ALGEBRA : JURNAL PENDIDIKAN, SOSIAL DAN SAINS

ISSN : 2807-663X e-ISSN : 2807-629X
Journal Homepage : https://algebra.yana.or.id/index.php/ejournal/index
Volume 6 Number 1 (2026)

APPLICATION OF DATA WAREHOUSE FOR ANALYZING THE EFFECT OF FINANCIAL RATIOS ON STOCK PRICES IN CONSUMER NON-CYCLICALS COMPANIES LISTED ON THE INDONESIA STOCK EXCHANGE FROM 2022 TO 2024

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ABSTRACT

This study aims to examine the effect of financial ratios on stock prices of primary consumer goods companies listed on the Indonesia Stock Exchange during the 2022 2024 period, utilizing a Data Warehouse as a data integration platform. Secondary data in the form of financial reports and stock prices were processed through an ETL (Extract, Transform, Load) process to produce a structured and consistent historical dataset. Multiple linear regression (OLS) analysis using SPSS was applied to assess the effect of ROA, TATO, DER, and EPS on stock prices. The results showed that all variables had a significant simultaneous effect, but partially only EPS had a significant positive effect. Conversely, ROA, TATO, and DER did not show a significant effect on stock price variations in the primary consumer goods sector. This finding confirms that earnings per share is a key indicator for investors, while asset efficiency and funding structure do not have a direct impact. Furthermore, this study confirms that implementing a Data Warehouse can improve the effectiveness of financial data integration and analysis across periods.

Keywords: Data Warehouse, ETL, ROA, TATO, DER, EPS, Stock Price, IDX

INTRODUCTION

Over the past decade, the rapid advancement of information technology has driven significant changes in the way organizations and companies manage their data. This digitalization process has transformed data from merely serving as business records into a strategic asset that plays a crucial role in evidence-based decision-making, often referred to as data-driven decision making (Tamanam, 2023). One of the key technologies supporting this transformation is the Data Warehouse, a storage system that integrates various data sources to enable comprehensive and historical analysis (Shiramshetty, 2023). Through its multidimensional analytical capabilities, the Data Warehouse contributes substantially to the development of Business Intelligence (BI) and data-driven financial reporting systems.

In capital market analysis, the availability of connected and reliable data is a critical element supporting the investment assessment process. Various fundamental indicators, such as profitability ratios (ROA), corporate capital structure (DER), earnings per share (EPS), and asset turnover (TATO), serve as primary references for investors in evaluating firm performance (Sihombing & Zakchona, 2024). Recent studies also indicate that the dynamics of these ratios are associated with stock price movements, particularly within firms in Indonesia's primary consumer goods subsector (Sintawati et al., 2025). However, financial data originating from multiple sources often remain fragmented, making historical analysis difficult unless the data are integrated into a consistent system.

Primary consumer goods companies listed on the Indonesia Stock Exchange (IDX) have become a focal point due to the sector's stable demand, yet their stock prices remain vulnerable to fluctuations caused by changes in fundamental conditions (Bursa Efek Indonesia, 2023). Through the implementation of a Data Warehouse, cross-period financial data can be consolidated and analyzed more efficiently to identify relationships between financial ratios and stock prices. This approach aligns with the evolving concept of smart data warehousing, which integrates artificial intelligence to enhance the accuracy and speed of analysis (Tamanam, 2023).

The findings of this study are expected not only to provide theoretical contributions to the development of financial information systems but also to generate practical implications for capital market participants in improving the efficiency and accountability of fundamental analysis in Indonesia.

The research problems are formulated as follows:

1. What is the role of the Data Warehouse in supporting the analysis of the relationship between financial ratios and stock price movements of primary consumer goods issuers listed on the Indonesia Stock Exchange (IDX)?
2. To what extent do Return on Assets (ROA), Earnings per Share (EPS), Debt to Equity Ratio (DER), and Total Asset Turnover (TATO) influence stock price fluctuations in this sector?

