Assessing the Long-Term Performance of MACD Strategy in the Philippine Stock Market: A 12-Year Review

Maricar M. Navarro
Industrial Engineering Department
Technological Institute of the Philippines
Cubao, Quezon City
mnavarro.ie@tip.edu.ph

Bryan B. Navarro
Electrical Engineering Department
Technological Institute of the Philippines
Cubao, Quezon City
bryan.navarro@tip.edu.ph

Abstract

This study aims to evaluate the long-term effectiveness of the Moving Average Convergence/Divergence (MACD) strategy in the Philippine stock market over a 12-year period. The MACD strategy is a widely used technical analysis tool that helps identify potential buy and sell signals based on the convergence and divergence of moving averages. By examining the historical performance of the Philippine stock market, this review provides insights into the profitability and reliability of the MACD strategy as an investment approach. The findings of this study contribute to the understanding of the MACD strategy's suitability for investors in the Philippine stock market and inform investment decisions based on its long-term performance.

Keywords
Technical analysis, Moving Average Convergence Divergence, Philippine stock market, Risk management, Trading signals.

1. Introduction
The Philippine stock market, also known as the Philippine Stock Exchange (PSE), plays a significant role in the country's financial landscape and serves as a crucial avenue for capital formation and investment. Established in 1927, the PSE has evolved into a vibrant marketplace where investors can buy and sell shares of publicly listed companies, providing an avenue for wealth creation and economic growth.

The Philippine stock market operates as a centralized exchange, facilitating the trading of equities, bonds, and other financial instruments. It serves as a platform for companies to raise capital by issuing shares to the investing public, enabling them to finance business expansion, infrastructure projects, and other strategic initiatives. Furthermore, the stock market offers individuals and institutional investor's opportunities to participate in the growth potential of the Philippine economy, while providing a regulated and transparent environment for trading activities. It is governed by the Securities and Exchange Commission (SEC) and operates under the supervision of the PSE. The market is segmented into various sectors, including banking, telecommunications, real estate, consumer goods, and manufacturing, representing a diverse range of industries. Market participants, including individual investors, institutional investors, and foreign investors, contribute to the liquidity and efficiency of the market, shaping the dynamics of stock price movements and trading volumes.

Over the years, the Philippine stock market has experienced periods of volatility, driven by both domestic and global factors. Economic indicators, political developments, investor sentiment, and external shocks can all influence the

performance of the market. Understanding the underlying trends, patterns, and dynamics of the Philippine stock market is essential for investors seeking to navigate the market effectively.

One widely used approach to analyze and predict market movements is technical analysis. Technical analysis involves studying historical price and volume data to identify patterns, trends, and trading signals. The Moving Average Convergence Divergence (MACD) indicator is one of the popular tools in technical analysis. It is designed to capture the momentum and trend-following characteristics of a stock or an index.

The MACD strategy involves calculating the MACD line, signal line, and histogram based on moving averages of different time periods. The MACD crossover signals, where the MACD line crosses above or below the signal line, are considered potential buy and sell signals, respectively, (Navarro et al., 2023). Traders and investors use these signals to make trading decisions, aiming to take advantage of market trends and reversals. While the MACD strategy has been widely studied and applied in various financial markets, its effectiveness in the Philippine stock market warrants further investigation. A comprehensive analysis of the long-term performance of the MACD strategy in the Philippine stock market over a 12-year period can provide valuable insights into its profitability, risk management capabilities, and practical implications for market participants. By examining the historical performance of the MACD strategy, researchers can assess its ability to generate consistent returns, identify market trends, and navigate different market conditions. Evaluating the strategy's performance relative to a benchmark index, such as the Philippine Stock Exchange Index (PSEi), can shed light on its comparative advantages or disadvantages.

