Can Technical Analysis Boost Stock Returns? Evidence from China

Stock Market

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Abstract

This paper focuses on the role of technical analysis which can provide effective buy and sell signals to boost stock returns. More specifically, we focus on the momentum phenomenon which is one of the toughest market anomalies that against the efficient market hypothesis. By using the versatile momentum oscillators, we establish several trading strategies and introduce test statistics to examine the performance of trading strategies. Relative Strength Index (RSI) can be used to measure the relative strength and weakness of a stock based on the closing prices during a certain trading period, and Average Directional Movement Index (ADX) is used to quantify the strength of an existing trend. In this paper, we apply the designed buying and selling strategies which consist of several indicators such as the RSI and the ADX to 5 stock indexes in China’s Stock Market from 2010 to 2016. Simulation results show that our trading strategies can generate significant positive returns, in general. Hence, we conclude that technical analysis based on historical data does increase the stock returns, and the prices of the stock cannot reflect all market information.

Key Words: technical analysis, stock returns, Relative Strength Index, Average Directional Movement Index

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1. Introduction

Technical analysis is a mechanism that uses the past prices trend to predict prices in the future. The concept of analysis can be dated back to 1600s when Japanese rice traders use this method to exchange in Dojima Rice Exchange in Osaka. On the one hand, earlier scholars insisted that technical analysis is null because there are no abnormal returns in an efficient market, which is consistent with the efficient market hypothesis. On the other hand, several researchers found out that the technical analysis does have significant forecasting power because of the existence of the momentum phenomenon. Technical analysis includes a variety of forecasting techniques such as chart analysis, pattern recognition analysis, seasonality and cycle analysis. The purpose of technical analysis is to develop a technical trading system, which consists of a set of trading rules. Each trading rule generates trading signals according to their parameter values.

In this paper, the technical analysis is applied in order to test whether it can boost the return of the stocks or not. We focus on the changing prices in Chinese stock market and use data on different stock indexes to come up with some mechanisms for buying and selling stocks to get positive returns. In this research, the Relative Strength Index (RSI) and Average Directional Movement Index (ADX) will be used to set up the buy and sell signals, gathering two sets of buy and sell signals separately. After detecting the sell and buy signals, the strategies will be evaluated. Besides, we will find the threshold value of the ADX that generates the highest total returns for investors and find out the trend of change in total returns along with the lengths of holding period.

This paper will be organized in seven parts. The next part provides literature reviews of related works. The third section is about the technical indicators that are used in this paper, and Section 4 discusses data and methodology that are contained in this research. The following part presents the empirical results. Then the conclusions are drawn in the last part.

2. Literature Review

Efficient market hypothesis (EMH) is treated as a fundamental theory in finance literature in the past decades. According to the weak form of the efficient market hypothesis, every historical trading information is already reflected in the price of the stock (Fama & Blume,
Besides, all investors are rational so that they can make unbiased decisions based on received information. Stock prices only fluctuate based on the release of the new information which is not predictable. Hence, the stock prices should be determined by the true value of the company and follow “random walk hypothesis” but not “technical analysis”.

However, this hypothesis had encountered strong contentions when different market anomalies were found (Chaarlas & Lawrence 2012). Momentum phenomenon is one of the toughest market anomalies that against the efficient market hypothesis. The first observation of this phenomenon is made by Jegadeesh and Titman, whose study indicates that investors over- or underreact to market information, then the stock prices should be different from the fundamental value so that there has to be a profitable investment strategy, which is momentum strategy, that is based on past stock profits (Jegadeesh & Titman, 1993). Their research also finds that the strategy's profits are at least temporary. Barberis, Schleifer and Vishny’s (1998), Daniel, Hirshleifer and Subrahmanyam’s (1998) and Hong and Stein’s (1999) articles support this idea as well. The further study done by Crombrez (2001) states that the momentum phenomenon can be observed even though the market is efficient and investors are rational.