The focus of this study is to examine how financial indicators influence stock price dynamics by designing a Data Warehouse system as an integrated financial analytical tool that supports data-driven investment decision-making. The findings are expected to enrich the theoretical foundation of financial information system development and offer practical implications for capital market practitioners in enhancing the efficiency and transparency of fundamental analysis in Indonesia.

Data Warehouse

As a conceptual foundation, Inmon explains that a data warehouse is a storage system designed to organize data based on specific subjects, integrate information from multiple sources, store long-term historical data, and provide consistent information to support managerial decision-making processes (Fan et al., 2022). These characteristics align with the view that a data warehouse functions as a centralized repository that stores structured and curated data for analytical purposes, with an emphasis on cross-system integration and data quality (Nambiar & Mundra, 2022). In the financial context, a data warehouse enables the consolidation of financial statements and ratio data such as profitability, leverage, and activity ratios consistently across periods, thereby supporting the analysis of their relationship with stock prices (Kumar, 2024).

The implementation of a data warehouse in this study reflects a shift toward a more structured and historically grounded analytical process. With its ability to integrate data across periods, the data warehouse facilitates the calculation of various financial ratios and improves the accuracy of assessing the relationship between corporate financial performance and stock price movements. This

approach is expected to enhance research consistency and validate findings within the context of the current capital market.

Extract, Transform, Load (ETL)

In modern data architectures, ETL (Extract, Transform, Load) remains the core sequence for extracting data from diverse sources, performing cleansing and transformation, and loading the results into a warehouse; meanwhile, ELT shifts the primary transformation workload to the computational engine of the target columnar or cloud platform (Reis & Housley, 2022). The primary difference lies in the transformation order. ETL performs transformation before loading, whereas ELT performs transformation after the data have been loaded, and the selection between the two approaches is generally guided by data scale, service-level agreements (SLA), cost, governance, and the distributed computing capabilities of modern platforms (K. Haryono, 2020).

With these practices, capital market research can implement ETL to standardize financial ratios, address heterogeneous reporting formats, and prepare reliable analytical datasets for testing the relationship between financial indicators and stock prices of primary consumer goods issuers.

Financial Ratios and Their Influence on Stock Prices

Financial ratios are used to interpret the relationships among items in financial statements, thereby describing profitability, operational efficiency, liquidity, funding structure, and corporate valuation. These ratios allow analysts to compare performance across firms and periods, providing a foundation for investment assessment (Hery, 2023). In the context of the Indonesian capital market, ROA (Return on Assets) is frequently associated with increases in stock prices because it reflects a company's ability to manage its assets productively, while EPS (Earnings per Share) has a direct influence through profit-related information that is closely linked to investor returns (Gafiarty et al., 2025; Hidayat et al., 2025). Meanwhile, DER (Debt to Equity Ratio) and TATO (Total Asset Turnover) represent a firm's reliance on debt and the effectiveness of its asset utilization, particularly in primary consumer goods companies (Hery, 2023).

This study adopts four major financial ratios as the basis for measurement, as they are considered the most representative for stock price analysis: Return on Assets (ROA), Total Asset Turnover (TATO), Earnings per Share (EPS), and Debt to Equity Ratio (DER). These ratios were selected because they sequentially reflect a company's ability to utilize its assets to generate profits, the efficiency of asset use in generating sales, the firm's ability to generate earnings per share, and the level of financial risk resulting from debt- and equity-based funding structures (Hery, 2023).

ROA (Return on Assets) is calculated using the formula:

$$\textbf{ROA} = \frac{\text{Laba Bersih}}{\text{Total Aset}}$$

This ratio indicates the extent to which a company's assets are capable of generating profits, making it a key indicator of operational effectiveness (Hery, 2023).

