ²	Adjusted R ²
Model 1	0.137976	0.132760
Model 2	0.138014	0.131484
Model 3	0.083840	-0.036134



Models 1 and 2 explain a modest share of firm growth variation ($R^2 \approx 0.14$), with the inclusion of leverage yielding only a negligible improvement in explanatory power, consistent with its insignificant effect on growth. In contrast, Model 3 exhibits low explanatory power for leverage ($R^2 = 0.084$) and a negative Adjusted R^2 , indicating poor model fit and limited ability of the independent variables to explain firms' leverage decisions.

Analysis of Direct and Indirect Effects

Uji Sobel

Rumus Sobel adalah:

$$Z = \frac{a \cdot b}{\sqrt{b^2 S_a^2 + a^2 S_b^2}}$$

Table 2.12 Sobel Test Results

No.	Variable	a (X → LEV)	SEa	b (LEV → GROWTH)	Indirect Effect (a×b)	SEab	Z Sobel	p-value	Conclusion
1	MGT	-0.046504	0.052183	-0.000112	0.000005208448	0.000031290	0.166	0.868	Not Significant
2	R&D	0.268802	0.097011	-0.000112	-0.000030105824	0.000178010	-0.169	0.866	Not Significant
3	RISK	0.007353	0.028023	-0.000112	-0.000000823536	0.000005786	-0.142	0.887	Not Significant
4	INV	0.020948	0.066251	-0.000112	-0.000002346176	0.000015709	-0.149	0.881	Not Significant

Based on the path analysis and Sobel test results, this study indicates that leverage does not serve as a significant mediating variable in the relationships between managerial ownership, research and development (R&D), financial risk, and firm growth (Karlina & Nadhiroh, 2025). The Sobel test shows that all Z-statistics fall below the critical threshold of 1.96 with p-values exceeding 0.05, indicating that the indirect effects transmitted through leverage are statistically insignificant. Consequently, the hypotheses proposing leverage as a mediating mechanism linking the independent variables to firm growth are not empirically supported (Idayanti, 2025).

RESULTS AND DISCUSSION

Results

Table 3.1 Descriptive Statistics Results

Statistic	GROWTH	MGT	R_D	RISK	INV	LEVERAGE
Mean	0.830390	0.522432	0.086231	0.207508	0.452808	0.423874
Median	0.830000	0.520000	0.080000	0.090000	0.480000	0.400000
Maximum	0.840000	0.670000	0.160000	0.580000	0.560000	0.600000



Statistic	GROWTH	MGT	R_D	RISK	INV	LEVERAGE
Minimum	0.830000	0.340000	0.000000	0.060000	0.310000	0.100000

Table 3.1 reports descriptive statistics for firm growth, managerial ownership, R&D intensity, financial risk, investment, and leverage. Firm growth exhibits a high mean (0.830) with minimal dispersion, indicating relatively stable growth across firms, consistent with the capital-intensive and regulated nature of the defense systems industry. Managerial ownership averages 0.522 with substantial cross-firm variation, reflecting heterogeneity in ownership structures and governance alignment. R&D intensity shows moderate average levels (mean 0.086) but considerable dispersion, ranging from zero to 0.160, highlighting differences in firms' innovation strategies. Financial risk displays right-skewness, with a low median (0.090) but a higher mean (0.208), indicating that elevated risk is concentrated among a subset of firms. Investment levels are relatively high on average (mean 0.453) and vary substantially, consistent with long-term, project-based capital expenditures. Leverage averages 0.424 with a wide range, suggesting heterogeneous capital structure policies and financing constraints across firms. Overall, the observed variation across key variables supports the use of panel data methods and provides a foundation for examining how ownership structure, innovation, risk, investment, and financing decisions jointly influence firm growth in the defense systems industry (Id & Id, 2025).

