RESEARCH ARTICLE | NOVEMBER 20 2025

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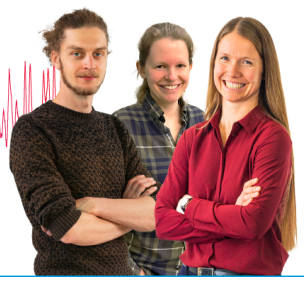
*AIP Conf. Proc.* 3446, 020020 (2025)
https://doi.org/10.1063/5.0308638





# Technical Comparison of Indonesia's Consumer Goods Companies Stock Data: Symbolic Aggregate Approximation Approach

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**Abstract.** Investment analysis can be categorized into two main approaches: Technical and fundamental. Technical analysis focuses on historical price movements and trading volume to identify trends and support levels. This study utilizes Symbolic Aggregate Approximation (SAX) to analyze stock data from two major Indonesian consumer goods companies—PT. Mayora Indah, Tbk. (MYOR) and PT. Unilever Indonesia, Tbk. (UNVR). SAX provides a novel approach to technical analysis by preserving crucial characteristics of stock data while simplifying complexity. Our findings reveal distinct patterns in stock movements: Mayora's stock exhibits stronger and more stable support and resistance levels, making it a more attractive option for long-term investment. In contrast, Unilever's stock shows weaker resistance and a slower recovery potential, suggesting limited growth prospects in the short term. These insights offer investors a structured method for comparing stocks based on trend stability and cyclical behavior. Overall, this study contributes to financial analysis by demonstrating SAX's effectiveness in identifying investment opportunities within volatile markets while minimizing data loss.



## INTRODUCION

Technology, infrastructure, productivity, and product innovation are inextricably linked to Indonesia's economic dynamics [1]. The economic sector's growth is an indicator of a country's progress, and companies' severe competitiveness drives economic growth, which might affect investment development [2], [3]. Investments encompass financial instruments such as savings, bonds, shares, mutual funds, gold, and property. Many investors choose equities due to their potential to generate substantial gains. Stocks provide superior returns compared to bonds or bank savings. Nevertheless, investing in equities carries a significant level of risk [4], [5].

This article examines explicitly consumer goods shares among the many forms of shares that are accessible. The consumer products industry has 18.36% stock market capitalization in Indonesia [6]. Consumer goods are crucial to the Indonesian economy since the populace is strongly tied to everyday requirements such household, food, clothing, and industrial products. Consumer products company shares are volatile, and in 2021, their average share price changed 7.61% [7]. Micro conditions like corporate performance and macro conditions like public consumption trends and regulatory policy changes affect these oscillations [8]. Some of these considerations make consumer goods industry companies share an alternate investing choice. This study investigates two consumer product share instances: Economic industry examples include PT. Mayora Indah, Tbk, a local company, and international consumer products company PT. Unilever Indonesia, Tbk. The two companies are employed to compare stock prices to assist investors in determining whether to invest in them, as their histories and markets are significantly distinct.

Before investing in stocks, investors must assess shares using several methodologies that might enhance dividends and capital gains [5]. In general, the correct analytical approach can track the capital market stock index and stock performance in the stock exchange market system. Technical and fundamental analysis are used to analyze investing decisions. Investors examine average prices to determine the capital market's share value strength and weakness using technical analysis. In technical analysis, investors utilize moving averages to spot trends and stock price reversals [9]. Fundamental analysis is what investors use to figure out what a business is worth. This company's growth can be seen

*The 5th International Conference on Mathematics and its Applications (ICoMathApp) 2024*
AIP Conf. Proc. 3446, 020020-1–020020-6; https://doi.org/10.1063/5.0308638
Published under an exclusive license by AIP Publishing. 978-0-7354-5298-5/$30.00

in its intrinsic value, which can change the profits from investments because investors can use this return to compare different financial choices [10]. Overall, technical analysis can help investors choose where to put their money by looking at past price changes and trading volume to find trend patterns and short-term investing support and resistance levels in the market.

