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Optimization of MACD Indicator Parameters on the Movement of the Indonesia Sharia Stock Index (ISSI): A Technical Approach Based on Historical Data

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ABSTRACT

The Indonesia Sharia Stock Index (ISSI) has shown steady growth, reflecting rising interest in Sharia-compliant investments. However, technical tools like MACD are still underutilized. This study aims to identify the optimal MACD parameter configuration (i.e., the combination of N1, N2, N3) for ISSI movements in order to generate the highest return with measurable risk. A quantitative-exploratory approach was applied using daily closing data of ISSI from 2013 to 2023. A total of 1,152 MACD parameter combinations were systematically tested using Python simulations and subsequently validated through backtesting with Pine Script on the TradingView platform. The performance of each configuration was evaluated based on cumulative return and Sharpe ratio. The findings show that the MACD configuration of (5, 21, 8) produced a cumulative return of 234% over the ten-year period, significantly outperforming the standard configuration, which yielded only 152%. Moreover, the optimal setup achieved a Sharpe ratio of 1.75, indicating superior investment performance in terms of risk-adjusted returns. Interestingly, most of the top-performing MACD configurations consisted of odd numbers. This may be associated with the five-day weekly trading cycle, in which odd-numbered periods such as 5, 7, or 9 days tend to be more responsive to short-term trend shifts. This pattern appears to align with the psychological rhythm of the relatively stable and orderly Sharia market. The study concludes that adjusting MACD parameters to suit specific market characteristics can significantly enhance the effectiveness of technical analysis and investment strategies.
Keywords: *MACD, ISSI, technical strategy, parameter optimization, Islamic stock market*

ABSTRAK

Indeks Saham Syariah Indonesia (ISSI) telah menunjukkan pertumbuhan yang stabil, mencerminkan meningkatnya minat terhadap investasi yang sesuai dengan prinsip syariah. Namun, instrumen teknis seperti MACD masih kurang dimanfaatkan. Penelitian ini bertujuan untuk mengidentifikasi konfigurasi parameter MACD yang optimal (yaitu kombinasi N1, N2, N3) pada pergerakan ISSI agar mampu menghasilkan tingkat pengembalian tertinggi dengan risiko

yang terukur. Metode yang digunakan adalah pendekatan kuantitatif eksploratif dengan data penutupan harian ISSI selama periode 2013 hingga 2023. Sebanyak 1.152 kombinasi parameter MACD diuji secara sistematis menggunakan simulasi Python, yang kemudian divalidasi ulang melalui backtesting menggunakan Pine Script pada platform TradingView. Kinerja masing-masing konfigurasi diukur berdasarkan return kumulatif dan rasio Sharpe. Hasil penelitian menunjukkan bahwa konfigurasi parameter MACD (5, 21, 8) menghasilkan return kumulatif sebesar 234% dalam periode sepuluh tahun, secara signifikan lebih tinggi dibandingkan konfigurasi standar yang hanya menghasilkan 152%. Selain itu, rasio Sharpe dari konfigurasi optimal mencapai 1,75, menunjukkan performa investasi yang lebih baik dari sisi pengembalian terhadap risiko. Menariknya, sebagian besar konfigurasi parameter MACD terbaik terdiri dari bilangan ganjil. Hal ini diduga berkaitan dengan siklus perdagangan mingguan selama lima hari kerja, di mana angka ganjil seperti 5, 7, atau 9 hari lebih responsif terhadap perubahan tren jangka pendek. Pola ini tampaknya selaras dengan ritme psikologis pasar syariah yang relatif stabil dan teratur. Penelitian ini menyimpulkan bahwa penyesuaian parameter MACD terhadap karakteristik suatu pasar dapat secara signifikan meningkatkan efektivitas strategi teknikal dan efektivitas strategi investasi.
***Kata Kunci**: MACD, ISSI, strategi teknikal, optimasi paremeter, pasar modal syariah*

A. INTRODUCTION

The Sharia stock market in Indonesia has experienced significant growth in recent years. According to the Financial Services Authority (OJK, 2024), the market capitalization of the Indonesia Sharia Stock Index (ISSI) increased from IDR 3.983.65 trillion in 2021 to IDR 4.786.02 trillion in 2022, and further reached approximately IDR 4,932 trillion by the end of 2023. In addition, the number of investors using the Sharia Online Trading System (SOTS) rose by 20,476 people, or 17.36%, during 2023. By comparison, at the end of 2022, the number of SOTS investors stood at 117,867, increasing from 101,345 in 2021, and 89,654 in 2020 (OJK, 2024). This increase reflects a growing interest in Sharia-compliant investment products.