In order to find out the pattern of price change and predict the future stock price in the case the momentum phenomenon exists, technical analysis should be introduced. It is a forecasting method of price movements using past prices, volume, and other related information. The technical approach to investment is a reflection of the idea that prices move in trends which are determined by various factors such as monetary policies, political events, and psychological forces.

The role of the technical analysis in predicting future price remains a controversial one since the work of Friedman (1953) and Fama (1970). Most studies of technical analysis, including Fama and Blume (1966) and Jensen and Benington (1970), conclude that the technical analysis is not useful. They argue that the returns generated by the mechanism are less than the returns from using the buy-and-hold strategy. Moreover, when the costs of the transaction are taken into consideration, negative returns would even occur (Fama & Blume, 1966; Jensen & Benington, 1970). This point of view satisfies the efficient market hypothesis because the current prices have already revealed all information and the stock prices were
driven to the level where the anticipated returns match up with the risk levels (Fama, 1970).

Notwithstanding the voice of disagreements, there are still several studies have been done by scholars that prove technical analysis is helpful in forecasting. Technicians or chartists believed that the trend of price changing can be captured by technical analysis if the price is sluggish to adjust, no matter what the reasons cause a change in stock price. The core to use successful technical analysis is to use the lag-time effect of the stock price responses to the fundamental prices. The research that done by Frankel and Froot indicates that the technical analysis is useful and there is a growing trend for investors to use technical analysis in forecasting services (Frankel and Froot, 1990). Brock, Lakonishok, and LeBaron (1992) documented that a simple set of technical trading rules possess significant prediction ability for variations in the (DJIA) over a long sample period. The similar trading rules also apply to a group of Asian stock markets and currency exchange rate (Bessembinder& Chan, 1995). Pruitt and White (1988), Neftci (1991), Neely, Weller, and Dittmar (1997), Brown, Goetzmann and Kumar (1998), Gencay (1998) and Chang and Osler (1999) support the idea that the technical analysis can increase the portfolio profits when compared to passive buy-and-hold strategies.

However, the investors who rely on the technical analysis can also magnify the original trend and lead to the formation of speculative bubbles. The mechanism of the technical analysis is that the investors identify and then follow the trend. In other words, the technical methods will tend to generate signals in the same direction with the original one, regardless of considering the factors that start the original trend. Hence, the predictions generated by technical indicators could satisfy the expectations themselves. According to the study done by Frankel and Froot, the technical analysis is a possible factor that results in the overpricing of the U.S. dollars in 1980s compared with the fundamental prices in the market (Frankel and Froot, 1990). De Bondt and Thaler proposed that the loser portfolio is more profitable than the winner portfolio if the holding period is more than two years, and the loser portfolio only has higher profits in January when the holding period is less than one year (De Bondt & Thaler, 1985). Inspired by De Bondt and Thaler, Jegadeesh and Titman (1993) found out that the momentum profits are linked with seasonality. In January, the profits are usually negative due to the January effect, while the profits are extremely high in April, November, and December.
Besides, they found out that the stocks gain profits only in 3 to 12-month holding periods. When the holding period is shorter than one month or longer than two years, the trading strategies are unprofitable (Jegadeesh & Titman, 1993).

Based on the past literature, the practicality of the technical analysis is waited to be clearly illustrated. In this paper, we need to establish clear mechanisms and evaluate them based on returns of a number of stocks for providing more information about the financial markets.

3. Technical Indicator

In this research, day traders are the target group of people that are considered. For the day traders, they predict the price trend on the same day after 3 o’clock when the stock market closes and trade the stock at the open price in the following days. Thus, the prices that are used in technical indicators, which will be introduced in the following part, are not open price but others, while the open prices are used in order to detect the trading prices in strategies.

3.1 Momentum Concept

In the stock market, momentum is a leading indicator that measures the rate of change of a stock's price, which is one of the most useful concepts in technical trading. It can be considered as the acceleration and deceleration of movements of stock price. As Wilder’s (1978) study showed that the momentum measures the velocity of directional price movement. The following part provides an example to illustrate the concept of momentum.

