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Binary Logistic Regression Analysis on Financial Performance of State-Owned Enterprises (Telkom and PLN): Case Study on NPM Change Based on ROA and TATO

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Abstract: This research investigates the effect of Return on Assets (ROA) and Total Asset Turnover (TATO) on the likelihood of Net Profit Margin (NPM) change in PT Telkom Indonesia (Persero) Tbk and PT Perusahaan Listrik Negara (Persero) over Semester II 2015 to Semester I 2024. Using binary logistic regression, the dependent variable, which increases NPM, is defined as a binary outcome (1 = increase, 0 = no increase), with ROA and TATO as independent variables. The analysis includes 34 valid cases from company financial reports. Regression results show ROA significantly predicts NPM growth (B = 0.609, p = 0.015), boosting the odds of increases, especially in Telkom's asset-efficient operations. TATO is also significant (B = -0.213, p = 0.006), but its negative coefficient indicates that higher turnover may hinder NPM growth due to rising costs, particularly in PLN's capital-intensive sector. The classification table reports 76.47% accuracy, with 73.68% correct predictions for non-increasing NPM (0) and 80% for increasing NPM (1). These findings reveal sector-specific patterns Telkom's strength in asset utilization versus PLN's operational cost challenges offering valuable insights for optimizing profitability and informing strategic financial decisions in the state-owned enterprises.

Keywords: binary logistic regression, financial ratios, net profit margin, state-owned enterprises, financial performance.

INTRODUCTION

State-Owned Enterprises (SOEs) play a strategic role in Indonesia's economy, serving not only as key drivers in vital sectors such as telecommunications, energy, infrastructure, and finance but also as agents of development that support national economic growth. Their contribution to the economy is evident through their generation of state revenue via dividends, taxes, and investments in various development projects that enhance societal welfare. Within this context, PT Telkom Indonesia (Persero) Tbk (Telkom) and PT Perusahaan Listrik Negara

(Persero) (PLN) stand out as two cornerstone SOEs, each dominating the telecommunications and electricity sectors, respectively. Telkom, as Indonesia's largest provider of telecommunications and digital services, plays a pivotal role in supporting national connectivity, accelerating digital transformation, and expanding access to information technology across the country. Meanwhile, PLN is responsible for providing reliable electricity, serving as a critical backbone for societal, industrial, and public sector activities throughout Indonesia. The financial performance of these two companies not only reflects the health of their respective sectors but also has a significant impact on national economic stability, given their essential role in sustaining the foundational infrastructure that drives economic growth.

As entities operating in strategic sectors, Telkom and PLN face unique challenges and opportunities. Telkom operates in a highly competitive telecommunications market, where technological innovation, such as the development of 5G networks and cloud-based services, is critical for maintaining market share. In contrast, PLN operates within in a more regulated environment, with electricity tariffs determined by the government, which limits its operational flexibility but still demands efficiency to meet the growing energy needs. Despite their differing characteristics, both companies share a common responsibility to deliver sustainable economic and social value. Consequently, analyzing their financial performance is crucial, not only to evaluate operational efficiency but also to understand how their business strategies contribute to the achievement of national development goals.

Profitability analysis is a primary tool for evaluating the operational efficiency and effectiveness of business strategies in SOEs. One of the most critical profitability indicators is the Net Profit Margin (NPM), which measures the percentage of revenue converted into net profit after deducting all operational costs, taxes, and other expenses. An upward trend in NPM over time indicates a company's ability to enhance efficiency, manage costs more effectively, or generate additional revenue through innovative strategies. However, NPM dynamics do not occur in isolation. Factors such as market competition, government regulatory changes, global commodity price fluctuations, and economic disruptions like the pandemic can influence a company's ability to maintain or improve its NPM. Therefore, understanding the factors driving NPM growth is essential, not only to strengthen a company's financial position but also to ensure its sustained contribution to national development.

In addition to NPM, other financial ratios such as Return on Assets (ROA), Return on Equity (ROE), Debt to Equity Ratio (DER), Current Ratio (CR), Total Asset Turnover (TATO), and Gross Profit Margin (GPM) serve as vital indicators for assessing a company's financial performance. ROA measures how efficiently a company uses its assets to generate profit, providing insight into resource productivity. ROE indicates the return generated for shareholders, reflecting the company's ability to leverage equity. DER highlights the company's capital structure, showing its reliance on debt to finance operations. CR assesses short-term liquidity, while TATO evaluates the efficiency of asset utilization in generating sales. GPM, as an indicator of operational efficiency, reflects the company's ability to manage production costs relative to revenue. Although these ratios offer valuable insights, their impact on profitability can vary depending on the industry in which a company operates.