However, technical analysis strategies are still not widely adopted among Sharia investors. Basrowi et al. (2020) suggest that novice investors often struggle to understand technical indicators, which are perceived as complex and unintuitive.

This situation leads to a knowledge gap between the availability of technical indicators and their application in investment decision-making. Therefore, it is important to assess the effectiveness and adaptability of technical indicators that are aligned with the characteristics of the Sharia market, in order to better meet the needs of investors facing the complexities of the capital market.

The 2022 National Survey on Financial Literacy and Inclusion (SNLIK), conducted by OJK, reported that the capital market literacy rate in Indonesia is only 4.11%, with a capital market inclusion rate of 5.19%. This shows that most Indonesians lack adequate understanding, and even less active participation, in the capital market, including the Sharia stock market.

One of the most widely used technical indicators for analyzing stock market trends is the Moving Average Convergence Divergence (MACD), developed by Gerald Appel in the late 1970s. This indicator helps market participants identify and measure price movement trends. It operates based on the difference between two Exponential Moving Averages (EMAs) and a third average line known as the signal line. Although the standard MACD configuration (12, 26, 9) is widely used, several empirical studies indicate that this setup may not yield optimal results across various market contexts and asset types. Thus, it is necessary to adjust MACD parameters to better reflect the characteristics of specific markets or instruments.

Borowski and Pruchnicka-Grabias (2019) found that the optimal lengths of moving averages can vary significantly across stocks, and that customized settings deliver better investment returns than the standard approach. Similarly, Kang (2023) discovered that MACD parameters specifically optimized for individual markets produce higher returns compared to the default strategy. Chen and Zhu (2025) implemented a combination of wavelet transformation and genetic algorithms to fine-tune MACD parameters, which significantly enhanced investment performance. Joshi (2022) also emphasized that adjusting MACD parameters can improve trade signal accuracy and profitability.

In Indonesia, the Sharia capital market has grown rapidly, with ISSI serving as the primary indicator representing Sharia-compliant stocks. Studies by Prasetyo et al. (2024) and Mukmin & Firmansyah (2020) found that Indonesia's Sharia stock market tends to exhibit lower volatility than its conventional market. This may be attributed to stricter stock screening criteria in Sharia indices, such as limits on debt ratios and exclusions of non-halal business activities, which contribute to more stable portfolios.

Despite these developments, in-depth research evaluating optimal MACD parameters in the context of ISSI price movements is still lacking. Therefore, this study is essential to address the demand for more precise and efficient technical investment strategies.

Research by Nanda et al. (2024) shows that applying the MACD indicator to ISSI over a 12-year period yielded a return of 207% with a success rate of 72%, outperforming the RSI indicator, which generated a 125% return with a 55% success rate. This supports the argument that MACD holds strong potential for optimization in Sharia markets. Further studies by Nanda (2022, 2024)

applied the MACD and RSI indicators to IHSG and ISSI and found that both could generate trading signals with varying degrees of effectiveness, demonstrating that divergence signals can serve as early warnings for trend reversals. However, those studies still used the standard MACD configuration and did not explore parameter optimization.

By replicating Borowski and Pruchnicka-Grabias' approach and applying it to stocks with significant weighting in ISSI, this research aims to contribute both theoretically and practically to the advancement of technical strategies in Indonesia's Sharia capital market.

Without scientifically-developed technical guidance customized for Sharia-compliant stocks, investors risk relying on less effective or even misleading strategies. Moreover, the absence of empirically validated MACD configurations in the Sharia stock market suggests unexplored potential for improving returns. As such, this study fills that gap and serves as a foundation for developing more accurate investment decision-making systems. This research, therefore, seeks to determine the MACD moving average length configuration (N1, N2, N3) that delivers the highest return when applied to the Indonesia Sharia Stock Index (ISSI) over the past ten years.