The easiest way to illustrate this concept is using a simple oscillator expressed as the today’s price minus the price “p” days ago as an example. We take p equals to 5 as an example. If the price 5 days ago is larger than today’s price, the value of oscillator is negative. Otherwise, it’s positive.

As figure 1 showed, as the price moves down by the same increment every day, the momentum indicator is a horizontal line. On day 10, when the price rises, the momentum indicator turns out to increase as well, and even faster since the price changes the direction. The indicator increases at this fixed rate until day 15 when it becomes a horizontal line again though the price is still increasing. On day 20, the price stays at 15 and the indicator begins to decrease. At this point, the movement of momentum oscillator is one step before the price. Therefore, momentum oscillators are leading indicators and can be excellent technical tools to analyze the
In this research, the concept of momentum is the key for the applied oscillator RSI and ADX. For RSI, it can be considered as the rate of an upward trend of close prices to total trend of that. The ADX measures the rate of difference between the upward trend and the downward trend to the total trend.

3.2 Relative Strength Index (RSI)

The relative strength index (RSI), one of the most commonly used momentum oscillators in the financial markets analysis, is used to measure the relative strength and weakness of a stock based on the closing prices during a certain trading period. Moreover, it indicates the direction of price movement.

3.2.1 The Equation of the Relative Strength Index

To calculate the $RSI_{t,x}$ at time $t$ of period $x$, the UP-closes $U_t$ to DOWN-closes $D_t$ over the period are used. Hence, index set is defined as $I_{t,x} = \{i: t - x \leq i \leq t\}$.

For any $i \in I_{t,x}$ and the UP-closes and DOWN-closes can be defined as:

$$U_i = \begin{cases} 
C_i - C_{i-1} & \text{if } C_i > C_{i-1} \\
0 & \text{otherwise}
\end{cases}$$

$$D_i = \begin{cases} 
C_{i-1} - C_i & \text{if } C_{i-1} > C_i \\
0 & \text{otherwise}
\end{cases}$$

where $C_i$ is the closing price at the time $i$.

The UP closes mean the positive differences generated from day’s price, which is higher, minus the previous day’s close price. Similarly, the DOWN closes represent the differences.
between close price in the previous day, which is higher, and smaller close price today. If today’s price is greater than the previous day’s price, then today’s UP close is determined and the DOWN close is zero. Similarly, if today’s price is lower than that of yesterday, then DOWN close is positive and the UP close is counted as zero.

Next, the average of \( U_t \) and \( D_t \) should be determined as follows:

\[
\bar{U}_{t,x} = \text{Average of } "x" \text{ day's closes UP}
\]

\[
\bar{D}_{t,x} = \text{Average of } "x" \text{ day's closes DOWN}
\]

The equation of the Relative Strength Index (RSI) is:

\[
RSI_{t,x} = \frac{\bar{U}_{t,x}}{\bar{U}_{t,x} + \bar{D}_{t,x}} \hspace{1cm} (1)
\]

the RS is defined as follows:

\[
RS_{t,x} = \frac{\bar{U}_{t,x}}{\bar{D}_{t,x}} \hspace{1cm} (2)
\]

then

\[
RSI_{t,x} = 100 \times \frac{RS_{t,x}}{RS_{t,x} + 1} \hspace{1cm} (3)
\]

In this research, the time interval \( x \) is 6 days. To calculate the RSI, the close prices of 6 days before today at time \( t \) are needed. The average of 6 day’s closes UP can be calculated by obtaining the sum of the all UP closes in 6 days and divided this sum by the time interval 6 days. Analogously, the denominator can be calculated by collecting the sum of all DOWN closes in 6 days and divided this sum by 6 days. Then, substituting the RS at time \( t \) to equation (1), the RSI at time \( t \) can be computed.

