

# Performance Evaluation of Trading Strategies from Composite Technical Indicators

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**Abstract—** Investing in the stock market poses significant challenges and risks due to the rapid fluctuations in prices that can result from a wide range of factors. To mitigate these risks, many investors utilize technical indicators, which are derived from trading price and volume data, to inform their decisions on when to buy or sell stocks. However, it is important to recognize that not all technical indicators are suitable for making trading decision on their own, and the choice of technical indicators have a substantial impact on the accuracy of trading signals. This research presents a performance evaluation of various trading strategies based on composite technical indicators over two distinct periods: during the pandemic and after with set100. The performance of each composite technical indicator is compared against a buy-and-hold strategy. The findings indicate that the proposed composite technical indicators can significantly improve investment profits, even after accounting for a 0.2% commission fee for all buying and selling transactions. The insights generated from this study are highly valuable for investors seeking to enhance their trading performance using technical indicators in the stock market.

**Keywords—**Trading Strategy, Technical indicator, Stock Market

## I. INTRODUCTION

Investing aims to bring in higher returns than saving [1], and one way of achieving this goal is through stock market investments, which provide an opportunity for substantial profits. However, the total return from such investments, including dividends and margin profit or loss, depends on various factors including company performance, economic indicators, industry trends, company news, market sentiment, political factors, etc. To achieve higher returns, investors need to learn and acquire helpful information and experience to make the best investment decisions.[2]

Various tools are available to assist investors in making trading decisions. One such tool is technical analysis, which is a trading approach that involves analyzing statistical trends derived from trading activity, such as price movements and trading volumes [3], to evaluate investments and identify potential trading opportunities. This method employs various technical indicators to estimate patterns of future behavior and identify buy and sell opportunities, making it a popular tool for making investment decisions. Trading rules derived from technical analysis have become the focus of many investors, especially high-frequency traders [4,5].

Although technical analysis can be useful for making investment decisions, selecting the most relevant indicators

can be a challenge for investors. This is especially true when different indicators provide conflicting signals, making it difficult to determine the best course of action. To address this issue, one possible solution is to create composite trading signals from different technical indicators and test them in different market conditions to evaluate their performance.

This research aims to evaluate the performance of different composite technical indicators through backtesting in various stocks in different conditions. Doing so will provide insights into the effectiveness of different technical indicators for making investment decisions.

## II. TECHNICAL INDICATOR

Technical indicators are mathematical calculations based on historic price, volume, or open interest information to predict asset price direction [6]. They are classified into four major types: trend indicators, momentum indicators, volatility indicators, and volume indicators.

Trend indicators are used to determine the direction of the market trend. They help investors identify whether a stock, currency pair, or any other asset is in an uptrend, downtrend, or sideways trend. Trend indicators are also known as oscillators because they move in a wave-like pattern between high and low and do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable. values. Moving Average Convergence Divergence (MACD) and Simple Moving Averages (SMA) are popular trend indicators [6].

Momentum indicators measure the strength of a trend and predict when it may reverse. They help investors identify the speed at which a trend is moving and whether it may be reaching a point of exhaustion. Relative Strength Index (RSI) [6], Average Directional Index (ADX) [7,8], and Stochastic Oscillator (STO) [9] are some examples of momentum indicators.

Volatility indicators are used to measure the magnitude of price movements in a particular asset. They help investors understand the level of risk associated with a particular investment. Bollinger Bands (BB) and Average True Range (ATR) [10] are examples of popular volatility indicators.

Volume indicators measure the number of shares or contracts traded in a particular asset over a given period of time. They help investors identify whether a particular trend is supported by high or low trading volume. Chaikin Oscillator

and On-Balance-Volume (OBV) are examples of volume indicators [6].

These values from technical indicators are widely used by investors to make decisions about when to buy or sell including the followings. Seventeen indicators are used in this research which consist of

#### A. Moving Average (MA)

The Moving Average (MA) indicator is a widely used technical analysis tool which helps traders identify trends in asset prices by calculating the average price over a specified period. A popular strategy involves observing the intersection of two MAs with different time frames.