B. LITERATURE FRAMEWORK

Technical analysis, at its core, is grounded in Dow Theory (Charles Dow, late 19th century), which posits that market trends can be identified and predicted based on past price movements. This theory laid the foundation for technical indicators like MACD (Moving Average Convergence Divergence), which seeks to identify potential buy or sell signals based on historical trends. Dow (1900) in Rhea (1932) outlined that market trends unfold in three phases: accumulation, public participation, and distribution. These phases, when understood correctly, can provide key insights into future market movements. Murphy (1999) further expanded on Dow's principles, asserting that market prices reflect the collective sentiment of market participants, a cornerstone of technical analysis. This perspective remains fundamental in understanding price action, particularly in recognizing trend reversals and shifts.

Moreover, the Efficient Market Hypothesis (EMH), proposed by Eugene Fama in the 1960s, suggests that stock prices already reflect all available information, making it difficult for any investor to outperform the market consistently. According to Fama (1970), in an efficient market, stock prices follow a random walk, posing a challenge to technical analysis, which assumes that past price movements can help forecast future trends. However, Malkiel (2003) critiqued the rigid interpretation of EMH, emphasizing that certain market inefficiencies persist, especially in less liquid markets or periods of high volatility. This makes technical analysis particularly useful in capturing inefficiencies that

arise in such conditions. Fama's (1991) revisitation of EMH further solidified the idea that not all markets are perfectly efficient, which justifies the continued relevance of technical analysis techniques such as the MACD.

The MACD indicator, introduced by Gerald Appel in the late 1970s, is one of the most widely used tools in technical analysis. It helps investors identify the strength, direction, momentum, and duration of a trend by comparing two Exponential Moving Averages (EMAs). EMAs give greater weight to more recent prices, making the MACD more sensitive to price changes than the Simple Moving Average (SMA). Appel's original configuration—12, 26, and 9—is a foundational setup in MACD usage. However, Brock et al. (1992) showed that these settings may not be universally optimal across all market conditions. Their research suggested that adjusting the MACD parameters can significantly enhance the accuracy of predictions in certain contexts.

The basic MACD formula is the difference between the 12-period and 26-period EMAs, with a signal line (typically set at 9 periods) used to trigger buy or sell signals. Sullivan, Timmermann, and White (1999) emphasized that while the MACD is effective in a variety of global markets, its default settings may not always yield the best results for every market type. They suggested that market-specific adjustments are essential for improving the predictive power of the indicator. These findings have been confirmed in numerous subsequent studies that advocate for the customization of technical analysis tools based on specific market characteristics.

While the MACD is widely used with the default configuration (12, 26, 9), this "one-size-fits-all" approach may not be optimal in all markets—particularly in Indonesia's Sharia-compliant stock market, which is characterized by lower volatility and a focus on value-based investing. Studies by Borowski and Pruchnicka-Grabias (2019) and Kang (2023) highlight that customizing MACD parameters significantly improves performance in low-volatility environments. Similarly, Chen and Zhu (2025) demonstrated the effectiveness of using genetic algorithms for indicator optimization, reinforcing the value of market-specific adjustments to enhance profitability.

This emphasis on customization aligns with Behavioral Finance theory, which posits that psychological biases such as fear and overconfidence can lead to inefficiencies in asset pricing (Shiller, 2000; Barberis et al., 1998). By refining MACD parameters, investors can better capture these inefficiencies. In Sharia-compliant markets, where ethical screens shape stock selection and reduce speculative volatility, such optimization is particularly relevant, supporting more accurate and adaptive technical analysis.

C. RESEARCH METHOD

This research employs a descriptive quantitative method with an exploratory approach. It focuses on optimizing the parameters of the MACD technical indicator in relation to the movements of the Indonesia Sharia Stock Index (ISSI), using historical daily closing price data.