From the above equation, the range of the RSI is between 0 and 100. When the average of “x” days’ close UP, \( \bar{U}_{t,x} \), equals to the average of “x” days’ close DOWN, \( \bar{D}_{t,x} \), the RSI equal to 50. In this case, it seems that the upward strength equals to the downward strength, no trend exists. When the average of "x" days' close UP, \( \bar{U}_{t,x} \), larger than the average of “x” days’ close DOWN, \( \bar{D}_{t,x} \), the RSI larger than 50, the upward trend exists. On the contrary, when the average
of “x” days’ close UP, $\bar{U}_{t,x}$, less than the average of “x” days’ close DOWN, $\bar{D}_{t,x}$, the RSI less than 50, the downward trend exists.

### 3.2.2 Divergence in the RSI

Divergence occurs when the RSI’s low is increasing but the price’s low is decreasing or flat, and vice versa. This is a very strong signal for the market reversal in the stock market. By searching for the points of the market reversal, the buying prices or selling prices can be found out. To simplify the concept of the divergence, it can be defined occurred when the RSI is increasing while the price is decreasing.

According to the figure 2, the momentum has already decreased while the price still increases at a lower rate on day 12, then the price begins to decrease in the next day as well. Conversely, on day 19, the momentum has already increased when the price still decreases at a lower rate, then the price starts to increase in the next day. Thus, when the shape of the price looks like a parabola, the RSI can be regarded as a leading indicator. Besides, when the direction of change of stock prices and that of RSI is in opposite direction, the stock prices are about to reach their local extremes, where are the points for trading. In other words, when the momentum indicator increases and price decreases, the stocks should be brought since the price will increase soon. On the contrary, When the momentum indicator decreases and price increases, it is the time that the stock should be sold.

#### Figure 2

3.3 Average Directional Movement Index (ADX)

Unlike the RSI, which is used to indicate the direction of a trend, Average Directional
Movement Index (ADX) cannot indicate the direction of price movement, instead, it is used to quantify the strength of an existing trend. Before introducing the equation of the ADX, two measurements used to compute the ADX called the strength of the upward trend (+DM) and the strength of the downward trend (-DM) should be introduced first.

### 3.3.1 Directional Movement Concept

The directional movement can be classified into three categories: upward trend, downward trend, and zero movement. +DM measures the distance from today’s highest price with that in yesterday, only if today's highest price is larger than yesterday's highest price, +DM will be a positive number, otherwise, it should be 0. While the –DM represents the distance from today’s lowest price with that in yesterday. When today’s low price is smaller than that of yesterday, it will be a positive number, otherwise, it should be 0. The following six figures cover all situations to consider for determining direction movement. Here, A and B represent the highest and lowest prices in the previous day, while C and D indicate today's the highest and lowest prices.

Plus DM (+DM) indicates that the movement is upward and it can be defined when satisfying either of the two cases:

i. When the movement is apparent upward, the strength of the upward trend is the distance between points C and A, which is today’s high minus yesterday’s high (Figure 3).

ii. When the difference between D and B (-DM) is smaller than the distance between C and A (+DM), the movement is considered as upward as well (Figure 5).

Minus DM (-DM) shows that the movement is downward and it can be defined when satisfying either of the two cases:

i. When the movement is apparent downward, the strength of the downward trend is the distance between points D and B, which is today’s low minus yesterday’s low (Figure 4).

ii. When the distance between D and B (-DM) is greater than the distance between C and A, the movement is considered as downward as well (Figure 6).
Zero movement occurs when either of the following two cases occurs:

i. When the distance between D and B (-DM) equals to the distance between C and A (+DM), the directional movement is zero, which means that there is no trend (Figure 7).

ii. When C is lower than A and D is higher than B, there are no –DM and +DM. In this case, the directional movement is counted as zero as well (Figure 8).

3.3.2 The Equation of the Average Directional Movement Index (ADX)

To calculate the $ADX_{t,n}$ at time $t$ of period $n$, the UP-closes $U_t$ to DOWN-closes $D_t$ over the period are used. Hence, index set can be defined as $I_{t,n} = \{i : t - n \leq i \leq t\}$.