Financial literature has extensively studied the evaluation of stock performance by investors. Recent studies emphasize the importance of machine learning and artificial intelligence in predicting stock movements. Ohliati and Yuniarty [11] used deep learning models to improve stock return predictions, demonstrating superior accuracy over traditional models. Du et al. [12] surveyed an in-dept review of transformative role of Natural Language Processing (NLP) in finance and explored that NLP enables data-driven decision-making and innovation in the financial sector. More recent research by Abolmakarem et al. [13] highlights machines learning approach to predict the next day's stock prices. Goodell et al [14] demonstrated that emotions influencing stock-market anomalies, behavioral biases, such as overconfidence and loss aversion, still play a crucial role in shaping investor decisions.

However, technical stock analysis is affected by big stock data volumes and swings. Investors will have trouble analyzing and calculating stock data that is recorded often and in big volumes. Moving averages can show stock movements from the past to the present, but they generate noise and latency, which is random fluctuations or volatility [15]. We use Symbolic Aggregate Approximation (SAX) to undertake technical analysis without removing stock data features. SAX reduces time series data by transforming values into symbols that describe patterns [16]. SAX analyzes time series data without losing information [17]. SAX is expected to be an alternative for investors to see trend patterns and cyclical forms of stock data in the analysis process by comparing stock data. Data reduction also simplifies calculation. Using the SAX approach should help stock analysts and investors detect stock data patterns and make better investment decisions.

# METHODS

## Technical Analysis

Technical analysis predicts price patterns by graphing market activity [18]. In addition to interpreting price chart patterns, technical analysis can be done by calculating each stock indicator using a formula. Short-term stock traders utilize technical analysis. Technical analysis examines market data, stock prices, and transaction volumes. Investors can start technical stock analysis by looking at market fluctuations, technical analysis indicators, and financial history. Market movement reflects conditions. Natural calamities, politics, and market participants' mental states can cause market movement.

Technical analysis indicators include MA, MACD, and Stochastic. MA analyzes stock price averages over time. MACD uses the long-short-term MA connection to calculate buy and sell signals [19]. Stochastic compares the last closing price to the period's lowest or highest price range.

## Symbolic Aggregate Analysis

The Symbolic Aggregate Approximation (SAX) method is a method that can reduce time series data based on time intervals [20]. However, this method can also be applied in bioinformatics and text data algorithms. The SAX method can accurately predict time series data because it is based on normalized and Gaussian data and is able to determine breakpoints according to the size of the selected alphabet [21]. The application of SAX is done through a series of steps as follows:

1. All-time series data is normalized.
2. Time series dimensions are reduced using Piecewise Aggregate Approximation (PAA). In PAA, the time series data is divided into segments of equal size, and the average value of the points within each segment is calculated.
3. The PAA representation of the time series data is discretized. This is done by determining the number and location of breakpoints. The interval between two consecutive breakpoints is represented by an alphabetic symbol, and each PAA segment in that interval is discretized to that symbol.

$$MINDIST(\tilde{S},\tilde{T}) = \sqrt{\frac{n}{N}}\sqrt{\sum_{i=1}^{N}(d(\tilde{s},\tilde{t}))^2}$$

$n$ is the original length of the time range, while $N$ is the total frames used, $\tilde{s}$ and $\tilde{t}$ represent the symbolization of the two-time series.

$$d(\tilde{s},\tilde{t}) = \sqrt{\frac{n}{N}}\sqrt{\sum_{I=1}^{n}(\tilde{s}_i - \tilde{t}_i)^2}$$

is the Euclidean distance. According to Yi and Faloutsos, the resulting distance is a form of lower bound applied in the original space of time series data. [22].

All calculations in this paper are coded using Python, under packages: pandas, numpy, matplotlib, scipy.stats, sklearn.preprocessing, sklearn.metrics.pairwise, sklearn.feature_extraction.text.

# RESULTS AND DISCUSSION

## Data Selection

This analysis selected closing stock data from March 17, 2023, to March 15, 2024, for two consumer goods stocks: Unilever Indonesia, Tbk. (UNVR) [23] and Mayora Indah, Tbk. (MYOR) [24], as shown in Figure 1. The operating scales of those two enterprises are distinct. Unilever is a multinational corporation, whereas MYOR is an Indonesian enterprise. Unilever-Indonesia distributes its products in both urban and rural locations across Indonesia. Despite being a local corporation, Mayora goods have successfully expanded to other nations, particularly in Southeast Asia. The operational scale of these two companies is different. The summary statistics of those two closing values are depicted in Figure 2 and Table 1.

