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Analysis of the Impact of Internal and External Factors on the Financial Performance of Energy Subsector Maritime Transport Companies in ASEAN (2020–2024)

Astrianto*, Lukman Hanif Arbi
Universitas Indonesia, Indonesia
Email: astrianto69@gmail.com*, lukman.hanif@ui.ac.id

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financial performance, sea transportation, energy sub-sector, ASEAN, panel data, fixed effects, total asset turnover, energy prices, freight rate.

Abstract
Maritime transportation supports energy distribution and international trade across ASEAN; however, its financial performance is exposed to both corporate conditions and external market volatility. This study aims to examine the effects of liquidity, capital structure, asset efficiency, firm size, growth, global energy prices, and freight rates on the financial performance of energy-subsector maritime transportation companies in ASEAN during 2020–2024. A quantitative explanatory research design was employed using secondary data obtained from S&P Capital IQ, the IMF Global Price of Energy Index accessed through FRED, and the Baltic Dirty Tanker Index. Purposive sampling was used to select 43 listed companies, resulting in 215 firm-year observations, of which 172 were included in the regression analysis because growth calculations required lagged data. Panel data regression was conducted using R software, supported by the Chow test, Hausman test, and Breusch–Pagan Lagrange Multiplier test, with firm-clustered robust standard errors applied to address potential heteroskedasticity and within-firm correlation. The fixed-effects model results indicate that all internal and external variables simultaneously have a significant effect on operating return on assets. Partially, only total asset turnover has a positive and significant effect, whereas liquidity, leverage, firm size, growth, energy prices, and freight rates do not show statistically significant effects. These findings indicate that efficient asset utilization, particularly fleet productivity, is the primary determinant of financial performance. Therefore, companies should prioritize asset optimization while strengthening financial management and external risk mitigation strategies

INTRODUCTION

Sea transportation plays a crucial role in international trade. Based on a report by the United Nations Conference on Trade and Development (UNCTAD), approximately 80% of international trade is conducted through maritime transportation. The ability of maritime transportation to carry large volumes of goods at relatively efficient costs makes it the primary mode of distribution in global trade (Hamilton, 2009).

During the 2020–2024 period, international trade experienced significant pressure due to the COVID-19 pandemic, which caused supply chain disruptions, reduced economic activity, and increased uncertainty in global demand (Kilian, 2009). Along with the post-pandemic economic recovery, rising energy demand was accompanied by increased volatility in the prices of energy commodities such as oil and coal. These conditions created new dynamics in international trade that affected not only trade volumes but also the cost structures and demand for maritime transportation services. In this context, energy commodities represent one of the main components of global maritime trade, characterized by large shipment volumes and high sensitivity to global economic fluctuations (Modigliani & Miller, 1958). Energy commodities such as crude oil, coal, oil products, liquefied natural gas (LNG), and liquefied petroleum gas (LPG) are important segments of global maritime trade, with crude oil representing the largest maritime energy commodity and coal demonstrating a long-term increasing trend (Myers, 1977, 1984).

Despite increases in energy prices and changes in global trade patterns, these conditions are not always accompanied by improvements in the financial performance of maritime transportation companies (Negkakis, 2025). This indicates that external dynamics alone may not sufficiently explain variations in corporate financial performance; therefore, internal company factors must also be considered.

The performance of maritime transportation companies is determined not only by external factors but also by internal factors related to financial structure management, operational efficiency, and growth potential. Differences in these factors cause each company to have varying levels of resilience in responding to market changes. ASEAN plays an important role in global energy trade, both as an energy producer and consumer. Several ASEAN countries are exporters of energy commodities, such as coal and natural gas, while others have a high dependence on energy imports, particularly crude oil. This condition has resulted in intensive cross-border energy trade within the ASEAN region, which relies heavily on maritime transportation as the primary distribution mechanism.

Previous studies have generally examined either internal company factors or external factors separately in explaining corporate performance. Furthermore, research on the maritime transportation industry has primarily focused on shipping companies in general and has not specifically addressed energy-subsector maritime transportation companies, which have greater sensitivity to fluctuations in energy prices. Therefore, studies that simultaneously examine the influence of internal corporate factors and energy prices on the financial performance of energy-subsector maritime transportation companies in ASEAN, particularly during the global shock period of 2020–2024, remain limited.

Based on these conditions, this study aims to empirically examine the influence of internal corporate factors and energy prices on the financial performance of energy-subsector maritime transportation companies in ASEAN, as well as identify the factors that have the most dominant influence in explaining variations in company performance (RAJAN & ZINGALES, 1995).

Previous studies on the factors affecting the financial performance of shipping companies have shown inconsistent findings. Some studies have found that capital structure, liquidity, and company growth influence profitability, whereas other studies have reported insignificant effects. These differences indicate that the relationship between internal corporate factors and financial performance has not yet reached consistent conclusions, particularly in the shipping industry, which has distinct characteristics across regions and subsectors.

Most previous studies have also focused on general shipping companies and have not examined energy-subsector maritime transportation companies, which have high sensitivity to changes in global energy prices. Therefore, this study addresses the research gap by simultaneously analyzing the influence of internal corporate factors, including liquidity, capital structure, asset efficiency, firm size, and company growth, as well as external factors in the form of global energy prices, on the financial performance of energy-subsector maritime transportation companies in the ASEAN region during the 2020–2024 period.

