RSI and MACD indicators integrated: evidence from S&P 500 and Li-Ning as an example

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Abstract. The price of the securities market is complex and fluctuating, which is undesirable for investors to blindly follow the main force when investing in the stock market. In this case, it is necessary to develop the own set of strategies to choose suitable investments. This paper first briefly introduces the principles of RSI and MACD indicators, then analyzes the impact of each indicator on stock price trend prediction based on cases analysis. To be specific, their advantages and disadvantages are summarized. Afterwards, the two indicators and analysis of their optimization utility are combined with cases to draw conclusions to argue the value of technical indicators in stock trading. Overall, these results shed light on guiding further exploration of technical indicators in the stock as a guide to practical operation.

Keywords: technical analysis; RSI; MACD; financial investment.

1. Introduction

Contemporarily, China's stock market has experienced from scratch, small to a large and partially effective market after nearly 25 years of development. The development of China's stock market has driven the large and medium-sized enterprises to go public and raise capital, broadening the channels of capital circulation and playing an important role in promoting the economic development of China. As of the end of January 2022, there were 4,644 listed companies in China, including a net increase of 29 in January. The total market capitalization of China's stock market was ¥8,392.27 billion, up ¥375.98 billion from the end of January 2021. In January 2022, the total value of China's stock turnover was ¥2006.38 billion, up ¥180.76 billion yuan from December 2021. In January 2022, China's stock financing was ¥152.9 billion, up ¥400 million from January 2021.In January 2022, China issued various bonds of ¥4,614.6 billion, including ¥116.49 billion of government bonds and ¥1,950.3 billion of financial bonds. The financing stock was ¥98.8 trillion, accounting for about 31.5% of the social financing stock.

The market has continuously improved the quality and efficiency of serving the real economy, played an active role in promoting economic transformation and upgrading, supporting poverty alleviation and rural revitalization, and promoting innovation-driven development, which has strongly supported economic and social development. At a press conference in 2022, the SEC claimed that the bond market rose 444.3% and the stock market rose 238.9% in the past decade, with both markets ranking second in the world. There are more than 200 million stock investors in the market, making an important contribution to serving high-quality development.

Generally, there are two types of stock analysis: the fundamental and technical analysis. As for technical analysis, there are a large amount of indicators. Among vairous of indicators, the MACD is a chronic trend indicator, while the RSI is a short term speculative buying and selling indicator. The RSI indicator is more focused on reflecting the short-term changes in the market, which is more sensitive due to the rapid price fluctuations up and down and "cheat line". In the real market, if one can combine the RSI indicator with more stable indicator (e.g., MACD), it will be more stable and better reflects the trend, hence better results can be achived.

With this in mind, this paper will investigtae the specific application of RSI and MACD through practical cases to verify their operational guidance. In this paper, the two indicators mentioned above will be investigated based on the examples about S&P 500 and Li Ning. The rest of the paper is organzied as follows. The Sec. 2 will discuss descriptions of RSI indicators . The Sec. 3 will go further

on basic descriptions of MACD. The Sec. 4 will give a comparison between RSI and MACD based on the stock analysis of Li'Ning. Eventually, a brief summary will be given in Sec. 5.

2. Descriptions of RSI indicators

Relative Strength Index (RSI) is mainly utilized to measure the strength of buyers and sellers. The concept behind it is the average price increase and average decline in a period of time, and then one can calculate the strength of buyers and sellers through the formulae to capture the trend timing to make the corresponding operation. The calculation formulae of RSI are listed below:

$$RSI = 100 - \frac{100}{1 + RS} \tag{1}$$

$$Average\ Gain = \ （Total\ Gains/n） \tag{2}$$

$$Average\ Loss = (Total\ Loss/n) \tag{3}$$

$$First\ RS = (Average\ Gain/Average\ Loss) \tag{4}$$

$$Smoothed\ RS = \frac{[(previsou\ Average\ Gain) \times 13 + \ Current\ Gain]/14}{[(previsous\ Average\ Loss) \times 13 + \ Current\ Gain]/14} \tag{5}$$

$$n = number\ of\ RSI\ periods \tag{6}$$

It should be noted that RSI is a value calculated based on a certain period, which is set as 14 days in this study. The value of RSI ranges from 0 to 100. The closer the index is to 0, the stronger the seller's power is, and the market is full of selling stocks; the closer the index is to 100, the stronger the buyer's power is, and the market is full of buying stocks. Generally, the value of the strength indicator is generally between 20 and 80, and thus the RSI is divided into four zones:

