Free Cash Flow, Business Risk, and Non-Debt Tax Shield Effects on Debt Policy

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Abstract

This study examines the effects of free cash flow, business risk, and non-debt tax shield on the debt policy of food and beverage subsector companies listed on the Indonesia Stock Exchange for the 2021-2025 period, drawing on agency, trade-off, and pecking order theories. Of the 48 companies selected through purposive sampling, one company with negative equity throughout the period was excluded, yielding a balanced panel of 47 companies and 235 firm-year observations. Debt policy was measured by the Debt-to-Equity Ratio (DER), free cash flow by operating cash flow minus capital expenditure and the change in net working capital scaled by total assets, business risk by the rolling standard deviation of the operating profit margin, and non-debt tax shield by depreciation expense scaled by total assets, with firm size, profitability (Return on Assets/ROA), tangibility, and sales growth as control variables. After winsorization at the 1st and 99th percentiles, the Chow, Breusch-Pagan Lagrange Multiplier, and robust Hausman tests favored the random effect model, which was estimated with firm-clustered robust standard errors. Free cash flow (coefficient=-7.517, p=0.712) and non-debt tax shield (coefficient=827.908, p=0.308) have no significant effect on debt policy, whereas business risk has a positive effect (coefficient=395.951, p=0.045) that is not robust across alternative specifications. The three variables are not jointly significant (F=1.388, p=0.247). Profitability is negatively related (p=0.043) and firm size positively related (p=0.016) to debt policy. The evidence favors the pecking order explanation, in which internally generated profits, rather than free cash flow, reduce reliance on debt.

Keywords: *Business Risk, Debt Policy, Free Cash Flow, Non-Debt Tax Shield, Panel Data, Pecking Order Theory*

1. INTRODUCTION

The food and beverage industry is one of the key sectors contributing to Indonesia's economic activity. Companies in this subsector differ in size and financing needs. Financial performance is closely monitored by the market: return on assets has a positive association with the value of Indonesian food and beverage companies (Widyantari, Yuniarti, & Ridwansyah, 2026). Debt policy matters because production facilities and distribution networks require financing, while the debt mix can affect firm valuation (Oranefo & Egbunike, 2022). The tax consequences of leverage have been documented in Indonesian listed firms (Sani, Dewi, & Ridwansyah, 2026).

Food and beverage companies face choices regarding the amount and maturity of debt used to finance operations and investments. Borrowing costs and cash flows affect these choices, and working-capital balances can be linked to a firm's financial policy (Flannery & Öztekin, 2024). Evidence from Malaysian firms also shows that financing determinants vary across companies (Saif-Alyousfi, Md-Rus, Taufil-Mohd, & Shahar, 2020). Firm-specific cash holdings and investment needs may therefore shape debt policy in developing economies (Nnadi, Surichamorn, Jayasekera, & Belghitar, 2022).

One internal factor believed to influence debt policy is free cash flow. Jensen (1986) proposed that debt can discipline managers by committing funds to fixed payments and reducing their discretion over free cash flow. Pecking order theory offers a competing view: because external financing is costly when managers know more than investors, firms with ample internally generated funds need less debt (Myers & Majluf, 1984). Another factor is business risk, reflected in fluctuations in operating earnings and cash flows (Harris & Roark, 2019). The food and beverage subsector faces risks from raw material prices, competition, and exchange-rate movements. The third factor is the non-debt tax shield, namely tax savings from deductions other than debt interest, such as the

depreciation of fixed assets. DeAngelo and Masulis (1980) show how such deductions can substitute for the tax benefits of debt. This mechanism is relevant to companies with substantial depreciable production assets.

Prior international studies have reported mixed associations between internal finance, operating risk, tax deductions, and leverage. A review of capital structure research identifies several determinants that differ by setting (Boateng, Ahamed, Soku, Addo, & Tetteh, 2022), and empirical findings depend on measurement choices (Hang, Geyer-Klingeberg, Rathgeber, & Stöckl, 2018). The link between cash flow risk and debt differs according to firms' operating cash flows (Harris & Roark, 2019). In a three-country Southeast Asian study, depreciation relative to assets was negatively related to leverage Rahman and Sannacy (2017), as it was in a Visegrad-country Small and Medium Enterprises (SME) sample Pham and Hrdý (2023), whereas a European study found a positive association with non-debt tax shields (Moradi & Paulet, 2019). An Indian study found a negative association Pathak and Chandani (2023), while a recent Indonesian manufacturing study found that business risk is positively associated with leverage (Sakir, Majid, Zainul, & Agustina, 2026). These divergent findings motivate the testing of the three factors together in the present subsector and period.

Inconsistent cross-country findings and industry differences in financing determinants Danso, Fosu, Owusu-Agyei, Ntim, and Adegbite (2021) and Panda, & Nanda, 2020 form the basis of this subsector-specific study. Post-pandemic evidence from Vietnamese SMEs provides a further comparison for capital-structure choices (Kim, 2023). A recent consolidation of 335 capital-structure studies identifies profitability, tangibility, growth, firm size, non-debt tax shield, and business risk as the most prominent firm-related determinants Mouton and Botha (2026), the effects of the three factors should therefore be assessed alongside these firm characteristics and with methods that account for unobserved company heterogeneity. This study examines the effects of free cash flow, business risk, and non-debt tax shield on debt policy, both partially and jointly, in food and beverage subsector companies listed on the Indonesia Stock Exchange for the 2021–2025 period, using panel data regression with firm size, profitability, tangibility, and sales growth as control variables. It contributes by contrasting the agency and pecking order predictions for free cash flow, by measuring business risk with a standard-deviation-based measure of operating risk, and by providing post-pandemic panel evidence for a capital-intensive subsector. The results are expected to enrich the financial management literature on the determinants of corporate debt policy and to inform financing decisions by corporate management.

