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Firm Size, Financial Leverage, and Return on Assets in Indonesian Transportation Companies

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ABSTRACT

Purpose: This study examines the associations of firm size and financial leverage with Return on Assets (ROA) among Indonesian transportation companies during 2019 to 2023.
Research Methodology: A pooled Ordinary Least Squares (OLS) model was estimated using 45 firm year entries for nine companies transcribed from the thesis appendix. Firm size is measured as the natural logarithm of total assets, and leverage as the Debt to Equity Ratio (DER).
Results: In the appendix based estimates, firm size is positively associated with ROA (b=0.01715), while DER is negatively associated with ROA (b=−0.04677). The model yields an adjusted R^2 of 0.6428. The estimates differ from those reported in the thesis results chapter, and checks against primary sources identify discrepancies involving a listing date and a reported profit figure.
Conclusions: The signs of the coefficients are consistent with the hypothesized directions, but the estimates remain provisional until the firm year dataset is rebuilt from primary disclosures and the model is estimated again.
Limitations: The analysis relies on transcribed appendix entries for a small number of firms, uses conventional OLS standard errors, and does not yet account for firm and year effects.
Contributions: The study examines asset scale and capital structure jointly in an Indonesian sector exposed to major shifts in demand and distinguishes asset scale from operational economies of scale and book leverage from broader financial risk.

Keywords: *Financial Leverage, Firm Size, Indonesia Stock Exchange, Return on Assets, Transportation*

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1. Introduction

Transportation companies commit resources to fleets, terminals, maintenance, information systems, and operating networks before they can earn revenue from those assets. When demand falls, fixed operating costs and debt service can place pressure on earnings. When volumes recover, firms with spare capacity may accommodate higher demand without proportionate asset growth. These differences make asset scale and capital structure relevant to understanding profitability across transportation companies (Alsulami, 2025).

The observation window from 2019 to 2023 spans the years before, during, and after the acute disruption associated with Coronavirus Disease 2019 (COVID 19). Statistics Indonesia reported that transportation and storage output grew by 13.96% in 2023 (Statistics, 2024). That figure describes aggregate sector output. Company profitability can respond differently depending on business segment, capacity utilization, financing obligations, and balance sheet conditions. Research on the pandemic also documents that greater financial flexibility was associated with a more favorable market response to the shock (Fahlenbrach et al., 2021), motivating attention to financing conditions in settings where revenue can fall abruptly.

The pandemic affected transportation and logistics firms in very different ways. Logistics firms in several large economies maintained or even improved their financial performance in 2020, while firms in other countries recorded weaker results (Atayah et al., 2022). Logistics service providers also changed their operations by adjusting delivery routes and fleet composition in response to new patterns of demand (Zenezini et al., 2024). Airlines and airports, in contrast, experienced sharp declines in traffic and relied heavily on liquidity support and government aid (Zamojska et al., 2025). This heterogeneity suggests that sector averages may hide important differences among companies in the same industry.

Firm level studies of the pandemic confirm that financial structure shaped how companies absorbed the shock. Firms with stronger finances before the pandemic, including lower leverage and larger cash holdings, experienced smaller declines in stock returns during the crisis (Ding et al., 2021). Evidence from China shows that the pandemic reduced firm performance, especially in industries that were severely affected by mobility restrictions (Shen et al., 2020). International evidence also indicates that firm performance during the outbreak varied across countries and depended on firm characteristics such as size and leverage (Golubeva, 2021).

The study addresses two research questions. The first concerns whether companies with larger asset bases report higher Return on Assets (ROA) after accounting for leverage. The second concerns whether a higher Debt to Equity Ratio (DER) is associated with lower ROA after accounting for asset scale. Examining both variables in the same model helps distinguish differences in asset scale from differences in how firms finance their activities. The contribution is sector specific evidence from an emerging market. The observation window provides context for the analysis, and the model estimates average associations across the period.

The study also has a methodological purpose. It reproduces the regression reported in an undergraduate thesis by transcribing the firm year entries listed in the thesis appendix and estimating the model again. Reproducibility is increasingly recognized as an important condition for the credibility of empirical accounting and finance research (Hail et al., 2020). Replication studies help researchers detect data errors, coding problems, and inconsistencies between reported results and underlying data before such findings are used by others (Breuer & Hofmann, 2025).

