ISSN:2790-1661 Volume-7-(2023)

Research on Stock Trading Strategies Based on Moving Average Technical Indicators

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Abstract. This study examines the application of the moving average indicator in stock trading to identify the most probable timing for profitable buying and selling of stocks. The trading data of Guizhou Maotai stock from August 27, 2020, to October 28, 2022, was selected. The conclusion drawn is that using a 5-day moving average for the short-term trend and a 20-day moving average for the long-term trend yields favorable results.The achievable profit amounts to 15,146.700000 RMB.

Keywords: Technical indicators; moving average line; candlestick chart; trading strategy.

1. Introduction

The financial market, as a significant reflection of the modern economy, possesses characteristics such as multiple random factors, dramatic price fluctuations, and a high noise-to-signal ratio [1]. Analyzing the behavioral characteristics of financial time series holds important theoretical and practical significance for investors in formulating appropriate investment strategies. Traditional stock market technical analysis methods mostly rely on averages or statistical approaches, with the moving average line method being the most commonly used [2].

There has been extensive research in the academic field on the effectiveness of the moving average line technical analysis method and its associated trading strategies. Abroad,Taylor (2014) [3] examined the predictability of the Dow Jones Industrial Average using technical indicators, while Park (2007) [4] and others explored the potential of technical analysis in forecasting. Sullivan (1999) [5] investigated quantitative trading methods. Domestically, Zou and Chen (2017) [6] compared and evaluated the effectiveness of MACD and MA analysis methods using trend recognition accuracy and tracking trading return rate as indicators. Zhou (2013) [7] tested the effectiveness of moving average strategies using data from the Chinese stock market. Chen et al. (2021) [8] proposed that price-based monetary policy tools could more effectively achieve the central bank's policy intentions in terms of the level and slope of the yield curve, but their impact on curvature remains relatively limited.

Despite the majority of evidence supporting the effectiveness of technical trading strategies, there have also been numerous studies questioning their validity [9]. This study aims to construct candlestick charts and moving average line strategies using representative stock data of Guizhou Maotai, in order to track the predictive ability of the moving average line analysis method and evaluate the investment performance of its trading strategies. The cumulative returns achieved by these investment strategies will be analyzed to determine the effectiveness of the moving average line analysis method in trading strategies.

2. Moving Average Technical Indicator Theory

2.1 Rate of Return Theory

In stocks, the focus is not on the absolute value of the price, but rather on the relative change. There are multiple ways to measure the relative value of stock prices, and the simplest method is to divide the current price by the initial price, known as the simple return rate：

$$\text{return}_{t,o} = \frac{\text{price}_t}{\text{price}_o} \quad (1)$$

The second method is to calculate the logarithmic difference of prices, known as the logarithmic return rate:

$$\text{change}_t = \log(\text{price}_t) - \log(\text{price}_{t-1}) \quad (2)$$

2.2 Candlestick Chart Theory

A Candlestick chart is drawn based on four data points: the opening price, the highest price, the closing price, and the lowest price. If the closing price is higher than the opening price, the K-line is called a bullish line or a "yang" line; otherwise, it is called a bearish line or a "yin" line.Bullish lines are represented in red, while bearish lines are represented in green.Certain candlestick patterns can provide preliminary indications of market strength or weakness：

Bullish Engulfing: The opening price is near the day's lowest point, and the price rises throughout the day, closing at the highest point. This indicates strong buying activity and a potential continuation of the upward trend.

Bearish Engulfing: The opening price is near the day's highest point, and the price declines throughout the day, closing at the lowest point. This signifies a strong bearish market, particularly concerning when it occurs in a high-price area.

Hanging Man at a high price level: It may indicate manipulation by major players to distribute their holdings, and caution should be exercised.

Tombstone Doji: It occurs when the opening is higher than the previous day's closing price in an upward gap.

2.3 Moving Average Theory

The moving average is the average value of the closing prices over a certain number of trading days, and it is plotted by connecting these average values. If a 5-day period is chosen, it represents the short-term moving average, while a 20-day period represents the long-term moving average. According to the eight trading rules by George Lane, when the moving average is below the stock price and shows an upward trend, it indicates a buying opportunity. Conversely, when the moving average is above the stock price and shows a downward trend, it indicates a selling opportunity. By comparing the 5-day moving average and the 20-day moving average, especially focusing on their crossover points, these points represent trading opportunities. Buy stocks when the 5-day moving average crosses above the 20-day moving average, and sell stocks when the 5-day moving average crosses below the 20-day moving average.

