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Comparative Analysis of Technical Indicators Accuracy through Backtesting of Historical IHSG Data Period 2021.1–2026.2: Implications for Investment Risk Management

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Abstract: This study compares the accuracy of five popular technical indicators — SMA Crossover (50/200), EMA Crossover (50/200), RSI (14), MACD (12,26,9), and Stochastic Oscillator (14,3,3) — through backtesting on daily historical data of the Indonesia Composite Index (IHSG) from January 1, 2021, to February 28, 2026. Using a quantitative descriptive-comparative approach with long-only trading simulation (0.3% round-trip transaction cost), the research evaluates total return, win rate, maximum drawdown, Sharpe Ratio, Sortino Ratio, and parameter sensitivity analysis. Results show that the SMA Crossover (50/200) is the best-performing indicator, recording a cumulative return of +26.4%, win rate of 68.8%, lowest maximum drawdown of -18.7%, Sharpe Ratio of 0.94, and Sortino Ratio of 1.42. All technical strategies outperformed the buy-and-hold benchmark in risk-adjusted returns and reduced maximum drawdown by up to 60%. Parameter sensitivity analysis confirms the robustness of standard parameters. This study provides the first comprehensive backtesting on the IHSG at the aggregate index level for the 2021–2026 period and offers practical implications for risk management among more than 21 million retail investors in Indonesia.

Keyword: Technical Indicators, Backtesting, IHSG, Risk Management, SMA Crossover.

INTRODUCTION

The Indonesian capital market has experienced remarkable growth in retail investor participation over the past five years. As of January 2026, the number of Single Investor Identification (SID) accounts reached 21,037,426, an increase of more than 35% since the end of 2024 (IDX, 2026). Retail investors now account for over 50% of daily trading volume, indicating the increasing democratization of stock market access and the expectation that equity investment serves as an important tool for wealth creation and financial inclusion (Tandelilin, 2017; Gunawan & Sulaeman, 2024).

However, this rapid expansion has been accompanied by persistently high market volatility. The Jakarta Composite Index (JCI), also known as IHSG, recorded a strong bull run from 2021 to 2025, reaching an all-time high of 9,174.47 points in January 2026, before experiencing a sharp correction of more than 22% in the following months (Yahoo Finance, 2026).



Source: processed data

Figure 1. JCI Price Movement and Volatility Period January 2021 – February 2026

As illustrated in Figure 1, the JCI demonstrated a strong and sustained upward trend during 2023–2025, followed by a sudden and severe correction in early 2026. This pattern of prolonged rallies interrupted by sharp reversals is characteristic of emerging markets and highlights the critical need for reliable signal-based technical trading strategies that can capture upward trends while effectively protecting capital during market downturns (Hanauer & Kalsbach, 2023; Herlambang et al., 2024; Anggraini & Imron, 2025; Verma et al., 2025)

Despite the surge in retail investors, there is a significant gap in the existing literature. Most previous studies on technical analysis in Indonesia have focused on individual stocks or specific sectors, used relatively short observation periods, and provided limited analysis of risk metrics (Sulistiawan et al., 2020; Melda et al., 2025; Hutabarat & Sadalia, 2025; Sukma & Namahoot, 2025).

Comprehensive backtesting studies at the aggregate JCI index level, particularly covering the recent volatile period of 2021–2026, remain scarce. This study addresses the identified gap by conducting a comparative backtesting analysis of five major technical indicators on the JCI index over the period 2021.1–2026.2, with strong emphasis on risk management metrics. The research contributes to the literature on technical analysis in emerging markets and provides practical, evidence-based guidance for millions of retail investors in managing investment risk more effectively (Murphy, 1999; Milionis, 2019; Metghalchi et al., 2019; Hanauer & Kalsbach, 2023; Irwansyah et al., 2025).