Numerous prior studies have explored the relationship between financial ratios and corporate performance, providing a robust theoretical foundation for this analysis. Putra and Yuniati (2019) found that ROE, Return on Investment (ROI), and accounts receivable collection periods significantly influenced revenue growth in SOEs listed on the Indonesia Stock Exchange (IDX) from 2012 to 2017. However, their study was limited to specific sectors and did not conduct an in-depth cross-sectoral comparison, leaving room for further exploration. Meanwhile, Rusdianto et al. (2020) examined the impact of financial ratios on profit growth in construction companies listed on the IDX, finding that Debt to Assets Ratio

(DAR) and NPM had a significant positive effect, while CR and TATO showed no significant impact. These findings underscore that the effectiveness of financial ratios as predictors of performance can vary depending on industry dynamics.

Another study by Manalu (2020) analyzed the effect of DER, TATO, NPM, and CR on profit growth in mining companies listed on the IDX from 2016 to 2019. The results indicated that only CR had a significant impact, while DER, TATO, and NPM were statistically insignificant. These findings highlight the variation in the influence of financial ratios across sectors, emphasizing the need for a more holistic comparative analysis to understand these dynamics. Additionally, Heikal et al. (2023) investigated the financial performance of SOEs in the infrastructure and logistics sectors, finding that ratios such as ROA, ROE, and DER did not consistently affect going concern audit opinions before and during the COVID-19 pandemic. This study underscores the importance of considering temporal contexts, such as global economic shifts, in financial analysis.

Despite the abundance of studies on financial ratios, there remains a research gap concerning cross-sectoral comparative analyses of SOEs, particularly in the context of NPM changes. Previous studies have often focused on a single sector or entity without considering the comparative financial dynamics across different industries. Therefore, this study aims to address this gap by analyzing two strategic SOEs—Telkom and PLN—operating in sectors with contrasting operational and regulatory characteristics. Telkom, as a player in the telecommunications sector, relies on innovation and asset efficiency to compete in a dynamic market. Conversely, PLN, operating in the heavily regulated electricity sector, depends more on operational cost control and energy supply stability. This comparative approach enables a deeper understanding of how financial ratios like ROA and TATO influence NPM growth in differing contexts.

This study adopts a binary logistic regression approach to model the binary dependent variable, namely the increase or decrease in NPM. This method was chosen for its ability to identify the most significant factors in predicting the probability of NPM growth. By focusing on ROA and TATO, the study seeks to explore the extent to which asset utilization efficiency and asset turnover can explain profitability dynamics. The findings of this analysis are expected to contribute not only to the academic literature on the financial performance of SOEs but also to provide practical implications for managers, investors, and policymakers in formulating data-driven strategies to enhance profitability.

Based on this background, the study aims to address three main research questions: (1) Do financial ratios, including ROA, DER, TATO, CR, ROE, and GPM, significantly affect the likelihood of NPM growth in SOEs? (2) How do ROA and TATO influence the probability of NPM growth in SOEs? (3) To what extent can ROA and TATO explain the likelihood of NPM growth? By exploring these questions, this study seeks to provide valuable insights into the financial dynamics of SOEs and their contribution to the national economy.

METHOD

Research Type

This study employs a descriptive and analytical quantitative research design, utilizing secondary data and applying binary logistic regression to analyze and compare the influence of financial ratios on the increase or decrease of Net Profit Margin (NPM) in two strategic State-Owned Enterprises (SOEs) operating in distinct sectors: PT Telkom Indonesia (Persero) Tbk (TLKM) in telecommunications and PT PLN (Persero) in electricity.

Binary logistic regression was selected as the analytical method because the dependent variable, NPM change (Increase in NPM), is binary (1 = increase, 0 = decrease), making this approach suitable for modeling the probability of a binary outcome based on independent variables.