- RSI in the range of 80 to 100 within the market range belongs to the very strong zone, which can be considered as a sell signal in investment operations.
- RSI in the range of 50 to 80 is a strong zone in the market range and can be considered as a buy signal in investment operations.
- RSI in the range of 50 to 80 is a strong zone in the market range and can be considered as a buy signal in investment operations.
- RSI in the range of 0 to 20 is a very weak zone in the market range, which can be considered as a buy signal in investment operations.

By measuring the size of the RSI index and 50, one can compare the high and low direction of stock price changes over a period of time. While confirming the best entry point and the best exit point, due to the different analysis, the specific range will be correspondingly different. General analysis will be greater than 70 range as overbought zone, indicating that at this time the buyer force dominates, i.e., it is the time to sell stocks less than 30 range. As the overbought zone, it means that the sellers' power is dominant and it is the time to buy. Additionally, RSI can be used to predict the rebound trend of a stock by analyzing top and bottom divergence. In 2020 February, the U.S. stock market began to plunge, with the S&P 500 Index plunging from 3,400 to 2,200, a drop of more than 34%. As can be seen from the graphical daily as well as the RSI movement trend presented in Fig. 1, the S&P 500 RSI peaked at 80 points on December 26, 2019, and then the RSI began a slow decline. Whereas the results shows that the S&P 500 was constantly making new highs until February 20, when the stock market collapsed rapidly across the board, and the jump low on February 24 even became the largest degree of a whole year. The top divergence reflected by the RSI indicator has long been a hint for the subsequent sharp decline, and the subsequent divergence trend has created a time for bottoming out accordingly.

The RSI indicator is one of the few responsive analytical indicators, and the application of its divergence theory has once made RSI the so-called strongest entry indicator in the market. However,s all technologies have their own blind spots. For example, for some surge stocks in the overbought area, a lot of good opportunities will be missed if the operation is carried out in accordance with the RSI indicator. Besides, the RSI itself does not have the ability to confirm the timing, which needs to

cooperate with other technical indicators to confirm the trend in order to play its maximum effectiveness.

Fig. 1 INDEX S&P 500 Trend (RSI)

