A COMPARATIVE STUDY OF MACD AND RSI INDICATORS IN IDENTIFYING ENERGY SECTOR STOCK TRENDS (EMPIRICAL STUDY ON PT ADARO ENERGY TBK 2022–2024)

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ABSTRACT

This study aims to compare the effectiveness of the technical indicators Moving Average Convergence Divergence (MACD) and Relative Strength Index (RSI) in identifying stock price trends of PT Adaro Energy Tbk during the 2022–2024 period. The research employed a quantitative approach using secondary data in the form of daily closing prices, with statistical testing conducted through the Wilcoxon Signed-Rank Test. The findings reveal that MACD performs better, producing 16 out of 18 signals (88.89%) that are statistically significant, with 14 signals (77.78%) aligned with price movements. In contrast, RSI generated only 7 significant signals (38.89%) and 11 signals (61.11%) consistent with price trends. Consequently, the null hypothesis is rejected, and the alternative hypothesis is accepted. The study concludes that MACD is more effective than RSI in identifying trends, recommending MACD as the primary indicator, while RSI can serve as a complementary tool in technical analysis of the energy

Keywords : *Technical Anaysis, MACD, RSI, Stock Price Tren, Wilcoxon-Signed*

INTRODUCTION

Capital markets play a crucial role in driving economic growth by connecting those with funds with those in need. This mechanism allows for more efficient resource allocation and supports sustainable economic development (Rosalena Belo Ratte, 2025). The stock market is increasingly popular as an investment instrument due to its potential for long-term returns, although it still carries the risk of price fluctuations that can lead to losses (Bodie et al., 2021) and (Patriya, 2020).

The energy sector, particularly coal, is highly sensitive to global dynamics, commodity price changes, and energy transition policies (Coal, 2025). PT Adaro Energy Tbk (ADRO), Indonesia's largest coal company with a market capitalization of IDR 156 trillion in 2023 (Tbk, 2023), is a relevant study. ADRO's stock volatility is quite high, with a beta value of 1.8, reflecting its sensitivity to fluctuations in global coal prices, geopolitical dynamics, and energy regulations (Hartono & Wijaya, 2022).

The 2022–2024 period exhibited complex market dynamics, ranging from surging coal prices due to the global energy crisis, declining international demand, and government decarbonization policies (ESDM, 2023). These conditions gave rise to recurring bullish and bearish trend patterns, making ADRO shares attractive for technical analysis. Technical analysis focuses on historical price and trading volume data to identify trends, with popular indicators such as the Moving Average Convergence Divergence (MACD) and the Relative Strength Index (RSI) widely used to detect momentum and overbought and oversold conditions (Eldridge, 2019)

Several previous studies have demonstrated the effectiveness of technical indicators in various sectors. For example, Kurniawan & Ramadhani, (2024) found that MACD and Stochastic RSI were effective in detecting trends in the mining sector, while Rosyidah & Hafi, (2021) demonstrated that MACD, RSI, and the Stochastic Oscillator were able to predict optimal returns on sharia-compliant stocks during the pandemic. However, studies directly comparing the effectiveness of MACD and RSI on energy sector stocks, particularly ADRO, are limited.

Therefore, this study aims to compare the effectiveness of MACD and RSI indicators in identifying price trends in energy sector stocks at PT Adaro Energy Tbk for the period 2022–2024. The results are expected to provide practical contributions to investors in selecting appropriate technical analysis strategies, while also enriching the academic literature on the effectiveness of technical indicators in the Indonesian capital market.

METHOD

This study uses a quantitative approach with a comparative method to analyze the effectiveness of the Moving Average Convergence Divergence (MACD) and Relative Strength Index (RSI) technical indicators in identifying the stock price trend of PT Adaro Energy Tbk for the 2022–2024 period. The data used is secondary data, namely the daily closing stock price obtained from the official website of the Indonesia Stock Exchange (IDX). PT Adaro Energy Tbk was selected as the research object based on the characteristics of energy sector stocks, which tend to be volatile and sensitive to changes in commodity prices.