2. LITERATURE REVIEW

2.1 The Effect of Free Cash Flow on Debt Policy

Agency theory explains a contractual relationship in which one or more persons, referred to as the principal, delegate tasks or authority to another party, referred to as the agent, to make decisions. Within a company, this relationship exists between shareholders and managers (Jensen & Meckling, 1976). Agency conflict arises when the agent does not always act in the best interests of the principal because of information asymmetry, consequently, the principal bears agency costs, which include monitoring costs, incentive costs, and residual loss (Jensen & Meckling, 1976). Jensen (1986) extended agency theory through the free cash flow hypothesis, which posits that managers with free cash flow tend to use it for their personal interests rather than distributing it to shareholders, thus, debt serves as a disciplinary mechanism because the obligation to pay interest and principal on time reduces the cash available to managers.

Pecking order theory provides a competing explanation. Because managers know more about the value of the firm's assets and investment opportunities than outside investors do, issuing risky securities is costly, therefore, firms finance investment first with internal funds, then with debt, and only as a last resort with new equity (Myers & Majluf, 1984). Under this view, firms with large internally generated cash flows need less external financing, so free cash flow and profitability are expected to be negatively related to leverage, whereas debt rises when internal funds fall short of investment needs. Recent evidence on this financing hierarchy is mixed: French family firms

consistently used debt to cover financing shortfalls (Chibani & Henchiri, 2025), whereas the response of debt to the financing deficit of Latin American companies was heterogeneous and inconsistent with the pecking order (Pinillos, Macías, Castrillon, Eslava, & De, 2025).

Debt policy determines the extent to which debt finances operating and investment activities. Free cash flow is the cash available after financing necessary investments, or the cash remaining after all positive net present value projects have been funded (Jensen, 1986). It can be used to repay debt, distribute dividends, or fund further investments. Cash holdings and debt policy can jointly affect investment in developing economies, including Indonesia Nnadi, Surichamorn, Jayasekera, and Belghitar (2022), while the effects of free cash flow on debt leverage differ among firms (Xiao, Zhao, & Zhou, 2022). The market also responds to free cash flow: Okvia, Mareta, and Ridwansyah (2026) found a positive association with the stock *r*eturns of Indonesian LQ45 firms, whereas capital structure measured by the debt-to-equity ratio had no significant effect.

The agency view implies a positive effect of free cash flow on debt policy through two mechanisms. First, firms with substantial free cash flow can more readily meet debt service obligations. Second, committing cash to debt service can constrain managerial discretion over surplus funds (Jensen, 1986). Institutional monitoring can also discipline free cash flow and influence the need for debt as a governance device (Karpavičius & Yu, 2017). The pecking order view implies the opposite sign because internal cash substitutes for borrowing, and a test of the free-cash-flow hypothesis among Nigerian firms did not support its predicted payout mechanism (Nwonye & Ugwuegbe, 2020). Because the two theories yield opposite predictions, we formulate the following hypotheses:

H_1: Free cash flow has a positive effect on debt policy (agency theory)

H_1: Free cash flow has a negative effect on debt policy (pecking order theory)

2.2 The Effect of Business Risk on Debt Policy

The trade-off theory considers the tax benefits of debt alongside the costs of financial distress. Interest deductibility can raise firm value (Modigliani & Miller, 1963), but greater debt also brings fixed payment obligations and potential distress. Empirical testing in emerging markets has supported the relevance of trade-off theory to financing choices (Kannadhasan, Thakur, Gupta, & Charan, 2018), and Latin American companies have been found to adjust toward a target debt level, partly supporting the theory (Pinillos, Macías, Castrillon, Eslava, & De, 2025). Debt financing is associated with different valuation effects for short- and long-term liabilities (Oranefo & Egbunike, 2022), and excessive capitalization is linked to lower profitability in a banking sample (Owusu & Garr, 2025).

Business risk is the uncertainty faced in day-to-day operations that can affect a firm's ability to generate profit, as reflected in the variability of Earnings Before Interest And Taxes (EBIT). Demand, input prices, competition, and operating leverage contribute to this variability. Operating leverage can reduce optimal financial leverage by Chen, Harford, and Kamara (2019), and ambiguity about future outcomes can likewise affect corporate debt financing (Chen, Ho, Yan, Yeh, & Yu, 2023). Empirical studies commonly capture operating risk through the volatility of operating earnings or cash flows (Harris, & Roark, 2019; Saif-Alyousfi, Md-Rus, Taufil-Mohd, & Shahar, 2020). An approach that avoids the instability of ratio-of-change measures such as the degree of operating leverage when sales change only slightly.