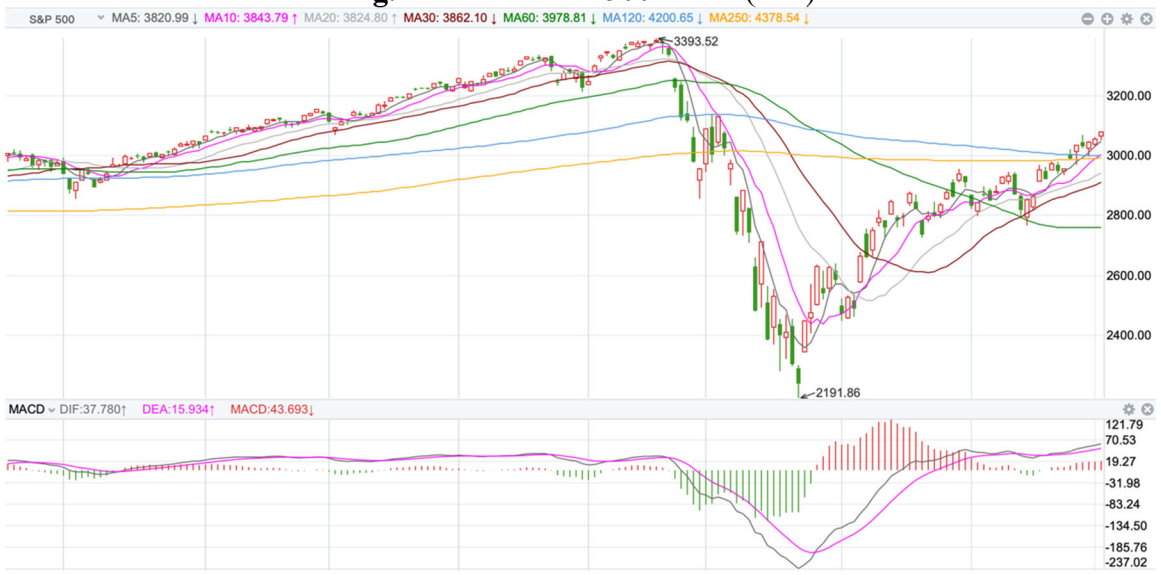

Fig. 2 INDEX S&P 500 Trend (MACD)

3. Basic descriptions of MACD

Exponential smoothing isotropic moving average MACD (Moving Average Convergence), from the development of double exponential moving average, MACD indicator formula is as follows.

$$\text{DIF: EMA (CLOSE, 12)} - \text{EMA (CLOSE, 26)} \quad (1)$$

$$\text{DEA: EMA(DIF, 9)} \quad (2)$$

$$\text{MACD: (DIF} - \text{DEA)} \times 2, \text{COLORSTICK; MACD} \quad (3)$$

$$\text{DIF: EMA(CLOSE, 12)} - \text{EMA(CLOSE, 26)} \quad (3)$$

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$$\text{MACD: (DIF} - \text{DEA)} \times 2, \text{COLORSTICK} \quad (5)$$

Its buying and selling principles are a total of the following.

- DIF, DEA are positive (DIFF and DEA are positive, i.e, both above the zero axis line, the trend is long market, DIFF breakthrough DEA upward), DIF breakthrough DEA upward, the formation of the golden cross, buy signal reference.

- DIF, DEA are negative (DIFF and DEA are negative, that is, both below the zero axis line, the trend is a short market, DIFF down below DEA, can be used as a sell signal), DIF down below DEA, the formation of a death cross, sell signal reference.
- MACD green to red: MACD value from negative to positive, the market from short to long.
- MACD red to green: MACD value changes from positive to negative, the market turns from long to short

Taking the S&P 500 as an example again, as illustrated in Fig. 2, on February 24, the day it jumped lower, the S&P 500 had a death cross, and the index plunged, falling 31%; while on March 25 there was a golden cross, and the DIF and DEA began to rise back above the 0 axis, and the index had a V-shaped rebound, and soared all the way to September, rising by more than 60%. Therefore, the meltdown crisis, which is enough to go down in history, can be perfectly avoided simply by analyzing the MACD indicator, while seizing the moment to seize the V-bounce bottoming time.

MACD indicator can be used in INDEX, STOCK, FOREX and many other areas, but if one uses MACD alone to make decisions, it is often counterproductive. Since MACD is calculated relying on the average volume, so the signal is often later. On this basis, it needs to experience a period of time up and down to predict the future trend, late positive opportunities and the timing of selling, which often bring immeasurable losses. Thus, MACD indicator is more applied to long-term stock investment reference.

