Evaluating the Performance of One-minute and Thirty-minute Datums in the Stock Market

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Abstract

The stock market applies data with different time intervals to invest. This paper aims to figure out how to apply stock data at different time intervals to build a range breakout model by comparing different data indicators to ensure profit maximization. The two groups of interval data are selected as intra-day data trading within 30 minutes and intra-day data within 1 minute. Through program code, this research calculates the real-time profit, maximum withdrawal rate and annual interest rate. Two times interval charts are drawn from data and compared. This paper finds that intra-day data trading in 30 minutes is more effective than intra-minute data trading in controlling stock risk. Data with a 30-minute interval yields a maximum decline rate of 5% and an annual profit of 2%. Data with an interval of 1 minute has a drawdown rate of 47% at most and an annual interest rate of -1%. In addition, the article also finds that if price of a stock fluctuates in a small range, the data indicators calculated by using two times intervals are almost equal. If stock price fluctuates greatly, data indicators of 30-minute data are basically better than the calculated indicator of 1-minute data.

Keywords: *interval breakthrough model, stock data, maximum drawdown rate, annualized rate of return.*

1.INTRODUCTION

With the continuous development of information technology and science technology, people can obtain a large amount of data from all aspects of areas. These kinds of data are capable of providing people with valuable information and scientific strategies. Cheong suggested that information helps to conduct next behavior of investors [2]. The methods obtained through data calculations can effectively help people in their lives to increase the probability of outcome that people aspire to achieve. In financial sector, people often exploit the above ideas to provide decision-making guidance for the purchase of stocks. These thoughts ensure to maximize benefits within the scope of risk control.

Hu pointed that due to uncertainty of stock fluctuations and the fact that humans may be affected by irrational emotions, people try to apply available data that can scientifically track the rise and fall of stocks [10]. Entering data into a program and using the program to perform next step is an effective way to leverage the data that is already available. Programming transactions is a common way of investing in international trade markets. It has the advantages of scientific, predictability and timeliness. This suggests that objective decision of programming transactions is more scientific than the subjective prediction of the investors. Arkolakis proposed that among recent years, data at micro level have had a non-negligible impact on international transactions. At the same time, many new trading models have been appeared to help people better understand the reality of situation [1]. There are many common mathematical models for program trading in securities market, such as random walking model, cumulative model, integral model and etc. These models play diverse roles in various trading strategies. For example, Matuttis pointed that in the random walk model, probability of mini-trends migrates downward with delay of market transactions by incorporating the practice of financial tagging into the model [5]. Among these trading models, interval breakthrough model is one of the classic models and is widely applied in financial, biological, medical and other fields.

Many studies avail breakthrough models to help them analyze data and decide what to do in the future. For example, a study of analysis in futures' investment is based on a comparative analysis of copper in Shanghai and copper in London [8]. Zhu focused on two strategies: moving average strategy and range breakout strategy. She

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eventually found that after substituting data related to Shanghai copper and London copper into calculation, the range breakout strategy could allow investors to get greater returns. Xie proposed a model. This model was based on the interval breakout model and only add an additional condition. It was an EXCARR model. It provided a new way to calculate possible fluctuation between intervals [6]. The range breakout strategy performs well on different symbols at different trading times. For example, when testing back on the application of China's treasury futures market, Chen found that opening range breakout strategy can help investors achieve good profits in different period [4]. Articles made by previous scholars can conclude that range-breaking strategies perform well in both domestic and foreign financial trading markets.