3. Moving Average Strategy

3.1 Data Selection and Preprocessing

This study selected the trading data of Guizhou Maotai stock from August 27, 2020, to October 28, 2022, from the website of NetEase Finance. After removing irrelevant information, the obtained data includes the following contents: opening price, highest price, closing price, lowest price, and trading volume, totaling 525 data points.

The visualization of the simple return rate for this data is shown in Figure 1:

Fig. 1 Simple returns chart

The visualization of the logarithmic return rate for this data is shown in Figure 2：

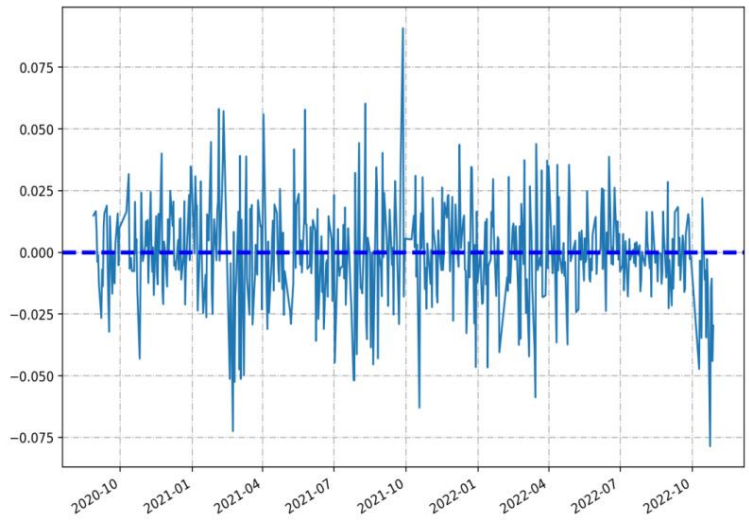


Fig. 2 Log returns chart

The statistical description of the log yields using the describe() function of python yielded 524 available log yields with a mean of-0.000460 and a standard deviation of 0.020534. Some partial results are shown in Table 1：

Table 1. Descriptive statistics for logarithmic returns

Count	Mean	Std	Min	75%	Max
524.000000	-0.000460	0.020534	-0.078574	0.012604	0.090792

3.2 Candlestick Charting

The candlestick chart is plotted using four data points: the opening price, the highest price, the closing price, and the lowest price.In the diagram below, bullish lines are represented in red, while bearish lines are represented in green, as shown in Figure 3:

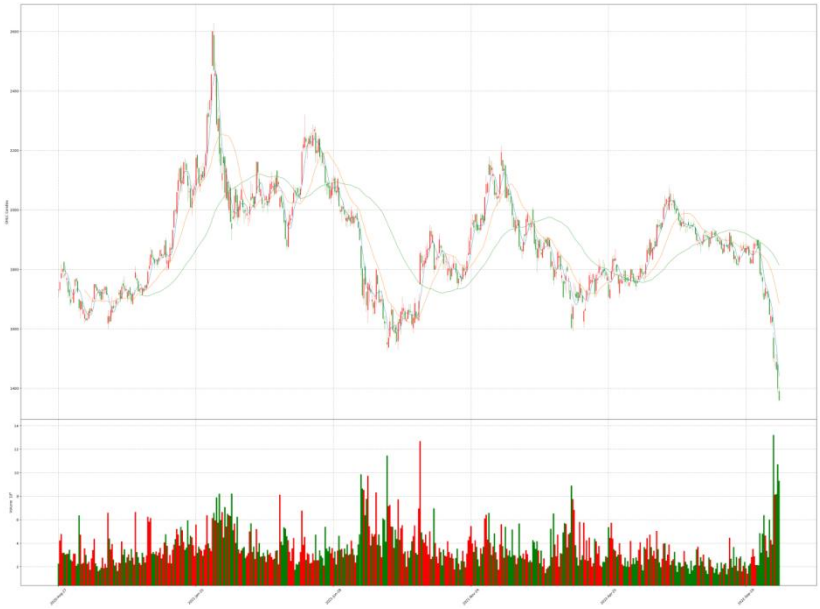
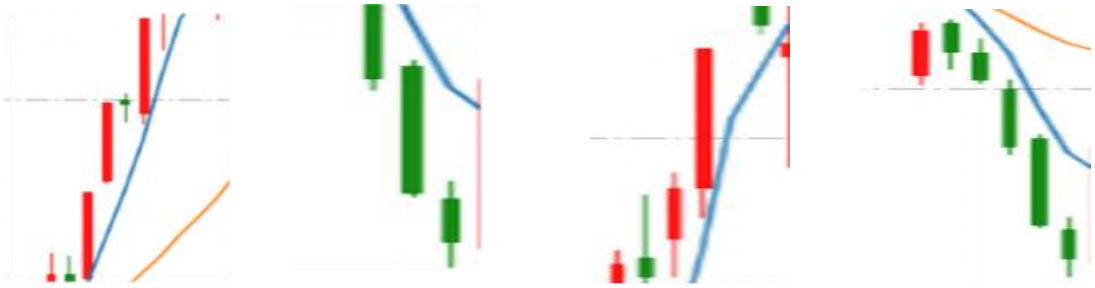