TATO (Total Asset Turnover) is calculated as:

$$\textbf{TATO} = \frac{\boldsymbol{Penjualan}}{\boldsymbol{Total\ Aset}}$$

This indicator reflects a company's ability to convert assets into revenue. A higher TATO value indicates that assets are being utilized more optimally to support sales activities (Hery, 2023).

EPS (Earnings per Share) is calculated using the formula:

$$\textbf{EPS} = \frac{\boldsymbol{Laba\ Bersih}}{\boldsymbol{Jumlah\ Saham\ Beredar}}$$

This ratio provides information regarding the profit earned per outstanding share. A higher EPS typically signals strong performance and potential firm value, making it attractive to investors (Hery, 2023).

DER (Debt to Equity Ratio) is calculated as:

$$\textbf{DER} = \frac{\boldsymbol{Laba\ Utang}}{\boldsymbol{Total\ Ekuitas}}$$

This ratio illustrates a company's leverage level, or how much of its financing comes from debt relative to equity, thereby reflecting the financial risk borne by shareholders (Hery, 2023).

The Relevance of Data Warehousing to Financial Ratio and Stock Price Analysis

The application of a data warehouse not only increases the technical efficiency of data processing but also strengthens methodological validity and scientific credibility in modern financial research (Pradnyana, 2021). In capital market studies, the data warehouse holds strategic value as it ensures consistent metrics across periods through uniform definitions of financial ratios throughout the observation timeframe. Moreover, the system synchronizes the timing between financial reports and stock prices using as-of logic, preventing look-ahead bias and ensuring that only publicly available data are used in the analysis. The data warehouse also accelerates statistical exploration and robustness testing because the data are structured within a fact dimension schema that is ready for quantitative analysis. Thus, a data warehouse is not merely an integrated data storage system but a crucial foundation for more predictive, transparent, and sustainable financial research.

Prior Research

Table 1. Research Data Warehouse Design

No.	Researcher & Year	Title/Research Focus	Methods/Data	Key Findings	Limitations (Gap)	Relevance & Contribution to the Research
1	(Saragih & Ermalina, 2021)	*Pengaruh ROE, CR, dan DY terhadap harga saham pada perusahaan barang konsumsi di BEI*	Quantitative, multiple linear regression, 12 issuer data (SPSS)	*ROE* (+) is significant; *DY* (+) signifies; *CR* is not significant; simultaneous models are significant	Short period, variable limited, not yet using data integration systems such as Data Warehouse	Demonstrate the importance of profitability and dividend variables, as well as the need for automated data integration for long-term analysis
2	(Imansyah & Mustafa, 2019)	*Pengaruh CR, NPM, ROE, DY terhadap harga saham perusahaan consumer goods (Kompas100)*	Panel data (EViews)	*NPM* (+) is significant; *ROE* (+) is significant; *CR & DY* are insignificant	Small sample (5 companies), no *DW/OLAP system* yet for data refresh and analysis updates	Strengthening the role of profitability on stock prices, it is relevant to be retested with *warehouse data in* the primary consumer goods sector
3	(Melisa Yuana & Taudlikhul Afkar, 2020)	*Analisis pengaruh ROA, EPS, CR, DER, TATO terhadap harga saham sektor barang konsumsi*	Regresi berganda (SPSS)	*ROA & EPS* is significant; *CR, DER, TATTOO* is insignificant	Does not include *DY, PER;* has not integrated daily price data and periodic ratios in the *DW system*	Unlocking opportunities for multi-period data integration using *DW* to increase depth of analysis
4	(E. M. Haryono et al., 2020)	*Penerapan Data Warehouse untuk analisis laporan keuangan pemerintah daerah*	Case study, DW design (ETL data mart OLAP)	DW improves data accuracy & consistency, supports *interactive* time-series reporting	Public domain (local government), not testing stock price ratios	To be a technical reference for the application *of DW* for the integration of financial ratios and stock prices in the capital market sector
5	(Halim et al., 2020)	*Critical Success Factors implementasi*	AHP (Analytic Hierarchy Process)	Key success factors: *project*	Not focusing on the relationship	Provide a managerial basis for the effective