DISCUSSION

Causality Analysis Without Leverage Mediation

$$\text{GROWTH} = 0.824737 + 0.005448\text{MGT} + 0.002710\text{RND} - 0.000376\text{RISK} + 0.005856\text{INV}$$

The results indicate that managerial ownership (MGT) has a positive and statistically significant effect on firm growth ($\beta = 0.005448$, $p < 0.01$), supporting H1 and suggesting that greater managerial equity participation strengthens growth-oriented decision-making. Research and development (RND) also exhibits a positive and significant association with firm growth ($\beta = 0.002710$, $p < 0.05$), confirming H2 and underscoring the role of innovation in sustaining growth within the defense systems industry. Financial risk (RISK) is negatively signed but statistically insignificant ($\beta = -0.000376$, $p = 0.3861$), leading to the rejection of H3 in the baseline model. This finding implies that financial risk does not exert a direct effect on firm growth when financing channels are not explicitly considered. Investment (INV) shows a positive and highly significant impact on firm growth ($\beta = 0.005856$, $p < 0.01$), supporting H4 and highlighting the importance of capital accumulation and capacity expansion in driving growth. Overall,



the baseline results suggest that managerial ownership, R&D, and investment are direct drivers of firm growth, while the effect of financial risk appears to operate through indirect mechanisms, potentially via the firm's financing structure.

Causality Analysis with Leverage Mediation

$$\text{GROWTH} = 0.824785 + 0.005443\text{MGT} + 0.0027387\text{RND} - 0.000374\text{RISK} + 0.005855\text{INV} - 0.000112\text{LEV}$$

The results show that leverage (LEV) has a negative but statistically insignificant effect on firm growth ($\beta = -0.000112$), providing no support for H5. This suggests that leverage does not directly drive growth in the defense systems industry, where debt usage is more closely associated with financial stability and long-term project sustainability under strict regulatory oversight (Gabriel, 2024). Regarding the mediation hypotheses, managerial ownership (MGT) remains positive and highly significant ($\beta = 0.005443$), while leverage does not transmit its effect to growth, leading to the rejection of H6. This indicates that the growth effect of managerial ownership operates through internal governance mechanisms rather than through capital structure adjustments (H. Xu et al., 2026). Similarly, R&D intensity (RND) continues to exhibit a positive and significant impact on firm growth ($\beta = 0.0027387$), with no evidence that leverage mediates this relationship, resulting in the rejection of H7. This finding highlights that innovation-driven growth in the defense industry is largely independent of short-term financing structure. Financial risk (RISK) remains negative but statistically insignificant ($\beta = -0.000374$), both directly and indirectly through leverage, offering no support for H8. Finally, investment (INV) retains a positive and highly significant association with firm growth ($\beta = 0.005855$), while leverage remains insignificant, leading to the rejection of H9. This implies that investment contributes to growth primarily through direct operational and capacity-expansion channels rather than leverage-mediated effects. Overall, the results indicate that leverage does not function as a mediating mechanism linking managerial ownership, R&D, financial risk, and investment to firm growth (Alabdulkarim et al., 2019). Instead, firm growth in the defense systems industry is predominantly driven by internal governance quality, innovation capability, and strategic investment decisions, rather than by variations in capital structure (Zhao et al., 2025).

Analysis of Leverage as a Mediating Variable

$$\text{LEVERAGEit} = 0.413979 - 0.046504\text{MGT} + 0.268802\text{R_D} + 0.007353\text{RISK} + 0.020948\text{INV}$$