Research Objects

The objects of this study are two major and strategic SOEs, namely:

1. PT Telkom Indonesia (Persero) Tbk — operating in the telecommunications and digital sector, characterized by intense competition and the need for technological innovation.
2. PT PLN (Persero) — operating in the electricity sector, influenced by government regulations, subsidies, and challenges in national energy provision.

These entities were chosen as they represent dominant SOEs in critical sectors and provide audited, publicly available financial data through consistent semiannual reports.

Research Period

The observation period spans from Semester II 2015 to Semester I 2024, encompassing 18 semi-annual periods for each company, resulting in a total of 36 observations for TLKM and PLN. Financial data were collected on a semi-annual basis (every six months), providing sufficient temporal coverage to examine periodic changes in financial performance. This period was selected as it includes significant digital transformation phases for TLKM, such as the expansion of 4G/5G networks and digital services, as well as national energy policy reforms affecting PLN, including the transition to renewable energy, alongside the availability of consistent financial data since 2015.

Research Variables

Independent Variables (Financial Ratios):

1. Return on Assets (ROA)
   A ratio measuring the efficiency of a company in utilizing its assets to generate net profit (%). ROA reflects management's ability to manage assets to produce profits, potentially influencing the net profit margin (NPM). It is calculated as:

$$\text{ROA} = \frac{\text{Nett Profit}}{\text{Total Assets}} \times 100$$

2. Debt to Assets Ratio (DAR)
   A ratio assessing the proportion of debt relative to total assets, indicating the company's financial leverage. High debt levels may increase financial risk, potentially affecting profitability (NPM). It is calculated as:

$$\text{DAR} = \frac{\text{Total Debt}}{\text{Total Assets}} \times 100$$

3. Current Ratio (CR)
   A ratio measuring a company's ability to meet short-term obligations with current assets, reflecting short-term liquidity. Good liquidity can support stable operations. It is calculated as:

$$CR = \frac{\text{Current Assets}}{\text{Current Liabilities}} \times 100$$

4. Equity to Asset Ratio
   A ratio indicating the company's capital structure and reliance on equity by measuring the proportion of equity to total assets. It is calculated as:

$$\text{Equity to Asset Rasio} = \frac{\text{Total Equity}}{\text{Total Assets}} \times 100$$

5. Return on Equity (ROE)
   A ratio measuring the efficiency of a company in using equity to generate net profit. It is calculated as:

$$\text{ROE} = \frac{\text{Nett Profit}}{\text{Total Equity}} \times 100$$

6. Gross Profit Margin (GPM)
   A ratio indicating a company's ability to generate gross profit from revenue before deducting operational costs. It is calculated as:

$$GPM = \frac{\text{Gross Profit}}{\text{Revenue}} \times 100$$

7. Total Asset Turnover (TATO)
   A ratio measuring the efficiency of a company in using assets to generate revenue (times). TATO reflects operational efficiency in utilizing assets to produce revenue, which may influence NPM. It is calculated as:

$$TATO = \frac{\text{Revenue}}{\text{Total Assets}}$$

8. Variabel Dependen
   The change in Net Profit Margin (NPM), defined as a binary variable:
   1 = If NPM increases compared to the previous period.
   0 = If NPM decreases or remains stagnant compared to the previous period.
   NPM is calculated as:

$$NPM = \frac{\text{Nett Profit}}{\text{Revenue}} \times 100$$

   The change in NPM is determined by comparing the NPM value of a given period with that of the preceding period using semi-annual data.

Analysis Methodology

This study adopts binary logistic regression as its analytical approach. According to Hosmer and Lemeshow in their book *Applied Logistic Regression*, binary logistic regression is used to model the probability of a binary event using independent variables that may be categorical or continuous.

Basuki and Prawoto (2016) in *Regression Analysis in Economic and Business Research* note that binary logistic regression is suitable for binary dependent variables such as financial status (e.g., profitability increase/decrease) and provides guidance on interpreting outputs such as the Classification Table and Variables in the Equation.

$$y = \frac{1}{1 + \exp^{(-c + \beta 1X1 + \beta 2X2 + \ldots\ldots\ldots + \beta nXn)}}$$

y: Dependent or Target Variable
c: Constant (intercept)
β1,β2,…,βn: Regression coefficients for the independent variables
X1,X2,…,Xn: Independent Variables

The results of the binary logistic regression are interpreted through the regression coefficients (β\betaβ) to determine the direction and magnitude of the independent variables' influence on the dependent variable.