Companies with volatile operating income may limit debt to reduce fixed interest obligations, a Malaysian study found that cash flow volatility was negatively related to debt measures (Saif-Alyousfi et al., 2020). However, the empirical relation can vary by context: Sakir, Majid, Zainul, and Agustina (2026) reported a positive association between business risk and leverage among Indonesian manufacturing firms, and risk was positively related to long-term and total debt among UK and US multinational energy firms (Ali, Rangone, & Farooq, 2022). Business risk may also condition other financing relationships: Hermayanti, Pentiana, and Dewi (2023) found that it moderated the

association between sales growth and capital structure in Liquidity 45 (LQ45) firms. These findings justify testing its direct effect in the food and beverage subsector.

H_2: Business risk has a negative effect on debt policy

2.3 The Effect of Non-Debt Tax Shield on Debt Policy

A non-debt tax shield refers to tax savings obtained by a company not from interest payments on debt but from other sources that are deductible from taxable income, primarily through the depreciation and amortization of assets. DeAngelo and Masulis (1980) showed that depreciation and other non-debt deductions can partly substitute for the tax advantages of debt; cross-country work also treats depreciation relative to assets as a measure of the non-debt tax shield (Rahman, & Sannacy, 2017; Zafar, Wongsurawat, & Camino, 2019). Tax loss carryforwards are another tax-related factor in capital structure choices, distinct from the depreciation measure used here (Rechbauer & Rünger, 2024). Because a non-debt tax shield can reduce taxes without interest and bankruptcy risk, companies with a high non-debt tax shield have a smaller incentive to borrow, so that the equilibrium point between tax benefits and financial distress costs shifts toward a lower level of debt.

Food and beverage companies invest in machinery, factories, and distribution assets that generate depreciation expenses. Greater deductions from depreciation can reduce the marginal tax benefit of debt, although tangible assets can support borrowing. In a sample of Indian companies, non-debt tax shields are negatively associated with leverage Pathak and Chandani (2023), whereas they are positively related to long-term and total debt among UK and US multinational energy firms (Ali, Rangone, & Farooq, 2022). Evidence from Spanish SMEs links tax avoidance to debt maturity, illustrating another tax-related financing channel (Sánchez-Ballesta & Yagüe, 2024). The link between leverage and taxation is relevant in Indonesia. Sani, Dewi, and Ridwansyah (2026) found a positive association between leverage and their measure of tax aggressiveness in energy companies. These findings motivate an empirical test in the food and beverage subsector without assuming that the effect has the same sign across all industries.

H_3: Non-debt tax shield has a negative effect on debt policy

2.4 The Simultaneous Effect of Free Cash Flow, Business Risk, and Non-Debt Tax Shield on Debt Policy

Debt policy is a multifaceted decision shaped by the simultaneous interaction of various financial factors. First, agency theory Jensen and Meckling (1976) and Jensen, 1986 explains that abundant free cash flow creates potential conflicts of interest between managers and shareholders, thus, debt is used as a disciplinary mechanism that limits managers' use of free cash flow, whereas pecking order theory predicts that internal funds reduce the need to borrow (Myers & Majluf, 1984). Second, trade-off theory Modigliani and Miller (1963) and Kannadhasan, Thakur, Gupta, and Charan (2018) explains that companies with high business risk, as indicated by large fluctuations in operating income, are more likely to face financial distress if they take on substantial debt and therefore tend to limit their use of debt. DeAngelo and Masulis (1980) explain that companies with high depreciation and amortization expenses have already obtained tax savings from non-debt sources; thus, the additional benefit of taking on new debt for tax efficiency becomes smaller. Thus, these three factors are expected to jointly affect debt policy, although the relative importance of firm-level determinants varies across sectors and countries (Khan, Akhtar, & Qasem, 2024; Panda, & Nanda, 2020; Shahzad, Azeem, Nazir, Vo, & Linh, 2021).

The model also controls for firm characteristics that the consolidation of 335 studies identifies as the most prominent firm-related determinants of capital structure, namely firm size, profitability, tangibility, and growth (Mouton & Botha, 2026). Trade-off theory predicts that larger firms, which are more diversified and face lower expected distress costs, and firms with more tangible assets, which can be pledged as collateral, carry more debt. Pecking order theory predicts that more profitable firms borrow less because they can rely on retained earnings, whereas fast-growing firms borrow more

because their investment needs exceed internal funds (Myers & Majluf, 1984), growth opportunities were positively associated with the total debt ratio of South African banks (Mabandla & Marozva, 2025). Omitting these characteristics could bias the estimated effects of the three main variables, particularly because free cash flow and profitability both reflect internally generated funds.

H₄: Free cash flow, business risk, and non-debt tax shield simultaneously affect debt policy

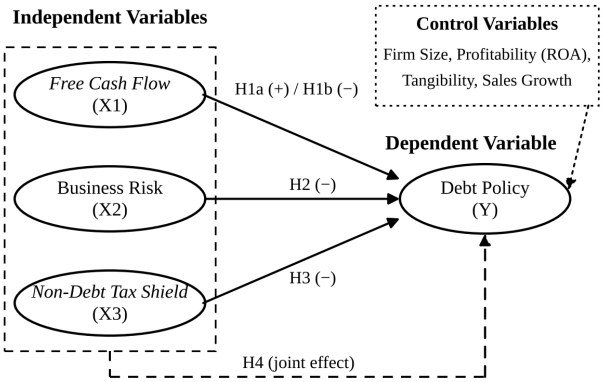


Figure 1. Research framework

Figure 1 illustrates the conceptual framework examining the effects of free cash flow (X_1), business risk (X_2), and non-debt tax shield (X_3) on debt policy (Y). The hypotheses include the positive or negative effect of free cash flow (H_1a/H_1b), the negative effects of business risk (H_2) and non-debt tax shield (H_3), and the joint effect of the three independent variables (H_4). The study also incorporates control variables, including firm size, profitability (ROA), tangibility, and sales growth, to account for other factors that may influence debt policy.