This study aims to determine the influence of internal factors, external factors, and their combined effects on the performance of energy-subsector maritime transportation companies in ASEAN. The findings are expected to provide theoretical contributions by enriching the literature on the determinants of financial performance, practical contributions for corporate management in strategic decision-making, and policy contributions for relevant stakeholders in improving industry competitiveness (Deloof, 2003). This research is limited to oil and coal transportation companies in the ASEAN region during the 2020–2024 period, using global energy prices as the primary external variable. Therefore, other external factors, such as freight rates, global trade volume, interest rates, and exchange rates, are not analyzed and may provide opportunities for future research (ORGANIZAÇÃO DAS NAÇOES UNIDAS, 2025).

METHOD

Research Approach

The research method employed in this study was a quantitative approach. The study used an explanatory research design to examine the influence of internal and external factors on the financial performance of energy-subsector maritime transportation companies in ASEAN during the 2020–2024 period. The analysis focused on determining the effects of independent variables on company performance as the dependent variable.

Population and Sample

The population in this study is all sea transportation companies in ASEAN that are related to the energy subsector, especially in oil and coal (*coal*) commodity transportation activities in 2020-2024. The selection of samples in this study was carried out using *purposive sampling* techniques. Samples are deliberately selected based on specific criteria so that the unit of analysis used is appropriate to the scope of the study and can adequately support model testing.

Based on *purposive sampling criteria*, the initial population consists of 56 marine transportation companies in the energy sub-sector listed on the stock exchanges of ASEAN countries during the period 2020–2024. After the data cleansing process, as many as 13 companies were excluded from the sample, namely 12 companies with incomplete financial data availability during the study period (due to *delisting* or not yet *initial public offering* in the study period) and 1 company that experienced trading suspension due to negative equity during the observation period. Thus, the final sample used in this study was 43 companies with a total of 215 *firm-year observations*.

Data Collection Techniques

Data collection is carried out after studying literature such as textbooks, previous research journals, final projects and other information needed. Data collection in this study was carried out using secondary data. Company financial data is obtained from the S&P Capital IQ database using the United *States Dollar (USD)*-denominated *Standardized Financials template* to ensure consistency of cross-company and cross-country units of measurement. Global energy price data is obtained from the *Global price of Energy index* series accessed through the FRED St. Louis Fed and sourced from *the IMF Primary Commodity Prices*. Global energy price data is then processed into an annual average for the 2020–2024 period. Sea freight rate data is obtained from the historical Baltic *Dirty Tanker Index* (BDTI) series published by the Baltic Exchange and accessed via Investing.com. The BDTI daily data is then processed into an annual average for the period 2020–2024 to be consistent with the annual data structure of other external variables.

Data Processing Techniques

The data processing techniques (Damodaran, 2012) in this study include descriptive statistical analysis (The R Core Team, 2025), outlier handling using winsorization of 1% and 99%, and regression analysis of panel data on marine transportation companies in the energy sub-sector in ASEAN for the 2020–2024 period. Model selection is carried out through the Chow Test, Hausman Test, and Breusch–Pagan Lagrange Multiplier Test to determine the most suitable model. Furthermore, an assumption test was carried out that included multicollinearity, heteroscedasticity, and autocorrelation, with the application of cluster-robust standard errors if heteroscedasticity was found. Hypothesis testing was carried out using a t-test for partial influence, an F-test for simultaneous influence, and a determination coefficient (R^2) to measure the model's ability to explain variations in dependent variables. The entire analysis was carried out using R software with plm, lmtest, car, and sandwich packages.

RESULT AND DISCUSSION

Sample Selection Results

The selection of the research sample refers to the criteria that have been determined in Chapter 3, namely marine transportation companies in the energy sub-sector in ASEAN during 2020-2024 (Rabinowitz & Rice, 1989). The criteria used by the author in selecting the sample are public companies with financial statements and those available on S&P Capital IQ that have complete data for all variables. An explanation of the selected sample will be described in table 1. The following.

Table 1 Sample Selection Results

Sample Selection Criteria	Quantity
Marine transportation companies in the energy sub-sector in ASEAN listed on the stock exchange 2020–2024	56
Reduced: incomplete financial data (delisting/pre-IPO)	(12)
Reduced: suspension of trading due to negative equity	(1)
Number of final sample companies	43
Research period (years)	× 5
Number of observations (firm-year)	215

Source: Reprocessed Data

The initial population of this study consists of 56 marine transportation companies in the energy sub-sector in the ASEAN region that are listed on the stock exchange during the period 2020–2024. Based on this number, the five-year observation period resulted in 280 initial year-long observations of the company. After the data cleansing process, as many as 13 companies were excluded from the sample, with details of 12 companies that did not have complete financial data for the entire research period (due to*delisting* or had not yet *initial public* *offering*) and 1 company that experienced trading suspension due to prolonged negative equity. Thus, the final sample used in this study was 43 companies with a total of 215 company-year observations.