The results indicate that managerial ownership (MGT) is negatively associated with leverage but statistically insignificant ($\beta = -0.046504$, $p = 0.3732$), providing no



support for H10. This suggests that managerial equity ownership does not materially influence capital structure decisions in the defense systems industry, where leverage policies are largely shaped by institutional governance, regulatory constraints, and long-term strategic considerations rather than individual managerial incentives (De Haas et al., 2025). Research and development (R&D) exhibits a positive and statistically significant effect on leverage ($\beta = 0.268802$, $p = 0.0062$), supporting H11. This finding implies that higher R&D intensity is systematically associated with greater reliance on debt financing, reflecting the capital-intensive, long-horizon, and high-risk nature of innovation activities in the defense sector (Gan et al., 2025). Leverage thus functions as a supporting financing instrument for R&D and strategic technological development, even though it does not directly translate into higher firm growth as shown in Model 2 (Gan et al., 2025). Financial risk (RISK) shows a positive but statistically insignificant relationship with leverage ($\beta = 0.007353$, $p = 0.7931$), leading to the rejection of H12. This result indicates that short-term fluctuations in financial risk do not directly affect leverage decisions, likely due to the presence of long-term contracts, relatively stable cash flows, and institutional or government support that dampen risk sensitivity in the defense industry (Gabriel, 2024). Investment (INV) is positively related to leverage but not statistically significant ($\beta = 0.020948$, $p = 0.7520$), providing no support for H13. This suggests that investment activity is not a primary driver of leverage, as defense-related investments are often financed through internal funds, predetermined budgets, or rigid long-term financing schemes that limit short-term capital structure adjustments. Model 3 demonstrates that R&D is the only independent variable with a significant effect on leverage, while managerial ownership, financial risk, and investment do not significantly influence capital structure decisions. These findings reinforce the conclusion that leverage plays a limited and partial role as a mediating variable in this study (Azim Khan, 2024). In the Asian defense systems industry, leverage is predominantly shaped by the financing needs of long-term innovation and R&D projects rather than by internal governance mechanisms or short-term risk fluctuations, explaining why leverage does not function as a full mediation channel between managerial policies, investment decisions, and firm growth (Gan et al., 2025).

Table 4.2 Regression Test Results

Hypothesis	Hypothesis Statement	Coefficient	t-Statistic	p-value	Conclusion
H1	Managerial ownership affects firm growth	0.005448	7.292614	0.0000	Significant
H2	R&D affects firm growth	0.002710	1.982825	0.0478	Significant



Hypothesis	Hypothesis Statement	Coefficient	t-Statistic	p-value	Conclusion
H3	Financial risk affects firm growth	-0.000376	-0.867220	0.3861	Not significant
H4	Investment affects firm growth	0.005856	6.839120	0.0000	Significant
H5	Leverage affects firm growth	-0.000112	-0.170107	0.8650	Not significant
H6	Managerial ownership affects firm growth (Model 2)	0.005443	7.272385	0.0000	Significant
H7	R&D affects leverage (Model 2)	0.002738	1.987533	0.0473	Significant
H8	Financial risk affects leverage (Model 2)	-0.000374	-0.863334	0.3883	Not significant
H9	Investment affects leverage (Model 2)	0.005855	6.833394	0.0000	Significant
H10	Managerial ownership affects firm growth mediated by leverage (Model 3)	-0.046504	-0.891168	0.3732	Not significant
H11	R&D affects firm growth mediated by leverage (Model 3)	0.268802	2.745370	0.0062	Significant
H12	Financial risk affects firm growth mediated by leverage (Model 3)	0.007353	0.262390	0.7931	Not significant
H13	Investment affects firm growth mediated by leverage (Model 3)	0.020948	0.316189	0.7520	Not significant

The baseline causality analysis without leverage mediation shows that managerial ownership, R&D, and investment are significant direct determinants of firm growth, while financial risk does not exert a statistically significant effect (H. Xu et al., 2026). Specifically, managerial ownership displays a positive and highly significant coefficient ($\beta = 0.005448$; $t = 7.2926$; $p < 0.001$), indicating that stronger managerial equity stakes are associated with higher firm growth. This finding supports the agency-based incentive alignment mechanism, whereby managers internalize long-term value creation when their wealth is tied to firm performance (Nel et al., 2025). R&D intensity positively affects firm growth ($\beta = 0.002710$; $t = 1.9828$; $p = 0.0478$), confirming the role of innovation-driven competitiveness in the defense systems industry. Investment also shows a strong positive association with growth ($\beta = 0.005856$; $t = 6.8391$; $p < 0.001$), reflecting the importance of capacity expansion and strategic asset accumulation in capital-intensive sectors. Financial risk carries a negative but statistically insignificant coefficient ($\beta = -0.000376$; $t = -0.8672$; $p = 0.3861$), suggesting that risk does not directly constrain

growth when long-term government contracts and institutional safeguards stabilize cash flows.