Analytical Tools

Data analysis was conducted using Microsoft Excel for initial data processing, calculating financial ratios (ROA, TATO, etc.), and creating preliminary visualizations such as NPM trends. SPSS version 29 was used for the statistical testing of binary logistic regression.

Variable Selection

The study initially considered seven financial ratios as independent variables. Variable selection was performed using correlation tests to identify variables with a significant relationship to NPM changes, alongside theoretical considerations based on relevant literature.

Consequently, only ROA and TATO were selected as independent variables in the final model due to their relevance to operational efficiency and significant association with NPM changes.

The selection of ROA and TATO is supported by literature, such as Brigham and Houston (2019), which highlights ROA and TATO as key indicators of operational efficiency that influence corporate profitability.

Data Sources

The data were sourced from audited semi-annual financial reports officially published by each company, as follows:

1. Telkom's data were obtained from semi-annual financial reports available on the official website of PT Telkom Indonesia (https://www.telkom.co.id/) and the Indonesia Stock Exchange (https://www.idx.co.id/), given Telkom's status as a publicly listed company.
2. PLN's data, as a non-public company, were sourced from semiannual financial reports published on the official website of PT PLN (Persero) (https://pln.co.id/).

RESULTS AND DISCUSSION

Table 1. Financial Performance Data of PT Telkom Indonesia (TLKM)

	Year	Semester	ROA (%)	TATO (x)	NPM (%)	Increase in NPM (1 = increase, 0 = decrease/stagnant)
TLKM	2015	2	14,0	61,7	22,8	
	2016	1	8,6	32,9	26,0	1
	2016	2	16,2	64,8	25,1	0
	2017	1	9,8	36,0	27,3	1
	2017	2	16,5	64,6	25,5	0
	2018	1	6,3	31,9	19,9	0
	2018	2	13,1	63,4	20,6	1
	2019	1	7,2	32,1	22,3	1
	2019	2	12,5	61,3	20,4	0
TLKM	2020	1	6,3	27,1	23,1	1
	2020	2	12,0	55,3	21,7	0
	2021	1	6,4	26,3	24,4	1
	2021	2	12,2	51,7	23,7	0
	2022	1	6,4	26,1	24,4	1
	2022	2	10,1	53,5	18,8	0
	2023	1	5,8	25,3	22,9	1
	2023	2	11,2	52,0	21,6	0
	2024	1	5,4	26,3	20,5	0

Source: Research data

Note: Ratios not used in the main analysis are not presented

Table 2. Financial Performance Data of PT PLN (Persero)

	Year	Semester	ROA (%)	TATO (x)	NPM (%)	Increase in NPM (1 = increase, 0 = decrease/stagnant)
PLN	2015	2	0,5	22,3	2,2	
	2016	1	0,6	11,0	5,9	1
	2016	2	0,6	22,1	2,9	0

	2017	1	0,2	11,2	1,5	0
	2017	2	0,3	22,6	1,5	0
	2018	1	-0,4	11,6	-3,4	0
	2018	2	0,8	23,1	3,4	1
	2019	1	0,5	11,6	4,1	1
	2019	2	0,3	22,7	1,2	0
	2020	1	0,0	10,2	0,2	0
	2020	2	0,4	21,7	1,7	1
	2021	1	0,4	11,1	3,8	1
	2021	2	0,8	22,7	3,6	0
	2022	1	1,1	12,9	8,2	1
	2022	2	0,9	26,9	3,3	0
	2023	1	1,6	14,2	11,1	1
	2023	2	1,3	29,2	4,5	0
	2024	1	0,3	15,5	1,9	0

Source: Research Data
Note: Ratios not used in the main analysis are not presented

Binary Logistic Regression Results

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Rasio Laba (Rugi) terhadap Aset ROA (%)	0,609	0,249	5,972	1	0,015	1,838
	Turn Asset Turnover	-0,213	0,077	7,573	1	0,006	0,808
	Constant	2,942	1,168	6,342	1	0,012	18,952

a. Variable(s) entered on step 1: Rasio Laba (Rugi) terhadap Aset ROA (%), Turn Asset Turnover.