After testing the completeness of the data on all research variables, the number of observations used in the regression analysis became 172 observations. The reduction from 215 to 172 observations was due to the calculation of *the Growth* variable that required previous year's data (*lag*), so that the first year in the observation period (FY2020) could not be used in regression. This is a common methodological consequence in studies that use *year-over-year change* variables.

Descriptive Statistics

Descriptive statistics were used to photograph the general characteristics of the research data, by examining the average values, highest and lowest values, and standard deviations of each variable.

To provide a further overview of the external variables used in the study, an analysis of energy price movements during the 2020–2024 period was conducted. In this study, energy prices are represented by two main commodities, namely coal and oil, which have an important role in sea transportation activities in the energy subsector.

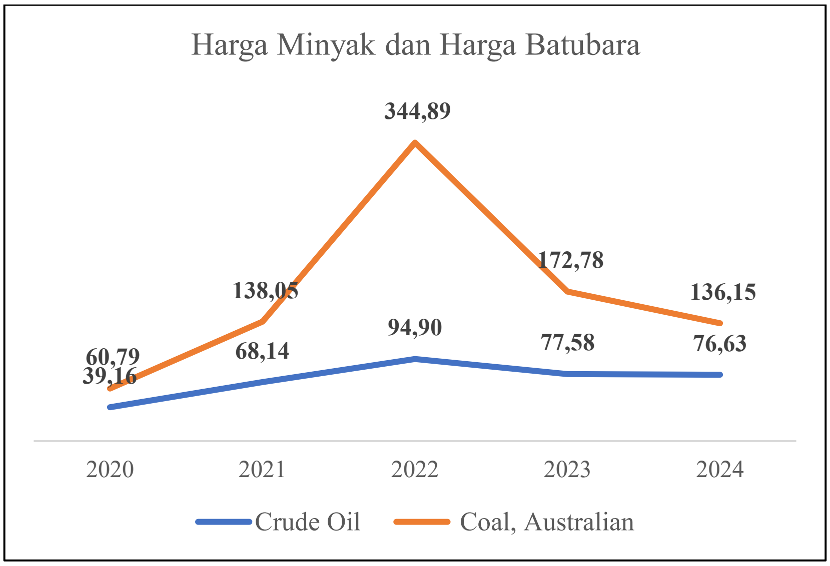

Figure 1 Oil and Coal Price Chart for the 2020-2024 Period

The chart shows that coal prices and oil prices have a tendency to move relatively in the same direction in certain periods, especially during economic shocks and recovery. Table 2 describes the descriptive statistics of each of the research variables.

Table 2 Research Variable Statistics

Variabel	N	Mean	SD	Min	Max
OROA	215	0.0696	0.106	-0.249	0.437
CR	215	3.69	6.28	0.186	35.7
THE	215	1.05	1.59	0.013	7.87
THIS	215	0.707	0.825	0.023	4.78

SIZE	215	11.5	1.54	8.17	16.4
Growth	172	0.224	0.841	-0.730	5.29
Energy	215	189	66.2	91.7	300
FreightRate	215	999.78	279.36	644.22	1390.51

Description:
OROA *: Operating return on assets.* CR *: Current ratio.* DER *: Debt to Equity Ratio.* TATO *: Total assets turnover.* SIZE *: Total assets.* Growth *: (Revenue_t − Revenue_t-1) / Revenue_t-1. Energy:* Average energy prices in t. FreightRate: Annual average of the Baltic Dirty Tanker Index (BDTI) in t.

Source: Reprocessed Data

Based on the results of descriptive statistics, most of the research variables had a number of observations of 215, namely OROA, CR, DER, TATO, SIZE, and energy, while the Growth variable had 172 observations. This difference in the number of observations is due to the calculation of the Growth variable that requires the previous year's data, so that the first year in the observation period (FY2020) cannot be calculated. After winsorization at the level of 1 % and 99 %, the range of values of the continuous variables becomes more controlled, so that the results of the regression estimation are not distorted by extreme values.

The OROA dependent variable has an average value of 0.070 with a standard deviation of 0.106. The minimum value was recorded at −0.249 and the maximum value was 0.437. These results show that the average marine transportation company in the energy sub-sector in ASEAN is able to generate an operating profit of around 7% of total assets during the study period, with a fairly diverse range between companies and between periods. Some companies recorded significant operational losses, as indicated by the negative minimum value.

In the liquidity variable, CR has an average value of 3.69 with a standard deviation of 6.28. The minimum value is 0.186 and the maximum value is 35.67. An average CR above 1 indicates that in general the companies in the sample have current assets that are greater than current liabilities, so they are relatively able to meet short-term liabilities (Jantadej & Kotcharin, 2025). The wide range indicates a variation in liquidity management strategies between companies, with some companies retaining cash and cash equivalents in relatively large amounts.

The DER variable showed an average value of 1.05 with a standard deviation of 1.59. The minimum value was recorded at 0.013 and the maximum value was 7.87. The average DER of around 1 indicates that on average marine transport companies in the energy sub-sector in ASEAN have a relatively balanced proportion of debt and equity in their funding structure. This is in line with the characteristics of the shipping industry which is capital-intensive and generally relies on combination debt and equity financing for the procurement and operation of fleets.