	DW/BI di sektor perbankan Indonesia	*leader*, data source system, *clear* requirements	between the financial ratio and the stock price, more on *DW project management*	implementation of *DW/BI* in this study in the context of the capital market

Conceptual Framework

The use of a Data Warehouse in this study serves to unify data from multiple sources into a single storage system that supports data-driven analysis and enables the retrieval of historical information across periods (Reis & Housley, 2022). The ETL (Extract, Transform, Load) process which includes data extraction, processing and format alignment, and loading data into the warehouse is employed to ensure that the data are clean, structured, and consistently ready for analysis in each observation period (K. Haryono, 2020).

Financial ratios, as quantitative performance measures, are used by investors to assess a company's prospects and risks. The accuracy of these ratios depends heavily on the quality and consistency of the underlying data used in their calculation (Hery, 2023).

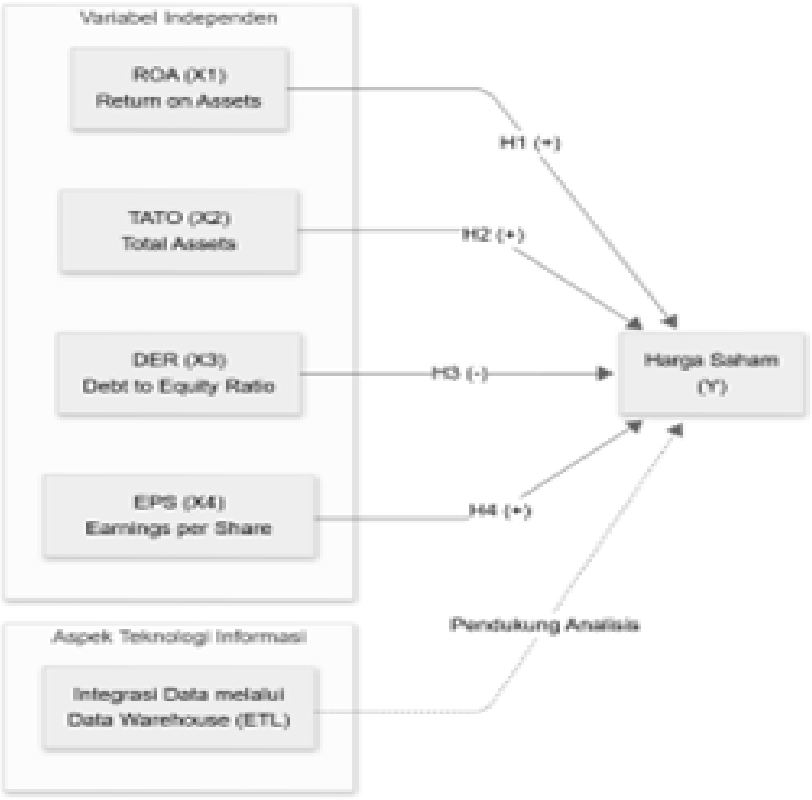

Figure 1. Conceptual Model

The conceptual framework connects two dimensions: (1) the implementation of a Data Warehouse with the ETL (Extract, Transform, Load) process as an integration system that ensures data quality, and (2) the influence of financial ratios on stock prices as the focus of empirical analysis. Thus, the Data Warehouse functions as a supporting mechanism that guarantees the reliability of testing relationships among financial variables, rather than serving as a research variable.

Hypotheses

As part of this research process, the hypotheses are tested based on the previously outlined conceptual framework by formulating the presumed relationships among the variables examined in this study as follows:

H1 : Return on Assets (ROA) is expected to have a positive effect on stock price changes in primary consumer goods companies listed on the Indonesia Stock Exchange.