In this study, we aim to conduct a detailed review of the 12-year historical performance of the MACD strategy in the Philippine stock market. By analyzing a diverse set of stocks listed on the PSE, we will assess the profitability and risk-adjusted performance of the strategy. In financial markets, technical analysis serves as a fundamental tool for traders and investors to make informed decisions based on historical price. Among the various technical analysis strategies, the Moving Average Convergence Divergence (MACD) has emerged as a popular methodology employed to identify potential buy and sell signals. The MACD strategy utilizes the convergence and divergence of moving averages to generate trading signals, aiding in the timing of entry and exit points in the market. While extensive research has been conducted on the effectiveness of the MACD strategy in various financial markets, there is a comprehensive study exploring its long-term performance in the context of the Philippine stock market. The findings of this research can provide valuable insights for investors, traders, and market participants seeking to incorporate the MACD strategy into their decision-making processes in the Philippine stock market. Understanding the long-term effectiveness of the MACD strategy can contribute to the body of knowledge on technical analysis and provide practical guidance for navigating the complexities of the Philippine stock market.

1.1 Objectives
This study aims to contribute to the understanding of the Philippine stock market by assessing the long-term performance of the MACD strategy within this market. By evaluating the effectiveness of this popular technical analysis tool, investors and market participants can gain insights into the profitability and reliability of the MACD strategy as an investment approach in the Philippine context.

To assess the effectiveness of the MACD strategy, this analysis encompasses a performance metrics such as stock return with different windows which contribute to a holistic evaluation of the strategy's performance.

2. Literature Review
Several studies have explored the use of the Moving Average Convergence Divergence (MACD) indicator in the stock market from different angles. Huang, Chen, and Zheng (2013) examined the profitability of MACD and other technical trading rules in the foreign exchange market, shedding light on the effectiveness of MACD as a trading strategy. Juhmani, Al-Omar, and Alrefai (2017) investigated the profitability of MACD and Relative Strength Index (RSI) trading rules in the Kuwait Stock Exchange, providing empirical evidence on the performance of MACD as a trading strategy. Katsiampa (2017) focused on volatility forecasting using MACD histograms, evaluating the effectiveness of MACD in predicting future stock market volatility. Siahpush and Siahpush (2014) evaluated the performance of MACD as a trading strategy in the Tehran Stock Exchange, examining its effectiveness in the Iranian stock market. Urquhart and McGroarty (2016) applied multifractal analysis to MACD and other technical indicators to investigate the 2007-2008 US stock market collapse, studying the behavior and predictability of the market using MACD. These studies have contributed to understanding the effectiveness of MACD in different stock markets by analyzing its profitability, volatility forecasting capabilities, and performance in various contexts (Huang et al. 2013; Juhmani et

al. 2017; Katsiampa 2017; Siahpush & Siahpush 2014; Urquhart & McGroarty 2016; Navarro et al. 2023). However, in the context of the Philippine stock market, there is a research gap in exploring the use of different window settings in the MACD indicator. Previous studies in the Philippine stock market have examined the effectiveness of technical analysis indicators, including MACD, in terms of profitability and predictive power (Balatbat & Mantaring, 2017; Gerpacio 2017; Yu, 2012; Navarro & Navarro 2023). However, none of these studies have specifically investigated the use of alternative MACD window settings such as MACD (4,22,3) in the Philippine stock market context.

The aim of this study is to provide a comprehensive analysis of the 12-year historical performance of the Philippine stock market using both the traditional MACD settings (12, 26, 9) and the alternative MACD settings (4, 22, 3). By examining the annual performance of the Philippine stock market from 2010 to 2020, we seek to evaluate the profitability and risk-adjusted performance of the MACD strategy with different window settings. This analysis will provide insights into the effectiveness of the MACD strategy in capturing market trends, identifying buy and sell signals, and navigating the Philippine stock market.

By comparing the performance of the traditional MACD settings with the alternative settings, we can determine whether the alternative settings offer any advantages in terms of profitability and risk management. Additionally, we will assess the sensitivity of the MACD strategy to two different window settings such as MACD (12,26,9) and MACD (4, 22,3) and explore the optimal parameter values for maximizing performance in the Philippine stock market.