Different stocks have different price levels, the same $1 incensement in stock price means totally different things to stocks have prices of $1 and $100. Hence, the Directional Indicator (DI) can be calculated to solve the scale problem by the following equations:

$$+DI_{t,n} = \begin{cases} 
+\frac{DM_{t,n}}{TR_{t,n}} \times 100 & \text{if the movement is upward} \\
0 & \text{otherwise}
\end{cases}$$
\[-DI_{i,n} = \begin{cases} \frac{-DM_{LN}}{TR_{i,n}} \times 100 & \text{if the movement is downward} \\ 0 & \text{otherwise} \end{cases}\]

where \(i \in I_{t,n}\), and \(n = 9\) in this paper.

Total range \((TR_i)\) is the largest absolute value of the following three:

1) The distance between today’s highest price and today’s lowest one
2) The distance between today’s highest and yesterday’s closing price
3) The distance between today’s lowest and yesterday’s closing price

As mentioned before, \(n\) equals to 9 in this paper. Thus, \(TR_{i,9}\) is calculated by sum up the 9 days’ true ranges (TR) prior to the time \(t\) (including time \(t\)). The \(+DM_{i,9}\) is calculated by sum up the 9 days’ plus directional movement (+DM) up to time \(t\). The \(-DM_{i,9}\) is calculated by sum up the 9 days’ minus directional movement (-DM) up to time \(t\).

Then Directional Movement Index (DX) can be computed by the equation:

\[DX_{i,n} = \frac{\left\{ (+DI_{i,n}) - (-DI_{i,n}) \right\}}{(+DI_{i,n}) + (-DI_{i,n})} \times 100\]

Sum up the \(DX_n\) days and calculate the average of it, the Average Directional Movement Index (ADX) can be calculated:

\[ADX_{t,n} = \frac{\sum DX_{i,n}}{n}\]

3.3.3 Functions of ADX

I) Non-directional: The equation of DX shows that the value of DX is always between 0 and 100. The larger difference between \(+DM\) and \(-DM\), the more directional the movement, and the larger the DX. However, the value of the DX cannot show whether \(+DI\) is larger or \(-DI\) is larger because it takes the absolute value. In other words, the DX cannot reflect the direction of movement. As a result, ADX, as an average of the DX, cannot reflect the direction of movement.

II) Quantify trend strength: ADX values indicate the strength of the trend, which can help traders to distinguish the trending and non-trending conditions. If the value of ADX is larger
than a certain number “a”, traders can trade stocks based on trend trading strategies. In this paper, “a” can be 15, 20, and 25. However, if ADX value is less than this number, there is no need to trade stocks, at least, one cannot trade based on trend trading strategies.

3.4 Trading Strategies

Investors are likely to buy stocks when the stock price reaches to its minimum level and sell stocks when the stock price is at its maximum level. In this paper, three conditions are applied in order to find trading points. Before the stock price reaches its extreme values, the market reversal occurred. However, the inverse powerful trend will happen after the trading points. By combining with the ADX, RSI can be a much more useful technical indicator than before. The combination of these two indicators can determine both the direction and strength of price movements. Besides, the divergences between the prices and the technical indicators help to find the approximate trading points.

1) For long position

When the open price at time \( t \) is still lower than yesterday’s open price but the RSI increases, it implies that the prices of the stock reach the minimum point approximately. Then if the RSI is larger than 50, it usually indicates that an upward trend is underway and the prices will increase in the future. To make sure the future trend of price change is strong, the threshold in ADX indicators will be established.

Hence, the trading strategy for the long position is:

a. The current open price of the stock is lower than open price in the previous day while the RSI value increases and the RSI value is larger than 50; and

b. The +DI is larger than the -DI, and it increases more than 20% compared to the previous day; and

c. The ADX value is larger than “a” (a = 15, 20, or 25).

2) For short position

In order to minimize the loss, investors will sell stocks before the price reverse, where price is still increasing but the RSI value begins to decrease. When the RSI value is less than 50, the stock market gluts so that stock prices will decrease in the future. If the -DI is larger than +DI and the -DI is increasing, the price may still keep moving downward in the future. Besides, if
the ADX is greater than 20, the downward trend is more likely to occur because the strength is strong.