Fig. 3 Candlestick chart

Based on certain patterns observed in the chart, preliminary judgments can be made regarding the strength or weakness of the market. The specific visual representation is shown in Figure 4:



(a)Bullish Engulfing (b)Bearish Engulfing (c)Hanging Man at a high price level (d)Tombstone Doji

Fig. 4 Partial Candlestick chart

3.3 Drawing Moving Average Lines

In this article, we use the 5-day and 20-day average price indicators to plot the moving average lines. The specific visual representation is shown in Figure 5:

Fig. 5 Moving average chart

To visually observe and identify trading opportunities more effectively, the difference between the 5-day average price and the 20-day average price is calculated, and its sign (positive or negative) is plotted in the chart below. Trading signals occur when the horizontal line jumps. The specific visual representation is shown in Figure 6:

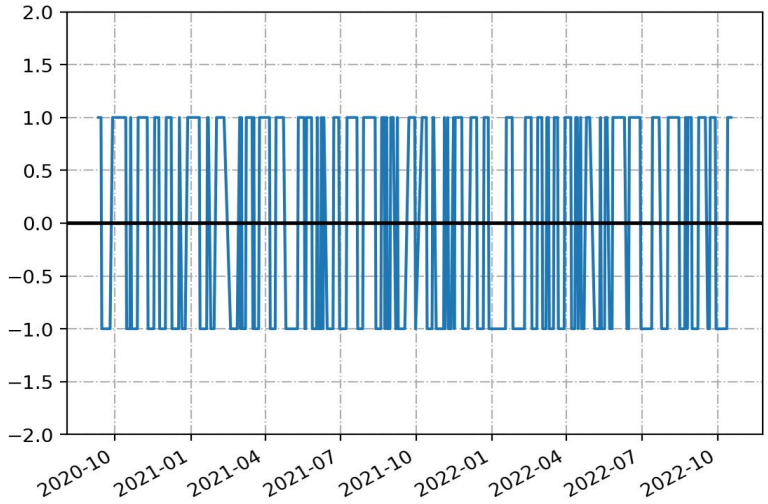


Fig. 6 Modified moving average chart

3.4 Decision

After plotting the moving average lines, decision-making takes place, and a portion of the decision-making process is illustrated in Table 2：

Table 2. Sales decision table

Date	Price	Operation
2020-09-11	1733.00	Buy
2020-09-14	1766.00	Buy
2020-09-15	1760.00	Sell
...	...	...
2022-10-14	1737.61	Buy
2022-10-17	1718.50	Buy

Ignoring other influencing factors and considering only the results obtained from the aforementioned strategy, the total sum of all buying and selling prices, along with the difference, yields a profit of 15,146.700000. This indicates a strong feasibility of the moving average strategy based on this data.

4. Summary

This study is based on Python programming techniques and utilizes the Guizhou Moutai stock data from August 27, 2020, to October 28, 2022. It examines the application of the moving average indicator in stock trading and achieves favorable results by setting parameters for buying and selling signals to guide stock market transactions.

However, alongside numerous valuable conclusions, there are several limitations in this research. Firstly, stock indices cannot be traded practically. Secondly, stop-loss and take-profit considerations were not taken into account. Thirdly, transaction costs were not considered. Fourthly, trading volume was not considered. Based on previous experiences, combining changes in trading volume to determine buy and sell signals yields better results. Subsequent research could focus on incorporating comprehensive indicators such as overall market trading volume and volume of main contracts, utilizing specific actively traded securities or bond indices with volume data. These aspects should be considered for further research [10].

5. Acknowledgement

This project was supported by Hunan Provincial Department of Education Scientific Research Project:Research on the Contagion, Transmission, and Recovery of Family Financial Crises of China (19C1030) ;General project of Hunan philosophy and Social Science Foundation "Research on statistical measurement and promotion path of high-quality development in Hunan" (19YBA115).

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