The TATO variable has an average value of 0.707 with a standard deviation of 0.825. The minimum value was recorded at 0.023 and the maximum value was 4.78. An average TATO of about 0.7 indicates that the companies in the sample generated revenues equivalent to approximately 70% of their total assets in a one-year period, which is a normal range for a capital-intensive industry such as shipping. The variation in the value of TATO indicates that there is a difference in the level of efficiency of asset utilization between companies in generating revenue.

The SIZE variable measured in the form of a natural logarithm of total assets has an average value of 11.51 with a standard deviation of 1.54. The minimum score was recorded at 8.17 and the maximum score was 16.48. Compared to other variables, SIZE shows a relatively symmetrical distribution and is more concentrated around the mean, as is commonly found when using logarithmic transformations. This shows that the size of the companies in the sample is quite varied but within a controlled range.

The Growth variable has an average value of 0.224 with a standard deviation of 0.841. The minimum value was recorded at −0.730 and the maximum value was 5.29. The average growth of around 22% indicates that in general the companies in the sample experienced positive revenue growth during the observation period, in line with the recovery in demand for marine transportation services in the post-pandemic energy sub-sector. The considerable variation between companies shows that the pace of growth is uneven, with some companies experiencing a fairly sharp decline in revenue and others experiencing very high growth.

The external energy variable has an average value of 189 with a standard deviation of 66.2. The minimum value was recorded at 91.7 in the initial observation period and the maximum value was 300 reflecting the peak of global energy prices during the study period. The relatively concentrated distribution reflects that the annual variation in external factors is more due to global energy price movements over the period 2020–2024 than to differences between companies, as energy values are applied uniformly across companies for each observation year.

The external variable freight rate measured using the Baltic Dirty Tanker Index (BDTI) has an average value of 999.78 with a standard deviation of 279.36. The minimum score was recorded at 644.22 and the maximum score was 1,390.51. Sea freight tariff movements during the observation period showed a significant spike in 2022, reflecting the impact of global supply chain disruptions and changes in energy trade patterns due to geopolitical tensions. As with the energy variable, the freight rate value is applied uniformly to all companies for each observation year, so that the variation comes from the dynamics of the global sea freight market between years, not from differences between companies.

The results of descriptive statistical research show that the research data has a fairly high heterogeneity, especially in financial ratio-based variables such as OROA, CR, DER, TATO, and GROWTH. However, for the SIZE and energy variables, the distribution pattern is relatively more stable. These findings provide an initial idea that the characteristics of the companies in the research sample are quite diverse, so further analysis using panel data regression is relevant to test the relationships between variables more systematically.

To provide a more comprehensive picture of the characteristics and distribution of the data, the following is presented a descriptive statistical visualization that includes the distribution of variables before and after winsorization, the distribution of each variable, the correlation matrix between variables, and the company's performance patterns during the observation period.

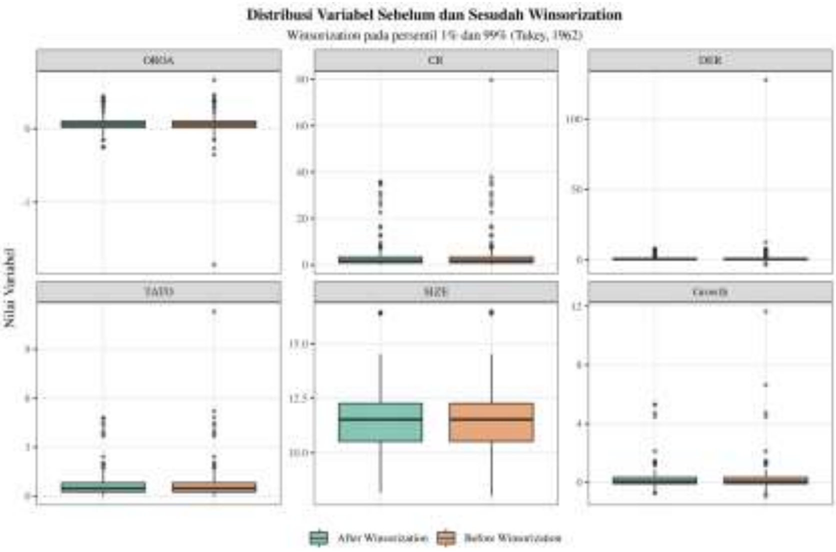

Figure 2 Variable Distribution Before and After Winsorization

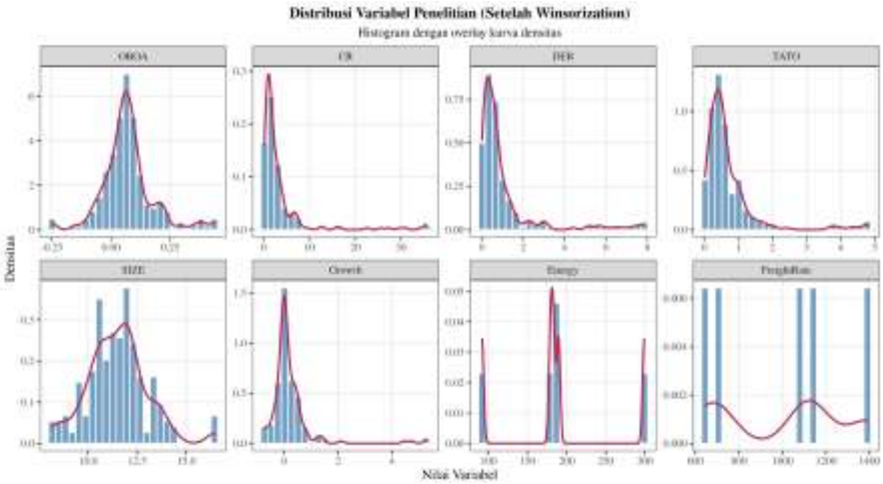

Figure 3 Distribution of Research Variables (Histogram and Density)

