

# Macroeconomic Conditions, Effective Taxation, and Capital Structure Decisions: Evidence from Indonesian Manufacturing Firms

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## Abstract

This study examines the associations between macroeconomic conditions, realized effective taxation, firm-specific characteristics, and capital structure among manufacturing firms listed on the Indonesia Stock Exchange during 2021–2025. Using a balanced panel of 97 firms and 485 firm-year observations, the study applies panel-data regression with the Random Effects Model (REM) as the baseline specification based on formal model-selection tests. Robustness is assessed using firm-clustered standard errors, a Fixed Effects specification, and additional ETR sensitivity analyses. The results show that the policy interest rate is negatively and statistically significantly associated with capital structure and remains robust across alternative panel specifications. Firm size is positively associated with capital structure in the baseline REM but becomes statistically insignificant under Fixed Effects, indicating specification sensitivity. In contrast, the Effective Tax Rate (ETR) exhibits a negative but statistically insignificant coefficient under firm-clustered inference and remains insignificant across bounded-ETR, positive-tax-expense, and winsorized specifications. Inflation and the remaining firm-specific variables are also statistically insignificant at the conventional 5% level. Overall, the findings indicate that interest rates exhibit a more stable association with corporate leverage than firms' realized annual effective tax burden. Given the observational design and limited time-series variation in national-level macroeconomic variables, the results should be interpreted as conditional associations rather than causal effects.

## KEYWORDS

capital structure; effective tax rate; interest rate; random effects model; manufacturing firms.

## Introduction

Capital structure is a key strategic financial decision because the choice between debt and equity affects firms' financing costs, financial risk, sustainability, and flexibility (Nishihara, 2023; Vinh et al., 2025). Changes in macroeconomic conditions, particularly inflation and interest rates, together with fiscal policy and taxation, increase the complexity of financing decisions (Ali et al., 2022; M. Febrianti & Widhiastuti, 2025). At the firm level, profitability, asset tangibility, investment opportunities, business risk, liquidity, firm size, firm age, and sales growth may further explain differences in financing behavior (Jeffrey et al., 2023a; Melananda & Ode Irma Sari, 2024; Widyakto et al., 2024).

Trade-Off Theory, Pecking Order Theory, and Agency Theory provide complementary explanations for corporate financing decisions through mechanisms involving tax benefits, financial distress costs, information asymmetry, and agency conflicts (Adair & Adaskou, 2015; Khan et al., 2021). However, empirical evidence on capital structure determinants remains mixed across countries, industries, and institutional settings, indicating that financing decisions are context-dependent and may vary with macroeconomic conditions, taxation systems, and firm characteristics (Fukui et al., 2023; Said, 2025; Salam & Shourkashti, 2019; Tan, 2024; Vintilă et al., 2025).

Recent studies have increasingly integrated macroeconomic and firm-specific

determinants of capital structure. Choi et al., (2024) examine macroeconomic and firm-level determinants among Korean firms, while S. Febrianti, Mustarruddin, et al., (2024) incorporate macroeconomic and financial characteristics of Indonesian listed companies. Saad & Belkacem, (2025) similarly analyze firm-specific and macroeconomic determinants in an emerging-market setting, whereas Egbunike & Okerekeoti, (2018) examine their interaction among manufacturing firms. Despite these contributions, evidence remains limited on whether firms' realized tax burden provides additional information in explaining financing decisions, particularly in Indonesian manufacturing firms, because previous studies generally employ conventional tax measures or do not explicitly incorporate the Effective Tax Rate (ETR) into their empirical models (Garcia-Bernardo et al., 2023; Putri et al., 2025).

Unlike statutory tax rates, ETR reflects firms' realized tax burden after considering tax planning, fiscal incentives, tax credits, and accounting adjustments (Andreas & Savitri, 2017a; Garcia-Bernardo et al., 2023; Putri et al., 2025). Thus, ETR provides conceptually different information from statutory tax rates and may capture aspects of firms' actual tax positions that are relevant to financing decisions. Nevertheless, evidence concerning its association with capital structure remains limited in the Indonesian manufacturing context.

To address this gap, this study examines the associations of inflation, interest rates, ETR, and firm-specific characteristics—profitability, asset tangibility, investment opportunity set (IOS), business risk, liquidity, firm size, firm age, and sales growth—with the capital structure of manufacturing firms listed on the Indonesia Stock Exchange (Ariefianto et al., 2024a; S. Febrianti, Mustarruddin, et al., 2024; Ibrahimov et al., 2025; Jeffry et al., 2023b; Wahyuni & Kristanti, 2024). The study specifically evaluates whether firms' realized tax burden, measured by ETR, provides additional explanatory information beyond conventional macroeconomic and firm-level determinants.

The study contributes to the literature in three ways. First, it provides additional evidence on the applicability of Trade-Off and Pecking Order theories within Indonesia's macroeconomic and institutional environment (Hastutik et al., 2022; Jahanzeb et al., 2013; Yulianto et al., 2016). Second, it incorporates ETR as a measure of firms' realized tax burden, capturing tax-related information not reflected in statutory tax rates (Andreas & Savitri, 2017b; Garcia-Bernardo et al., 2023; Putri et al., 2025). Third, it extends Indonesian evidence by assessing ETR jointly with macroeconomic conditions and firm-specific characteristics in explaining leverage among manufacturing firms (Table 1). The findings may also assist managers, investors, and policymakers in evaluating financing decisions under changing monetary and taxation environments (Gazali et al., 2021; Vintilă et al., 2025).