Interval breakthrough trending strategies utilize data at regular intervals of time to trade. The execution of interval breakout strategy is related to data of different intervals selected. In general, the larger amount of data strategies applies, the more accurate results will be executed. Unlike the above study, this research will utilize data from two different intervals to evaluate the performance of same stock over equal period of time. These two times intervals are each minute interval and every thirty minutes intervals. Choice of strategy is based on these following three indicators. One is the maximum drawdown rate. The maximum drawdown rate is a key to measure of a stock's risk. The risk of policy using relevant interval data is evaluated by the maximum drawdown rate. Second one is the annual interest rate. Using data to calculate corresponding annual interest rate, it can help investors intuitively determine how much return can be brought to themselves by using relevant data. The third is daily net profit. Through daily net profit comparison, it can clearly reflect relevant data for investors to the profits it brings every day. Based on the comprehensive judgment of these three indicators, it is possible to determine which one of the two different time intervals of data performs better. When using the range breakout strategy, this paper artificially sets breakout range. Then real-time data broke through the relevant interval and made relevant operations. Eventually, experimental results show that data with a time interval of 30 minutes perform better. The data for these three indicators of maximum drawdown rate, annual interest rate, and net profit per day are all better than the data with a time interval of 1 minute.

2.METHOD

Now the research will show you how to utilize the top price, the bottom price and the closing price to build an interval breakthrough model and exploit the model to calculate data of Hong Kong 08098 from March 8th to April 1st to analysis the maximum withdrawal rate, annual rate of return and real-time profits every day. In part A, the article describes interval breakout model. In part B, the paper describes three metrics exploited to measure data of the relevant intervals.

2.1. Intervals

From introduction, it is distinctly that constructing an appropriate interval is the key for this article. The securities market believes that four data are important. They are the opening price (OP), the highest price (HP), the lowest price (LP) and the closing price (CP). This paper will avail these four indicators to construct the relevant model.

2.1.1. Construct intervals

The interval is

$$Range = Max\ (HH - LC,\ HC - LL) \quad (1)$$

From figure 1, HH is the highest price of the previous N-day high. LC is the lowest price of the previous N-day closing price. HC is the closing price of the previous N-day highest price. LL is the lowest price of the previous N-day low. Take the maximum value between (HH-LC) and (HC-LL) as the interval. In the stock market, stocks are often affected by data from all sides and are extremely volatile.

Therefore, this research considers that the data for stocks is less correlated with the previous data, so in this article, N=1.

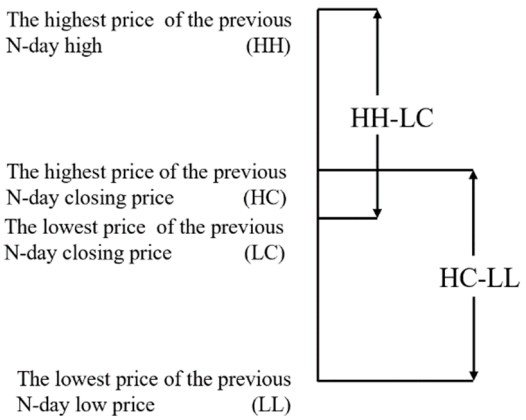

Figure 1: Method of constructing interval breakout model.

2.1.2. Execution Policy

After constructing the interval using the four data of HH, HC, LC and LL, the paper utilizes the construction interval to construct upper and lower lines of the data. Thus, the upper and lower lines are defined as follows:

$$The\ buy\ line(BL) = OP + Range \times k_1 \quad (2)$$

$$The\ sell\ line(SL) = OP - Range \times k_2 \quad (3)$$

OP is the opening price of the stock for the day. $k_1$and k_2 are related parameters. Values of k_1 and k_2 can be tested with reference to historical data. They can also be adjusted periodically according to the subsequent judgment of the investor on the stock. Figure 2 is the schematic diagram about how program performs related operations.

In general, it is normal for stocks to fluctuate within a certain range. Purpose of the BL and SL set is to reflect the fluctuation range of the normal price of the stock.

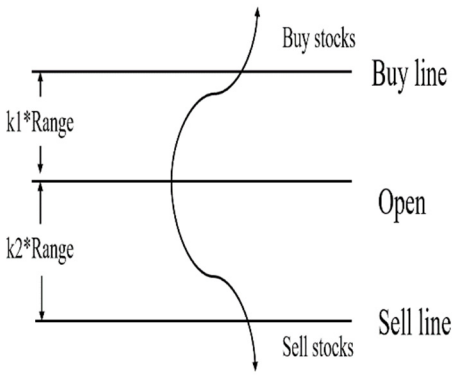

Figure 2: Diagram of buying or selling stocks using the range breakout model.