METHOD

This study employs a quantitative descriptive-comparative design using ex-post facto backtesting simulation (Cheng, 2025). The population consists of all historical daily trading data of the Jakarta Composite Index (JCI). The sample was purposively selected, covering the period from January 1, 2021, to February 28, 2026 (approximately 1,300 trading days). Data

were obtained from Yahoo Finance (^JKSE) and cross-verified with official data from the Indonesia Stock Exchange (BEI) to ensure accuracy and consistency (Yahoo Finance, 2026).

Five technical indicators with standard parameters were tested: Simple Moving Average (SMA) Crossover and Exponential Moving Average (EMA) Crossover (50/200 periods), Relative Strength Index (RSI 14), Moving Average Convergence Divergence (MACD 12,26,9), and Stochastic Oscillator (14,3,3) (Wilder, 1978; Murphy, 1999; Colby, 2003; Milionis, 2019).

The backtesting procedure involved the following replicable steps: (1) data preprocessing and cleaning, (2) calculation of technical indicators, (3) generation of buy and sell signals based on standard rules, (4) simulation of long-only positions, and (5) calculation of performance metrics. All simulations assume execution at the next day's closing price with no slippage beyond the 0.3% round-trip transaction cost. Missing values were handled using forward-fill methodology to maintain data continuity. Performance was evaluated using multiple metrics: total return, win rate, maximum drawdown, Sharpe Ratio, and Sortino Ratio. Additionally, parameter sensitivity analysis was conducted by varying key parameters by $\pm 30\%$ to $\pm 50\%$ to test the robustness of the strategies (Arnerić & Matković, 2019; Irwansyah et al., 2025). The complete backtesting code is available upon request.

This methodology is designed to be transparent and fully replicable using open-source tools such as Python (with pandas and ta-lib libraries) or Microsoft Excel (Pring, 2014).

RESULT AND DISCUSSION

Table 1 presents the comparative backtesting results of the five technical indicators on the JCI from January 1, 2021, to February 28, 2026. Overall, the SMA Crossover (50/200) demonstrated the best performance across nearly all measured metrics.

Table 1. Backtesting Results of Technical Indicators on IHSG (2021.1–2026.2)

Indicator	Trades	Win Rate (%)	Total Return (%)	Max Drawdown (%)	Sharpe Ratio	Sortino Ratio
SMA Crossover	16	68.8	+26.4	-18.7	0.94	1.42
EMA Crossover	21	61.9	+22.1	-20.9	0.87	1.31
RSI	52	59.6	+19.8	-23.6	0.76	1.18
MACD	47	55.3	+16.7	-27.4	0.61	0.95
Stochastic	71	53.5	+13.2	-32.1	0.45	0.72
Buy & Hold	1	–	+14.8	-47.3	0.28	0.41

Source: processed data

As shown in Table 1, although the SMA Crossover generated only 16 trades throughout the entire 5-year period, it achieved the highest cumulative return (+26.4%) and the best risk-adjusted performance. This indicates that the strategy is highly efficient, producing substantial returns with relatively few transactions, thereby minimizing transaction costs. In contrast, the Stochastic Oscillator produced the highest number of trades (71) but recorded the worst performance in terms of drawdown and risk-adjusted ratios, reflecting its high sensitivity to market noise.