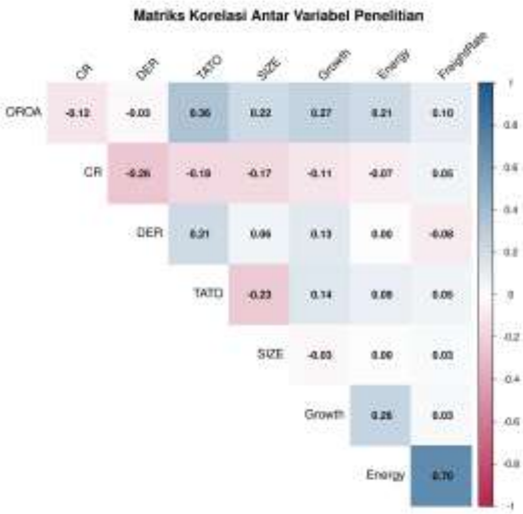

Figure 4 Correlation Matrix Between Research Variables

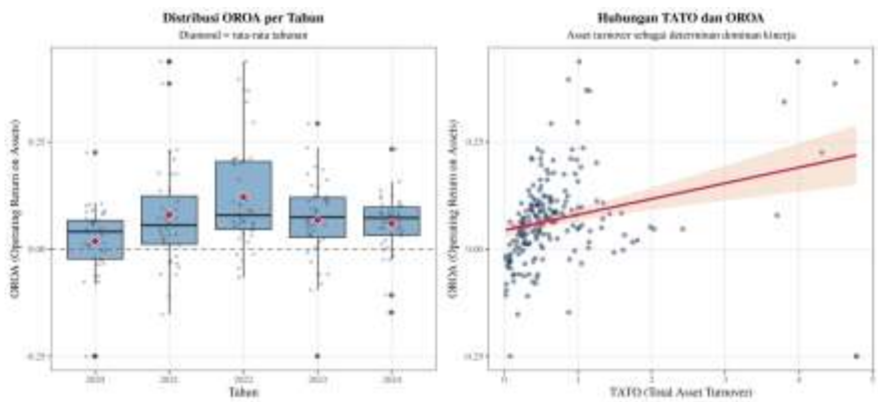

Figure 5 Distribution of OROA per Year and the Relationship of TATO to OROA

Test Panel Data

Before estimating the regression of the panel data, this study first conducted a model selection test. This test is necessary because the analysis of panel data can be estimated using three approaches, namely the pooled model, the fixed effects model, and the random effects model. To determine the most suitable model, three tests were used, namely the Chow test, the Hausman test, and the Lagrange Multiplier test. These three tests are the basis for determining the final model used in this study.

1. Chow Test

The Chow test aims to determine a regression model between Pooled Least Square (PLS) and Fixed Effect (FE) based on the alpha value obtained. The following are the results of the Chow Test related to this study.

Table 3 Chow Test Results

Testing	Statistic	P_value	Interpretasi
F-test Poolability (Pooled vs FE)	5,0824	1.09E-12	*Fixed Effects*

Source: Output results using R, reprocessed

The test yielded an F-test for Poolability value of 5.0824 with a probability of 1.09×10^{-12}. Since the probability number is well below 5%, the null hypothesis is not tenable. These findings provide strong support that the fixed effects approach is more appropriate than the pooled model, as well as indicating the existence of heterogeneity between firms that need to be accommodated in the estimation, so that *the fixed effects* model is a more appropriate choice at this stage.

2. Hausman Test

The Hausman test was carried out to determine a model that is more suitable between fixed effects and random effects. This test aims to assess whether there is a significant difference between the two models. If there is no significant difference, then the random effects model can be chosen as a more suitable model to use. The following are the results of the Hausman Test related to this study.

Table 4 Hausman Test Results

Testing	Statistic	P_value	Interpretasi
Hausman Test (FE vs RE)	48,1668	3.30E-08	Fixed Effects

Source: Output results using R, reprocessed

As presented in Table 4.4, this test gives a chi-square value of 48.1668 with a probability of 3.30×10^{-8}. A much lower probability of 5% causes the null hypothesis to be rejected, which indicates that strong support for *the fixed effects* model is more appropriate than *for the random effects* model. Based on this, the *fixed effects* model was chosen as the model used in this study.