The technical indicator calculations were performed using Microsoft Excel. For the MACD indicator, the calculation is based on the difference between the short-term Exponential Moving Average (EMA) and the long-term EMA, using the formula:

$$MACD = EMA12 - EMA26$$

A buy signal occurs when the MACD line crosses the signal line (the 9-day EMA of the MACD) from bottom to top, while a sell signal occurs when the MACD line crosses the signal line from top to bottom (Murphy, 1999). Meanwhile, the RSI indicator is calculated using the following formula:

$$RSI = 100 - (100/1+RS)$$

where:

$$RS = \frac{\text{Average Increase}}{\text{Average Decrease}}$$

The RSI is used to measure market saturation levels, with a buy signal appearing if the RSI value is <30 (oversold), and a sell signal appearing if the RSI value is >70 (overbought) (Wilder, 1978).

The data collection technique involved three stages: (1) downloading historical data on PT Adaro Energy Tbk's closing stock prices, (2) calculating the MACD and RSI values based on the formula above, and (3) recording the buy and sell signals generated by both indicators. Next, the accuracy of each indicator's signals was analyzed based on their correspondence with the direction of stock price movements within 10 days of the signal's appearance.

To compare the effectiveness of the MACD and RSI, the Wilcoxon Signed-Rank Test was used with a 5% significance level. This test was chosen because the data being tested were paired and did not assume a normal distribution. The research instruments used were Microsoft Excel for technical indicator calculations and SPSS for statistical analysis. The entire research process is carried out by upholding scientific principles, using valid data, and ensuring the validity of the analysis results.

Background of the Research Object

PT Adaro Energy Indonesia Tbk (ADRO) is one of the largest energy companies in Indonesia, focusing on coal mining and integrated energy. Founded in 2004 and listed on the Indonesia Stock Exchange since 2008, Adaro is known as a producer of environmentally friendly thermal coal with low ash and sulfur content through its subsidiary, PT Adaro Indonesia, in South Kalimantan. Furthermore, the company has diversified its business into power generation and renewable energy as a commitment to a sustainable energy transition.

As an energy sector issuer with a large market capitalization and high liquidity, ADRO stock is a top choice for investors. Its stock price movements are heavily influenced by global coal prices, energy demand, and environmental regulations. These dynamics make ADRO relevant for analysis using technical indicators, specifically the Moving Average Convergence Divergence (MACD) and the Relative Strength Index (RSI), to evaluate their ability to identify stock trends.

Stock price data for the 2022–2024 period was processed using Microsoft Excel to generate price, MACD, and RSI charts. The price chart shows the dynamics of stock movements, while the MACD chart is calculated from the difference between the 12-EMA and the 26-EMA, and the RSI chart is calculated based on a standard 14-day period to identify overbought and oversold conditions.

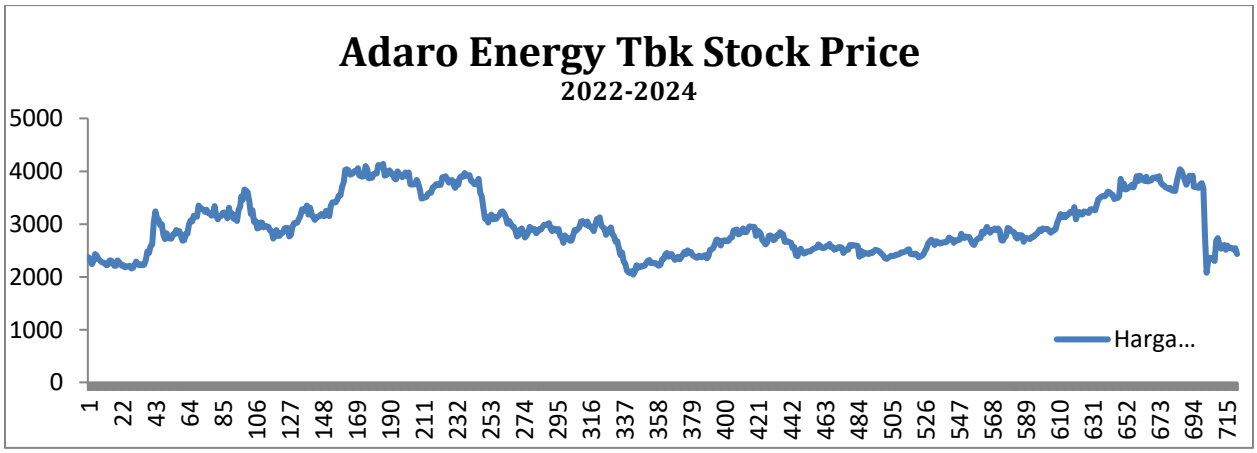


Figure 1. Stock Price Graph

RESULTS AND DISCUSSIONS

Presentation of Data Test Results

This section presents the results of processing the MACD and RSI technical indicators before and after the buy/sell signals. Statistical analysis uses the Wilcoxon Signed Ranks Test, which is appropriate for paired data with non-normal distributions.