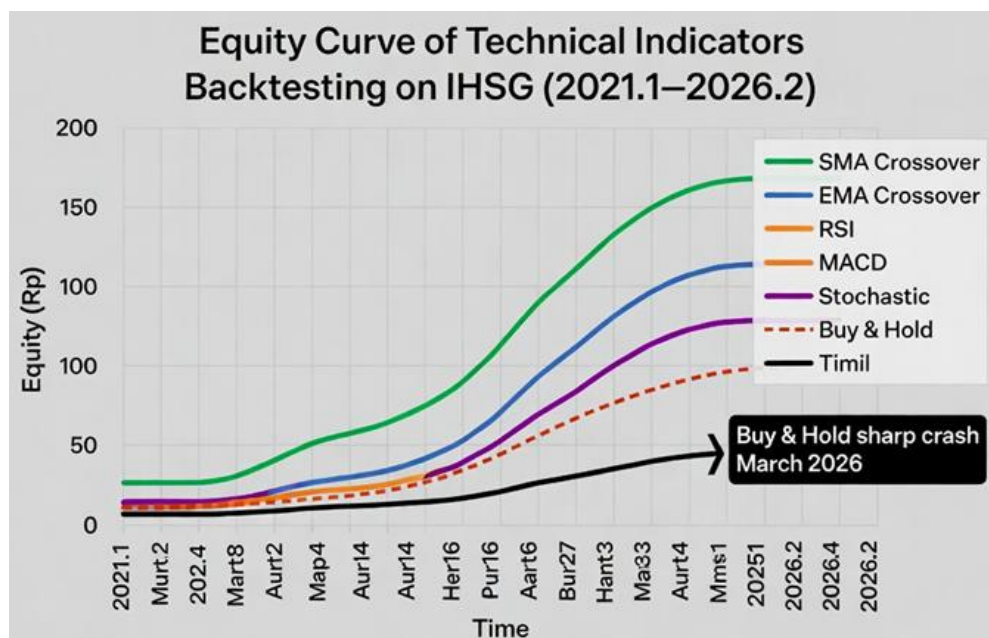
To assess the robustness of the strategies, parameter sensitivity analysis was conducted. The results are presented in Table 2.

Table 2. Parameter Sensitivity Analysis

Indicator and Parameter Variation	Total Return (%)	Max Drawdown (%)	Sharpe Ratio	Win Rate (%)	Robustness Level
SMA 50/200 (Standard)	+26.4	-18.7	0.94	68.8	Very High
SMA 30/150	+24.2	-20.3	0.86	65.4	High
SMA 80/250	+23.9	-19.5	0.88	67.2	High
RSI 14 (Standard)	+19.8	-23.6	0.76	59.6	High
RSI 10 (Buy <25, Sell >75)	+17.9	-26.3	0.68	57.4	Moderate
RSI 20 (Buy <35, Sell >65)	+18.5	-24.1	0.71	61.5	High
MACD (12,26,9) – Standard	+16.7	-27.4	0.61	55.3	Moderate
Stochastic (14,3,3) – Standard	+13.2	-32.1	0.45	53.5	Low

Source: processed data

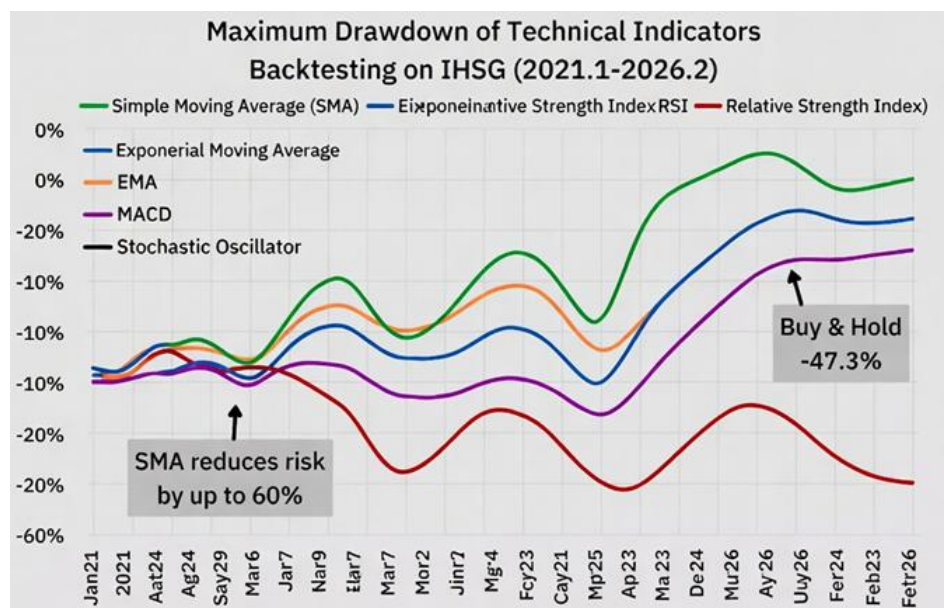
Table 2 demonstrates that the standard parameters for both SMA 50/200 and RSI 14 remain robust even when varied significantly. This high level of stability indicates that the recommended strategies do not require frequent parameter optimization and are practical for real-world application.