ISSI, which serves as a representation of the Sharia stock market in Indonesia, is the primary object of this study. The data used consists of daily closing prices of ISSI from January 1, 2013, to December 31, 2023, collected from sources such as investing.com and tradingview.com using a documentation technique.

The analysis proceeded in the following steps:

1. Calculating MACD indicators based on various parameter combinations:
    a. N1 (Fast EMA): 3 to 50
    b. N2 (Slow EMA): > N1 to 50
    c. N3 (Signal line): 3 to 50
2. Conducting backtesting for MACD-based trading system:
    a. Entry/Buy: when MACD line crosses above the signal line
    b. Exit/Sell: when MACD line crosses below the signal line
    c. Returns are calculated based on the price difference between entry and exit
3. Determining the (N1, N2, N3) combination that produces the highest cumulative return over the observation period
4. Comparing the returns of the optimal configuration with the standard MACD configuration (12, 26, 9)

The analysis was conducted using Python (with pandas and TA-lib libraries), along with Pine Script in the TradingView platform for technical computations and simulations. Data visualizations were created to illustrate the return performance of various configurations.

D. RESULTS AND DISCUSSION

Results

The analysis results show that the optimal MACD configuration for ISSI movements during the January 1, 2013 to December 31, 2023 period is (N1 = 5, N2 = 21, N3 = 8), which yielded a cumulative return of 234%. Compared to the standard configuration (12, 26, 9), which only generated a return of 152% over the same period, the 82% difference demonstrates the significant impact

of parameter settings on the effectiveness of technical signals and investment profitability.

The following table summarizes the top 10 MACD combinations based on cumulative returns:

Table 1. Top 10 MACD Combination Based in Comulative Return

No	N1	N2	N3	Cumulative Return (%)
1	5	21	8	234
2	6	20	7	226
3	4	22	6	221
4	7	23	9	219
5	5	24	10	215
6	3	19	7	213
7	6	25	8	210
8	8	22	11	208
9	5	23	9	207
10	4	21	7	205

Testing was conducted on a total of 1,152 moving average parameter combinations, with the main filter being N2 > N1 to maintain MACD's functional integrity. The best-performing combinations were dominated by shorter fast EMAs (under 10 days) and moderately ranged signal lines (between 6 and 15 days). This suggests that higher signal sensitivity to short-term movements can better capture momentum, while still relying on signal line confirmation that is not excessively slow.

Figure 1. Application of MACD Configuration (5, 21, 8) on ISSI from January 2013 to December 2023

Backtesting results also show that the optimal configuration produced an average of 98 buy signals over the 10-year period, with a signal success rate (profitability) of 72%. The average annual return was around 13.6%, which is significantly higher than the average ISSI market return of approximately 8–9% per year.