H2 : Total Asset Turnover (TATO) is expected to have a positive influence on the stock prices of primary consumer goods companies on the Indonesia Stock Exchange.

H3 : Debt to Equity Ratio (DER) is assumed to have a negative effect on the stock prices of primary consumer goods companies in Indonesia.

H4 : Earnings per Share (EPS) is expected to have a positive effect on the stock prices of primary consumer goods companies listed on the Indonesia Stock Exchange.

RESEARCH METHODS

Type and Research Approach

This study employs a quantitative approach to analyze the relationship between financial ratios and stock price movements of companies. To analyze the data, this research uses multiple linear regression (OLS) with SPSS software, as this technique can estimate the effect of each variable both individually and simultaneously. This method was selected because it aligns with the nature of the study, which requires empirical testing of causal relationships based on numerical data.

The data processing stage begins with integration and cleansing using ETL (Extract, Transform, Load) techniques implemented within the Data Warehouse system, ensuring that cross-period data have a uniform format and are ready for analysis. This approach guarantees data quality, consistency, and reproducibility of the results, enabling more accurate statistical interpretation.

Research Population and Sample

The population of this study includes all issuers in the primary consumer goods sector listed on the Indonesia Stock Exchange (IDX) during the period 2022 2024. The sector was chosen due to its characteristics of having stable market demand and its relative resilience to economic fluctuations. Sample selection was conducted using several screening criteria. Companies must have been consistently listed on the IDX throughout the analysis period, possess complete annual financial statements, and provide the necessary data for calculating financial ratios and stock prices. Firms experiencing trading suspension or delisting during the period were excluded from the sample. Based on these criteria, the sample consists of several companies from the food, beverage, tobacco, and household necessities subsectors.

Types, Sources, and Data Collection Techniques

The data used in this research were obtained from annual financial statements and closing stock price information available on the official website of the Indonesia Stock Exchange for the 2022 2024 period. The research sample consists of several companies in the primary consumer goods sector for three years, resulting in data variation across firms and across periods. All data were used to calculate financial ratios, which were subsequently analyzed for their influence on stock prices using multiple linear regression (OLS).

Data collection and processing were conducted using the ETL (Extract, Transform, Load) approach within the Data Warehouse system. During the extraction phase, financial reports and stock price data were downloaded from the Indonesia Stock Exchange. The transformation phase involved data cleaning, format standardization, alignment of reporting periods, and computation of the required financial ratios.

Regression Model

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

With the following description:

Y = Stock Price
X_1 = ROA (Return on Assets)
X_2 = DER (Debt to Equity Ratio)
X_3 = EPS (Earnings per Share)
X_4 = TATO (Total Asset Turnover)
β_0 = Constant
$\beta_1 \ldots \beta_4$ = Regression coefficients of each independent variable
ε = Error term

This model is used to analyze the effect of financial ratios on stock prices, both simultaneously and partially.

Data Analysis Techniques

Data analysis is carried out in several stages to ensure accurate and reliable estimation results. In the initial stage, descriptive statistics are used to describe the basic characteristics of each research variable. Subsequently, a series of classical assumption tests including tests for normality, multicollinearity, heteroskedasticity, and autocorrelation are conducted to ensure that the regression model meets the criteria for applying OLS. If all assumptions are met, the analysis proceeds with multiple linear regression to examine the effect of financial ratios on stock prices. The final stage involves hypothesis testing, including the t-test to assess the partial influence of each variable, the F-test to assess simultaneous effects, and the calculation of the coefficient of determination (R^2) as a measure of the model's ability to explain the dependent variable.