## Literature Review

Capital structure concerns firms' financing choices between debt and equity and their implications for firm value, financing costs, and risk (S. Febrianti, Giriati, et al., 2024; Mazumdar & Mara, 2024). While Modigliani and Miller initially demonstrated capital-structure irrelevance under perfect-market assumptions, subsequent research recognizes that taxation, bankruptcy costs, information asymmetry, and agency conflicts influence financing decisions (Fukui et al., 2023; Wazzan, 2018). These market imperfections provide the basis for integrating macroeconomic conditions, taxation, and firm-specific characteristics when explaining financing behavior, particularly in emerging markets (Yeboah et al., 2024a; Yıldırım & Karabayır, 2024).

Trade-Off Theory proposes that firms balance the tax benefits of debt against expected financial distress and bankruptcy costs in determining leverage. (Ai et al., 2021; Cekrezi, 2013). Within this framework, inflation and interest rates affect borrowing conditions, while taxation influences the potential benefits of interest-related tax shields (Ariefianto et al., 2024b; S. Febrianti, Mustarruddin, et al., 2024). However, institutional constraints and macroeconomic volatility may prevent firms from continuously maintaining a single optimal leverage ratio, resulting in adaptive financing behavior (Abdeljawad & Farhood, 2025; Hackbarth & Sun, 2024a). Pecking Order Theory emphasizes financing hierarchy arising from information asymmetry between managers and external investors. Firms generally prefer internal funds, followed by debt, and issue equity as a last resort (Kakouris & Psychoyios, 2025; Leary & Roberts, 2010). Accordingly, profitability and liquidity can reduce dependence on debt, while financing needs may increase external borrowing. This mechanism is particularly relevant in emerging markets characterized by information asymmetry and capital-market imperfections (Abdeljawad & Jaradat, 2025; Saputra & Kusuma, 2025). Agency Theory complements these perspectives by emphasizing conflicts among managers, shareholders, and creditors. Debt can constrain managerial discretion but may also generate risk-shifting and underinvestment problems when leverage becomes excessive (Gifari et al., 2025; Hu et al., 2025). Consequently, firm characteristics such as asset tangibility, business risk, investment opportunities, and firm size can affect debt capacity and creditor-shareholder conflicts (Bishwas & Hossain, 2025; Vengesai, 2023; Zaighum et al., 2024).

Together, these theories suggest that capital structure reflects interactions between firm characteristics and the broader financing environment. Macroeconomic conditions, particularly inflation and interest rates, may alter borrowing costs, the real value of liabilities, and financing incentives (Budianto, 2025; Chen et al., 2025; Febrianti et al., 2024; Mustofa & Faizin, 2025). However, mixed empirical findings

**Table 1.** Comparison of Closest Empirical Studies and Research Gap

| Study                     | Sample                         | Period    | Variables                                  | Estimator            | Research Gap                                                       |
|---------------------------|--------------------------------|-----------|--------------------------------------------|----------------------|--------------------------------------------------------------------|
| Choi et al. (2024)        | Korean Listed Firms            | 1995-2021 | Macroeconomic + Firm characteristics       | Dynamic Panel        | Does not examine ETR                                               |
| S.Febrianti et al. (2024) | Indonesian listed firms        | 2019-2023 | Macroeconomic + Financial characteristics  | Panel Regression     | No measure of realized tax burden                                  |
| Saad & Belkacem (2025)    | Emerging-market firms          | 2006-2019 | Firm-specific + Macroeconomic              | Fixed Effects        | Does not analyse ETR                                               |
| This Study                | Indonesian manufacturing firms | 2021-2025 | Macroeconomic + ETR + Firm characteristics | Random Effects Model | Evaluates the incremental role of firms' realized tax burden (ETR) |

indicate that firms may respond differently to macroeconomic changes depending on their financial characteristics and institutional environment (Kim et al., 2023).

#### Hypothesis Development

##### Inflation and Capital Structure

Inflation can affect leverage through competing mechanisms. Higher inflation may reduce the real value of nominal debt, potentially encouraging borrowing, but persistent inflation can also increase uncertainty, financing costs, and financial distress risk (Budianto, 2025; Febrianti et al., 2024). Given these competing effects, the study proposes a non-directional relationship: H1. Inflation is significantly associated with capital structure.

##### Interest Rate and Capital Structure.

Trade-Off Theory suggests that higher interest rates increase borrowing costs and reduce the attractiveness of debt, whereas Pecking Order Theory implies that financing hierarchy may moderate firms' responses to borrowing costs (Ai et al., 2021; Cekrezi, 2013; Leary & Roberts, 2010). Consistent with mixed empirical evidence regarding the strength of this relationship (Chen et al., 2025; Kim et al., 2023) the following hypothesis is proposed: H2. Interest rates are associated with capital structure.