Wilcoxon Test Results for MACD vs. Price

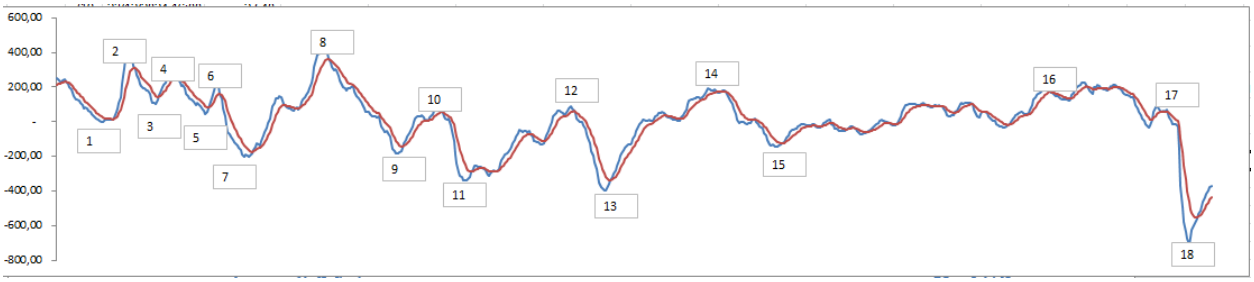


Figure 2. MACD Indicator Graph

The image above displays the movement of the MACD line and signal line for PT Adaro Energy Tbk shares during the study period. The chart identified 18 technical signals, including uptrends, downtrends, and sideways trends, which were then tested using the Wilcoxon Signed Ranks Test.

Table 1. MCD Test Results and Prices

Signal	Trend Signal	MACD		Price		Price Response
		Z-Value	Asymp. Sig. (2-tailed)	Z-Value	Asymp. Sig. (2-tailed)	
1	Up	-2.803a	0.005	-1.958a	0.050	in line
2	Down	-2.395b	0.017	-1.784b	0.074	in line
3	Up	-2.803a	0.005	-2.090a	0.037	in line

4	Down	-2.090b	0.037	-2.192b	0.028	in line
5	Up	-2.803a	0.005	-1.175a	0.240	opposite
6	Sideways	-.561a	0.575	-.968a	0.333	in line
7	Up	-2.803a	0.005	-2.803a	0.005	in line
8	Down	-2.803b	0.005	-2.599a	0.009	in line
9	Up	-2.395a	0.017	-1.682b	0.093	opposite
10	Sideways	-1.328b	0.184	-.765a	0.444	in line
11	Up	-2.803a	0.005	-2.402b	0.016	in line
12	Down	-2.346a	0.019	-2.395a	0.017	in line
13	Up	-2.599a	0.009	-2.599a	0.009	in line
14	Down	-2.701b	0.007	-2.807b	0.005	in line
15	Up	-2.701a	0.007	-2.499a	0.012	in line
16	Down	-2.803b	0.005	-2.505b	0.012	in line
17	Down	-2.090a	0.037	-.204b	0.838	opposite
18	Up	-2.803a	0.005	-2.293a	0.022	in line

The test results (Table 1) show that almost all MACD Z-values are significant ($p < 0.05$), except for signals 6 and 10. The stock price response is also significant for most signals, except for signals 2, 5, 6, 9, 10, and 17. Of the 18 signals, 14 indicate a direction consistent with the price movement, while 4 signals move in the opposite direction.

These findings indicate that the MACD indicator is quite effective in identifying trend reversal points in ADRO stock. Although some signals are not followed by a significant price response, overall, the MACD is able to provide signals consistent with the direction of price movement.