3. RESEARCH METHODOLOGY

The research population comprised 82 food and beverage subsector companies listed on the Indonesia Stock Exchange (IDX) for the 2021-2025 period. The sample was determined using the purposive sampling technique, namely, sample selection based on certain considerations or criteria. The criteria were as follows: companies consistently listed on the IDX during the 2021-2025 period; companies that published complete and audited annual financial statements to ensure data quality, reliability, and comparability, companies that presented their financial statements in Indonesian Rupiah (IDR) to maintain data consistency and comparability across companies, and companies that did not incur consecutive losses during the 2021-2025 period, because consecutive losses reflect abnormal and unstable financial conditions. The selection yielded 48 companies, or 240 firm-year observations. One company (PT Bakrie Sumatera Plantations Tbk/UNSP) reported negative equity in every year, which makes its DER economically uninterpretable, it was excluded from the estimation, leaving a balanced panel of 47 companies and 235 firm-year observations (Table 1). The figures in parentheses indicate the number of companies excluded at each step.

Table 1. Sample selection criteria

No	Sample Selection Criteria	Total
1.	Food and beverage subsector manufacturing companies consistently listed on the Indonesia Stock Exchange (IDX) during the 2021-2025 period	82
2.	Food and beverage subsector manufacturing companies that published complete and audited annual financial statements during the 2021-2025 period	(20)
3.	Food and beverage subsector manufacturing companies that presented their financial statements in Indonesian Rupiah (IDR)	(2)
4.	Food and beverage subsector manufacturing companies that did not incur consecutive losses during the 2021-2025 period	(12)
Companies meeting the sampling criteria		**48**

No	Sample Selection Criteria	Total
5.	Companies with negative equity in every year, for which DER is not interpretable	(1)
Companies in the estimation sample		47
Firm-year observations (5 × 47)		235

The data are secondary data from the audited annual financial statements of the sample companies for the 2021–2025 period, obtained from the official IDX website (www.idx.co.id) and collected using the documentation method, EBIT and sales for 2020 and net working capital for 2020 were also collected to compute lagged values. The dependent variable, debt policy, is measured by the Debt-to-Equity Ratio (DER), namely total debt (all current and non-current liabilities) divided by total equity at December 31 of each year and expressed as a percentage, book values are used because book-based leverage measures appear more reliable than market-based measures (Mouton & Botha, 2026). Free Cash Flow (FCF) is measured as Operating Cash Flow (OCF) minus Capital Expenditure (CapEx) and the Change In Net Working Capital (ΔNWC), divided by total assets. OCF is obtained from net cash provided by operating activities in the statement of cash flows; CapEx is obtained from the acquisition of fixed assets under investing activities and is operationalized through the indirect method approach when this item is not presented explicitly; and ΔNWC is the difference between net working capital (total current assets minus total current liabilities) in the current year and in the previous year.

Business risk (RISK) is measured as the standard deviation of the operating profit margin (EBIT divided by sales) over a rolling three-year window from t−2 to t. This standard-deviation-based measure replaces the degree of operating leverage, whose ratio of percentage changes becomes extremely volatile when sales change only slightly, because 2020 is the earliest year with EBIT and sales data, the 2021 value is computed from 2020 and 2021. The Non-Debt Tax Shield (NDTS) is measured as the depreciation expense divided by total assets (M'ng et al., 2017; Zafar et al., 2019), depreciation expense is obtained from the notes to the financial statements or from non-cash adjustments in the statement of cash flows and includes only the depreciation of tangible fixed assets. The control variables are firm size (SIZE), the natural logarithm of total assets, profitability (ROA), EBIT divided by total assets, tangibility (TANG), non-current assets divided by total assets, and sales growth (GROWTH), the annual percentage change in sales. ROA is based on EBIT and tangibility on non-current assets because these items were collected consistently for all sample companies.

Debt policy (*Y*) refers to a management decision that determines the extent to which debt is used in a company's capital structure to finance its operating and investment activities. In this study, debt policy is measured using the Debt-to-Equity Ratio (DER), calculated by dividing total debt by total equity. The measurement Formula 1 is:

$$DER = \frac{TotalDebt}{TotalEquity} \times 100 \quad (1)$$

Free cash flow (X_1) refers to the amount of cash available to a company after deducting capital expenditure and the working capital required to maintain or expand its operations (Jensen, 1986). Free cash flow is measured by subtracting Capital Expenditure (CapEx) and Changes in Net Working Capital (ΔNWC) from operating cash flow (OCF), then dividing the result by total assets. The measurement Formula 2 is:

$$FCF = \frac{OCF - CapEx - \DeltaNWC}{TotalAssets} \quad (2)$$

Business risk (X_2) represents the variability of operating profitability, measured over a rolling period from $t-2$ to t, which may affect a company's ability to meet its fixed financing obligations. Business risk is measured using the standard deviation of the operating profit margin (EBIT divided by sales) over the observation period. The measurement Formula 3 is:

$$RISK = SD(\frac{EBIT}{Sales}) \tag{3}$$

Non-debt tax shield (X_3) refers to tax savings obtained by a company from sources other than interest payments on debt, particularly deductions associated with depreciation and amortization of assets (DeAngelo & Masulis, 1980). In this study, the non-debt tax shield is measured by dividing depreciation expense by total assets. The measurement Formula 4 is:

$$NDTS = \frac{DepreciationExpense}{TotalAssets} \tag{4}$$

Firm size (SIZE) is a control variable representing the scale of a company's assets. It is measured using the natural logarithm of total assets to represent differences in company size. The measurement Formula 5 is:

$$Ln(TotalAssets) \tag{5}$$

Profitability (ROA) is a control variable representing the operating return generated by a company's assets. Profitability is measured by dividing Earnings Before Interest And Taxes (EBIT) by total assets. The measurement Formula 6 is:

$$ROA = \frac{EBIT}{TotalAssets} \tag{6}$$

Tangibility (TANG) is a control variable representing the proportion of long-lived assets relative to a company's total assets. In this study, tangibility is measured by dividing non-current assets by total assets. The measurement Formula 7 is:

$$TANG = \frac{TotalAssets - CurrentAssets}{TotalAssets} \tag{7}$$

Sales Growth (GROWTH) is a control variable representing the annual change in a company's sales. Sales growth is calculated by subtracting the previous year's sales from the current year's sales and dividing the result by the previous year's sales. The measurement Formula 8 is:

$$GROWTH = \frac{Sales(t) - Sales(t-1)}{Sales(t-1)} \tag{8}$$

To limit the influence of extreme values without discarding observations, all continuous variables were winsorized at the 1st and 99th percentiles of the pooled sample, which replaced six

values of each variable (three in each tail) and preserved the balanced panel. The analysis uses panel data regression. Three estimators were compared: the Common Effect Model (CEM), pooled ordinary least squares), the Fixed Effect Model (FEM, within estimator with company effects), and the Random Effect Model (REM), generalized least squares). The Chow test compares the CEM with the FEM, the Breusch-Pagan Lagrange Multiplier (LM) test compares the CEM with the REM, and the Hausman test compares the FEM with the REM (Hausman, 1978). Because the conventional Hausman statistic can be negative in finite samples and assumes homoscedastic errors, its robust regression-based (Mundlak) form was used, in which the company means of the regressors are added to the REM and their joint significance is tested with a cluster-robust Wald test. Multicollinearity was assessed with the Variance Inflation Factor (VIF), groupwise heteroscedasticity with the modified Wald test, and first-order serial correlation with the Wooldridge test for panel data. All inferences use standard errors clustered by company, which are robust to heteroscedasticity and within-company serial correlation. The Formula 9 is as follows:

$$DERit = \alpha + \beta 1 FCFit + \beta 2 RISKit + \beta 3 NDTSit + \beta 4 SIZEit + \beta 5 ROAit + \beta 6 TANGit + \beta 7 GROWTHit + ui + \varepsilon it \quad (9)$$

where i denotes the company, t the year, α the constant, β_1 to β_7 the regression coefficients, ui the company-specific effect (fixed in the FEM, random in the REM, and absent in the CEM), and εit the idiosyncratic error. Hypotheses H_1a, H_1b, H_2, and H_3 were tested with two-tailed t-tests of β_1, β_2, and β_3 at the 5% significance level, H_1a is supported if β_1 is significantly positive and H_1b if it is significantly negative. H_4 was tested using a cluster-robust Wald F-test of the joint restriction $\beta_1 = \beta_2 = \beta_3 = 0$. The analysis was performed in Python 3 using the linearmodels and statsmodels packages.

4. RESULTS AND DISCUSSION

Table 2. Descriptive statistics results

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Debt Policy/DER (Y, %)	235	7.216	444.306	82.577	74.669
Free Cash Flow (X_1)	235	-0.550	0.363	0.029	0.135
Business Risk (X_2)	235	0.003	0.161	0.034	0.034
Non-Debt Tax Shield (X_3)	235	0.005	0.083	0.029	0.016
Firm Size (SIZE)	235	24.993	32.849	29.082	1.747
Profitability (ROA)	235	-0.009	0.400	0.121	0.071
Tangibility (TANG)	235	0.109	0.884	0.537	0.212
Sales Growth (GROWTH)	235	-0.377	0.855	0.142	0.200

Table 2 shows that DER has a mean of 82.577% and a standard deviation of 74.669, ranging from 7.216% to 444.306%; therefore, debt policy differs widely across companies and years. Free cash flow has a mean of 0.029 and a standard deviation of 0.135, ranging from -0.550 to 0.363, indicating that free cash flow is small on average and varies considerably. Business risk has a mean of 0.034, meaning that the operating profit margin fluctuates by approximately 3.4 percentage points within a three-year window, with a maximum of 0.161. Non-debt tax shield has a mean of 0.029 and a narrow standard deviation of 0.016, indicating that depreciation intensity is relatively uniform. The sample companies are large (mean SIZE of 29.082, corresponding to a geometric mean of total assets of about IDR4.3 trillion), profitable (mean ROA of 0.121), moderately asset-intensive (mean TANG of 0.537), and growing (mean sales growth of 0.142).