##### Profitability and Capital Structure.

Pecking Order Theory predicts that profitable firms rely more on retained earnings and therefore require less debt, whereas Trade-Off Theory suggests that profitability may increase debt capacity and tax-shield benefits. Given the expected dominance of internal financing and evidence from emerging markets (Abdeljawad & Jaradat, 2025; Leary & Roberts, 2010). H3. Profitability is negatively associated with capital structure.

##### Asset Tangibility and Capital Structure.

Tangible assets provide collateral, reduce expected creditor losses, and can mitigate shareholder-creditor agency conflicts, thereby increasing firms' debt capacity (Camisón et al., 2022; Vengesai, 2023). Therefore: H4. Asset tangibility is positively associated with capital structure.

##### Investment Opportunity Set and Capital Structure.

Firms with greater growth opportunities may use less debt because leverage can create underinvestment problems and because future investment opportunities provide limited collateral value. Although growing firms may require external financing, the agency-cost mechanism predicts: H5. Investment Opportunity Set is negatively associated with capital structure.

##### Business Risk and Capital Structure.

Higher business risk increases earnings volatility and financial distress exposure, while creditors may impose tighter financing conditions on firms with volatile operating performance. Accordingly: H6. Business risk is negatively associated with capital structure.

##### Effective Tax Rate and Capital Structure.

Trade-Off Theory predicts that firms facing higher effective tax burdens may have stronger incentives to use debt because interest payments generate tax shields. However, institutional constraints and tax regulations may limit these benefits (Ariefianto et al., 2024b; Cekrezi, 2013). Therefore: H7. Effective tax rate is positively associated with capital structure.

##### Liquidity and Capital Structure.

Pecking Order Theory suggests that highly liquid firms

have greater internal resources and therefore rely less on debt, although Trade-Off Theory recognizes that stronger liquidity may increase debt-servicing capacity. Following the internal-financing mechanism: H8. Liquidity is negatively associated with capital structure.

##### Firm Size and Capital Structure.

Larger firms generally have greater diversification, lower perceived bankruptcy risk, and better access to external financing, supporting greater debt capacity under Trade-Off and Agency perspectives. Therefore: H9. Firm size is positively associated with capital structure.

##### Firm Age and Capital Structure.

Older firms generally have longer credit histories, stronger reputations, and established relationships with financial institutions, which may reduce information asymmetry and improve access to debt. Although accumulated retained earnings may reduce financing needs, this study expects the financing-access mechanism to dominate. Therefore: H10. Firm age is positively associated with capital structure.

##### Sales Growth and Capital Structure

Growing firms require additional resources for working capital, production, and expansion. When internal funds are insufficient, Pecking Order Theory predicts that firms will use debt before issuing equity, although uncertainty associated with growth may constrain excessive borrowing. Accordingly: H11. Sales growth is positively associated with capital structure.

## Methods

This study employs a quantitative, explanatory, and associational panel-data design to examine the relationships

**Table 2.** Sample Selection Procedure

| Sample Selection Criteria                              | Firms   |
|--------------------------------------------------------|---------|
| Manufacturing firms listed on the IDX during 2021-2025 | 153     |
| Less: Firms delisted during 2021-2025                  | (11)    |
| Less: Firms with incomplete annual reports             | (17)    |
| Less: Firms with incomplete research variable data     | (28)    |
| Final Sample (Firms)                                   | 97      |
| Observation period                                     | 5 years |
| Firm-year-observations                                 | 485     |

**Table 3.** Expected Signs of the Regression Coefficients and Their Theoretical Basis

| Variable                         | Expected Sign | Theoretical Basis    |
|----------------------------------|---------------|----------------------|
| Inflation (INF)                  | +/-           | Trade-Off Theory     |
| Interest Rate (IR)               | -             | Trade-Off Theory     |
| Profitability (PROF)             | -             | Pecking Order Theory |
| Asset Tangibility (TANG)         | +             | Trade-Off Theory     |
| Investment Opportunity Set (IOS) | -             | Pecking Order Theory |
| Business Risk (BRISK)            | -             | Trade-Off Theory     |
| Effective Tax Rate (ETR)         | +             | Trade-Off Theory     |
| Liquidity (LIQ)                  | -             | Trade-Off Theory     |
| Firm Size (SIZE)                 | +             | Trade-Off Theory     |
| Firm Age (AGE)                   | +             | Trade-Off Theory     |
| Sales Growth (GROWTH)            | +             | Pecking Order Theory |

between macroeconomic conditions, effective taxation, firm-specific characteristics, and capital structure. Panel data allow the analysis to exploit cross-sectional and time-series variation while accounting for unobserved firm heterogeneity. Given the observational design and the absence of a formal causal identification strategy, the estimated coefficients are interpreted as conditional associations rather than causal effects.

The population comprised 153 manufacturing firms listed on the Indonesia Stock Exchange during 2021–2025. Purposive sampling excluded 11 delisted firms, 17 firms with incomplete annual reports, and 28 firms with incomplete research-variable data, resulting in 97 firms. Complete observations for all firms over five years produced a balanced panel of 485 firm-year observations (see Table 2). Data were screened for potentially influential or economically unusual observations, with any alternative treatment reported separately in the sensitivity analyses.