Similar to the trading strategy for the long position, the trading strategy for the short position is:

a. The current open price of the stock is higher than open price in the previous day while the RSI value fails, and the RSI value is less than 50; and
b. The -DI is larger than the +DI, and it increases more than 20% compared to the previous day; and
c. The ADX value is larger than “a” (a = 15, 20, or 25).

4. Data and Methodology

The daily open, high, low, and close of the 5 China Stock Market indexes for the period from January 2010 to December 2016 were used. Since individual stocks performance can be affected by some unexpected factors, such as manipulation, extremely bad performance of the companies, stock split, and stock dividends, it may influence the accuracy of technical indicators. Thus, indexes, which are statistical indicators that measure the value of a specific stock market section, are used in this research to test if technical indicators can boost the stock returns. Though the indexes in Chinese stock market cannot be invested directly, the similar returns by investing in portfolio or index funds still can be gotten. Specifically, the trading strategies introduced above to each index are applied and calculated the average daily returns. Then a t-test will be used to examine if buy and sell strategies can generate significant positive returns.

The opening prices of the indexes were used to compute the daily returns \( r_t \)

\[
r_t = \ln \left( \frac{\text{OpnIndex}_t}{\text{OpnIndex}_{t-1}} \right)
\]

where \( \text{OpnIndex}_t \) is the open price of a specific index for the day \( t \) and \( \text{OpnIndex}_{t-1} \) is the previous day’s open price. After applying trading strategies, several buy and sell signals can be generated. Besides, the test holding period “\( y \)” days should be determined. In this paper, “\( y \)” equals to 5, 10, 20, and 30 days. Then the average daily returns in the following “\( y \)” days, which start at time \( t + 1 \), can be calculated by adding up \( r_{t+1} \) to \( r_{t+y} \) and dividing by “\( y \)”.
example, if the trading signal appears at day \( t \), then the average daily returns can be calculated by calculating mean returns \( \bar{r} \) of the following “\( y \)” days

\[
\bar{r} = \frac{r_{t+1} + r_{t+2} + \cdots + r_{t+(y-1)} + r_{t+y}}{y}
\]

where \( \bar{r} \sim N(\mu, \frac{\sigma^2}{n}) \). Here, \( \mu \) is the mean of \( \bar{r} \), \( \sigma \) is the standard deviation of \( \bar{r} \), and \( n \) is the number of \( \bar{r} \).

For the average returns \( \bar{r}_{buy} \) of the following “\( y \)” days after a buy signal appearing at day \( \alpha \) can be calculated by the following equation:

\[
\bar{r}_{buy} = \frac{r_{\alpha+1} + r_{\alpha+2} + \cdots + r_{\alpha+(y-1)} + r_{\alpha+y}}{y}
\]

Similarly, the average returns \( \bar{r}_{sell} \) of the following “\( y \)” days after a sell signal appearing at day \( \beta \) can be calculated by the following equation:

\[
\bar{r}_{sell} = \frac{r_{\beta+1} + r_{\beta+2} + \cdots + r_{\beta+(y-1)} + r_{\beta+y}}{y}
\]

The average of \( \bar{r}_{buy} \) is

\[
\bar{\bar{r}}_{buy} = \frac{\sum \bar{r}_{buy}}{n_{buy}}
\]

Where the \( n_{buy} \) is the total number of buy signals during the period.

Analogously, the average of \( \bar{r}_{sell} \) is

\[
\bar{\bar{r}}_{sell} = \frac{\sum \bar{r}_{sell}}{n_{sell}}
\]

Where the \( n_{sell} \) is the total number of sell signals during the period.