4. The dual-indicator integrated application analysis

RSI indicator is more focused on reflecting the short-term changes in the market, it is more sensitive, often due to rapid price fluctuations up and down and "cheat line", so combined with the MACD indicator running pattern, in the short term trading can better control the position. The actual operation can be selected in the RSI‘s strong and weak areas combined with MACD to make buying and selling decisions. For example, when the RSI indicator is greater than 60, when the market's upward force is strong, MACD has a buy signal, one can enter. On the contrary, when the RSI is less than 40, when the market's downward force is strong, MACD has a sell signal decisively leave the market. If the MACD indicator line is running steadily above the 0 axis, which represents the overall preponderance of forces, the price trend in the upward channel. In thi case, if the RSI appears dead cross pattern, or into the overbought range, we should not clear out of the market, after all, the uptrend pattern of operation is still good, the actual market, it is appropriate to reduce positions, to avoid the possible short-term pullback. Conversely, if the MACD indicator continues to run below the 0 axis, which represents the overall dominance of the short-side forces, the price trend in the downtrend, after a wave of rebound, if the RSI into overbought state, it is appropriate to liquidate positions away from the field, this is because the price of the overall direction of operation downward, do not liquidate positions, the risk is greater.

In the second quarter of 2020, the Land HKT fund top 10 targets of long positions in Hong Kong stocks 4 consumer stocks, respectively, Meituan-W, Anta Sports, Li Ning, China Resources beer, information technology and communications business stocks each 2, respectively, Tencent Holdings, Sun Microelectronics Technology, Xiaomi Group, China Mobile. Thereinto, Tencent Holdings, although 12.5 billion yuan less than in the first quarter, but the market value of holdings remains the largest, the market value of holdings in the second quarter was 96.5 billion yuan. Meituan-W is also the favorite of many land and Hong Kong funds, with a market value of 50.7 billion yuan of holdings in the second quarter, the second largest Hong Kong stocks long position in the subject.

Owing to the Xinjiang cotton incident, making the Li Ning brand re-occupy the public eye, from the stock trend all the way to red, it is a glimpse to know the whole picture. In addition, according to the National Bureau of Statistics released in 2020, the national total retail sales of consumer goods related data. Among them, the sales of clothing and footwear categories for ¥138.42 billion, an increase of 12.7% year-on-year; clothing market is huge and has continued to grow in recent years. With the rapid rise of domestic sports brands, the domestic consumers' consumer recognition of

domestic brands has gradually increased. Anta, Li Ning, Hongxing Erke and a number of quality domestic sports brands again "burst", sales have been climbing, ushering in the "wild consumption" boom. Through Li Ning's financial report in 2020, Li Ning's revenue in 2020 was 22.572 billion yuan, up 56.1% year-on-year, with three consecutive years of counter-trend growth during the epidemic. 2017 to date, Li Ning's turnover has grown nearly three times, and profits have grown more than 10 times.

On August 13, 2020, as shown Fig. 3, in Li Ning opened up over 4%, meanwhile in the morning of August 13, Li Ning disclosed its interim results for the six months ended June 30, 2020 on the Hong Kong Stock Exchange: in the first half of the year, revenue rose 65% to RMB 10.197 billion, net profit attributable to equity holders rose 187% to RMB 1.962 billion, and net profit margin improved from 11.1% to 19.2%.

Fig. 3 STOCK Li Ning trend (MACD)

Fig. 4 STOCK Lining Trend (RSI/MACD)

However, one can clearly notice from the MACD indicator trend, as shown in Fig. 4, MACD indicator in May 3 when the dead cross began to appear, a week later on May 10 again, if only based on this, it will miss a wave of nearly 20% of the positive opportunities. However, the RSI indicator at this time captured this uptrend very well and accurately grasped the opportunity. Similarly, the RSI indicator value jumped above 80, which is a sign that the market is overbought in the short term. Nevertheless, the MACD indicator line is running solidly above the 0 axis, which indicates that the current market is still dominated by multiple parties. The overbought status at this point only means a short term pullback, the overall direction of price action has not changed. In the actual market, it will be more appropriate to reduce positions at a high level, rather than clearing out of the market.