Panel-data regression was employed to account for firm heterogeneity and variation across firms and time. The baseline estimator was selected using the Chow/F test, Hausman test, and Breusch–Pagan Lagrange Multiplier (LM) test to compare the Common Effects, Fixed Effects, and Random Effects specifications. The tests supported the Random Effects Model (REM) as the baseline specification. Because REM assumes that unobserved firm-specific effects are uncorrelated with the explanatory variables, an alternative Fixed Effects Model (FEM) with firm-clustered standard errors was also estimated as a robustness check. The general panel-data regression model is specified as:

$$CS_{it} = \alpha + \beta_1 INF_t + \beta_2 IR_t + \beta_3 PROF_{it} + \beta_4 TANG_{it} + \beta_5 IOS_{it} + \beta_6 BRISK_{it} + \beta_7 ETR_{it} + \beta_8 LIQ_{it} + \beta_9 SIZE_{it} + \beta_{10} AGE_{it} + \beta_{11} GROWTH_{it} + \mu_i + \varepsilon_{it}$$

where CS denotes capital structure, measured as total debt divided by total assets; INF is inflation; IR is the central bank policy interest rate; PROF is profitability measured by return on assets; TANG is asset tangibility; IOS is the investment opportunity set; BRISK is business risk; ETR is the Effective Tax Rate; LIQ is liquidity; SIZE is firm size; AGE is firm age; and GROWTH is sales growth. The term  $\mu_i$  represents the unobserved firm-specific effect and  $\varepsilon_{it}$  the idiosyncratic error term.

Inflation and interest rates are national macroeconomic variables that vary across years but not across firms within a given year. Their coefficients are therefore identified from time-series variation over the five-year observation period. A complete set of year fixed effects is not included because these national variables would be perfectly or nearly collinear with year indicators. Accordingly, their coefficients are interpreted cautiously as conditional associations rather than isolated causal effects. Firm-clustered standard errors are used to account for within-firm dependence. Given the limited five-year time dimension, procedures requiring a larger time dimension, such as Driscoll–Kraay standard errors, were not adopted.

The theoretically expected coefficient signs are summarized in Table 3, while variable definitions and measurements are reported in Table 4.

The Effective Tax Rate (ETR) is measured as total tax expense divided by earnings before tax. Because annual ETR may take unusual values due to negative tax expense, deferred-

**Table 4. Measurement**

| Variable & Symbol                | Description                                                                                                                                                                   | Measurement                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Capital Structure (CS)           | financing mix Represents the extent of a firm's dependence on debt financing in funding its assets and operations. It indicates the firm's financial policy and risk profile. | Total Debt / Total Assets                                                                             |
| Inflation (INF)                  | Inflation represents the general and sustained increase in price levels in the economy, affecting firms' cost of capital and financial decision-making.                       | Year-over-year percentage change in the Consumer Price Index (CPI)                                    |
| Interest Rate (IR)               | Interest rate reflects the cost of borrowing and monetary policy conditions that influence firms' financing decisions.                                                        | Central bank policy interest rate (%)                                                                 |
| Profitability (PROF)             | Profitability measures the extent to which a firm can generate earnings from the effective utilization of its assets and internal resources.                                  | Net Income / Total Assets (ROA)                                                                       |
| Asset Tangibility (TANG)         | Asset tangibility measures the degree to which a firm's tangible assets can be employed as collateral to facilitate access to debt financing.                                 | Fixed Assets / Total Assets                                                                           |
| Investment Opportunity Set (IOS) | IOS represents the firm's growth opportunities and future investment prospects.                                                                                               | Market-to-Book Value of Equity                                                                        |
| Business Risk (BRISK)            | Business risk reflects the volatility of operating income arising from the firm's core business activities.                                                                   | Standard deviation of EBIT                                                                            |
| Effective Tax Rate (ETR)         | effective tax burden captures the actual tax burden borne by the firm after considering tax planning, incentives, and accounting adjustments.                                 | Tax Expense / Earnings Before Tax                                                                     |
| Liquidity (LIQ)                  | Liquidity reflects a firm's ability to meet its short-term obligations using its current assets.                                                                              | Current Assets / Current Liabilities                                                                  |
| Firm Size (SIZE)                 | Company size reflects the overall scale of a company's operations and the resources available to support its activities                                                       | Firm size is measured by the natural logarithm of total assets                                        |
| Firm Age (AGE)                   | Firm age reflects the length of time a firm has been operating, indicating experience and organizational maturity.                                                            | Firm Age was measured as the natural logarithm of the number of years since the firm's establishment. |
| Sales Growth (SG)                | Sales growth captures a firm's ability to generate sustained revenue increases and serves as a proxy for its business growth dynamics.                                        | (Sales <sub>t</sub> – Sales <sub>t-1</sub> ) / Sales <sub>t-1</sub>                                   |

tax adjustments, or other accounting items, its underlying components were verified before estimation. No observations in the final baseline sample had negative earnings before tax; therefore, observations were not mechanically excluded solely because ETR fell outside the conventional 0–1 interval.