2. Literature Review and Hypothesis Development

2.1 Firm Size and Profitability

Economies of scale arise when an increase in output lowers average cost. In transportation, spreading scheduling, administration, and maintenance infrastructure costs across more trips or shipments may improve operating margins. A larger asset base can also support an extensive network, greater service capacity, or stronger bargaining power when purchasing inputs. These advantages depend on whether firms use their assets productively. Idle capacity, additional coordination costs, and a larger depreciation burden can weaken the relationship between size and profitability.

Empirical evidence on the size and profitability relationship is mixed. A panel study of firms in Asia Pacific markets finds that firm size and growth are related to profitability, but the strength and direction of the relationship vary across countries and firm characteristics (Yadav et al., 2022). Evidence from Croatian manufacturing firms shows that size is one of several determinants of profitability, together with productivity, liquidity, and past profitability (Pervan et al., 2019). A

study of Malaysian listed firms also reports that firm size, working capital, and asset efficiency are positively related to profitability (Alarussi & Alhaderi, 2018).

Firm size is measured using the natural logarithm of total assets because assets capture the stock of resources committed to operations. Measures based on sales or market capitalization capture different aspects of size and can yield different empirical conclusions (Mouton & Botha, 2026). Because total assets also appear in the denominator of ROA, a positive relationship implies that earnings tend to rise sufficiently with asset scale in the observed sample. The coefficient alone cannot identify lower average costs or directly measure scale economies.

Firm size can also condition the relationship between financing and performance. Among Indonesian listed nonfinancial firms, size strengthens the effect of financing choices on firm value (Diantimala et al., 2021). Evidence from manufacturing firms listed in Tehran similarly shows that firm size intensifies the negative association between capital structure and profitability (Ahmed et al., 2023). These findings suggest that size and leverage should be examined together rather than separately. Based on this reasoning, H_1 states that firm size is positively associated with ROA.

2.2 Financial Leverage and Profitability

Trade off theory relates borrowing decisions to the benefits of debt, including potential tax savings, and the expected costs of financial distress (Mouton & Botha, 2026). Borrowing can support productive investment when cash flows cover financing costs. In a downturn, contractual payments are harder to adjust than variable operating expenses, and high leverage can constrain spending on maintenance, fleet renewal, or service expansion. Interest expense also enters net income, which is the numerator of ROA in this study. A negative association is therefore plausible when financing burdens outweigh the benefits of assets financed through borrowing.

Empirical studies in several emerging markets support a negative relationship between leverage and accounting profitability. Listed manufacturing firms in China show an inverted U relationship in which leverage reduces profitability beyond a certain level (Dalci, 2018). Pakistani nonfinancial firms with high debt also report weaker accounting performance, particularly in competitive product markets (Ahmed & Afza, 2019). More recent evidence from South Africa suggests that moderate debt can raise ROA while high leverage produces diminishing returns (Dsouza et al., 2025).

The relationship between leverage and performance is not uniform across settings. In Germany, capital structure has been found to be positively associated with firm performance, although the relationship weakened after the adoption of International Financial Reporting Standards (IFRS) (Abdullah & Tursoy, 2021). Corporate governance can also moderate the link between capital structure and performance, as shown in a study of firms in Sub Saharan Africa (Bawuah, 2024). Evidence from consumer goods firms listed in Johannesburg points to a nonlinear effect of leverage on ROA (Khoza, 2025).

The causal direction can also run from profitability to leverage. Profitable firms can retain earnings, increasing the book equity denominator of DER and reducing their need for external financing. A recent consolidation of capital structure research identifies profitability as one of the most consistent determinants of leverage, typically with a negative sign (Mouton & Botha, 2026). Evidence from Egyptian listed companies during the pandemic likewise shows that leverage falls with profitability and rises with firm size (Abdel Zaher, 2026). These findings make reverse direction and financing choices relevant to interpretation here.

DER is used as a book leverage measure, which captures one aspect of financial exposure alongside liquidity, refinancing requirements, and earnings volatility. During the pandemic, leverage was generally linked to lower ROA among firms listed in the United Kingdom, with stronger adverse effects for nonfinancial firms (Jaiswal & Elmarzouky, 2025). Based on this reasoning, H_2 states that financial leverage is negatively associated with ROA. The joint F test examines whether both regression slopes are zero, while the individual slopes address the directional hypotheses.

2.3 Profitability and Financial Risk in Transportation

Transportation companies are particularly exposed to financial risk because of their high fixed costs and large asset bases. In the European air transport industry, leverage and liquidity are important determinants of financial distress, and flag carriers show different patterns from other airlines (Shi & Li, 2021). Airline performance evaluations also show that liquidity and debt ratios provide useful information about the financial condition of airline companies (Alsulami, 2025). Integrated performance models for airlines further indicate that financial indicators carry substantial weight in overall performance assessments (Ertuğrul & Özdarak, 2025).