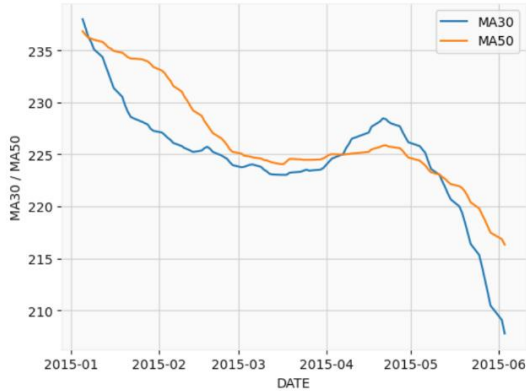


Fig 1. MA crossover graph

#### B. Moving Average Convergence Divergence (MACD)

The Moving Average Convergence Divergence (MACD) is a popular momentum indicator used to track the strength and direction of a trend. It is calculated by subtracting the 26-period Exponential Moving Average (EMA) from the 12-period EMA [11].

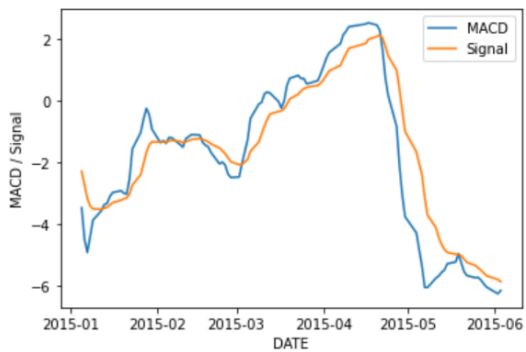


Fig 2. MACD crossover graph

#### C. Relative Strength Index (RSI)

The Relative Strength Index (RSI) is a momentum oscillator which captures the speed and magnitude of price changes in an asset. It derives its value by comparing an asset's average gains and losses over a specific time period. The RSI score ranges from 0-100. The RSI formula can be calculated as:

$$RSI = 100 - \left[ \frac{100}{1 + \frac{\text{Average gain}}{\text{Average Loss}}} \right]$$



Fig 3. RSI graph

#### D. AVERAGE DIRECTIONAL INDEX (ADX)

The Average Directional Index (ADX) is a technical analysis tool that gauges the strength of a trend by comparing positive and negative directional movements over a specific time period. Unlike other indicators, ADX doesn't indicate the direction of the trend, only its magnitude or strength [b]. ADX values range from 0 to 100, with higher values indicating stronger trends. Traders typically pair ADX with Plus Directional Indicator (+DI) and Minus Directional Indicator (-DI) to detect potential changes in trend direction [7].

#### E. RENKO CHARTS

Renko charts are a unique technical analysis tool designed to filter out market noise and improve trend detection. Unlike traditional price charts, Renko charts are formed by a sequence of bricks or boxes, with each representing a fixed price shift chosen by the trader. A new brick of the same color is added to the chart if the price movement corresponds to the prior brick's direction, on the other hand, a new brick of the opposite color is added if the price moves in the opposite direction [6].

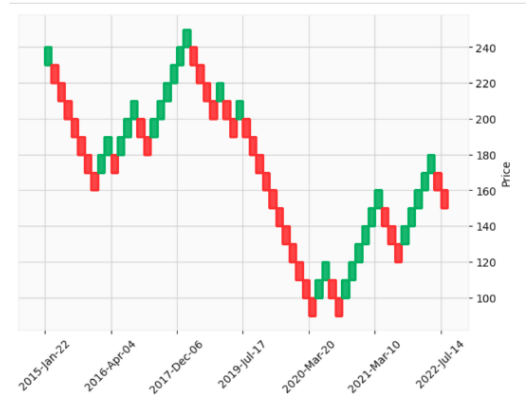


Fig 4. Renko chart

#### F. On Balance Volume (OBV)

The On-Balance Volume (OBV) is a technical indicator that measures buying and selling pressure by adding or subtracting the asset's volume based on whether the price closes higher or lower than the previous day. The OBV line, which is plotted on the price chart, rises when the closing price is higher than the previous close, falls when the closing price is lower, and remains unchanged when the closing price is the same. The OBV formula is as follows:

$$OBV = OBV_{prev} + \begin{cases} Volume, & ; close > close_{prev} \\ 0, & ; close = close_{prev} \\ -Volume, & ; close < close_{prev} \end{cases}$$

Where  $OBV_{prev}$  is the previous  $OBV$  value,  $Volume$  is the current volume of trades, and  $close$  is close price of particular timeframe.