Wilcoxon Test Results for RSI vs. Price

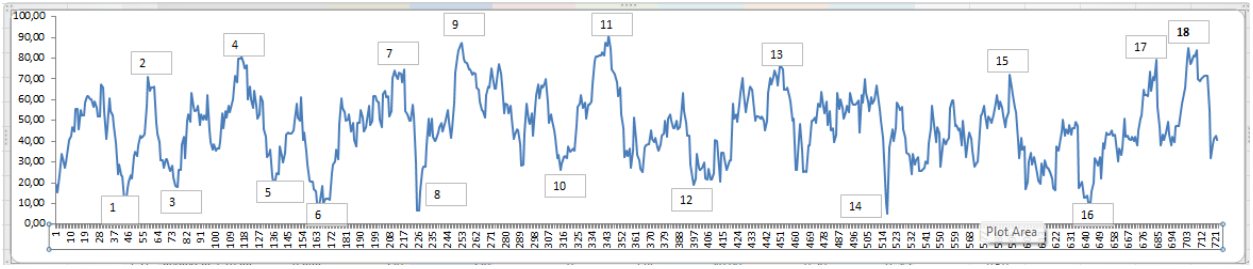


Figure 3. RSI Indicator Chart

The following figure shows the movement of the RSI indicator for PT Adaro Energy Tbk shares during the research period. Eighteen extreme points that crossed the overbought (70) and oversold (30) limits were identified as the basis for testing the RSI's effectiveness.

Table 2. RSI vs. Price Test Table

Signal	Trend Signal	RSI		Price		Price Response
		Z-Value	Asymp. Sig. (2-tailed)	Z-Value	Asymp. Sig. (2-tailed)	
1	Sideways	-.663a	0.508	-1.784b	0.074	in line
2	Sideways	-1.021b	0.307	-1.989b	0.047	opposite
3	Up	-2.314b	0.021	-.770a	0.441	opposite
4	Down	-2.073b	0.038	-2.805a	0.005	in line
5	Sideways	-1.581a	0.114	-2.191a	0.028	opposite
6	Up	-2.143a	0.032	-2.599a	0.009	in line
7	Sideways	-1.326a	0.185	-.969a	0.333	in line
8	Sideways	-1.541a	0.123	-1.474a	0.141	in line
9	Sideways	-1.719b	0.086	-1.989b	0.047	opposite
10	Up	-2.295a	0.022	-1.836a	0.066	opposite
11	Sideways	-.306a	0.760	-1.682a	0.093	in line
12	Up	-2.668a	0.008	-2.805b	0.005	in line
13	Sideways	-1.376a	0.169	-.510b	0.610	in line
14	Sideways	-.357a	0.721	-1.367a	0.172	in line
15	Sideways	-1.886a	0.059	-2.668b	0.008	opposite
16	Sideways	-.459a	0.646	-2.524b	0.012	opposite
17	Down	-2.654a	0.008	-2.807b	0.005	in line
18	Down	-2.497b	0.013	-2.599a	0.009	in line

The Wilcoxon test results (Table 2) show only 7 RSI signals were significant ($p < 0.05$), while the majority of signals showed no significant changes. However, the stock price responded significantly to 10 of the 18 signals.

In terms of movement direction, 11 signals were in line with the price, while 7 signals moved against it. These results indicate that the RSI tends to be less consistent than the MACD in generating significant signals, especially in sideways conditions. Therefore, the RSI is more appropriate as a confirmation indicator rather than a primary indicator in stock trend analysis.

Hypothesis Test Results

This study examines the differences in effectiveness between the Moving Average Convergence Divergence (MACD) and Relative Strength Index (RSI) indicators in identifying stock price trends for PT Adaro Energy Tbk for the 2022–2024 period. The hypotheses tested are:

H_0: There is no significant difference between the accuracy of MACD and RSI.

H_1: There is a significant difference between the accuracy of MACD and RSI.