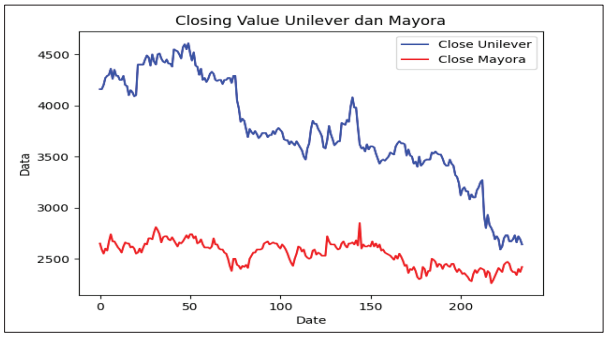


**FIGURE 1.** Closing stock value of UNVR and MYOR from March 17 2023 – March 15, 2024

The price range for Unilever shares (UNVR.JK) is broader than that of Mayora (MYOR.JK). The price range is determined by calculating the difference between the first quartile (Q1) and the third quartile (Q3) on the boxplot. A broader price range suggests a higher level of volatility in its share price. In contrast, Mayora's stock prices exhibit more excellent stability due to a tighter range distribution of the resultant data.

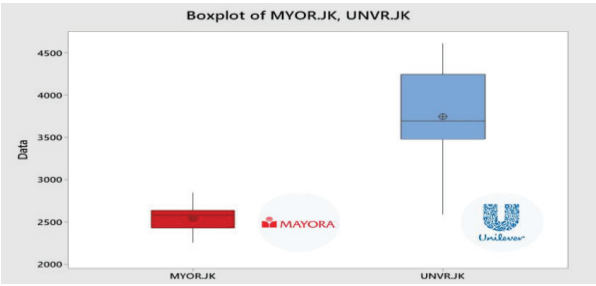


**FIGURE 2.** Boxplots of MYOR vs UNVR

**TABLE 1.** Summary statistics of MYOR vs UNVR

| Summary Statistics | MYOR | UNVR |
|---|---|---|
| MAX | 2850 | 4610 |
| Q1 | 2430 | 3480 |
| Mean | 2545.2 | 3751 |
| Median | 2580 | 3700 |
| Q3 | 2640 | 4250 |
| IQR | 210 | 770 |
| Stdev | 123.5 | 509.2 |

## The SAX Modeling

The SAX' step started with normalization of the two stocks data such that those two datasets have the same scale. Normalization facilitates the comparison of distinct data features (see Figure 3).

At the next stage, the stock data is divided into several segments of the same length. Here The closing stock data of each company is divided into 16 segments of the total data length original length of 235 data. Following that, the average of each data segment is determined from the series. The average data substitutes the original data, resulting in more concise data. This stage is known as Piecewise Aggregate Approximation (PAA). The average value from the PAA is then transformed into symbols representing specific intervals. Four symbols are generated: alphabet symbols a, b, c, and d. Figure 4 shows the outcomes of data reduction and symbolization.