#### G. Stochastic Oscillator (STO)

The Stochastic Oscillator is a momentum indicator that compares a security's closing price to a range of its prices over a set period. Adjusting the period or taking a moving average can reduce its sensitivity to market movements. It generates trading signals for overbought and oversold conditions, using a range of values between 0 and 100 [9].

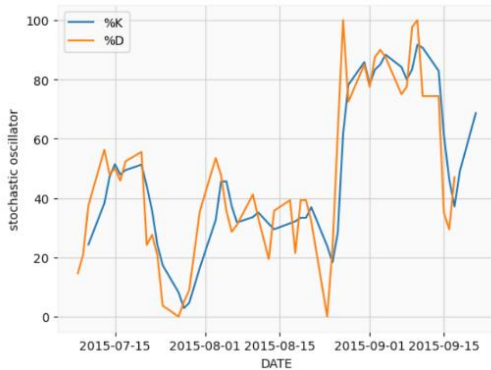


Fig 5. STO graph

#### H. COMMODITY CHANNEL INDEX (CCI)

The Commodity Channel Index (CCI) is a momentum oscillator which helps traders determine when an asset is overbought or oversold [12]. It evaluates the direction and strength of price trends, allowing traders to decide whether to enter or exit a trade, hold off on trading, or increase an existing position.

#### I. Bollinger Band (BB)

Bollinger Bands replace a moving average with a band around the price movement and allow traders to analyze the results for a trading protocol [13]. It consists of two trendlines plotted as two standard deviations from a simple moving average, and can be customized. It helps identify when an asset is overbought or oversold, increasing the probability of successful trades.

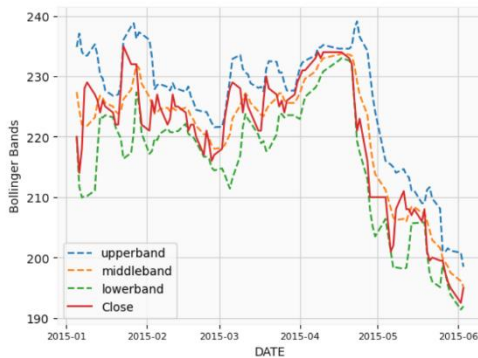


Fig 6. BB graph

#### J. Williams Percent Range (William %R)

Williams %R is a momentum indicator which measures overbought and oversold levels on a scale of 0 to -100.

Similarly to the Stochastic oscillator, it can be used to determine entry and exit points in the market by comparing a stock's closing price to its high-low range over a specific period, usually 14 days. [14]

#### K. Rate of Change (ROC)

Rate of Change (ROC) is a technical indicator that measures the percentage change in an asset's price over a specified period, indicating momentum. ROC can help traders determine entry and exit points, with a negative ROC suggesting a decline in value and a positive ROC suggesting an increase in value [15].

#### L. Aroon

The Aroon indicator is a tool used to detect trend shifts and their strength in asset prices. It measures the duration between highs and lows over a period of time to identify whether a strong uptrend or downtrend is present. When new highs or lows occur regularly, the indicator signals a strong trend, and when they don't, it indicates a weak trend [11].

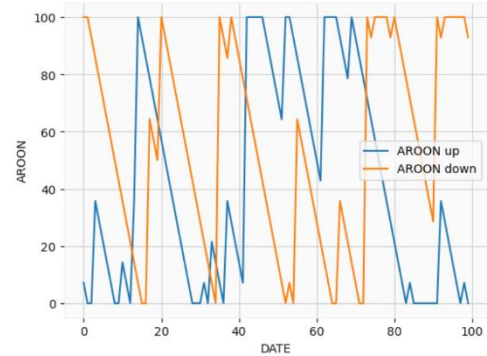


Fig 7. AROON graph

The Aroon indicator includes the "Aroon up" line, which measures uptrend strength, and the "Aroon down" line, which measures downtrend strength.

#### M. CDC ACTIONZONE

The CDC Action Zone V3 2020 is a custom technical indicator created in Pine script which helps identify trends and potential trading opportunities in the market [16]. It's based on two Exponential Moving Averages (EMAs) that cross over each other, allowing for identification of bullish and bearish trends. This indicator plots two EMAs on the price chart, one with a shorter period (12 by default) and another with a longer period (26 by default). Depending on the price position relative to these EMAs, the indicator defines different "zones" on the chart. These zones, consisting of three buy and sell zones each, can be used to activate other trading strategies. The buy zones are colored green, blue, and light blue, while the sell zones are red, orange, and yellow.