The test uses the Wilcoxon Signed-Rank Test for two paired groups with a non-normal distribution (n=18 signals). The comparison results are presented in the following table:

Table 3. MACD vs. RSI Test Results

Metric	MACD	RSI
Total Signals	18	18
Significant Signals (p-value < 0.05)	16 (88.89%)	7 (38.89%)
Consistent Price Response (Accuracy)	14 (77.78%)	11 (61.11%)
Contrary Price Response	4 (22.22%)	7 (38.89%)

The test results show that the MACD consistently produces significant signals and aligns with price movements more consistently than the RSI. The Wilcoxon test also indicates that the MACD Z-value is generally <-2.0 with p <0.05, confirming stronger statistical significance

Thus, H_0 is rejected and H_1 is accepted: the MACD indicator is proven more effective than the RSI in identifying ADRO's stock price trend. This finding supports the view that the MACD, which combines trend and momentum, is more reliable for fluctuating energy sector stocks, while the RSI is more appropriate as a confirmation indicator in sideways market conditions.

Analysis of Test Results

This study analyzes the effectiveness of the MACD and RSI technical indicators in identifying the stock price trend of PT Adaro Energy Tbk (2022–2024).

MACD Accuracy

Of the 18 signals, 16 (88.89%) were significant (p <0.05), with 14 (77.78%) in the price direction. Only 4 signals were in the opposite direction. This shows that the MACD is consistent and effective as a leading trend indicator, particularly for energy sector stocks.

RSI Accuracy

Of the 18 RSI signals, only 7 (38.89%) were significant, although 11 (61.11%) were in line with price direction. The RSI is more sensitive to short-term fluctuations, making it less stable in sideways conditions, and is more appropriate as a confirmatory indicator than a leading indicator.

MACD vs. RSI Comparison

Overall, the MACD has proven to be more effective than the RSI. The MACD provides more significant, accurate, and stable signals across various market conditions, while the RSI is more useful as a complement to detecting overbought/sold conditions.

MACD

The MACD confirms medium-to-longer trends through the intersection of the MACD line and the signal line (Appel, 2005). In ADRO stock, the MACD is effective in validating trend changes despite its lagging nature (Jones & Kang, 2023).

RSI

The RSI (Wilder, 1978) is quicker to detect overbought/oversold conditions, but is prone to producing false signals in volatile or sideways markets. This is consistent with findings from Agustin & Fariono, (2023)

Effectiveness Comparison

• Signal accuracy: RSI is faster, MACD is more valid.
• Market conditions: RSI is suitable for high volatility, MACD is more stable in trends.
• Risk of false signals: RSI is more susceptible, MACD is stronger as confirmation.

Implications

Short-term investors can utilize the RSI for rapidly changing overbought/oversold conditions, while medium- to long-term investors are more likely to use the MACD to identify more sustainable momentum and trend direction. The combination of the two enhances the validity of the analysis (Melda, Mira, 2025). Thus, the MACD is effective as a leading trend indicator, while the RSI functions as a supporting indicator.

CONCLUSIONS

This study shows that the Moving Average Convergence Divergence (MACD) indicator is more effective than the Relative Strength Index (RSI) in identifying the stock price trend of PT Adaro Energy Tbk for the 2022–2024 period. The Wilcoxon Signed-Rank Test results demonstrate that the majority of MACD signals are statistically significant and align with price movements, while the RSI has less effectiveness, especially in market conditions without a clear trend. Therefore, the MACD can be used as a primary indicator for detecting trend changes, while the RSI is more appropriate as a complementary indicator for detecting overbought and oversold conditions.

Research Limitations

This study has several limitations. First, the analysis timeframe is limited, thus not covering a wide range of extreme market conditions. Second, the study focused only on one issuer in the energy sector, so the results cannot be generalized to other sectors. Third, only two technical indicators were used: the MACD and the RSI, despite the numerous other indicators that could provide additional perspective. Fourth, this study did not consider fundamental and external factors such as macroeconomic conditions or investor behavior, which previous research has shown to significantly influence stock price trends (Perdana et al., 2024); (Maresti et al., 2024).

Research Implications

Theoretically, this study confirms that medium- to long-term momentum-based indicators such as the MACD are superior to the RSI in detecting trends in volatile energy sector stocks. Practically, these results suggest that investors should use the MACD as the primary indicator in trend analysis, while the RSI complements signals by identifying overbought or oversold conditions, thus minimizing false signals.

Recommendations

Further research is recommended to expand the analysis period, include more stocks across sectors, and incorporate other technical indicators such as Bollinger Bands or the Stochastic Oscillator. Furthermore, the integration of fundamental and macroeconomic factors is also necessary to produce a more comprehensive and relevant analysis for investment decision-making.

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