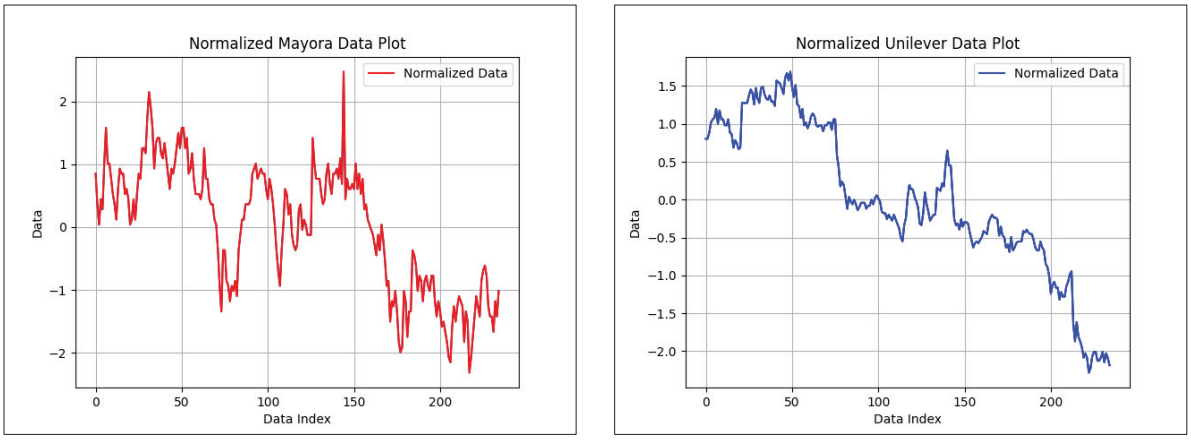


**FIGURE 3.** Normalized closing data stock of MYOR (red) and UNVR (blue)

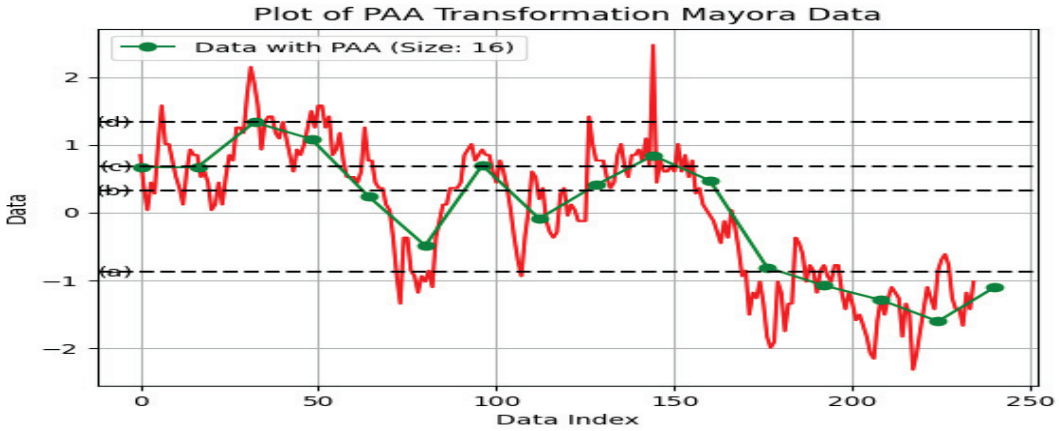


**FIGURE 4.** The PAA of closing data stock of MYOR UNVR

Mayora's stock PAA (Figure 4) revealed that the price range (d) represents the resistance level, with (d) serving as a ceiling for closing price data over a year. This resistance level has been exceeded (broken) at many moments, showing sufficient purchasing pressure to drive the price over this boundary. These resistance points shift roles throughout time, becoming both resistance and support levels. The support level acts as a floor for the stock price when purchasing demand is strong enough to keep the price from dropping further. In contrast, a resistance level is an upper boundary beyond which selling pressure is strong enough to prevent the price from rising further.

Additionally, level (a) maintains a very strong support level until the 150th period. This condition demonstrates that when the price approaches level (a), purchasing pressure rises, preventing the price from decreasing further. However, after the 150th session, level (a) was eventually breached. This move suggests that there is enough pressure to send the price below level (a), hence level (a) takes on the function of resistance until the present session. In the present market conditions, there are hints that Mayora's shares are beginning to rise. This pattern suggests that prices may return to the prior support level, point (a), which is now a new resistance level. Suppose purchasing pressure continues to build and the price surpasses level (a). In that case, this will be a strong bullish signal, signaling a potential trend reversal and the possibility of future price gains.

Mayora's share price movement demonstrates significant fluctuations between support and resistance levels. This finding is critical for investors and traders to comprehend probable future market changes better and make more informed investment decisions. Monitoring how the price reacts to level (a) will be critical in establishing future investment plans, mainly if the price manages to breach the resistance level and exhibits a stronger bullish trend.