#### N. Parabolic Stop and Reverse (PSAR)

The PSAR is a technical indicator that helps identify potential trend reversals in asset price movements. It's calculated based on an asset's price action and displayed on a price chart as a series of dots. The dots are positioned above or below the asset price to indicate the trend direction. When dots are below the price, it's bullish, and when above, it's bearish. The dots are calculated using a mathematical formula that considers the previous PSAR value, current price, and acceleration factor (AF). The AF starts at 0.02 and increases by 0.02 for each period the trend continues. [17]

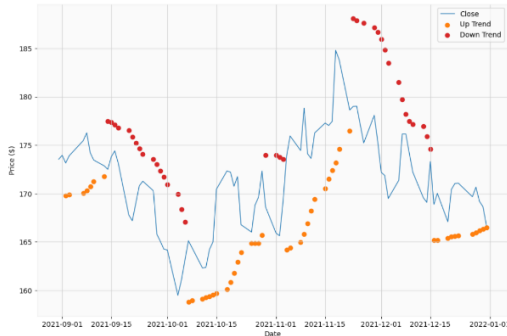


Fig 8. PSAR graph

#### O. Volume profile

Volume Profile is a sophisticated charting technique that identifies significant price levels based on trading volume. It allows traders to pinpoint crucial price levels and potential areas of support or resistance, making it a powerful tool for gaining insight into market trends and making informed trading decisions.

Moreover, the trading volume can help traders identify the equilibrium price, which is the price level with the highest trading volume within a certain time and price range. If we have identified an equilibrium price in the market, we know that the market tends to return to the original market equilibrium or create a new market equilibrium. This means that we can identify price levels that are advantageous for buying or selling an asset [18,19].

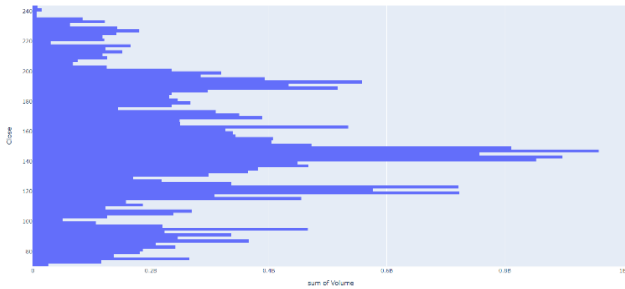


Fig 9. Volume profile graph

#### P. Value Weighted Average Price (VWAP)

The Volume Weighted Average Price (VWAP) is a vital technical indicator used on intraday charts, which calculates the average price at which a security has been traded throughout the day. It's the most commonly used benchmark price, determined by weighting the average stock price by market volumes [20]. VWAP takes into account both the price and volume of trades, providing a valuable tool for traders to analyze trends and assess the value of a security. As a result, VWAP is a critical indicator for making informed trading decisions. This indicator resets at the start of each trading session, allowing traders to track the average price of a security in real-time throughout the day.

### III. TRADING STRATEGY

Most traders follow a well-established trading philosophy, but it may not always lead to profitability. To ensure higher returns from intraday trading, trading strategies based on technical indicators have been developed. This paper proposes 35 trading strategies generated by using values from combining technical indicators and setting conditions for each indicator to meet certain criteria to create a signal. [21] These

technical indicators are commonly used by investors to make informed decisions about when to buy or sell including

#### A. Volume Profile

The Volume Profile is a tool utilized in technical analysis to identify crucial price levels based on trading volume. These price levels are considered key value areas that can help determine the equilibrium price of a stock at a particular time.

In order to formulate a trading strategy using the Volume Profile, two notable peaks of tight consolidation and high trading volume were identified. When the current price is lower than the second significant peak, it indicates that the current price is below the two key equilibrium prices, thus generating a buy signal. Conversely, if the current price is higher than the two significant peaks, it implies that the price has surpassed the equilibrium price, triggering a sell signal. [18]

#### B. STO and ADX.

Stochastic is a popular technical indicator used to identify potential reversal points in a trending market. However, like any indicator, it has its limitations and potential drawbacks. One of the main challenges with the stochastic oscillator is its tendency to generate false signals, which can lead to losing trades. This is because the oscillator is calculated based on a fixed number of periods, typically 14, and can be influenced by short-term price fluctuations and market noise.