Table 3 reports the model selection and diagnostic tests. The Chow test rejects the CEM in favor of the FEM ($F(46, 181) = 24.654$, $p < 0.001$), and the Breusch-Pagan LM test rejects the CEM in favor of the REM ($\chi^2(1) = 299.083$, $p < 0.001$), indicating significant company-specific effects. The conventional Hausman statistic was negative (-1.648) because the difference between the two covariance matrices is not positive definite; the robust Mundlak form does not reject the null hypothesis that the company effects are uncorrelated with the regressors ($\chi^2(7) = 12.144$, $p = 0.096$). Therefore, the REM is the preferred model. The VIF values range from 1.187 to 1.546, well below 10,

so multicollinearity is not a concern. The modified Wald test indicates groupwise heteroscedasticity ($\chi^2(47) = 49{,}097.934$, $p < 0.001$), and the Wooldridge test indicates weak first-order serial correlation ($F(1, 46) = 3.555$, $p = 0.066$), both are addressed by company-clustered standard errors rather than by transforming the variables.

Table 3. Model selection and diagnostic tests

Test	Null Hypothesis	Statistic	*p*-value	Decision
Chow test	CEM is adequate (no company effects)	$F(46, 181) = 24.654$	<0.001	FEM preferred over CEM
Breusch-Pagan LM test	CEM is adequate (no random company effects)	$\chi^2(1) = 299.083$	<0.001	REM preferred over CEM
Robust Hausman test (Mundlak form)	Company effects are uncorrelated with the regressors (REM consistent)	$\chi^2(7) = 12.144$	0.096	REM preferred over FEM
Variance inflation factor	No harmful multicollinearity (VIF <]10)	1.187–1.546	-	No multicollinearity
Modified Wald test	Homoskedastic errors across companies	$\chi^2(47) = 49{,}097.934$	<0.001	Heteroskedasticity, clustered standard errors used
Wooldridge test	No first-order serial correlation	$F(1, 46) = 3.555$	0.066	Not significant at 5%, clustered standard errors used

Table 4 presents the estimates of the three models; the figures in parentheses are company-clustered robust standard errors, and *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively. In the REM, free cash flow has a negative but insignificant coefficient ($\beta_1 = -7.517$, $t = -0.370$, $p = 0.712$), thus, H_1a and H_1b are not supported. Business risk has a positive coefficient ($\beta_2 = 395.951$, $t = 2.019$, $p = 0.045$), because its sign is opposite to the predicted negative effect, H_2 is rejected. The non-debt tax shield has a positive but insignificant coefficient ($\beta_3 = 827.908$, $t = 1.022$, $p = 0.308$), thus, H_3 is rejected. The robust Wald test does not reject the joint restriction $\beta_1 = \beta_2 = \beta_3 = 0$ ($F(3, 227) = 1.388$, $p = 0.247$), thus, H_4 is rejected.

Table 4. Panel regression estimates

Variables	CEM	FEM	REM (selected)
Free Cash Flow (X_1)	51.629 (36.105)	-10.701 (18.481)	-7.517 (20.303)
Business Risk (X_2)	378.546 (279.378)	402.671** (184.959)	395.951** (196.101)
Non-Debt Tax Shield (X_3)	9.331 (673.058)	1,289.188 (1,112.461)	827.908 (810.127)
Firm Size	10.006** (4.565)	12.870 (17.226)	11.884** (4.908)
Profitability (ROA)	-235.038 (149.559)	-133.043 (83.895)	-155.368** (76.447)
Tangibility	12.692 (47.702)	-44.901 (99.123)	-24.467 (68.937)
Sales Growth	65.829** (26.849)	24.035* (13.334)	25.650* (13.049)
Constant	-210.656* (122.971)	-305.852 (517.247)	-272.059** (129.498)
Observations / companies	235 / 47	235 / 47	235 / 47
R^2 (overall)	0.156	0.054	0.106
R^2 (within)	-	0.191	0.185
Joint test of X_1–X_3 (H_4), F (*p*-value)	1.264 (0.288)	1.673 (0.174)	1.388 (0.247)
Robust F for all regressors (*p*-value)	1.957 (0.062)	1.539 (0.157)	2.008 (0.055)

Among the control variables, profitability has a negative effect (β_5 = -155.368, p = 0.043), and firm size has a positive effect (β_4 = 11.884, p = 0.016), sales growth is positive and marginally significant (β_7 = 25.650, p = 0.051), and tangibility is insignificant (p = 0.723). Because DER is expressed as a percentage, a one-percentage-point increase in ROA lowers DER by about 1.55 percentage points, a 0.01 increase in the standard deviation of the operating margin raises DER by about 3.96 percentage points, and a 10% increase in total assets raises DER by about 1.13 percentage points. The REM explains 10.6% of the overall variation in DER (within R^2 = 0.185), and the company-specific component accounts for 82.9% of the composite error variance; including company effects, the FEM explains 88.4% of the variation in DER. Persistent company characteristics therefore account for most of the differences in debt policy across companies.