3. Methodology

The Moving Average Convergence/Divergence (MACD) is a widely used momentum indicator in technical analysis, initially developed by Gerald Appel in the late 1970s (Appel, 1979). It is a versatile indicator that is commonly employed by both long-term and short-term investors. The MACD line is calculated by taking the difference between the 12-day exponential moving average (EMA) and the 26-day EMA. This calculation allows the MACD line to capture the trend and momentum of a security or market.

Over time, the MACD line and its accompanying signal line, represented by the MACD moving average, exhibit various patterns and movements. They oscillate around the zero-level line and display divergent, convergent, and crossover movements, providing insights into potential shifts in market dynamics (Murphy, 1999). The MACD indicator can be customized by adjusting the values of three parameters, typically denoted as n_1, n_2, and n_3, to suit specific trading goals. The standard representation of MACD with the parameters 12, 26, and 9 is denoted as MACD (12, 26, 9).

In the case of MACD (12, 26, 9), the indicator is calculated using exponential moving averages, which assign more weight to recent data points in the calculation process. Specifically, it involves subtracting the shorter EMA of window length n_1 (12) from the longer EMA of window length n_2 (26). The resulting MACD line is then smoothed by calculating a signal line, often represented by a 9-day EMA, to generate trade signals and identify potential buy or sell opportunities.

By utilizing the MACD indicator in its classic form, traders and investors can gain insights into the momentum and direction of price movements in a security or market. The MACD (12, 26, 9) setting provides a common configuration that captures short-term and intermediate-term trends while considering recent price dynamics. However, it is important to note that alternative parameter settings can be utilized based on specific trading strategies and objectives.

The MACD trading indicator consists of the following three elements:

1. The MACD line: the difference between the short- and long-term exponential moving averages (EMA).
2. The Signal line: an exponential moving average of the MACD line.
3. Histogram: a graphical representation of the distance between the MACD line and the Signal line.

The EMA is defined as,

$$EMA_t(N) = \left[\frac{2}{N}\left(I_t - EMA_{t-1}(N)\right)\right] + EMA_{t-1}(N) \tag{1}$$

$$MACD_t(n_1, n_2) = EMA_t(n_1) - EMA_t(n_2) \tag{2}$$

$$Signal_t(n_3) = \left[\frac{2}{n_3+1} \times \left(MACD_t(n_1, n_2) - Signal_{t-1}(n_3)\right)\right] + Signal_{t-1}(n_3) \tag{3}$$

$$Histogram_t = MACD_t - Signal_t \tag{4}$$

Where;
$EMA_t(N)$ = Exponential moving average at time t
N = window length of EMA (e.g., n1 and n2)
n_3 = denotes the period for the EMA calculation of the $MACD_t$ series
I_t = closing day price (index value) at time t
$Signal_t(n_3)$ = EMA of MACD line at time t; (Signal Line)
$Signal_{t-1}$=initial previous signal line that starts at 2nd period EMA of MACD line at time t

3.1 Moving Average Convergence/Divergence (MACD) Trading Rules
The MACD (Moving Average Convergence/Divergence) indicator, along with its signal line, provides valuable insights into market trends and potential overbought or oversold conditions. The MACD and signal line oscillate around the zero axis or midline, reflecting different market scenarios. When the exponential moving averages (EMA) used in the calculation of the MACD are close together, it indicates convergence, while a wider separation signifies divergence. The sensitivity of the MACD line to price movements is influenced by the length of the moving average used. Shorter moving averages result in a more responsive MACD line. Traders often look for specific patterns and signals generated by the MACD, such as signal line crossovers, centerline crossovers, and divergence. The signal line represents the EMA of the MACD line itself. It follows the MACD line's average and assists in identifying potential turning points. A bullish crossover occurs when the MACD line crosses above the signal line, indicating a potential upward trend and bullish market sentiment. Conversely, a bearish crossover occurs when the MACD line falls below the signal line, signaling a potential downward trend and bearish market sentiment.