Shipping companies face similar financing challenges. In the shipping industry, capital lease intensity is positively associated with operating performance, but the benefit weakens for highly leveraged firms (Negkakis, 2025). Financial flexibility also matters for firms in sectors that are sensitive to demand shocks, and economic policy uncertainty has been shown to affect the debt and cash flexibility of firms during the pandemic (Dalwai, 2023). These findings indicate that leverage in transportation should be interpreted together with the business model and operating risk of each company.

Firm age and ownership can also influence financing and performance. Firm age moderates capital structure choices in emerging markets, suggesting that younger and older firms respond differently to financing opportunities (Matemilola et al., 2025). Foreign ownership and financial leverage have also been found to mediate the relationship between firm age, business sector, and performance (Mallinguh et al., 2020). These characteristics are not included in the present model but are relevant for interpreting the estimates.

3. Methodology

3.1 Research Design and Observations

The original thesis adopted a quantitative archival design using annual financial statements. It specified purposive sampling of transportation firms listed on the Indonesia Stock Exchange (IDX) throughout 2019 to 2023, with financial statements available for all sample years and sufficient data to calculate the variables. Its appendix lists nine issuers (BIRD, BLTA, GIAA, HATM, IATA, MBSS, MIRA, NELY, and SAFE) for each of five years. The preliminary reproduction transcribes all 45 entries from Appendix 4 to establish whether those entries reproduce the thesis results. The sample roster and accounting inputs require verification before they can support a sector level analysis.

The sampling criteria of the thesis are important for interpreting the reproduction. A firm qualifies only if it was listed on the IDX throughout the whole period from 2019 to 2023 and published financial statements for every year. Any issuer that was listed after the start of the period or that lacks complete statements should therefore be excluded from the sample. Applying this rule consistently is a precondition for comparing the reproduced estimates with the hypotheses.

3.2 Variable Measurement

Table 1. Variable definitions

Variable	Role	Measurement
Return on Assets (ROA)	Outcome	Net income divided by year end total assets
Firm Size (SIZE)	Predictor	Natural logarithm of year end total assets, expressed in rupiah
Debt to Equity Ratio (DER)	Predictor	Book total debt divided by book total equity, using the appendix debt field

Table 1 summarizes the definitions of the three variables used in the regression model. ROA serves as the outcome variable, while SIZE and DER serve as predictors. All three variables are calculated from year end financial statement figures as reported in the thesis appendix. The appendix reports the underlying amounts in millions of rupiah. Its displayed SIZE values can be reproduced to two decimal places by converting assets to rupiah before taking logs. A final data dictionary should

identify whether the debt field represents total liabilities or interest bearing debt. It should also specify the net income line, the currency conversion policy for foreign currency statements, and the treatment of nonpositive equity.

3.3 Estimation

The pooled model is specified in Formula 1, where i identifies the company and t identifies the fiscal year. The reproduction uses the displayed ratios in the appendix and includes an intercept. The reported standard errors and p values are conventional OLS quantities, and they are included for comparison with the thesis output.

$$\mathrm{ROA}_{it} = \alpha + \beta_1 \mathrm{SIZE}_{it} + \beta_2 \mathrm{DER}_{it} + \varepsilon_{it} \tag{1}$$

Repeated observations for each firm and shared year shocks can affect inference. The pooled coefficients combine differences across companies with changes within companies. When the number of firms is small, standard cluster robust approximations can be unreliable, and alternative inference methods are recommended (MacKinnon et al., 2023).

4. Results and Discussion

4.1 Descriptive Statistics

The transcribed appendix entries yield a mean ROA of 0.07513, a mean log asset size of 27.91533, and a mean DER of 1.75220. All displayed ROA values are positive. That feature is material for this period and prompted a comparison against the underlying statements.

Table 2. Descriptive statistics of the appendix entries

Variable	N	Minimum	Maximum	Mean	SD
ROA	45	0.00230	0.23410	0.07513	0.06315
SIZE	45	25.12000	31.87000	27.91533	1.82686
DER	45	0.12340	5.67890	1.75220	1.43187

Table 2 presents the descriptive statistics of the 45 firm year entries transcribed from the thesis appendix. ROA ranges from 0.00230 to 0.23410, which means that no entry shows a loss. DER ranges widely from 0.12340 to 5.67890, indicating large differences in financing structure across the companies.