Procedural Research Framework

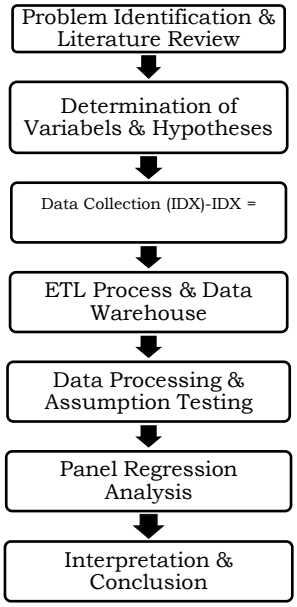

Figure 2. Procedural Research Framework

The research process begins with problem identification and a literature review to determine existing research gaps. Subsequently, the research variables are defined and hypotheses are formulated based on relevant theories and previous empirical findings. The next stage involves collecting data from the Indonesia Stock Exchange (IDX) and processing it through the ETL procedure to ensure that the data is clean, integrated, and ready for analysis within the data warehouse. Once the data meets the required quality standards, statistical assumption tests are conducted as prerequisites before performing panel regression analysis.

The following stage involves selecting the most appropriate panel regression model through tests such as the Chow Test and the Hausman Test. Regression estimation is then carried out to evaluate the influence of financial variables on stock prices. The results are subsequently interpreted systematically to answer the research questions and serve as the basis for the discussion in Chapter 4.

RESULTS AND DISCUSSION

Descriptive Analysis Results

Descriptive analysis is used to provide an overview of the research variables, including Stock Price, ROA (Return on Assets), DER (Debt to Equity Ratio), EPS (Earnings per Share), and TATO (Total Asset Turnover). The descriptive statistical results are presented in Table 2.

Table 2. Descriptive Statistics of Research Variables

Variabel	Mean	Std. Deviation	N
Stock Price	4203.53	4678.345	60
ROA	0.105280	0.0632925	60
DER	0.8458	1.00978	60
EPS	349.8223	466.47119	60
TATO	1.4888	1.14668	60

These results indicate that stock prices exhibit substantial variation (SD = 4,678.34), while ROA (Return on Assets) shows a relatively low but stable average value. DER (Debt to Equity Ratio) and EPS (Earnings per Share) display considerable variation across companies.

Classical Assumption Tests

Normality Test

Residual normality was tested using the Histogram and Normal P P Plot.

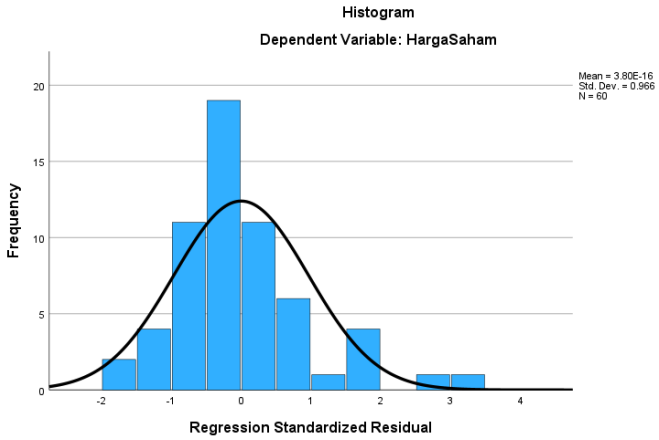

Figure 3. Residual Histogram

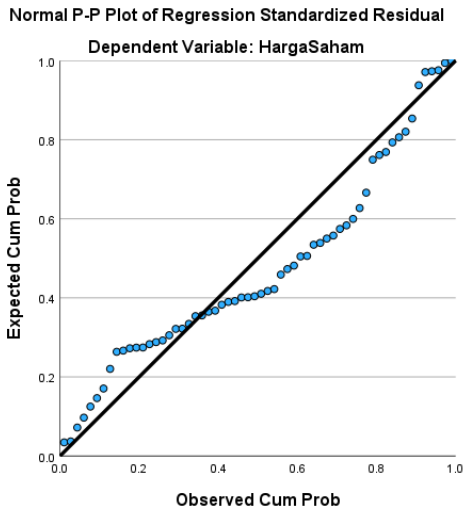

Figure 4. Normal P P Plot of Residuals

The results of both graphs indicate that the residuals follow a distribution approaching normality, with the points tending to align with the diagonal line in the P P plot. This demonstrates that the model satisfies the normality assumption.