Three sensitivity analyses were conducted to assess whether the ETR results were driven by unusual tax positions or influential observations. First, the sample was restricted to ETR values between 0 and 1 (423 firm-year observations). Second, the model was estimated using observations with positive reported tax expense (425 observations). Third, ETR was winsorized at the 1st and 99th percentiles while retaining all 485 observations. All baseline and sensitivity specifications used firm-clustered standard errors. Because no observations had negative earnings before tax, an additional loss-firm exclusion based on negative pre-tax income was not applicable.

## Result and Discussion

Table 5 presents descriptive statistics for 485 firm-year observations from 97 Indonesian manufacturing firms during 2021–2025. Capital structure (CS) averages 0.581, indicating that debt represents approximately 58.1% of total assets on average, although its range of 0.016–2.979 indicates substantial variation across firms. Values above one are retained because they may reflect economically possible conditions in which total debt exceeds total assets rather than data-entry errors.

Inflation and interest rates show relatively limited dispersion because they are national-level variables that vary across years but not across firms within the same year. Firm-specific variables exhibit greater heterogeneity, particularly profitability, asset tangibility, IOS, business risk, liquidity, and sales growth.

ETR averages 0.212 and ranges from –1.430 to 2.095. Verification confirmed that these unusual values were not associated with negative earnings before tax. Specifically, 60 observations had ETR values below zero and two exceeded one. These observations were retained in the baseline analysis because they represent reported accounting tax positions rather than confirmed data errors, while their potential influence is examined through separate sensitivity analyses.

Liquidity also exhibits substantial dispersion, with a maximum of 206.864. Overall, the descriptive statistics indicate considerable heterogeneity, particularly in capital structure, ETR, and liquidity.

Table 6 reports the panel-data model-selection tests. The Chow/F test favors FEM over the pooled Common Effects Model, whereas the Hausman test supports REM relative to FEM at the 5% significance level. The Breusch–Pagan LM test also favors REM over the pooled model. Accordingly, REM is retained as the baseline specification. Because REM relies on

the assumption that unobserved firm-specific effects are uncorrelated with the regressors, FEM with firm-clustered standard errors is additionally reported as a robustness specification.

Table 7 presents the baseline REM estimates for 97 firms and 485 firm-year observations. The model is statistically significant overall ( $F = 3.0863$ ,  $p < 0.001$ ), although its explanatory power is modest ( $R^2 = 0.0670$ ; adjusted  $R^2 = 0.0453$ ).

Interest rates are negatively and significantly associated with capital structure ( $\beta = -3.8642$ ,  $p = 0.0009$ ), while firm size is positively significant ( $\beta = 0.0671$ ,  $p = 0.0016$ ). ETR has a negative but statistically insignificant coefficient ( $\beta = -0.0399$ ,  $p = 0.2671$ ). Profitability and liquidity are marginally above the 5% significance threshold, whereas inflation, asset tangibility, IOS, business risk, firm age, and sales growth are statistically insignificant.

### Robustness Analysis

Table 8 compares REM and FEM estimates using firm-clustered standard errors. The interest-rate coefficient remains negative and statistically significant in both REM ( $\beta = -3.8643$ ,  $p = 0.0057$ ) and FEM ( $\beta = -3.8975$ ,  $p = 0.0060$ ), indicating that this finding is robust across alternative estimators.

Firm size remains positive and significant in the firm-clustered REM ( $\beta = 0.0671$ ,  $p = 0.0039$ ) but becomes statistically insignificant in FEM ( $\beta = 0.0754$ ,  $p = 0.2342$ ), indicating sensitivity to model specification. ETR remains negative and insignificant under both REM ( $\beta = -0.0399$ ,  $p = 0.2042$ ) and FEM ( $\beta = -0.0391$ ,  $p = 0.2272$ ). Thus, the interest-rate result is the most stable across specifications, whereas the firm-size result is specification-sensitive and the ETR association is not statistically supported.

Table 9 examines whether the ETR result is sensitive to unusual tax observations. The ETR coefficient remains negative but statistically insignificant in the baseline firm-clustered model ( $\beta = -0.0399$ ,  $p = 0.2042$ ), bounded-ETR sample ( $\beta = -0.0088$ ,  $p = 0.8857$ ), positive-tax-expense sample ( $\beta = -0.0068$ ,  $p = 0.8766$ ), and winsorized specification ( $\beta = -0.0584$ ,  $p = 0.1531$ ).

These results show that alternative treatments of ETR do not change the substantive conclusion: the data do not provide statistically significant evidence of an association between firms' realized effective tax burden and capital structure. The negative interest-rate coefficient remains statistically significant across the ETR sensitivity specifications, while firm size remains positive and significant, indicating greater stability of these findings across alternative ETR treatments.