4.2 Pooled Regression

Table 3. Preliminary pooled OLS estimates based on the appendix

Term	Coefficient	Std. Error	*t*	*p*
Intercept	−0.32179	0.11198	−2.874	0.00634
SIZE	0.01715	0.00423	4.058	<0.001
DER	−0.04677	0.00539	−8.671	<0.001

Table 3 reports the preliminary pooled OLS estimates obtained from the transcribed appendix entries. SIZE has a positive coefficient and DER has a negative coefficient, and both are statistically significant under conventional standard errors. The model explains about 66% of the variation in ROA, and the joint F test rejects the hypothesis that both slopes are zero.

Within the appendix based model, a one unit increase in log assets corresponds to an estimated 1.72 percentage point difference in ROA at the same DER. A one unit increase in DER corresponds to an estimated 4.68 percentage point lower ROA at the same log asset size. The signs match the directions of H_1 and H_2. These magnitudes describe the transcribed entries and may change when the firm year observations are verified.

4.3 Reconciliation with the Thesis and Source Records

The thesis reports SIZE and DER slopes of 0.0312 and −0.0187, respectively, with an adjusted R^2 of 0.397. The reproduction yields the same slope directions and different magnitudes and fit statistics. A full comparison is included in the author appendix. Several factors may explain the difference between the thesis results and the reproduction. The thesis may have used unrounded figures, a different set of observations, or different variable definitions from those displayed in the appendix. Transcription errors in either the thesis output or the appendix could also produce different estimates. Without the original data file, the source of the difference cannot be determined precisely.

Table 4. Comparison of thesis results and appendix based reproduction

Statistic	Thesis Results Chapter	Appendix Based Reproduction
SIZE slope	0.0312	0.01715
DER slope	−0.0187	−0.04677
Adjusted R^2	0.397	0.64281

Table 4 compares the main statistics reported in the thesis with those obtained from the reproduction. Both sets of estimates show a positive slope for SIZE and a negative slope for DER. However, the magnitudes of the slopes and the adjusted R^2 differ substantially, which indicates that the thesis results cannot be reproduced exactly from the appendix entries.

Two checks against public records identify issues requiring resolution. First, the thesis includes Habco Trans Maritima (HATM) for every year from 2019 to 2023. The Indonesian Central Securities Depository records its IDX listing on 26 July 2022 (Bisnis, 2022). The entries for 2019 to 2021 precede its listing, and the firm itself fails the stated requirement of having been listed throughout the study window.

Second, the appendix lists positive net income and a positive ROA for Garuda Indonesia (GIAA) in 2020. The annual report of the issuer describes a consolidated loss of approximately US$2.48 billion (Garuda Indonesia, 2021). A currency conversion would preserve the sign of the loss. These findings require a reconstruction of the sample and accounting inputs before testing the hypotheses on verified observations.

Table 5. Discrepancies identified in the appendix entries

Issuer	Appendix Entry	Primary Source Record	Implication
Habco Trans Maritima (HATM)	Included for every year from 2019 to 2023	IDX listing on 26 July 2022	Entries for 2019 to 2021 precede listing, and the firm fails the sampling rule
Garuda Indonesia (GIAA)	Positive net income and ROA in 2020	Consolidated loss of approximately US$2.48 billion	The sign of ROA in 2020 is inconsistent with the annual report

Table 5 summarizes the two discrepancies identified by checking the appendix entries against primary sources. Each discrepancy affects either the eligibility of an issuer or the sign of a reported profitability figure. Both issues must be resolved before the regression estimates can be interpreted as evidence on the hypotheses.

4.4 Firm Size and ROA

The positive preliminary coefficient on asset size is consistent with a scale based mechanism under which firms spread fixed costs across a larger volume of activity. A pooled model also admits explanations based on differences in business segment, asset composition, network coverage, and other characteristics that vary across firms. Direct evidence of economies of scale would require

information on output and cost, such as operating expense per passenger kilometer or ton kilometer within a comparable segment.

The direction of the size coefficient is consistent with studies that report a positive relationship between size and profitability in Asian markets (Alarussi & Alhaderi, 2018; Yadav et al., 2022). At the same time, the sample combines airlines, shipping companies, land transportation, and logistics firms whose asset structures differ substantially. Larger firms in this sample may simply operate in segments with different margins rather than benefit from lower average costs. A within firm analysis would help separate these explanations.