Let \( \bar{r}_{buy} \) and \( s_{buy} \) be the mean and standard deviation of average daily returns generated by buy signals. Since the expectations of the average daily returns generated by buy signals should be positive, the hypothesis \( H_0: \mu_{buy} = 0 \), and \( H_1: \mu_{buy} > 0 \) are tested using the test statistic:

\[
T_b = \frac{\bar{r}_{buy}}{s_{buy} / \sqrt{n_{buy}}}
\]
Given the significance level of $\alpha$, if $T_b > z_\alpha$, the null hypothesis $H_0: \mu_{buy} = 0$ should be rejected so that the mean average daily return is significantly larger than zero. The statistic $T_b$ is presented in the table as Stat-B.

Similarly, let $\bar{r}_{sell}$ and $s_{sell}$ be the mean and standard deviation of average daily returns generated by sell signals. Because the expectation of the average daily returns generated by sell signal should be negative, we test the hypothesis $H_0: \mu_{sell} = 0$, and $H_a: \mu_{sell} < 0$ using the test statistic listed below.

$$T_s = \frac{\bar{r}_{sell}}{s_{sell} / \sqrt{n_{sell}}}$$

If $T_s < -z_\alpha$, the null hypothesis should be rejected and conclude that the mean average daily return is significantly less than zero. The statistic $T_s$ is presented in the table as Stat-S.

The summary of the statistics is given in Table 1. In this table, for statistics in the correct sign, if the significance level is 1%, it’s marked “a”, if the significance level is between 1% and 5%, it’s marked “b”, if the significance level is between 5% and 10%, it’s marked “c”. For those statistics in the incorrect sign, the signs “d”, “e”, and “f” represent significance level of 1%, between 1% to 5%, between and 5% to 10% respectively. Besides, the ranges of z-value are listed in the table as well.

<table>
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<th>Significance level</th>
<th>Stat-B</th>
<th>Stat-S</th>
<th>Markings</th>
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<tr>
<td>1%</td>
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<td>$T &lt; -2.3263$</td>
<td>a</td>
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<td>$-2.3263 &lt; T &lt; -1.6449$</td>
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<td>$-1.6449 &lt; T &lt; -1.2816$</td>
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<td>$1.6449 &gt; T &gt; 1.2816$</td>
<td>f</td>
</tr>
</tbody>
</table>

5. Results

As described in section 3, the strategy with different ADXs values will be applied to the 5 indexes. The number of holding days after the signal to be tested is given by the column under “Day”. The mean of average daily return generated from the buy signals is given by the column
under "Mean-B" and that of the sell signals is given by "Mean-S". The test statistics for buy signals and sell signals are shown in column "Stat-B" and "Stat-S" respectively. The number of buy signals and that of sell signals are donated "Count-B" and "Count-S" individually. The total returns\(^1\) during the holding days for buy signals are listed in “Total Returns-B” and that for sell signals are listed in “Total Returns-S”. Here, “Count” and “Total Returns” are listed only for those signals’ statistics are significant at 10% level or better. Two tables are established to record the results for buy signals and sell signals for the five indexes in Shanghai Stocks Exchange and China Securities Index separately.

Table 2 provides the results for buy signals. For ADX equals to 15, there is only one Mean-B is negative, and all others are positive. For ADX is 20 and ADX is 25, all Mean-B are positive. This shows that buy signals can generate positive returns, in general. Table 3 provides the results for sell signals. For ADX equals to 15, all Mean-S are negative when the holding days are 5 or 10, but most of them become positive by holding longer period. For ADX equals to 20 and ADX equals to 25, all Mean-S are negative. This indicates that all sell signals can generate positive returns when holding days are 5 or 10.

For buy signals, most of the indexes generate significantly positive returns only for holding 5 and 10 days. Besides, all of them generate more total returns for holding 10 days than holding 5 days no matter what the value of the ADX is. However, when the holding days increase to 20 days, the significantly positive returns cannot be generated. For sell signals, none of the statistics for the signals are significant at 10% level or better when the ADX equals to 15. When ADX equals to 20 and 25, most of the statistics for the signal are significant at 10% level or better. Besides, for those who have significant positive returns, the total returns increase more than 10% or change from insignificant to significant as the holding days increase from 5 days to 10 days. However, when the holding days increase from 10 days to 20 days, the total returns may decrease or increase which contains uncertainty.