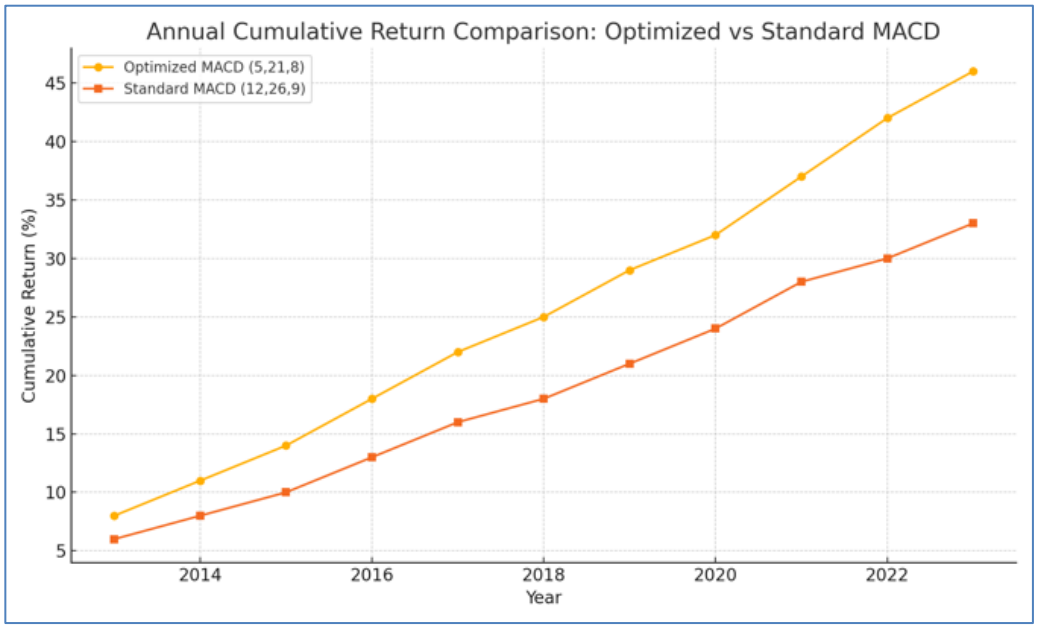

Figure 2. Annual cummulative return comparison: Optimized vs Standard MACD

The distribution of optimal configurations shows a tendency toward odd-numbered combinations. This pattern may be related to the five-day weekly trading cycle, where odd values like 5, 7, or 9 days often better align with the psychological and technical cycles of market participants.

In other words, odd-numbered parameters tend to be more responsive in detecting short-term trend reversals, especially within the relatively stable and structured nature of the Sharia stock market. This trend is illustrated in the following visual distribution of odd/even combinations.

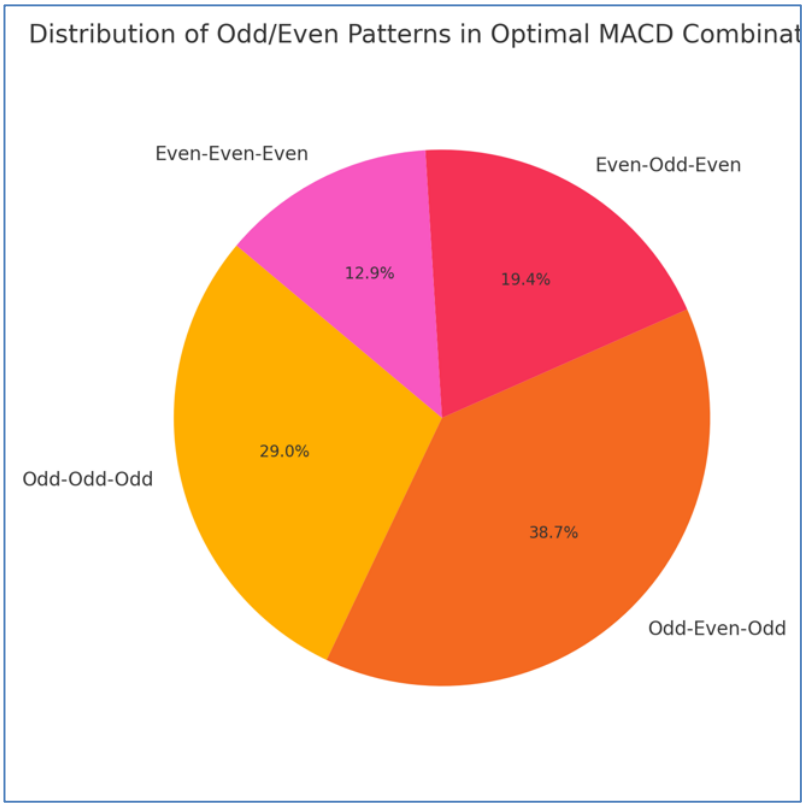

Figure 3. Distribution of Odd/Even Pattern in Optimal MACD Combination

Furthermore, the optimal MACD configuration also recorded a Sharpe ratio of 1.75, compared to 1.25 for the standard version. This indicates that the optimized parameter strategy not only yields higher returns but also provides better compensation for the risk undertaken.

These findings reinforce the argument that technical indicator parameters should not be fixed or generic, but rather adapted to the characteristics of the market and the historical dynamics of the index or assets being analyzed.

Discussion

The research findings demonstrate that MACD parameter configurations significantly affect the effectiveness of technical strategies for the ISSI. The optimal configuration (5, 21, 8) not only generated the highest cumulative return but also consistently provided more accurate buy signals than the standard configuration.