### Interpretation of Key Findings

Interest rates exhibit a negative and statistically significant association with leverage, while firm size is positively significant in the baseline REM. In contrast, inflation, profitability, asset tangibility, investment opportunity set, business risk, ETR,

**Table 5. Descriptive Statistics**

|                                  | Mean   | Std.Dev | Median | Minimum | Maximum | N   |
|----------------------------------|--------|---------|--------|---------|---------|-----|
| Capital Structure                | 0.581  | 0.480   | 0.454  | 0.016   | 2.979   | 485 |
| Inflation (INF)                  | 0.029  | 0.014   | 0.026  | 0.017   | 0.055   | 485 |
| Interest Rate (IR)               | 0.048  | 0.010   | 0.050  | 0.035   | 0.060   | 485 |
| Profitability (PROF)             | 0.094  | 0.112   | 0.074  | -0.881  | 0.730   | 485 |
| Asset Tangibility (TANG)         | 0.458  | 0.207   | 0.448  | 0.001   | 0.980   | 485 |
| Investment Opportunity Set (IOS) | 1.033  | 0.588   | 0.890  | 0.010   | 5.010   | 485 |
| Business Risk (BRISK)            | 0.052  | 0.064   | 0.030  | 0.000   | 0.540   | 485 |
| Effective Tax Rate (ETR)         | 0.212  | 0.301   | 0.229  | -1.430  | 2.095   | 485 |
| Liquidity (LIQ)                  | 3.338  | 9.786   | 2.074  | 0.204   | 206.864 | 485 |
| Firm Size (SIZE)                 | 28.976 | 1.650   | 28.623 | 25.049  | 33.731  | 485 |
| Firm Age (AGE)                   | 2.880  | 0.772   | 3.296  | 1.099   | 3.737   | 485 |
| Sales Growth                     | 0.138  | 1.420   | 0.062  | -0.662  | 30.772  | 485 |

liquidity, firm age, and sales growth are statistically insignificant at the 5% level. Given the observational design, these findings represent conditional associations rather than causal effects.

The negative association between interest rates and leverage is consistent with the financing-cost mechanism of Trade-Off Theory. Higher interest rates increase the cost of debt and may reduce the net benefits of additional borrowing, encouraging firms to reduce or postpone debt financing. This interpretation is consistent with evidence that monetary-policy conditions affect corporate financing through the cost and availability of external debt (Yadav & Panda, 2024) and with Indonesian evidence emphasizing the relevance of macroeconomic conditions in capital-structure decisions (S. Febrianti, Mustarruddin, et al., 2024). Importantly, the interest-rate coefficient remains negative and statistically significant under both firm-clustered REM and FEM specifications, indicating robustness across alternative estimators. Nevertheless, because interest rates vary only across five annual periods, the result should be interpreted cautiously as an association with the annual monetary environment rather than an isolated causal effect.

Firm size is positively associated with leverage in the

baseline REM, consistent with Trade-Off Theory and the debt-capacity argument that larger firms tend to be more diversified, face lower perceived default risk, and have greater access to external financing. This finding is consistent with evidence from Indonesian listed firms (Shanthana & Basana, 2020; Tursina, 2024). However, firm size becomes statistically insignificant under the Fixed Effects specification. Therefore, unlike the

**Table 6. Panel Data Model Selection Result**

| Test                  | Statistic | d.f      | p-value | Decision                   |
|-----------------------|-----------|----------|---------|----------------------------|
| Chow/F Test           | 23.6995   | (96,377) | <0.001  | FEM preferred to CEM       |
| Hausman Test          | 11.2312   | 11       | 0.4241  | REM preferred to FEM at 5% |
| Breusch-Pagan LM Test | 603.6709  | -        | <0.001  | REM preferred to CEM       |

**Table 7. Baseline Random Effects Model Estimates**

| Variable                     | Coefficient | Std. Error  | t-Statistic | Prob.    |
|------------------------------|-------------|-------------|-------------|----------|
| C                            | -1.187072   | 0.624378    | -1.901207   | 0.0579   |
| Inflation (INF)              | 0.783522    | 0.811137    | 0.965955    | 0.3346   |
| Interest Rate (IR)           | -3.864214   | 1.157766    | -3.337648   | 0.0009   |
| Profitability (PROF)         | 0.275319    | 0.141236    | 1.949351    | 0.0518   |
| Asset Tangibility (TANG)     | -0.038510   | 0.147390    | -0.261279   | 0.7940   |
| IOS                          | -0.031938   | 0.026187    | -1.219610   | 0.2232   |
| Business Risk (BRISK)        | 0.040350    | 0.247386    | 0.163105    | 0.8705   |
| Effective Tax Rate (ETR)     | -0.039901   | 0.035915    | -1.110982   | 0.2671   |
| Liquidity (LIQ)              | -0.002130   | 0.001146    | -1.858583   | 0.0637   |
| Firm Size (SIZE)             | 0.067085    | 0.021092    | 3.180636    | 0.0016   |
| Firm Age (AGE)               | 0.007870    | 0.026608    | 0.295776    | 0.7675   |
| Sales Growth (SG)            | 0.007996    | 0.007821    | 1.022379    | 0.3071   |
| <b>Model Statistics</b>      |             |             |             |          |
| R-squared                    |             |             |             | 0.066968 |
| Adjusted R-squared           |             |             |             | 0.045270 |
| F-statistic                  |             |             |             | 3.086332 |
| Prob(F-statistic)            |             |             |             | 0.000508 |
| Number of Firms              |             |             |             | 97       |
| Observations                 |             |             |             | 485      |
| <b>Effects Specification</b> |             | <b>S.D.</b> | <b>Rho</b>  |          |
| Cross-section random         |             | 0.418103    |             | 0.8217   |
| Idiosyncratic random         |             | 0.194784    |             | 0.1783   |

Note: Table 7 reports the baseline Random Effects Model estimates using conventional model-based standard errors. Because conventional standard errors may not account for within-firm dependence, Table 8 supplements the baseline results by reporting REM and FEM estimates with standard errors clustered at the firm level. The firm-clustered estimates are used to assess the robustness of statistical inference to within-firm dependence.