Table 5. Robustness checks (random effect model)

Variables	(1) Year effects	(2) Ln DER	(3) DAR	(4) Two-year risk window	(5) DOL as risk
Free Cash Flow (X_1)	-2.279 (0.924)	0.090 (0.612)	-0.001 (0.976)	-3.259 (0.874)	-8.358 (0.705)
Business Risk (X_2)	375.063* (0.071)	1.712 (0.174)	0.359 (0.151)	223.349 (0.125)	-0.008 (0.918)
Non-Debt Tax Shield (X_3)	905.922 (0.256)	6.998 (0.289)	1.326 (0.334)	702.037 (0.395)	680.339 (0.420)
Firm Size	14.823*** (0.001)	0.082 (0.200)	0.020* (0.088)	11.698** (0.020)	11.227** (0.023)
Profitability (ROA)	-154.745** (0.032)	-0.879 (0.319)	-0.246 (0.173)	-163.984** (0.038)	-204.968** (0.025)
Tangibility	-41.707 (0.516)	0.398 (0.454)	0.066 (0.536)	-27.414 (0.706)	-23.366 (0.747)
Sales Growth	19.490 (0.200)	0.397** (0.011)	0.074** (0.018)	34.374** (0.011)	39.011*** (0.004)

Table 5 reports robustness checks based on the REM, with p-values in parentheses. The specifications add year dummies to absorb common shocks such as the 2022–2023 interest rate increases, replace DER with its natural logarithm, replace DER with the Debt-to-Assets Ratio (DAR), compute business risk over a two-year window (t−1 to t), and use the Degree of Operating Leverage (DOL) as the risk measure. Free cash flow and non-debt tax shields remain insignificant in every specification. Business risk keeps a positive sign but is not significant at the 5% level in specifications (1) to (4), with p-values from 0.071 to 0.174, and the DOL measure is unrelated to debt policy (p = 0.918). Profitability and firm size keep their signs and remain significant at the 5% level in specifications (1), (4), and (5), but not when leverage is measured in logarithms or as DAR, whereas sales growth is positive throughout and significant at the 5% level in four of the five checks. The insignificance of free cash flow and non-debt tax shields is therefore robust, whereas the positive effect of business risk should be interpreted with caution.

4.1 The Effect of Free Cash Flow on Debt Policy

Free cash flow has no significant effect on debt policy (β_1 = -7.517, p = 0.712), thus, the data support neither the agency prediction (H_1a) nor the pecking order prediction (H_1b). The agency argument implies that firms with large free cash flows take on debt to commit managers to fixed payments (Jensen, 1986), the absence of a positive effect suggests that this disciplinary use of debt is not the dominant financing motive in the sample. The negative sign is consistent with pecking order theory, in which internal funds are used before debt (Myers & Majluf, 1984), but the effect is small and imprecise once company heterogeneity and profitability are controlled for. The pecking order mechanism appears instead through profitability: companies with higher ROA carry significantly less debt, which indicates that earnings generated by operations, rather than the residual cash left after investment and working capital needs, reduce reliance on debt.

Two features of the data help explain why the free cash flow loses its explanatory power. First, free cash flow is correlated with profitability and non-debt tax shields (r = 0.352 and 0.345, respectively); thus, part of its association with leverage reflects these firm characteristics. Second, free cash flow deducts capital expenditure and the change in net working capital, which fluctuates from year to year; 60% of its variance occurs within companies, whereas 86% of the variance in DER

occurs between companies. This interpretation is consistent with evidence that firms with different internal funding positions show different patterns of debt leverage (Xiao et al., 2022) and that cash holdings interact with debt maturity and investment in developing economies (Nnadi et al., 2022). Evidence from Nigerian listed firms also questions whether the free cash flow mechanism is universal (Nwonye & Ugwuegbe, 2020), and recent tests of the financing hierarchy report differing responses of debt to financing shortfalls across firm types and countries (Chibani & Henchiri, 2025; Pinillos et al., 2025). The theoretical implication is that, in this subsector, the pecking order operates through profitability rather than free cash flow.

4.2 The Effect of Business Risk on Debt Policy

Business risk has a positive effect on debt policy in the main REM (β_2 = 395.951, p = 0.045), which is opposite to the negative effect predicted by trade-off theory; therefore, H_2 is rejected. Trade-off theory implies that firms with volatile operating income limit debt because volatility raises the probability of financial distress (Modigliani & Miller, 1963; Kannadhasan et al., 2018), and operating leverage can reduce optimal financial leverage (Chen et al., 2019). The positive coefficient is more consistent with a financing-need interpretation: companies whose margins fluctuate more generate less stable internal funds and, in line with the pecking order, cover shortfalls with debt rather than equity. A positive association between business risk and leverage has also been reported for Indonesian manufacturing firms (Sakir et al., 2026) and for UK and US multinational energy firms (Ali et al., 2022), whereas cash flow volatility was negatively related to debt among Malaysian firms (Saif-Alyousfi et al., 2020).

The results should nevertheless be interpreted with caution. The coefficient of the standard-deviation-based measure remains positive but is not significant at the 5% level when year effects are included, when leverage is measured in logarithms or as DAR, or when risk is measured over a two-year window, and the DOL-based measure is unrelated to DER. The standard-deviation-based measure is more stable than DOL, whose ratio of percentage changes reached extreme values when sales changed little, but a three-year window still provides only a short history of each company's earnings. Business risk may also operate indirectly: Hermayanti et al. (2023) found that it moderated the relationship between sales growth and capital structure, and the relation between cash flow risk and leverage can differ with financial performance (Harris & Roark, 2019).