Multicollinearity Test

The results of the multicollinearity test are presented in Table 3.

Table 3. Multicollinearity Test Results

Variabel	Tolerance	VIF
ROA	0.902	1.108
DER	0.848	1.179
EPS	0.909	1.100
TATO	0.894	1.119

All VIF values are < 10 and all Tolerance values are > 0.10, indicating that the regression model is free from multicollinearity.

Heteroskedasticity Test

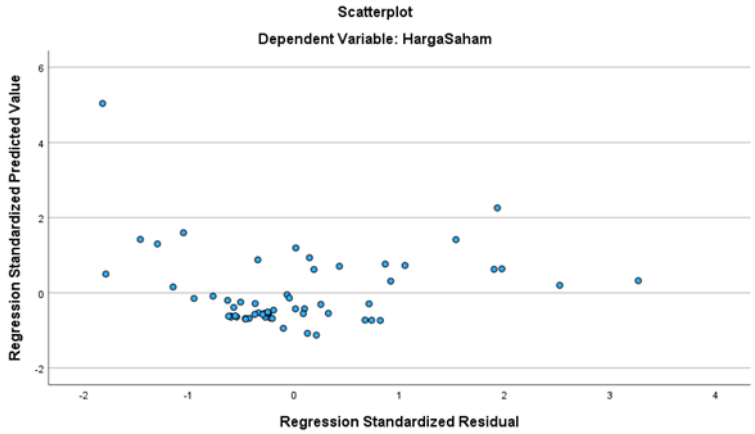

Figure 5. Heteroskedasticity Test Scatterplot

The distribution pattern of the residuals appears random and does not form a funnel shape or any other specific pattern. Thus, it cn be concluded that heteroskedasticity is not present.

***Autocorrelation* Test**

Autocorrelation is tested using the Durbin Watson (DW) statistic.

Table 4. Autocorrelation Test Results

Statistik	Nilai
Durbin-Watson	1628

The Durbin Watson (DW) value of 1.682 falls within the acceptable range of 1.5 2.5, indicating that the model is free from autocorrelation.

Multiple Linear Regression Analysis

Multiple linear regression analysis is employed to examine the influence of ROA (Return on Assets), TATO (Total Asset Turnover), DER (Debt to Equity Ratio), and EPS (Earnings per Share) on stock prices. The analysis includes the F-test to evaluate the simultaneous effect of the variables, the t-test to assess partial effects, the coefficient of determination (R^2) to measure the model's explanatory power, and the formulation of the regression equation as a basis for interpreting the relationships among variables.

t-Test (Partial Test)

The t-test is used to determine the extent to which each independent variable individually influences stock prices.

Table 5 Results of the t-Test (Partial Test)

Variabel	B	Sig.	Information
ROA	737.062	0.887	Insignificant
DER	294.006	0.382	Insignificant
EPS	8.499	< 0.001	Positive Significance
TATO	-474.932	0.103	Insignificant

The results of the t-test indicate that only the EPS (Earnings per Share) variable has a positive and significant effect on stock prices (significance value < 0.05). This suggests that an increase in earnings per share tends to be followed by an increase in stock prices. Conversely, the variables ROA (Return on Assets), TATO (Total Asset Turnover), and DER (Debt to Equity Ratio) do not exhibit significant effects, as their significance values exceed 0.05.

F-Test

The F-test is used to assess whether ROA (Return on Assets), TATO (Total Asset Turnover), DER (Debt to Equity Ratio), and EPS (Earnings per Share) collectively have a significant influence on stock prices.