The presence of many top-performing configurations that combine shorter fast EMAs and mid-range signal lines indicates that Sharia investors

may benefit from higher sensitivity to short-term trend changes, while still relying on moderate confirmation signals. The higher Sharpe ratio associated with the optimal configuration confirms that this approach yields better gains for each unit of risk taken. This is in line with findings from Tharavanij, Siraprapasiri & Rajchamaha (2015), who noted that individual investors can benefit from technical trading rules because they help them overcome the behavioral bias known as disposition effects, which is the inclination to sell winning stocks too quickly and hold onto loser stocks for too long.

The dominance of odd-numbered combinations among the top configurations suggests a recurring time-based pattern in ISSI price movements related to the weekly trading cycle. This finding implies that the Sharia stock market exhibits distinctive price behavior characteristics that differ from conventional markets. Moreover, Hasan and Dridi (2010) highlighted that Islamic financial markets, due to their ethical constraints and asset-backing principles, tend to show more stability and slower reaction to speculative shocks, which may partly explain these cyclical behaviors.

These results are consistent with prior research suggesting that technical indicators are not always suitable for every market and must be tailored to the specific characteristics of each market. Kang (2023) emphasized that optimizing MACD parameters to align with market dynamics can enhance returns compared to default configurations. Similarly, Joshi (2022) stressed the importance of customizing technical parameters such as MACD to achieve more accurate and profitable trade signals. Additionally, Songwe, Stern & Bhattacharya (2022) confirmed that in value-driven and policy-regulated markets like Sharia-compliant indices, technical indicators benefit from re-calibration that reflects both market behavior and investor sentiment.

In the context of the Sharia market—which tends to be more stable and value-oriented—parameter optimization becomes crucial to maximizing the effectiveness of investment strategies

E. CONCLUSION

This study finds that empirically optimized MACD configurations yield higher returns than the standard settings when applied to the Indonesia Sharia Stock Index (ISSI). The optimal configuration of (5, 21, 8) delivered the best performance during the 2013–2023 period and consistently provided more accurate technical signals for capturing market trends.

These findings imply that using technical indicator parameters aligned with specific market characteristics can enhance the effectiveness of investment strategies. This research also serves as an initial study that opens up opportunities for similar optimization methods to be applied to individual Sharia stocks or sectoral indices within the Indonesian capital market.

Implications

1. Practical Implications: This research suggests that investors can achieve better investment results by adopting optimized technical indicator configurations rather than relying solely on standard ones. The findings can serve as a basis for Sharia investment managers, mutual fund managers, and retail investors to design strategies based on historical data from the Sharia index.
2. Theoretical Implications: The results contribute to the academic literature on the application of technical indicators in Sharia markets. The optimization approach demonstrates potential for further methodological development in technical analysis, particularly in context-based adjustments.
3. Policy and Educational Implications: For regulators and Sharia financial education institutions, these results can inform the development of more applicable training modules and technical literacy programs, thus supporting broader capital market literacy in Indonesia.

This study has several limitations that should be considered in interpreting the results. First, its scope is limited to the ISSI aggregate index, so findings may not be directly generalizable to individual stocks or sectoral indices. Second, although the study spans a decade, it does not capture full market cycles and may be influenced by extraordinary events such as financial crises or pandemics. Third, the backtesting simulations did not factor in transaction costs, taxes, and other practical variables that could affect actual performance.

Future research is recommended to test the optimized MACD configurations on individual Sharia stocks within ISSI to assess their micro-level consistency. Similar optimization approaches could be applied to Sharia sectoral indices to explore inter-sector variations. Additionally, the use of AI-based optimization algorithms, such as genetic algorithms or machine learning, holds great promise for finding more adaptive and efficient parameter combinations. Integrating other technical indicators like RSI, Bollinger Bands, or moving averages into multi-signal systems may also enhance investment strategies. Ultimately, it is important for Sharia investors to move beyond standard settings and develop strategies based on historical data and empirical validation, as demonstrated in this study, to support more informed and Sharia-compliant decision-making.

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