3. Uji Breusch and Pagan Lagrange Multiplier Test

The Lagrange Multiplier test is carried out to assess whether the random effects model is more appropriate than the pooled model. This test is used to see if there are any differences between entities that need to be accounted for in the model. If the difference is proven to be significant, then the random effects model is considered more appropriate than the pooled model. The following are the results of the Breusch and Pagan Lagrange Multiplier Test related to this study.

Table 5 Hasil Uji Breusch and Pagan Lagrange Multiplier Test

Testing	Statistic	P_value	Interpretasi
Lagrange multiplier	26,0019	3.41E-07	Random Effects

Source: Output results using R, reprocessed

This test gives a Lagrange Multiplier value of 26.0019 with a probability of 3.41×10^{-7}. Since the probability is less than 5%, the null hypothesis is again rejected, so that the existence of an interentity effect in the model is confirmed. Thus, the three tests—Chow, Hausman, and Lagrange Multiplier—consistently led to the selection of *the fixed effects* model as the regression model used in this study.

Model Assumption Test

Model assumption testing was performed to assess whether the independent variables used in the study met the basic conditions that supported the feasibility of the regression model (Gujarati D.C., 2014). In this study, the testing of model assumptions is focused on the relationship between independent variables through correlation analysis and multicollinearity testing using Variance Inflation Factor (VIF). The two tests are to ensure that the variables used in the model do not have too strong a relationship with each other, so that the estimated results can be better interpreted.

1. Multicollinearity Test

The multicollinearity test is aimed at checking the presence or absence of a close relationship between independent variables in the model. An indication of this problem is characterized by a VIF value that exceeds 10 or a tolerance (1/VIF) that is below 0.01. The test results are presented as follows.

Table 6 Multicollinearity Test Results

Variable	LIVE	1/LIVE
CR	1,1636	0,8594
THE	1,1264	0,8878
THIS	1,1766	0,8499
SIZE	1,1249	0,8889
GROWTH	1,1492	0,8702
energy	2,2314	0,4481
freight_rate	2,1037	0,4754

Source: Output results using R, reprocessed

Based on Table 6 above, it can be seen that there is no problem of multicollinearity in the research model. This can be seen from the VIF value of all independent variables which is in the range of 1.12 to 2.23, far below the tolerance limit of 10. The slightly higher VIF value of energy and freight rate variables than internal variables reflects the relationship between global energy prices and sea freight rates, both of which are influenced by global commodity market dynamics; However, this value is still far below the multicollinearity threshold, so the estimated coefficient in the regression model remains undistorted.

1. Heteroscedasticity Test

The heteroscedasticity test was intended to check whether the variety of errors in the regression model remained constant across observations. A variety of non-uniform errors have the potential to reduce the accuracy of estimates, so this test is important to ensure that the basic assumptions of regression are met. The results are described below.

Table 7 Heteroscedasticity Test Results

LM Statistical Value	p-value LM	Statistical Value F	p-value F	Interpretasi
44,1682	1,983E-07	-	-	There is heteroscedasticity; dikoreksi via cluster-robust SE

Source: Output results using R, reprocessed

In this study, the heteroscedasticity test was carried out using the Breusch-Pagan test. Based on the test results, a BP value of 44.1682 with a p-value of 1.983×10^{-7} was obtained. The probability value is well below the significance level of 5%, so the hypothesis of zero homocedasticity is rejected. These results indicate that the residual variance of the model is not constant between observations. As a correction for the violation of this assumption, the regression coefficient estimation in this study uses *cluster-robust standard errors* at the company level following (Petersen, 2009), so that the inference on the significance of the coefficient remains valid.

2. Autocorrelation Test

Autocorrelation testing was undertaken to trace the relationship of errors between different observations in the regression model. The existence of autocorrelation can reduce the accuracy of estimates and statistical testing, so this step is necessary to ensure that the assumption of error independence is fulfilled. The test results are as follows.

Table 8 Autocorrelation Test Results

Wooldridge (chi-sq)	Interpretasi
29,1960	There is autocorrelation; dikoreksi via cluster-robust SE

Source: Output results using R, reprocessed

In this study, the autocorrelation test was performed using the Wooldridge test for panel data, which is more accurate than the Durbin-Watson for models with panel structure. Based on the test results, a chi-square value of 29.1960 with a p-value of 7.13×10^{-6} was obtained. The probability value is below the significance level of 5%, so the null hypothesis of the absence of serial correlation is rejected. These results indicate an autocorrelation in the residual model. As a correction, the regression coefficient estimation uses *cluster-robust standard errors* at the company level that simultaneously corrects heteroscedasticity and *serial within-firm* correlation (Petersen, 2009), so that the inference on the significance of the coefficient remains valid.

3. Coefficient Significance Test (t-statistical)

The coefficient significance test is used to assess the partial influence of each independent variable on the dependent variable. The test in this study used a significance level of 5%, so a variable is considered to have a significant effect if the probability is less than 0.05. The results are presented below.