In this paper, the MACD trading rules used will be based on these principles and patterns. The specific trading rules and strategies employed in this study will be further outlined to provide a comprehensive analysis of the MACD's effectiveness in the Philippine stock market.

Buy Signal:

$$Histogram_t = MACD_t - Signal_t > 0 \tag{5}$$

Sell Signal:

$$Histogram_t = MACD_t - Signal_t < 0 \tag{6}$$

Also, the annual return is calculated as,

$$R_A = \sum_{i=1}^{M} P_{Sell} - \sum_{j=1}^{N} P_{Buy} \tag{7}$$

And the annual rate of return,

$$R_i = \frac{R_A}{R_{BS}} \times 100\% \tag{8}$$

Where;
R_A = Annual Return
R_i = Annual Rate of Return

R_{BS} = Closing index value where the first transaction occurs (Buy or Sell)
M = number of sell signal
N = number of a buy signal
P_{Buy} and P_{Sell} are the closing index values on the days to execute buying and selling transactions, respectively

4. Test Data

The data used in this assessment corresponded to a 12-year performance from 2010 to 2021 of 178 companies listed in the Philippine Stock Market. It composes of different sectors such as transportation, mining, media, utilities, food, banking, construction, etc.

5. Results and Discussion

The corresponding annual rate of return, R_i, per company has been calculated for a 12-year period starting from 2010 to 2021 for both MACD (12,26,9) and MACD (4,22,3). The calculation of R_i was coded in MATLAB Platform.

5.1 Graphical Results

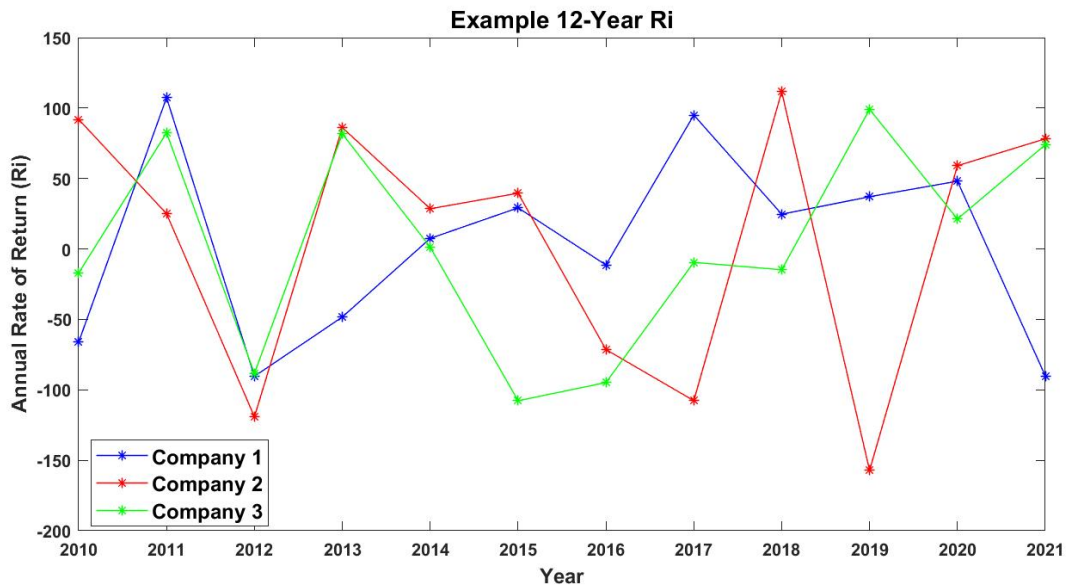Figure 1 shows an example of three companies' performance from 2010 to 2021.

Figure 1. Example Three Companies' Performance

5.2 Numerical Results

With the intermittent characteristics of R_i per company for the 12-year period, this paper set a subjective approach to define performance. Within the 12-year period, a company with more than or equal to eight positive R_i will be considered as good company. Table 1 shows the comparison of MACD (12,26,9) and MACD (4,22,3). The percentage indicated in the table are the number of companies with more than or equal to eight positive R_i over the total number of companies in each sector class.