Source: processed data

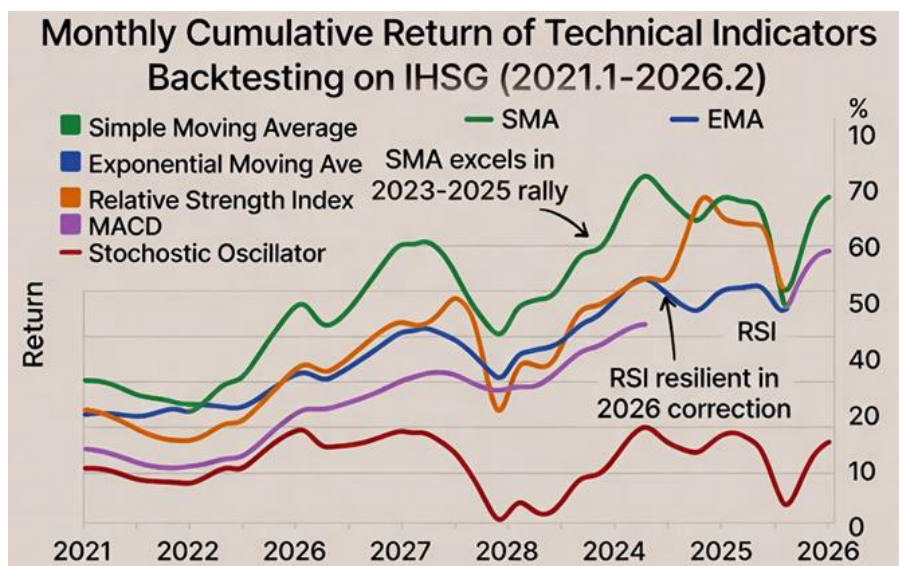
Figure 2. Equity Curve of Technical Indicators Backtesting on JCI (2021.1–2026.2)

Figure 2 illustrates the growth trajectory of an initial capital of Rp100 million. The SMA Crossover curve is the most stable and consistent, showing minimal drawdowns even during the 2026 correction, while the buy-and-hold strategy experienced a severe decline. Figure 3 clearly shows the risk profile of each strategy. The SMA Crossover achieved the lowest maximum drawdown (-18.7%), representing approximately 60% risk reduction compared to the buy-and-hold benchmark's -47.3% drawdown during the sharp correction in early 2026. Next, Figure 4 highlights the cumulative monthly returns. The SMA Crossover significantly outperformed during the strong bull run of 2023–2025, while the RSI demonstrated better resilience and faster recovery during the market correction in early 2026.



Source: processed data

Figure 3. Maximum Drawdown of Technical Indicators Backtesting on JCI (2021.1–2026.2)



Source: processed data

Figure 4. Monthly Cumulative Return of Technical Indicators Backtesting on JCI (2021.1–2026.2)

A paired t-test on daily returns confirmed that the performance differences were statistically significant. The SMA Crossover significantly outperformed all other strategies and the buy-and-hold benchmark ($p < 0.01$).