Souce: Research Results

Figure 1. **Variables in the equation Binary Logistic Regression**

Variables in the Equation

The "Variables in the Equation" section provides details on the regression coefficients, significance, and effects of the independent variables (ROA and TATO) on the probability of an NPM increase (NPM = 1). The results are as follows: Constant B = 2.942, p = 0.012 (significant at $\alpha = 0.05$).

Return on Assets (ROA): B = 0.609, p = 0.015 (significant at $\alpha = 0.05$), Exp(B) = 1.838. For each 1% increase in ROA, the odds of an NPM increase (Naik_NPM = 1) rise by 1.838 times (or 83.8% higher), holding TATO constant. Companies with higher ROA (indicating better asset efficiency) are more likely to experience an NPM increase. This aligns with the classification results, where the model accurately predicts NPM = 1 at 80.0%.

Total Asset Turnover (TATO): B = -0.213, p = 0.006 (significant at $\alpha = 0.05$), Exp(B) = 0.808. For each unit increase in TATO, the odds of an NPM increase (Naik_NPM = 1) decrease by 0.808 times (or 19.2% lower), holding ROA constant. TATO has a significant negative effect on the probability of an NPM increase. This negative effect may arise because a high TATO often correlates with increased operational costs, particularly in capital-intensive companies like PLN in the electricity sector, which faces challenges such as subsidies and large infrastructure investments. For TLKM, this effect may be less pronounced as the telecommunications sector tends to be more flexible in managing operational costs through digital innovation. However, rapid revenue growth (high TATO) can still suppress NPM if marketing or technology investment costs also rise

Classification Table[a]

Observed			Predicted		
			Y= naik NPM; 1, Turun 0		Percentage Correct
			0	1	
Step 1	Y= naik NPM; 1, Turun 0	0	14	5	73,7
		1	3	12	80,0
	Overall Percentage				76,5

a. The cut value is .500

Souce: Research Results

Figure 2. Classification Table for Binary Logistic Regression

Classification Table Results

The binary logistic regression model demonstrates an overall accuracy of 76.5%, indicating that it performs reasonably well in predicting whether NPM will increase or not based on ROA and TATO. The model is more accurate in predicting cases where NPM increases (80.0%) compared to cases where NPM does not increase (73.7%). This suggests that the model is more sensitive in identifying NPM increases. An overall accuracy of 76.5% is considered acceptable, as accuracy above 70% is generally deemed satisfactory in binary logistic regression studies (Hosmer & Lemeshow, 2013).

The resulting probability equation for the dependent variable (NPM Increase) influenced by the independent variables (ROA and TATO) for Telkom and PLN is as follows;

$$Y = \frac{1}{1 + \text{Exp}\,(-2.942 + (0.609 * \text{ROA}) + (-0.213 * \text{TATO}))}$$

Consistency with Literature

This study aligns with findings from Heikal, J., Yudianto, I., & Zubir, A. (2023), titled *Comparative Analysis of the Impact of Financial Conditions of SOEs on the Receipt of Going Concern Audit Opinions Before and During the COVID-19 Pandemic*. Their research analyzed the financial conditions of SOEs (including the telecommunications and electricity sectors) using financial ratios such as ROA and TATO to predict going concern audit opinions.

A similar study by Kusuma, H. A., & Roundhy, R. A. (2022), titled *Analysis of Financial Ratios on the Profitability Performance of Companies in the Utilities Sector*, examined the impact of financial ratios, including ROA and TATO, on profitability (measured by NPM) in utility companies, such as PLN. However, their study did not employ a binary logistic regression model.

Another relevant study by Ramadhan, F., & Wahyuni, I. (2023), titled *Profitability Analysis in SOEs: An Empirical Study on Telecommunications Companies*, focused on profitability in the telecommunications sector (e.g., Telkom) and used ROA as one of the predictors.

CONCLUSION

This study aimed to analyze the influence of Return on Assets (ROA) and Total Asset Turnover (TATO) on the probability of an increase in Net Profit Margin (NPM) at PT Telkom Indonesia (Persero) Tbk and PT PLN (Persero) over the period from Semester II 2015 to Semester I 2023, utilizing binary logistic regression. The findings indicate that ROA has a positive and significant effect, increasing the likelihood of an NPM increase by 1.838 times per 1% increase, particularly in Telkom, which leverages asset efficiency. These results underscore sector-specific dynamics, whereby Telkom enhances profitability through asset efficiency, whereas PLN requires effective operational cost management to support NPM growth.

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