When the real-time price of the stock breaks through the BL, stock can be considered to have an appreciation trend and the buy operation is carried out. When the real-time price of the stock breaks through the SL, the stock can be considered to have a downtrend at this time and the sell operation is carried out at this time.

2.2. Metrics

After constructing the interval, the paper substitutes the relevant data into the interval breakout model calculation and measures the two-time intervals using the following three indicators.

2.2.1. Drawdown and Maximum drawdown rate

$$DD = \frac{\mathrm{Y} - \mathrm{X}}{\mathrm{X}} \tag{4}$$

This paper defines X as the net profit of the previous day. Y is the current real-time profit. DD is the drawdown rate.

The drawdown rate is applied to measure the extent by which a fund draws back from a historically high value over that period to the lowest value of the data exploited in the calculation of a given period of time.

This paper defines the maximum drawdown rate as MD, the day value of the account as DV and maximum value of the account before the day as MV. Thus, the MD is defined as

$$MD = \max\left(\frac{1 - \mathrm{DV}}{\mathrm{MV}} \times 100\%\right) \tag{5}$$

There may be multiple decreases in net profit over a period of time. In these cases, the maximum time to pullback is the maximum drawdown rate. The maximum drawdown rate is mainly applied to assess whether the risk of the stock is large. It calculates the drawdown range from the highest point of return in history to the lowest point of the data utilized. This indicator is often applied to describe the maximum loss an investor is likely to face. For example, Landriault argued that maximum drawdown rates are applied to account for extreme events [3]. In order to select the maximum drawdown rate, this paper calculates all the drawdown rates in the program. In order to make the drawdown rates of the two data comparable, this research expands the size of the relevant data for the drawdown rate with a time interval of thirty minutes to the size of the relevant data equal to the drawdown rate with a time interval of one minute. The specific operation of the expansion is that this paper maintains that the drawdown rate at a time interval of 30 minutes is unchanged within thirty minutes, so the relevant data is repeated 30 times. It corresponds to the data with a time interval of 1 minute. The largest of the calculated drawdown rates from two groups are selected and compare together.

2.2.2. Annualized Rate of Return

This research defines the annual rate of return as AN, the return on investment as RI, the principal as P and the number of the day as ND. The number of trading days in a year is NT. AN is defined as

$$AN = \frac{RI/P}{ND/NT} \times 100\% \tag{6}$$

Generally speaking, after deducting the number of days on Saturdays and Sundays, the actual number of trading days in a year is 250 days. Here NT is 250. The annual rate of return is availed to allow investors to more intuitively measure the return on the invested stock. For example, Gencay exploited annual interest rate to consider the accuracy of his model [9]. For stocks, it is difficult for people to hold stocks for a year because people often buy and sell stocks. Therefore, there is often a certain difference between the annual interest rate people calculate and the real annual interest rate. This indicator is often applied as a reference for investors to select stocks by comparing the annualized returns of different stocks. For example, Wang compared his own annualized rate of return with that of others and concluded that the gcForest algorithm had obvious advantages in this paper [7]. In this study, the final net profit is calculated by using a program and brought into the annual profit calculation formula. Conclusions are drawn by a comprehensive comparison of the maximum drawdown rate and annual profit.

2.2.3. Real-time profits

$$RP = TVA - OF \quad (7)$$

RP are real-time profits. TVA is total value of the account. OF is the original funds. Real-time profits can help investors effectively judge the current capital situation in the account and provide a certain reference for whether they need to continue to increase or reduce their holdings in next step. In this article, the real-time profit is calculated by using data from two times intervals. Since the corresponding stock data is considered unchanged during the process of utilizing data with a time interval of 30 minutes, the relevant operation is not performed.

3.RESULT AND DISCUSSION

In this article, two data sets are selected. One data set contains data of the one-minute interval from March 8 to April 1 in Hong Kong stock 08098. Another data set contains data with 30-minute intervals over the same period of time. Among them, the number one-minute interval data is 5280. The number of thirty-minute interval data is 176. They are separately substituted into method for calculations. Table I presents the result calculated by program.