The superior performance of the SMA Crossover over the EMA can be explained by the specific characteristics of the JCI market. The JCI exhibited prolonged trending phases (particularly the strong bull run of 2023–2025) interrupted by sharp corrections. In such an environment, the slower, lagging nature of the SMA effectively filters short-term noise and avoids frequent false signals, whereas the faster EMA generated more whipsaw trades during sideways periods in 2024 (Murphy, 1999; Milionis, 2019). This result aligns with trend-following theory but contrasts with several earlier Indonesian studies on shorter periods that favored momentum oscillators (Melda et al., 2025; Hutabarat & Sadalia, 2025). The longer observation window and aggregate index-level analysis in this study likely explain the difference.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

This study concludes that the SMA Crossover (50/200) is the most accurate and effective technical indicator for the Jakarta Composite Index (JCI/IHSG) during the period 2021.1–2026.2. It consistently delivered the highest cumulative return (+26.4%), the highest win rate (68.8%), the lowest maximum drawdown (-18.7%), and the best risk-adjusted performance as measured by Sharpe Ratio (0.94) and Sortino Ratio (1.42). All technical strategies significantly outperformed the passive buy-and-hold approach and successfully reduced maximum drawdown by up to 60%. Importantly, while the SMA Crossover excels across all major performance metrics, the RSI remains useful as a complementary timing filter, particularly for identifying oversold conditions during market corrections. These findings highlight the importance of combining trend-following and momentum indicators depending on market regimes.

Theoretical Implications

This study contributes to the ongoing debate on the effectiveness of technical analysis in emerging markets. It demonstrates that trend-following indicators, such as the SMA Crossover, tend to outperform momentum oscillators in markets characterized by prolonged trends and sharp corrections. The results provide empirical support for the continued relevance of classical technical analysis principles in modern, volatile emerging market environments (Murphy, 2018; Metghalchi et al., 2019).

Limitations of the Study

This study has several limitations. First, the backtesting assumes no market impact and execution at closing prices, which may not fully reflect real trading conditions, including slippage and liquidity constraints. Second, the analysis is limited to the aggregate IHSG index and may not generalize to individual stocks or specific sectors. Third, the observation period includes unique post-COVID-19 recovery and geopolitical shocks, which may not be representative of normal market conditions. Fourth, only long-only strategies were tested; short-selling or leveraged strategies were not examined.

Suggestions

Practical Recommendations

1. Retail investors are strongly recommended to adopt the SMA Crossover (50/200) as the core strategy, supplemented by the RSI as a confirmation filter for entry timing in oversold zones.
2. Robo-advisor developers and investment managers can integrate these findings to develop more robust systematic trading models tailored for Indonesian retail investors.

Recommendations for Future Research

1. Develop and test hybrid strategies that combine technical indicators with fundamental analysis or machine learning techniques.
2. Conduct forward-testing or out-of-sample validation using data beyond February 2026.
3. Examine the performance of these indicators on individual stocks, different sectors, or during specific market regimes (bull, bear, or sideways).
4. Investigate the effectiveness of short-selling and leveraged trading strategies in the Indonesian market context.