After all, the rising momentum of individual stocks has not changed, hence the combination of two stocks, it is a good grasp of the uptrend

5. Limitation & Prospects

Juming out of the analysis of RSI and MACD in this article, one can conduct an objective analysis of RSI and MACD from the whole stock market. In fact, there are limitations for both RSI and MACD. As for RSI, oversold and overbought appears to cause the indicator to appear obtuse phenomenon. Normally, when the indicator appears in the overbought area, it is a sell signal, and vice versa is a buy signal, but in a bear market or in a bull market, the RSI value rises to 90, or falls below 10 often occurs, when the indicator will appear obtuse, misleading investors, if investors still operate in accordance with the overbought, oversold signal, they may miss the opportunity to profit, or buy too early trapped. Moreover, RSI indicator and the stock price divergence is a reversal signal, but there will also be lagging phenomenon, that is, when the RSI indicator and the top of the stock price divergence, the stock price may continue to rise, creating a new high, while the RSI indicator and the bottom of the stock price divergence, the stock price may continue to fall, creating a new low. Investors need to combine multiple technical indicators or wait for multiple divergences before proceeding. In the future, further studies should present constitute a variety of graphs of the bar chart. As RSI calculation is generally 14 days as a period, the rise as the sum of the buyer's power, the fall as the sum of the seller's power, and to judge the future movement of the exchange rate, is to refer to the results of the comparison of the two forces. When the RS line diverges from the broad market index, it means that the trend is about to reverse. When the index makes a new high or low and the RS1 does not match the new high or low, it is a sign of a reversal or retracement of the trend. One can use the intersection of the fast RSI line and the slow RSI line to study the timing of stock entry and exit, and to measure the mutual strength of the long and short sellers and buyers.

Regarding to MACD, it is calculated based on historical prices, only when the price is generated MACD will follow the change, with a certain lag. Therefore, the MACD appears to buy the golden cross, may have finished the uptrend; dead cross, may have finished the downtrend. In addition, the situation of oscillation market indicators distortion should also be focused on. Oscillation refers to the time when the stock price does not have an obvious upward or downward trend, but maintains a horizontal direction of finishing. At this time, the DIF line and DEA line will frequently cross, while the MACD red and green columns will also frequently switch, issuing a false buy-sell signal. As for the prospect for MACD, it is necessary to get rid of the frequent buy and sell signals generated by MA, which increases the requirements and restrictions for issuing signals, avoids false signals, and is more certain than MA when used. Moreover, it should be automatically defined the current stock price trend pointing to avoid the danger of reverse operation. On this basis, it can be used to study and judge the beginning and end of medium-term uptrend or downtrend, filter market disorderly noise, establish entry and exit strategies, and avoid unnecessary entry and exit.

6. Summary

In summary, this paper discusses two representatives of the many technical indicators in the stock marketfrom the perspective of two practical examples of Li Ning and the S&P 500. Optimization indicators can quickly test the market bottom and reversal time, MACD averages long and short detection and RSI relative strength detection combined, can more effectively grasp the stock reversal price and the timing of opening positions, MACD top and bottom divergence, is a way to judge the trend. When the price forms a bottom divergence, it means that the next to rise, RSI indicator is a way to judge the top and bottom. When the RSI indicator hits the 20 axis, it means that the price has reached a relatively low level, so one can consider going long. Technical analysis through the evaluation of data and the development of strategies are crucial to improve the conditions of return on investment. With this in mind, technical analysis is very useful, but the value of investment is

flexible. In other words, technical analysis is only a fluctuation tendency, is calculated according to certain data statistical tendency, i.e., a probability. Thus, the results of technical analysis is not absolute, it is only a probability of greater possibility. Therefore, relying only on one technical indicator analysis is not enough to support the prediction for stock trend, each indicator has its advantages and disadvantages, and only by combining the advantages of each indicator can we improve the yield more favorably. Nevertheless, both the RSI and MACD are subject to exclusions, such as bear markets or time lags, which can lead to errors in judgment due to large changes in the range of fluctuations. In the future, however, in the mainstream stock market, RSI and MACD are still the basis of many technical indicators. It is necessary to rely not only on these two indicators but also on other indicators together when analyzing stocks. Overall, these results offer a guideline for a single RSI and MACD can be used to analyze a stock over a certain period of time, but to forecast the long-term operation of the stock, multiple indicators need to be used.

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