4.3 The Effect of Non-Debt Tax Shield on Debt Policy

The non-debt tax shield has a positive but insignificant coefficient (β_3 = 827.908, p = 0.308), and this result holds in all robustness checks, H_3 is therefore rejected. Trade-off theory, as extended by DeAngelo and Masulis (1980), states that tax savings from depreciation can substitute for the tax benefits of interest on debt, so that companies with a high non-debt tax shield have a smaller incentive to borrow. However, the depreciation-to-assets measure of the non-debt tax shield also reflects fixed asset intensity: firms with large depreciable assets may have collateral that increases debt capacity, which offsets the substitution effect. Moreover, the non-debt tax shield varies within a narrow range (standard deviation of 0.016), and only 7% of its variance occurs within companies, which limits the information available to identify its effect once company effects are modeled. Cross-country evidence is mixed: M'ng et al. (2017) and Pathak and Chandani (2023) found negative associations between non-debt tax shields and leverage, whereas Moradi and Paulet (2019) and Ali et al. (2022) reported positive associations, and Zafar et al. (2019) identified non-debt tax shields among the determinants of leverage in Asian emerging markets. The present estimate is positive but statistically insignificant, so it does not establish either direction for this subsector.

4.4 The Simultaneous Effect of Free Cash Flow, Business Risk, and Non-Debt Tax Shield on Debt Policy

The robust Wald test shows that free cash flow, business risk, and non-debt tax shield do not jointly affect debt policy ($F(3, 227) = 1.388$, p = 0.247), thus, H_4 is rejected. Agency theory links free cash flow to debt through conflicts of interest between owners and managers (Jensen & Meckling, 1976), whereas trade-off theory links debt decisions to the balance between tax benefits and financial distress costs, which are influenced by business risk and non-debt tax shield (DeAngelo & Masulis,

1980; Modigliani & Miller, 1963; Khan et al., 2024). However, in this subsector, the three characteristics add little explanatory power once company effects and standard determinants are considered. All seven regressors together are significant only at the 10% level ($F(7, 227) = 2.008$, $p = 0.055$), and the large share of the company-specific component indicates that persistent company characteristics outside the model, which may include ownership, business-group affiliation, and banking relationships, explain most of the differences in debt policy, other firm-level and country-level determinants have been documented elsewhere (Shahzad et al., 2021).

4.5 Control Variables and Theoretical Implications

Profitability is negatively related to debt policy ($\beta_5 = -155.368$, $p = 0.043$), supporting the pecking order theory: profitable companies finance more of their needs with retained earnings and, therefore, borrow less (Myers & Majluf, 1984). This result contrasts with the positive association between profitability and debt reported for UK and US multinational energy firms (Ali et al., 2022). Sales growth has a positive, marginally significant effect ($\beta_7 = 25.650$, $p = 0.051$), which is significant in four of the five robustness checks, consistent with the pecking order view that growing firms need external funds and the positive association between growth opportunities and total debt among South African banks (Mabandla & Marozva, 2025). Firm size has a positive effect ($\beta_4 = 11.884$, $p = 0.016$), consistent with the trade-off view that larger and more diversified companies face lower expected distress costs and have better access to credit. Tangibility is insignificant ($p = 0.723$), possibly because the non-current asset proxy also includes intangible assets and long-term investments. Together, these results indicate that debt policy in the food and beverage subsector is better explained by the pecking order hierarchy, operating through profitability and growth, than by the agency role of free cash flow, while the size effect remains consistent with trade-off theory.

5. CONCLUSIONS

5.1 Conclusion

Using panel data for 47 food and beverage subsector companies listed on the Indonesia Stock Exchange for the 2021–2025 period, this study finds that free cash flow and non-debt tax shield have no significant effect on debt policy, whereas business risk has a positive effect that is not robust across specifications, the three variables have no significant joint effect. Profitability reduces and firm size increases debt policy, and sales growth tends to increase it. These findings support pecking order theory, in which companies rely first on internally generated profits, and do not support the agency prediction that free cash flow increases debt. Corporate management is advised to consider operating profitability and growth needs when determining debt policy, and investors and creditors are advised to assess leverage in light of profitability, size, and growth rather than free cash flow alone.

5.2 Research Limitations

This study covers one subsector over five years. Because 2019 data were not collected, the 2021 value of business risk was based on a two-year window, and the three-year window remains short. Profitability is measured using EBIT rather than net income, and tangibility with non-current assets rather than net fixed assets, because these items were available consistently for all companies. The models capture contemporaneous associations and do not address possible reverse causality between leverage and its determinants.

5.3 Suggestions and Directions for Future Research

Future researchers are advised to use longer panels to compute business risk over longer windows, measure tangibility with net fixed assets, apply dynamic panel estimators that address endogeneity and adjustment toward target leverage, and add determinants such as liquidity, cash holdings, ownership structure, and bank relationships.

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AUTHOR CONTRIBUTIONS

FGK contributed to conceptualization, data collection, literature review, data analysis, and drafting of the original manuscript. FM contributed to the research methodology, validation, supervision, and critical revision of the manuscript. DP contributed to data interpretation, manuscript review, and refinement of the final version. AKD contributed to critical review and feedback for manuscript improvement. All authors have read and approved the final manuscript.

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