Larger firms may also enjoy easier access to external finance and a stronger negotiating position with lenders and suppliers. This advantage can lower financing costs and support profitability even when operating efficiency does not differ. In Indonesian listed firms, size has been shown to change the way financing choices relate to firm value (Diantimala et al., 2021). The size coefficient in this study may therefore capture both operating and financing advantages of larger firms.

4.5 Financial Leverage and ROA

The negative preliminary coefficient on DER is consistent with higher financing burdens or with profitable firms accumulating equity through retained earnings. DER can also rise when losses reduce equity even if reported debt remains unchanged. This denominator mechanism matters when interpreting a leverage and ROA relationship.

A further analysis could use total liabilities to assets or interest bearing debt to assets, with the accounting definition specified in each case. An operating return calculated before interest expense would help assess how strongly the leverage association depends on the definition of earnings. The negative direction is in line with evidence from China, Pakistan, and the United Kingdom (Ahmed & Afza, 2019; Dalci, 2018; Jaiswal & Elmarzouky, 2025), although the magnitude in the present sample remains provisional.

In the transportation sector, leverage is also closely connected with liquidity and financial distress. Studies of airlines show that debt ratios and liquidity ratios jointly describe the financial condition of carriers during and after the pandemic (Alsulami, 2025; Shi & Li, 2021). For shipping firms, the benefits of lease financing weaken when leverage is already high (Negkakis, 2025). These patterns suggest that the leverage coefficient in a mixed transportation sample may reflect several different financing mechanisms.

4.6 Inference and Model Specification

Inference is constrained by the small number of firms and by heterogeneous activities across modes of transportation. A verified sample could support a comparison of pooled estimates with models that account for year and firm effects. Firm effects would use changes within each company to estimate associations, while year effects would absorb shocks shared across firms.

Because the small number of firms limits the reliability of standard cluster based approximations, a revised study should report the inference method and use leave one firm out checks to show whether a single issuer drives the estimates (MacKinnon et al., 2023). With only nine companies, a single issuer such as GIAA or HATM can have a large influence on the coefficients. Reporting the estimates with and without each issuer would therefore make the results more transparent.

4.7 Implications for Financial Statement Users

For financial statement users, the research question has a practical implication once the results are verified. Asset growth is most informative when read alongside capacity utilization and operating returns. Book leverage is most informative when read alongside interest coverage, debt maturities, cash flows, and the level and sign of equity. These indicators help explain why companies with similar asset bases can have different profitability and financing exposures.

The reconciliation also has implications for users of student research and secondary datasets. Results reported in a thesis may not match the data listed in its appendix, and appendix entries may not match primary disclosures. Users should therefore verify key inputs against audited financial statements and official listing records before relying on reported coefficients (Hail et al., 2020).

5. Conclusions

5.1 Conclusion

This study develops a framework for examining whether asset scale and book leverage are associated with profitability in Indonesian transportation companies. A reproduction of the thesis appendix yields a positive coefficient for size and a negative coefficient for leverage. The regression output differs from the thesis results chapter, and primary sources contradict specific listing and income entries. Evidence on the hypotheses therefore depends on rebuilding the firm year dataset from primary disclosures, applying a consistent eligibility rule, and estimating the model again.

The preliminary estimates are directionally consistent with H_1 and H2, but they should not yet be treated as confirmation of either hypothesis. The magnitude of the coefficients and the fit of the model may change substantially once ineligible observations are removed and incorrect income figures are corrected. The main contribution of the present analysis is therefore the identification of data issues and the specification of a model that can be estimated reliably on verified data.

5.2 Research Limitations

The analysis relies on 45 firm year entries for nine companies transcribed from a thesis appendix rather than on data collected directly from primary disclosures. At least one issuer does not meet the stated sampling requirement for part of the period, and at least one profitability figure contradicts the annual report of the issuer. The model uses conventional OLS standard errors and does not account for firm and year effects. The definitions of debt, net income, and currency conversion in the appendix have not yet been fully documented.

5.3 Suggestions and Directions for Future Study

Future research should rebuild the firm year dataset directly from audited financial statements and official listing records, applying a consistent eligibility rule to all issuers. The verified sample should then be used to compare pooled estimates with models that include firm and year effects, together with inference methods suited to a small number of firms. Robustness checks that exclude one firm at a time would show whether any single issuer drives the results.

Future studies could also use alternative measures of leverage, such as total liabilities to assets or interest bearing debt to assets, and an operating return calculated before interest expense. Separating airlines, shipping, land transportation, and logistics firms would help identify whether the relationships differ across modes of transportation. Including measures of output and cost would allow a direct test of economies of scale.

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