To overcome these limitations, traders often combine the stochastic oscillator with other technical indicators. One such indicator is ADX, which can be used to confirm that a trend is strong and worth trading. By using these indicators in combination, traders can identify potential entry and exit points more accurately and filter out false signals.

In recent research, a strategy has been developed that uses a combination of STO and ADX to generate buy and sell signals. A buy signal is triggered when three conditions are met: %k is lower than 20, %k surpasses the %d line, and ADX shows a strong trend with a value greater than 25. On the other hand, an exit signal is generated when %k is higher than 80, %k falls below the %d line, ADX is greater than 40 and starts to fall, indicating the end of a strong uptrend.

#### C. OBV and MACD

This trading technique combines leading and lagging indicators to identify potential entry and exit points in the market with greater accuracy [11]. The leading OBV indicator analyzes volume data to gauge buying and selling pressure, while the lagging MACD indicator analyzes moving averages to identify potential trend changes and momentum shifts.

A buy signal is generated when the OBV slope is greater than 30 degrees, indicating increasing buying pressure, and the MACD line is above the signal line, with the MACD value over the last 5 periods greater than the MACD signal value, suggesting a trend reversal. Conversely, a sell signal is generated when the MACD line goes below the signal line, the MACD value over the last 5 periods is lower than the MACD signal, and the OBV slope is lower than 30, indicating decreasing buying pressure.

#### D. Renko chart and ADX

Combining Renko charts with ADX can be a powerful trading strategy for trend following. By using Renko charts to identify significant price movements and filter out market noise, while ADX can help confirm the strength of a trend and



signal potential entry and exit points. A buy signal is generated when Renko chart produces 3rd brick of three consecutive green bricks with MACD value greater than 0 indicates a positive momentum with an uptrend. On the other hand, if Renko chart produces 3rd brick for every three consecutive red bricks at the same time that MACD value is lower than 0.

#### E. Renko chart and MACD

This strategy uses a combination of MACD and Renko charts to generate buy and sell signals. A buy signal is generated when three conditions are satisfied which are Renko chart produces 3rd brick of three consecutive green bricks, MACD value is greater than MACD signal value and 5 session slopes of MACD line is greater than 5 session slopes of MACD signal line. On the other, an exit signal is generated when the MACD value is less than the MACD signal value and the 5-session slope of the MACD line is less than 5 session slopes of the MACD signal line at the same time that Renko chart produces 3rd brick for every three consecutive red bricks.

#### F. Aroon

The Aroon Indicator was used in two ways to build a trading strategy. First is the crossover trading strategy. This strategy reveals a buy signal if the Aroon up line crosses from below to above the Aroon down line, similarly, a sell signal is revealed if the Aroon up line moves from above to below the Aroon down line.

The second strategy is constructing a higher and lower threshold which represents a buy signal if the Aroon up line has a reading of and above 70 and parallelly, the Aroon down line has a reading of and below 30. Likewise, when the Aroon up line has a reading of or below 30 and the reading of Aroon down line is observed to be at or above 70, a sell signal is revealed.

#### G. CDC

This indicator plots two EMAs on the price chart, one with a shorter period (12 by default) and another with a longer period (26 by default). A buy signal is generated when the shorter EMA crosses above the longer EMA. Conversely, a sell signal is generated when shorter EMA crosses under the longer EMA.

#### H. SMA50 and SMA100

If a shorter-term SMA (SMA50) crosses above a longer-term MA (SMA100), a sell signal is generated. Conversely, if the shorter-term MA falls below the longer-term MA, the sell signal is generated.

#### I. RSI and MACD

Technical analysis using MACD and RSI indicators enables investor to know the current trend and direction of stock prices, trading cycles [22].

#### J. VWAP

This indicator gives a volume-weighted average price. For the method used by the group is to use the vwap line as an indicator in whether the price of a security is in an upward or downward trend. When the price crosses above the vwap, it is a buy signal. As for if the price cuts down, vwap is a sell signal.

#### K. RSI and ADX

RSI reading of 35 or below represents the market is in the state of oversold together with ADX lower than 35 generate a sell signal.