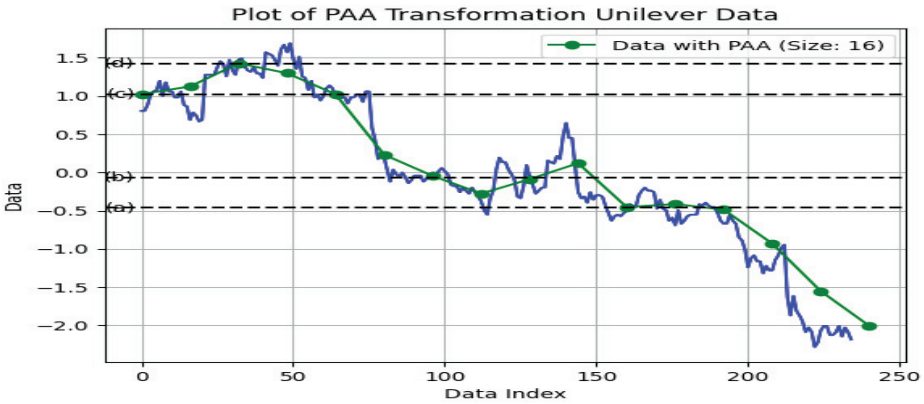


**FIGURE 5.** The PAA of closing data stock of UNVR

Price range (d) in Unilever stock data analysis exposes level resistance based on one-year stock closing data (Figure 5). Unilever attained the support point (c) after fifty stock data cycles. This condition suggests notable buying demand, pushing the price beyond the barrier level. These resistance points change throughout time to correspond with degrees of support and opposition. Furthermore, the PAA point drops consecutively from 100 to 150. Prices reach or surpass support at this stage, making the previous support point a resistance level. One year of closing stock data showed that four points in the lowest range stayed consistent and declined, despite overall share price movements. This fall could provide a new support level below range (a). The stock price may reach a new equilibrium at a lower level before attempting to rebound, utilizing this new support level as a basis.

## Discussion

This research suggested utilizing SAX (Symbolic Aggregate approXimation) as a method for comparing two consumer product companies within the context of technical analysis. In addition, firm financial data is reviewed for further specificity.

According to Mayora's 2023 Annual Report [25], there was an upward trend in closing value during all four quarters of the year. According to Unilever's financial reports [26], there was a decline in the company's financial performance compared to the preceding quarter. From the first quarter until the fourth quarter. Fundamental analysis is an approach that assists in conducting technical analysis. To decide which company's share data can be relied upon for making investment decisions, it is essential to evaluate its cash flow, profit and loss, and capacity to generate profitability ratios. Based on the available information, PT. Mayora Indah, Tbk. is a potentially favorable investment option. The stock's movement has shown signs of breaking through its support level, indicating potential growth. Additionally, the company's profit movements also suggest positive prospects

## CONCLUSION

The study employs stock technical analysis and SAX to analyze the shares of MYOR and UNVR. The SAX results suggest that although both equities have the same number of symbols and dots, certain levels play distinct roles over a year. MYOR has a more stable symbol (a) support and a more potent symbol (d) opposition than Unilever. Mayora's share price remained stable for a year, as evidenced by its long-standing resistance to symbol (d) and strong support for symbol (a). Furthermore, Mayora shares are on the brink of breaching their resistance level, which provides investors with optimism for future price increases.

Despite having the same symbols and points, Unilever shares have worse resistance and support than Mayora. Unilever doesn't appear to be recovering close to resistance. This suggests that Unilever shares have weaker growth potential than Mayora since buying pressure was insufficient to push the price above its resistance barrier. Further

research should evaluate external elements including market conditions, economic news, and company policies that may greatly affect stock price changes. Additionally, longer data can be used to analyze trends over time and more complicated analysis methods can provide deeper insight. This study used limited historical data and may prejudice symbolic data interpretation, thus future stock analysis should use that approach.

Both stock data options can be purchased or invested in based on the criteria of each individual, as per SAX methodologies and technical analysis. The following notes are provided. Mayora Indah is not inferior to PT. Unilever Indonesia, Tbk. We can buy and sell Unilever shares if we want a short-term investment. Mayora outperforms Unilever in terms of long-term investment decisions.

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