Table 1. Comparative Results

Sector Class	Number of Companies	MACD (12,26,9)		MACD (4,22,3)	
		Number of Good Companies	Percent	Number of Good Companies	Percent
Transportation Services	7	4	57%	5	71%
Mining	18	7	39%	7	39%
Holding Firms	30	6	20%	16	53%
Media	4	2	50%	4	100%
Electricity, Energy, Power; Water	12	6	50%	7	58%
Property	30	14	47%	18	60%
Food, Beverage; Tobacco	17	7	41%	6	35%
Other Services	5	2	40%	2	40%
Casinos; Gaming	6	1	17%	4	67%
Banks	10	1	10%	4	40%
Hotel; Leisure	2	0	0%	0	0%
Other Financial Institutions	9	3	33%	6	67%
Construction, Infrastructure; Allied Services	7	2	29%	3	43%
Education	4	1	25%	3	75%
Information Technology	6	2	33%	2	33%
Chemicals	2	1	50%	1	50%
Telecommunications	2	0	0%	0	0%
Electrical Components; Equipment	3	2	67%	1	33%
Small, Medium; Emerging Board	1	0	0%	0	0%
Oil	2	2	100%	2	100%
Retail	1	0	0%	0	0%

The result shows that MACD (4,22,3) provide promising results compared to the classical MACD (12,26,9). This also shows that shorter window has more transactions (buying/selling) compared to longer window, it yielded best results.

6. Conclusion

The MACD strategy, using the traditional settings of (12,26,9) window has demonstrated a positive performance over the 12-year period analyzed. The strategy's ability to generate profitable trades and capture favorable market movements suggests its potential value as a technical analysis tool for investors in the Philippine stock market.

The new window settings of MACD, (4, 22,3), have shown promising results in terms of performance and profitability. The alternative window lengths may provide traders with additional insights and trading opportunities, offering an alternative approach to utilizing the MACD indicator in the Philippine stock market.

The MACD strategy, regardless of the specific settings used, appears to be particularly effective in capturing bullish trends and identifying potential buying opportunities. The strategy's ability to generate bullish crossovers and signal upward price movements can be valuable for investors seeking to capitalize on positive market conditions.

Risk management is a crucial aspect of successful trading, and the MACD strategy can contribute to risk mitigation. By incorporating MACD-based signals, traders can potentially identify potential trend reversals, divergence patterns, or bearish crossovers, allowing for timely exits or risk management measures to protect against potential losses.

The findings of this study provide valuable insights for investors and traders in the Philippine stock market, enabling them to make informed decisions based on the historical performance and characteristics of the MACD strategy. However, it is essential to consider that past performance is not indicative of future results, and market conditions may evolve over time, requiring ongoing evaluation and adaptation of trading strategies.

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Maricar M. Navarro is a Professional Industrial Engineer (PIE) awarded by the Philippine Institute of Industrial Engineers (PIIE) and an ASEAN Engineer (AE) awarded by the ASEAN Federation of Engineering Organizations. She is an Assistant Professor IV in the Department of Industrial Engineering and a Professor of the Graduate School Program at the Technological Institute of the Philippines-Quezon City. Engr. Navarro has done research projects that deal with the optimization of production, warehouse operations, and service operations. Her research interests include manufacturing, simulation, optimization, facility layout, and design. She is an active member and Professional Industrial Engineer of the Philippine Institute of Industrial Engineers (PIIE) organization in the Philippines.

Bryan B. Navarro is an Assistant Professor in the Department of Electrical Engineering at the Technological Institute of the Philippines and is currently a Staff Engineer at Manila Electric Company (MERALCO). He earned B.S. in Electrical Engineering from the Technological Institute of the Philippines, Quezon City, Master of Science in Electrical Engineering major in Power Systems from the University of the Philippines, Diliman, Quezon City. He has published journal and conference papers. He is an active member of the Institute of Integrated Electrical Engineers of the Philippines (IIEE).