### IV. PERFORMANCE EVALUATION

Backtesting, also known as Systems Testing, is a crucial process for evaluating the effectiveness of a trading strategy. It involves simulating trades based on historical data to determine how well a strategy would have performed if it had been used in the past. By comparing the performances of different strategies on the same historical data, traders can identify the most profitable strategies. [23]

In this study, Backtesting was conducted to evaluate the profitability of composite technical indicators on 78 stocks in SET100 from the Thai stock market. The stock data was analyzed in three datasets to evaluate the performance of trading strategies in different periods, including pre-pandemic period (2/1/2016 to 31/12/2017), another pre-pandemic period (2/1/2018 to 31/12/2019), during-pandemic period (2/1/2020 to 31/12/2020), and post-pandemic period (2/1/2021 to 01/05/2023). This comprehensive approach enables traders to assess the performance of their strategies under various market conditions, providing valuable insights for future trading decisions.

#### A. Data preprocessing

To obtain the historical data of stocks, the yfinance library from Python is used. Technical indicators are calculated using TA-lib, which generates commonly used technical indicators. However, the TA-lib has limitations regarding available indicators, so a manual method for calculating technical indicators is also developed to create the missing indicator values. Trading signals are generated by using the values from technical indicators and setting conditions that the values from each indicator have to meet the criteria to create a signal. These values from technical indicators are widely used by investors to make decisions about when to buy or sell.

#### B. Trading Simulation

To evaluate the effectiveness of each trading strategy, a trading simulation was conducted for each stock, starting with an initial capital of 1,000,000 Baht. At the end of each testing period, the average returns for each strategy were calculated and compared with the returns from a buy-and-hold (B&H) strategy.

Both the proposed strategy and the B&H strategy were subjected to a 0.2% commission fee for every buying and selling transaction. This fee was included to ensure that the simulations accurately reflected the actual costs of trading. By accounting for transaction costs, the simulations provided a more realistic evaluation of the profitability of each strategy.

#### C. Result and Discussion

The results of the backtesting provided in Table. It shows the resulted average return of 60 stocks in term of % for ~~both~~ each testing periods.

TABLE I. RETURN OF EACH STRATEGY

Proposed Trading Strategy	% Returns (2016-2017)	% Returns (2018-2019)	% Returns (2020)	% Returns (2021-2023/05)	% Average Returns
Volume Profile	60.14	12.93	36.72	60.0	42.45
RSI and MACD	47.26	-1.81	30.8	22.03	24.57
OBV and MACD	64.79	-9.41	23.19	19.41	24.49
STO and ADX	59.58	-7.26	33.73	9.59	23.91
OBV and Renko	57.6	-10.51	19.41	16.57	20.77
Renko and ADX	46.69	-6.81	28.97	11.47	20.08
Renko and MACD	36.26	-4.18	32.13	14.0	19.55
MACD	30.44	-5.19	34.63	16.1	18.99
CDC	29.87	-5.23	35.43	14.96	18.76
Aroon	32.83	-7.61	35.04	12.08	18.08
DMI	24.14	-10.11	43.49	10.68	17.05
SMA30 and SMA50	31.72	-4.36	16.81	27.51	17.92
SMA50 and SMA200	34.77	-5.93	12.85	28.2	17.47
SMA25 and SMA89	-0.21	-2.87	5.93	44.11	21.77
SMA30 and SMA100	37.84	1.59	8.39	31.69	19.88
SMA50 and SMA100	38.57	0.09	6.07	33.89	19.66
B&H	65.97	-8.40	16.53	29.57	25.92

## V. CONCLUSIONS

In conclusion, this paper presents an experimental approach for evaluating the performance of composite technical indicators in three distinct periods, including pre-crisis during crisis and post-crisis. The results of Backtesting on 60 stocks in the US and Thai markets suggest that combining multiple technical indicators can improve the stability of trading strategies and reduce the risk of losing money, particularly in normal market conditions. The study's findings reveal that the many trading strategies significantly outperform buy and hold strategies on average, although building effective trading strategies during times of crisis remains a challenge. Furthermore, the many trading strategies are more effective for stocks with fluctuating or downward trends, but less effective for those with upward trends, due to the excessive commission fees incurred by frequent trading during an upward trend. Future research could extend this work by testing more stocks and comparing with additional trading strategies.

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