Table 6. F-Test (Simultaneous Test)

Source	F	Sig.
Model Regresi	43.036	< 0.001

Based on Table 6, the F-value obtained is 43.036 with a significance value of 0.000 < 0.05. This indicates that the regression model is statistically significant as a whole, meaning that ROA (Return on Assets), TATO (Total Asset Turnover), DER (Debt to Equity Ratio), and EPS (Earnings per Share) collectively influence the stock prices of companies in the primary consumer goods sector.

Coefficient of Determination (R^2)

The Model Summary shows an R^2 value of 0.758, indicating that 75.8% of the variation in stock prices can be explained by ROA (Return on Assets), TATO (Total Asset Turnover), DER (Debt to Equity Ratio), and EPS (Earnings per Share). The remaining 24.2% is influenced by other factors.

Table 7. Coefficient of Determination

Statistics	Value
R Square	0.758

***Regression* Equation**

Based on the Unstandardized Coefficients (B), the multiple linear regression equation obtained is as follows:

$$\mathbf{Y = 1611.209 + 737.062X_1 + 294.006X_2 + 8.499X_3 - 474.932X_4}$$

Interpretation of the direction of relationships:

- $\mathbf{X_1}$ → positive but not significant
- $\mathbf{X_2}$ → positive but not significant
- $\mathbf{X_3}$ → positive and significant
- $\mathbf{X_4}$ → negative but not significant

Discussion

The results of the analysis show that among the four variables tested, only EPS (Earnings per Share) has a positive and significant effect on stock prices. This finding confirms that EPS is the primary indicator considered by investors when evaluating company prospects in the primary consumer goods sector, consistent with valuation theory and prior empirical findings.

Conversely, ROA (Return on Assets) and TATO (Total Asset Turnover) do not show significant effects, as investors in this sector generally prioritize external factors such as demand stability,

market prospects, and dividend consistency rather than internal operational efficiency (Wahyudi et al., 2025).

A similar trend is observed with DER (Debt to Equity Ratio), where leverage is not a major consideration because investors tend to focus more on management's ability to manage resources effectively and create long-term value rather than the company's debt levels (Marindra et al., 2021).

Thus, **H4 is supported**, while **H1, H2, and H3 are not supported** by the research findings.

Research Implications

Practically, this study's findings indicate that EPS (Earnings per Share) can be used as a key indicator in investment decision-making within the primary consumer goods sector, given its proven significant effect on stock prices. Therefore, companies in this sector need to maintain and enhance their profitability to ensure positive EPS growth that can attract investors.

From a methodological perspective, this study demonstrates that the application of a Data Warehouse can facilitate the integration of financial data across periods, producing a more structured and accurate analysis process that supports more data-driven decision-making.

CONCLUSIONS

Based on the analysis, it can be concluded that EPS (Earnings per Share) is the variable that most strongly influences stock price movements of primary consumer goods companies listed on the Indonesia Stock Exchange. This finding confirms that investors place greater emphasis on EPS when assessing a company's stock value. In contrast, ROA (Return on Assets), TATO (Total Asset Turnover), and DER (Debt to Equity Ratio) do not have a significant effect on stock prices in this sector. In other words, investors tend to prioritize profitability indicators over asset efficiency and capital structure. Therefore, hypothesis H4 related to EPS is accepted, while H1, H2, and H3 are not supported by the results. This study provides several recommendations. For investors, EPS (Earnings per Share) can be used as a primary indicator when evaluating stock potential in the primary consumer goods sector, as it has been proven to significantly influence stock prices. For companies, efforts to improve profitability either through increasing net income or implementing effective cost management are essential to strengthening EPS and attracting investor interest. For future researchers, it is recommended to include additional fundamental variables such as PBV, PER, firm size, and macroeconomic indicators so that stock price prediction models become more comprehensive. Additionally, applying panel data analysis using software such as EViews may provide deeper insights into inter-company and inter-period data behavior. From a methodological perspective, the utilization of a Data Warehouse has proven effective in integrating multi-year financial data, making this approach highly relevant for further development in data-driven financial research.

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