Table 9 Coefficient Significance Test Results (t-statistic)

Variabel	Coeficin	Robust SE	T-Statistics	p-value	Say.
CR	0,0017	0,0018	0,9562	0,3409	
THE	0,0286	0,0260	1,0998	0,2736	
THIS	0,1454	0,0297	4,8938	0,0000	***
SIZE	0,0640	0,0824	0,7770	0,4387	
Growth	0,0074	0,0111	0,6666	0,5063	
energy	0,0003	0,0003	1,1259	0,2624	
freight_rate	-0,00002	0,00004	-0,5374	0,5919	

*Remarks: Estimation of the Fixed Effects model with cluster-robust standard errors at the company level (Petersen, 2009). p<0.01; ** p<0.05; * p<0.10. Source: Output result R, reprocessed.*

Based on the results of the fixed effects model estimation with cluster-robust standard errors, the TATO variable showed a significant positive influence on OROA at the level of 1%, with a coefficient of 0.1454 and a very small probability value (p<0.001). In contrast, the two external variables—global energy prices (coefficient of 0.0003; p-value 0.262) and sea freight rates (coefficient −0.00002; p-value of 0.592)—did not show a significant individual effect on OROA. These results show that among all internal and external variables tested, only TATO consistently and strongly influences a company's financial performance, while external factors in the form of global price signals have not been shown to have a direct effect in the context of within-firm variation.

The variables CR (coefficient 0.0014; p-value 0.391), DER (coefficient 0.0305; p-value 0.282), SIZE (coefficient 0.0569; p-value 0.443), and Growth (coefficient 0.0086; p-value 0.403) did not show a significant effect on OROA at the 5% level. Constants (intercepts) are not displayed on fixed effects models, which is a common characteristic of such models because differences between entities have been accommodated in each entity's intercept. These results show that in a fixed effects model using *within-firm* variations, the variation of all four variables within the same firm over a five-year period was not large enough to produce a statistically significant influence.

4. Model Significance Test (F-Statistic)

The model significance test is aimed at assessing the influence of independent variables simultaneously on dependent variables. This step is useful to find out the extent to which the regression model is able to explain the variation of dependent variables thoroughly. The test results are presented below.

Table 10 Model Significance Test Results (F-statistic)

Model	F-statistic	p-value	Interpretasi
Pooled	-	-	Significant models
Fixed Effects	16,3734	4,53E-15	Significant models
Random Effects	26,65475	1.11022E-16	Significant models

Source: Output results using R, reprocessed

In this study, the model significance test was carried out using F-statistics on the selected model, namely fixed effects. A model is declared significant if the F-statistical probability value is less than the significance level of 5 percent.

Based on the test results, the fixed effects model showed a statistical F-value of 16.3734 with a p-value of 4.53×10^{-15}. The probability value is well below the significance level of 5 percent, so the null hypothesis is rejected.

Thus, it can be concluded that the variables CR, DER, GROWTH, SIZE, TATTOO, and energy simultaneously had a significant effect on OROA in the fixed effects model used in this study.

5. Model Determination Coefficient (R^2)

The coefficient of determination (R^2) is used to measure the model's ability to explain variations in dependent variables. The value of R^2 indicates the proportion of variations of dependent variables that can be explained by independent variables in the model. The greater the R^2 value, the greater the model's ability to explain changes in dependent variables. The following is the Model Determination Coefficient (R^2) related to this study.

Table 11 Model Determination Coefficient (R^2)

Model	R-squared
Pooled	-
Fixed Effects	0,4844
Random Effects	0,463656959

Source: Output results using R, reprocessed

In this study, the determination coefficient was reported for the selected fixed effects model. Based on the estimated results, the fixed effects model has an R^2 (within) value of 0.4844 and an Adjusted R^2 of 0.2773.

These results show that independent variable variation in the fixed effects model is able to explain about 48.44 percent of OROA's within-firm variation. The lower Adjusted R^2 value (27.73 percent) reflects a penalty for a relatively large number of parameters to the number of observations in the fixed effects model, which is a common characteristic of panel models with many entities and a limited observation period.

The selection of the fixed effects model as the main model is not based solely on the R^2 value, but on the results of a series of panel data model selection tests (Chow, Hausman, and Lagrange Multiplier tests) that consistently support the use of fixed effects, as well as the coefficient significance test and model assumptions described earlier.

After a series of model tests, including a panel data model selection test, a model assumption test, and significance testing, this study then presents the results of regression estimation as a basis for analyzing the influence of internal and external factors on the company's financial performance. Based on the results of previous tests, *the fixed effects model* was chosen as the main model because the results of the Chow test, Hausman test, and Lagrange Multiplier test consistently support the selection of this model, which reflects the heterogeneity between firms that needs to be accommodated in the estimation. The standard errors estimator uses *cluster-robust* at the enterprise level to correct heteroscedasticity and *within-firm serial correlation* according to Petersen's (2009) approach.

The estimated results show that simultaneously, internal factors consisting of CR, DER, TATO, SIZE, and Growth, as well as external factors represented by global energy prices and sea freight rates, have a significant effect on OROA. This is indicated by the F-statistical value of 16.3734 with a p-value of 4.53×10^{-15}, well below the significance level of 5%. An Adjusted R^2 of 0.2773 indicates that the independent variable is able to explain about 28% *of the within-firm variation* in OROA after accounting for the number of parameters in the model. Thus, the combination of internal and external factors has a statistically significant ability to explain the variation in the financial performance of marine transportation companies in the energy sub-sector in the ASEAN region.