**Table 8. Robustness Analysis: REM and Fixed Effects with Firm Clustered Standard Errors**

| Variable | REM Coef. | REM Clustered SE | REM p-value | FEM Coef. | FEM Clustered SE | FEM p-value |
|----------|-----------|------------------|-------------|-----------|------------------|-------------|
| INF      | 0.784509  | 0.622013         | 0.2103      | 0.824767  | 0.606728         | 0.1772      |
| IR       | -3.864270 | 1.367650         | 0.0057      | -3.897521 | 1.386346         | 0.0060      |
| PROF     | 0.276773  | 0.344431         | 0.4236      | 0.330885  | 0.348480         | 0.3447      |
| TANG     | -0.043206 | 0.202415         | 0.8314      | -0.396694 | 0.241041         | 0.1031      |
| IOS      | -0.031959 | 0.036244         | 0.3801      | -0.033264 | 0.041195         | 0.4214      |
| BRISK    | 0.040948  | 0.175776         | 0.8163      | 0.058701  | 0.167478         | 0.7267      |
| ETR      | -0.039874 | 0.031194         | 0.2042      | -0.039132 | 0.032196         | 0.2272      |
| LIQ      | -0.002121 | 0.001579         | 0.1823      | -0.001759 | 0.001289         | 0.1754      |
| SIZE     | 0.067135  | 0.022691         | 0.0039      | 0.075424  | 0.063002         | 0.2342      |
| AGE      | 0.007916  | 0.018891         | 0.6761      | 0.010252  | 0.020000         | 0.6094      |
| SG       | 0.008024  | 0.005096         | 0.1187      | 0.010756  | 0.010284         | 0.2982      |

interest-rate result, the positive firm-size association is specification-sensitive and should not be interpreted as uniformly robust. ETR exhibits a negative but statistically insignificant association with capital structure under firm-clustered inference. This conclusion remains unchanged when ETR is restricted to the 0–1 interval, the sample is limited to positive tax-expense observations, and ETR is winsorized at the 1st and 99th percentiles. Thus, the negative direction of the coefficient does not constitute robust evidence that firms with higher realized tax burdens systematically use less debt.

From a Trade-Off Theory perspective, the insignificant ETR result suggests that annual accounting-based ETR may not adequately capture the marginal tax incentives underlying debt-financing decisions. ETR reflects firms' realized tax positions and can be affected by tax planning, incentives, deferred-tax adjustments, and other accounting items that differ from statutory or marginal tax rates. Indonesian evidence similarly indicates that alternative tax measures may capture different dimensions of the taxation–financing relationship (Alfandia, 2018; Kumalasari & Wahyudin, 2020). Accordingly, the findings should be interpreted as a lack of robust statistical evidence for an ETR–leverage association rather than evidence that taxation is economically irrelevant.

The remaining firm-specific variables are statistically insignificant at the 5% level. Profitability and liquidity are close to, but remain above, the conventional significance threshold, while asset tangibility, IOS, business risk, firm age, and sales growth are also insignificant. These findings provide selective rather than comprehensive support for the predictions of Trade-Off, Pecking Order, and Agency theories and may reflect the relatively short observation period, heterogeneous firm responses, and institutional factors not fully captured by the contemporaneous specification.

#### Comparison with Previous Studies

The results provide differentiated support for previous capital-structure research. The robust negative interest-rate association supports the view that monetary conditions influence firms' financing decisions through borrowing costs and access to external debt (S. Febrianti, Mustarruddin, et al., 2024; Yadav & Panda, 2024). The positive firm-size coefficient in the baseline REM is also consistent with previous Indonesian evidence linking larger firm size to greater debt capacity (Tursina, 2024; Shanthana & Basana, 2020), although its loss of significance under FEM indicates that this relationship is sensitive to the treatment of unobserved firm heterogeneity.

By contrast, the insignificant ETR coefficient does not provide empirical support for a systematic relationship between realized annual effective taxation and leverage. This result is consistent with the broader observation that accounting-based ETR may capture tax planning, deferred-tax adjustments, incentives, and firm-specific tax positions rather than the marginal tax incentives emphasized by Trade-Off Theory (Andreas & Savitri, 2017b; Garcia-Bernardo et al.,

2023). Similarly, the insignificant results for profitability, liquidity, asset tangibility, and IOS differ from studies identifying these characteristics as significant leverage determinants (Bose et al., 2025; Camisón et al., 2022; Chen et al., 2019). Such differences reinforce the context-dependent nature of capital-structure decisions across institutional environments, industries, periods, and empirical specifications (Choi et al., 2024).