In sum, for both buy signals and sell signals, holding 10 days is the most ideal period to maximize the total returns among the 4 periods tested in the research. By taking the counts into

\[ \text{Total Returns} = \text{Counts} \times \text{Mean} \times \text{The number of holding days (Day)} \]

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\(^1\) Total Returns = Counts*Mean*The number of holding days (Day)
consideration, holding for 10 days doesn't reduce many counts compared to holding for 5 days, which means that for each signal, the returns generated by 10 days is larger than that for holding 5 days. This implies that the index price is in an upward/downward trend in 10 days for buy/sell signals. However, when the holding days increases to 20 days, some of the indexes’ total returns decrease. It implies that the trend may reverse after holding 10 days so that the strategy is helpful in short-term trading while it cannot be used to predict the long-term trend. Thus, the strategy can be used to gain more returns in the short run than in the long run because of the market reverse.

For buy signals, when the period of holding days is fixed at 5 or 10 days, there is no difference for indexes 000001 and 000002 in total returns for applying ADX is 15 or ADX is 20. For the index 000010 and 000300, the total returns increase from the ADX equals to 15 to the ADX equals to 20. For the index 000902, the total returns decrease less from the ADX equals to 15 to the ADX equals to 20. Thus, in general, the total returns generated by the ADX equals to 20 outperform that generated by the ADX equals to 15. When compared the ADX equals 25 to the ADX equals to 20, most of the total returns decrease. Besides, even though positive average daily returns which the statistics are significant at 10% level are generated when ADX equals to 25, its total returns cannot exceed that for holding 10 days when the ADX equals to 20.

For sell signals, when the holding days hold unchanged, all indexes’ statistics change from insignificance when the ADX equals to 15 to significance at 10% level or better when the ADX equals to 20 except for the index 000010. However, when the ADX equals to 25, the statistics become insignificant again when the period of holding days equals to 5. Besides, for 60% of the sell signals that can generate significant returns, the returns are greater when the ADX equals to 20 compared to the ADX equals to 25. Moreover, even though when ADX equals to 25, the total returns increase a lot by holding 20 days compared to holding 10 days, most of them cannot exceed that for holding 10 days when the ADX equals to 20. In conclusion, the strategy can generate the largest returns when the threshold value of the ADX equals to 20.

In sum for both the buy signals and sell signals, the ADX equals to 20 can generate the best returns among the three. This implies that when the ADX equals to 15, it cannot indicate a
strong trend. As a result, the signals generated by trading strategies may lead to negative returns, and reduce the total returns. On the other hand, when compared the ADX equals to 25 to the ADX equals to 20, the total returns don’t increase as expected. One possible reason is that the ADX equals 20 is enough to indicate a strong trend. When the ADX equals to 25 is applied in the strategy, it only reduces the counts, and thus, reduce the total returns. Hence, the strategy can generate the largest returns when the strength is strong enough to indicate a certain trend, but not so strong that eliminate the potential profitable trading signals.

Table 2. Buy Signals

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Table 3. Sell Signals

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6. Conclusion

This paper shows how trading strategy is established by using various characteristics of the technical indicators, as well as how the strategy is applied to the indexes in China stock market. In this paper, RSI and ADX are the two technical indicators that help investors to detect buy and sell signals. The strategies are tested to be applied in indexes from Shanghai Stocks Exchange and China Securities Index. For both buy and sell signals that occupy significant impact on the daily returns of the stock indexes, the total returns of them are increasing when the holding period elongates from 5 days to 10 days, holding the value of ADX the same. Besides, for both sell and buy signals, the total returns are highest in general when ADX equals to 20, which implies that the moderate strength and sensitivity makes the mechanism works better in the short term.

In conclusion, that technical indicators play useful roles in searching the long and short signals during the stock transactions in the short term. By applying the trading strategy, one can generate positive average returns by creating a good profile or investing on funds relate to the indexes.

References