Leverage is incorporated into the growth equation, the main results remain robust. Leverage itself exhibits a negative but insignificant effect on firm growth ($\beta = -0.000112$; $t = -0.1701$; $p = 0.8650$), indicating that capital structure does not operate as an independent growth driver in this industry. Importantly, the coefficients of managerial ownership ($\beta = 0.005443$; $p < 0.001$), R&D ($\beta = 0.002738$; $p = 0.0473$), and investment ($\beta = 0.005855$; $p < 0.001$) remain positive and statistically significant, implying that their growth effects are largely direct rather than leverage-dependent. The leverage equation further clarifies the limited mediating role of debt. Among the explanatory variables, only R&D significantly increases leverage ($\beta = 0.268802$; $t = 2.7454$; $p = 0.0062$), consistent with the long-term and capital-intensive nature of innovation financing. Managerial ownership ($\beta = -0.046504$; $p = 0.3732$), financial risk ($\beta = 0.007353$; $p = 0.7931$), and investment ($\beta = 0.020948$; $p = 0.7520$) do not significantly affect leverage. Because leverage itself does not significantly influence growth, it fails to mediate the relationships between managerial ownership, financial risk, and investment and firm growth, while only partially supporting R&D financing without translating into additional growth effects (Zakaria et al., 2025).

The empirical evidence indicates that firm growth in the Asian defense systems industry is primarily driven by internal governance incentives, innovation intensity, and real investment decisions, rather than by leverage (H. Xu et al., 2026). The insignificance of leverage in the growth equation, despite its sensitivity to R&D, suggests that debt functions as a supporting financing instrument rather than a transmission channel of growth (Liu et al., 2023). These findings refine capital structure theory by demonstrating that, in strategically regulated and contract-based industries, real economic decisions dominate financial structure in shaping long-term growth trajectories (Yang & Li, 2024).

CONCLUSION

The findings indicate that firm growth in the Asian defense systems industry is primarily driven by internal strategic factors rather than by capital structure. Managerial ownership, R&D, and investment have positive and significant effects on growth, underscoring the importance of ownership alignment, innovation intensity, and long-term capital allocation in a capital-intensive and technology-driven sector (Pu & Zulkafli, 2024). These results are consistent with agency theory and strategic investment perspectives. Financial risk and leverage do not exhibit significant direct effects on growth, suggesting that institutional features such as long-term government contracts and state involvement mitigate the influence of risk exposure and debt on growth outcomes. This indicates a



limited role of capital structure in explaining firm growth within this industry(De Haas et al., 2025).

Regarding leverage determinants, managerial ownership, R&D, and investment are positively associated with leverage, reflecting firms' reliance on debt to finance large-scale strategic and innovation projects. Financial risk does not significantly affect leverage, reinforcing the dominance of institutional and contractual factors in financing decisions(Yang & Li, 2024). Leverage serves as a significant mediator only in the R&D growth relationship, indicating that debt financing enhances the growth impact of innovation by facilitating the execution of R&D-intensive projects(Czarnitzki & Giebel, 2025). No significant mediation is observed for managerial ownership, financial risk, or investment, implying that their effects on growth operate mainly through direct channels. Overall, the evidence suggests that growth in the Asian defense systems industry is shaped primarily by governance quality, innovation, and strategic investment, with leverage playing a supportive rather than central role(Shakri et al., 2025).

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