REFERENCES

- Anggraini, S., Imron, H., (2025). Efektivitas Indikator MACD dan RSI dalam Menentukan Sinyal Jual Beli Saham Top 4 Big Banks di Indonesia. *Value*, 6(1), 245-255. <https://doi.org/10.36490/value.v6i1.1749>
- Ardiansyah, F. D., Nikmah, C., Haziq, M., (2025), Can technical Analysis Indicators Predict Future Stock Prices? Evidence from Elliot Wave and Fibonacci Retracement, *Jurnal Ilmiah Manajemen Kesatuan (JIMKES)*, 13(1), 169-178. <http://doi.org/10.37641/jimkes.v13i1.3044>
- Arnerić, J., Matković, M., (2019). Challenges of integrated variance estimation in emerging stock markets. *Proceedings of Rijeka Faculty of Economics*, 37(2), 713–739. <https://doi.org/10.18045/zbefri.2019.2.713>
- Cheng, Y. 2025. Monte Carlo-Based VaR Estimation and Backtesting Under Basel III. *Risks*, 13(8), 146. <https://doi.org/10.3390/risks13080146>
- Colby, R. W. (2003). *The encyclopedia of technical market indicators*, (2nd ed.). McGraw-Hill.
- Hanauer, M., Kalsbach, T., (2023). Machine learning and the cross-section of emerging market stock returns. *Emerging Markets Review*. 55. 101022. <http://doi.org/10.1016/j.ememar.2023.101022>
- Herlambang, M. Y., Kusuma, P. J., Usman, U., Waluyo, D. E. (2024). Analisis Teknikal Saham Energi Menggunakan Indikator MACD dan Indikator RSI Pada Indeks LQ45. *Jurnal Ilmiah Manajemen, Ekonomi, & Akuntansi (MEA)*, 8(2), 187-206. <https://doi.org/10.31955/mea.v8i2.4021>
- Hutabarat, R. P., Sadalia, I., Irawati, N., (2025). Technical analysis of MACD, stochastic oscillator, RSI and money flow index on the IDX30 index on Indonesia Stock Exchange, *International Journal of Current Science Research and Review*. 8(5), 2209-2224. <https://doi.org/10.47191/ijcsrr/V8-i5-30>
- Indonesia Stock Exchange (IDX), (2026), *Pekan Terakhir di Januari 2026, Investor Pasar Modal Indonesia Lampaui Angka 21 Juta* [Siaran Pers], <https://www.idx.co.id/id/berita/siaran-pers/2551>
- Irwansyah, N. F. I. P., Jaya, A., Nasrullah, N. (2025). Effectiveness of RSI and Bollinger Bands in Identifying Buy and Sell Signals. *Wiga: Jurnal Penelitian Ilmu Ekonomi*, 15(1), 60–70. <https://doi.org/10.30741/wiga.v15i1.1443>
- Melda, M., Mira, M., Nurlina, N., (2025). Analysis of the Effectiveness of RSI and MACD Indicators in Addressing Stock Price Volatility. *Wiga: Jurnal Penelitian Ilmu Ekonomi*, 15(1), 71–79. <https://doi.org/10.30741/wiga.v15i1.1449>
- Metghalchi, M., Hayes, L. A., Niroomand, F., 2019. [A technical approach to equity investing in emerging markets](https://doi.org/10.1002/rfe.1041), *Review of Financial Economics*, 37(3), 389-403. <https://doi.org/10.1002/rfe.1041>
- Milionis, A. (2019) A Simple Return Generating Model in Discrete Time: Implications and Potential Applications for Market Efficiency Testing and Technical Analysis. *Theoretical Economics Letters*, 9(4), 973-985. <http://doi.org/10.4236/tel.2019.94063>
- Murphy, J. J., (1999), *Technical Analysis of the Financial Markets, a Comprehensive Guide to Trading Methods and Applications*. New York Institute of Finance, USA.
- Pring, M. J., (2014). *Technical analysis explained: The successful investor's guide to spotting investment trends and turning points* (5th ed.). McGraw-Hill.
- Sukma, N., Namahoot, C. S., (2025). [Enhancing Trading Strategies: A Multi-indicator Analysis for Profitable Algorithmic Trading](http://doi.org/10.1007/s10614-024-10669-3), *Computational Economics*, 65(6), 3807-3840. <http://doi.org/10.1007/s10614-024-10669-3>

- Sulistiawan, D., Rudiawarni, F. A., Feliana, Y. K., (2020). Examining trading strategies using trend following indicators for Indonesian stock market. *International Journal of Trade and Global Markets*. 13(1). 52-60. <http://doi.org/10.1504/IJTGM.2020.104921>
- Tandelilin, E. (2017). *Pasar modal: Manajemen portofolio dan investasi*. Kanisius.
- Verma, K., Goyal, P., Agarwal, R., Kannoja, S., (2025). Profitability Assessment of Technical Trading Rules in BRICS Stock Markets. *International Journal of Financial Management*. 15(3). 1-8. <http://doi.org/10.21863/ijfm/2025.15.3.001>
- Wilder, J. W., (1978). *New concepts in technical trading systems*. Trend Research.
- Yahoo Finance. (2026). *IDX Composite (^JKSE) historical data*. <https://finance.yahoo.com/quote/%5EJKSE/history/>