#### Limitations and Cautions

Several limitations should be considered. First, the sample is restricted to manufacturing firms listed on the Indonesia Stock Exchange during 2021–2025, limiting generalizability to other industries, periods, and institutional settings (Hazmi et al., 2023).

Second, although the model-selection tests support REM and the results are supplemented with FEM and firm-clustered robustness specifications, REM assumes that unobserved firm-specific effects are uncorrelated with the regressors. More importantly, potential endogeneity between leverage and firm-specific variables such as profitability, firm size, and IOS remains unresolved. Reverse causality, simultaneity, and omitted-variable bias therefore cannot be ruled out, and the coefficients should be interpreted as conditional associations rather than causal effects. Future studies may address these concerns using correlated random effects, instrumental-variable approaches, or dynamic panel estimators such as System GMM or Difference GMM.

Third, inflation and interest rates are national-level variables that vary only across the five annual periods. Their coefficients are therefore identified from limited time-series variation and may partly capture unobserved shocks common to firms within the same year. Because a full set of year fixed effects would absorb the variation used to identify these variables, the macroeconomic coefficients should be interpreted cautiously. The short time dimension also limits the reliability of covariance estimators requiring many time clusters.

Finally, ETR is an accounting-based measure calculated as tax expense divided by earnings before tax and may be affected by tax planning, deferred-tax adjustments, tax benefits, and other accounting items. Although the underlying data were verified and alternative ETR treatments produced the same substantive conclusion, annual ETR should not be interpreted as a direct measure of the marginal tax incentive to use debt.

#### Recommendations for Future Research

Future research could extend the sample across sectors, countries, and longer periods to improve external validity and provide greater macroeconomic time-series variation (Yeboah et al., 2024). Alternative tax measures and governance or institutional variables may provide additional insight into financing decisions (Colak & Sarioglu, 2025; Iazzi et al., 2025). Econometrically, correlated random effects,

**Table 9.** Sensitivity Analysis of the Effective Tax Rate

| Variable / Model Statistic | Baseline Full Sample | Bounded ETR (0–1) | Positive Tax Expense | Winsorized ETR (1–99%) |
|----------------------------|----------------------|-------------------|----------------------|------------------------|
| ETR coefficient            | –0.0399              | –0.0088           | –0.0068              | –0.0584                |
| Firm-clustered SE          | (0.0312)             | (0.0608)          | (0.0435)             | (0.0406)               |
| p-value                    | 0.2042               | 0.8857            | 0.8766               | 0.1531                 |
| Interest Rate coefficient  | –3.8643              | –3.0061           | –3.0046              | –3.8846                |
| Firm Size coefficient      | 0.0671               | 0.0373            | 0.0383               | 0.0667                 |
| Observations               | 485                  | 423               | 425                  | 485                    |
| Number of firms            | 97                   | 96                | 96                   | 97                     |
| R <sup>2</sup>             | 0.0671               | 0.1293            | 0.1305               | 0.0685                 |
| Adjusted R <sup>2</sup>    | 0.0455               | 0.1060            | 0.1073               | 0.0468                 |

instrumental-variable methods, and dynamic panel estimators could be employed to address endogeneity and better capture capital-structure adjustment dynamics (Hackbarth & Sun, 2024).

## Conclusion

This study examines the associations between macroeconomic conditions, effective taxation, firm-specific characteristics, and capital structure among Indonesian manufacturing firms during 2021–2025. The results show that interest rates are negatively and statistically significantly associated with capital structure, and this relationship remains robust across firm-clustered REM and FEM specifications. Firm size is positively significant in the baseline REM but becomes statistically insignificant under FEM, indicating that the firm-size result is sensitive to model specification.

The Effective Tax Rate (ETR) exhibits a negative but statistically insignificant association with capital structure. This conclusion remains unchanged across the bounded-ETR, positive-tax-expense, and winsorized specifications. Accordingly, the study does not provide robust statistical evidence that firms' realized annual effective tax burden systematically leverages. Inflation, profitability, asset tangibility, IOS, business risk, liquidity, firm age, and sales growth are also statistically insignificant at the 5% level.

Overall, the findings indicate that monetary financing conditions, particularly interest rates, have a more stable association with corporate leverage than realized effective taxation in the Indonesian manufacturing context. The results also highlight the importance of distinguishing robust findings from specification-sensitive relationships when evaluating

capital-structure determinants. For managers and investors, changes in borrowing costs should therefore receive particular attention when assessing financing decisions, while ETR should not be interpreted as a stand-alone predictor of leverage.

Given the observational design, limited five-year variation in national macroeconomic variables, and unresolved potential endogeneity, the estimated coefficients should be interpreted as conditional associations rather than causal effects. Future research could extend the observation period and sectoral coverage and employ alternative tax measures, correlated random effects, instrumental-variable approaches, or dynamic panel estimators to strengthen identification.

## Author contributions

The first author contributed to conceptualization, research design, data collection, empirical analysis, interpretation, and manuscript drafting. The second author contributed to methodology, supervision, validation, theoretical refinement, and critical review. The third author contributed to the literature review, data verification, presentation of findings, and manuscript editing. All authors reviewed and approved the final manuscript and are accountable for its content.

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