However, the results of the test partially show that not all internal and external factors have a significant influence individually. In terms of internal factors, only the TATO variable was proven to have a significant influence on OROA at the level of 1%, with a coefficient of 0.1454. These findings indicate that every increase in one TATO unit is associated with an increase in OROA by 14.54 percentage points, *ceteris paribus*. These results are in line with operational theory and corporate financial literature which places *asset turnover* as the main indicator of asset utilization efficiency (Penman, 2013; Ross et al., 2021). For capital-intensive industries such as shipping, *asset turnover* reflects the utilization rate of the fleet—a combination of cargo occupancy rate, duration of trips, and *turnaround time* at ports (Stopford, 2009). Companies that are able to maximize fleet utilization will generate greater revenue from the same asset base, resulting in higher financial performance. This result received H3 which stated that TATO had a significant positive effect on financial performance.

On the other hand, the other internal variables, namely CR, DER, SIZE, and Growth, did not show a significant influence on the company's financial performance at the level of 5%. These results are interpreted in the context of a *fixed effects* model that uses only *within-firm* variations. For CR (coefficient 0.0014; p-value 0.391) and DER (coefficient 0.0305; p-value 0.282), variations in liquidity ratios and capital structure within a single company over the five years of observation tend to be limited because capital structure decisions in the shipping industry are generally long-term and tied to the characteristics of long-term assets such as the fleet of ships (Drobetz et al., 2013). Thus, H1 and H2 are rejected. For SIZE (coefficient 0.0569; p-value 0.443), firm size measured as a natural logarithm of total assets tends to be relatively stable over a five-year period, so the *available within-firm* variation is not large enough to detect its effect, causing H4 to be rejected. For Growth (coefficient 0.0086; p-value 0.403), the high variability of revenue growth between years in the shipping industry that is sensitive to global market cycles makes the coefficient statistically difficult to detect, causing H5 to be rejected. These findings are in line with the literature showing that the structural factors of shipping companies are more influenced by *inter-firm variation* than changes within one company over time (Xiao et al., 2024).

In terms of external factors, neither global energy prices nor freight *rates* show a significant individual influence on OROA. The energy variable has a coefficient of 0.0003 with a p-value of 0.262, while the freight rate has a coefficient of −0.00002 with a p-value of 0.592. Thus, H6 and H7 were rejected. These findings need to be interpreted in the context of *fixed effects* specification that only utilizes *within-firm* variations. Because energy price values and ocean freight rates are uniform across companies for each year, most of the effect is absorbed by the same year-to-year variation for all companies, making it difficult to detect the partial effect on *within-firm* performance differences. In addition, the two external variables have a fairly high correlation ($r = 0.70$) because they are both influenced by global commodity market shocks in the 2022 period, which also weakens the partial significance of each variable. Theoretically, the direction and strength of the influence of global price signals on the profitability of shipping companies are also indirect and mediated by the characteristics of charter contracts, fleet composition, and the company's *hedging* capabilities (Kavussanos & Visvikis, 2006; Stopford, 2009) In other words, shipping companies in the energy sub-sector appear to absorb external price fluctuations through contractual and operational mechanisms, rather than passing them directly into *within-firm operating returns*. Overall, the combination of internal and external factors simultaneously still had a significant effect on financial performance (H8 was received with an F-statistic of 16.3734 and a p-value of 4.53×10^{-15}), but only partially TATO was the dominant driver of the financial performance of marine transportation companies in the energy sub-sector in the ASEAN region.

Overall, the results of this study show that although internal and external factors simultaneously affect financial performance, only partially internal factors related to asset efficiency are proven to have a significant influence. Thus, the company's ability to manage and utilize assets optimally is the most dominant factor in determining the company's financial performance in this study.

CONCLUSION

Based on the results of the study examining the influence of internal and external factors on the financial performance of energy-subsector maritime transportation companies in the ASEAN region during the 2020–2024 period, it was concluded that, partially, only Total Asset Turnover (TATO) had a positive and significant effect on Operating Return on Assets (OROA). This finding indicated that asset utilization efficiency was the primary factor determining companies' financial performance. Meanwhile, the Current Ratio (CR), Debt-to-Equity Ratio (DER), firm size (SIZE), firm growth (Growth), global energy prices, and sea freight rates did not show significant effects on financial performance. However, simultaneously, all internal and external variables examined had a significant effect on companies' financial performance.

The findings demonstrated that optimizing the utilization of operational assets was a key factor in improving the profitability of energy-subsector maritime transportation companies. Meanwhile, the effects of external factors, such as global energy prices and sea freight rates, tended not to be directly reflected in companies' operational performance, as they were influenced by various contractual arrangements and managerial policies. Based on these findings, future research should extend the observation period, incorporate additional external variables and financial performance indicators, and apply analytical approaches capable of capturing variations among companies. From a practical perspective, company management should prioritize improving asset utilization efficiency, maintaining sound capital and liquidity structures, and continuously monitoring external risks through appropriate mitigation strategies. This study was limited by its relatively short observation period, restricted external variables, the characteristics of the fixed-effects model that emphasized within-firm variations, the absence of consideration for differences among ASEAN countries, and the limited number of observations due to data availability.

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