Table 1: Results of the program.

Time- interval	30-minute interval	1-minute interval
Number of days	16	16
Data points' number	176	5280
MD	5%	47%
Annual interest rate	2%	-1%

Notes: MD is Maximum drawdown rate

3.1. Analysis of real-time profits

Figure 3 shows the curve of profits changing over time. They can be concluded from figure 3 that before the 4000 time points, the price of the stock has a slight fluctuation in a small range. These data correspond to the real-time share price of the stock. In the range where the stock price fluctuates in a smaller range, the corresponding buy and sell operations performed by the range breakout system are also less. Numbers can be seen from figure 3 that the real-time profit of data with a time interval of 1 minute is always above the profit of data with a time interval of 30 minutes.

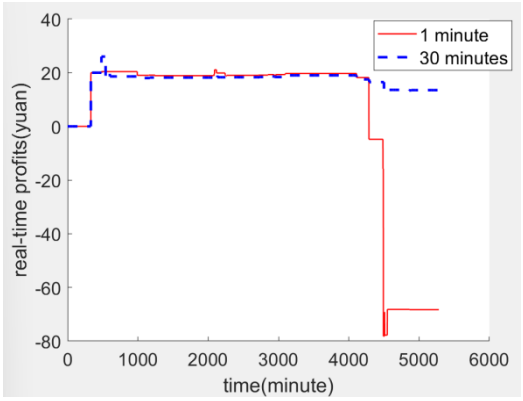

Figure 3: Curves of real-time profit corresponding to times intervals.

From figure 3, the paper concludes if the data is in a reasonable range of fluctuations, the data with a time interval of 1 minute can track the trend of stock prices in a timely manner. At this time, investors get higher profits. When the data is about 4500, it can be seen from the real-time data of the stock price that the stock data at this time has fluctuated violently within a certain range. But it quickly returned to the original stock price.

Data with a time interval of 1 minute performs too many operations when the interval breakout is performed. Due to the large number of stocks bought by previous appreciation, the instability of investment is exacerbated. At this time, real-time profit of the data with a time interval of 30 minutes is more stable.

3.2. Analysis of drawdown rate and maximum drawdown rate

Figure 4 displays how drawdown rate change after the real-time data is substituted into relevant formula for the drawdown rate. It can be seen from figure 4 that the drawdown rate of data with a time interval of 30 minutes before 4500 data points is higher than that of data with a time interval of 1 minute.

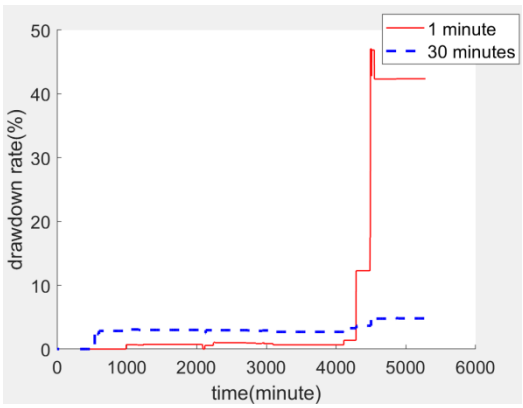

Figure 4: Curves of drawdown rate corresponding to two times intervals.

From figure 3 and figure 4, it can be concluded that before 4000 data points, the drawdown rate does not

fluctuate sharply for a longer period of time and before 4500 data points, real-time profits fluctuate in a very small range. Around 4500 data points, combined with real-time profits, it can be seen that the stock price at this time has fluctuated greatly. The interval breakout model using data with a time interval of 1 minute is too sensitive. The underlying model performs too many buy-sell operations, which magnifies the original risk to some extent.

The maximum drawdown rate is the largest of the drawdown rates. From figure 4, the results can be seen that the maximum drawdown rate with a time interval of 1 minute is about 47%. A value of 47% is also high for the maximum drawdown rate. This means that when a stock fluctuates more intensely over a certain period of time, investing with data spaced 1 minute increases the risk of investing. The result can be found that when a stock fluctuates violently over a certain period of time and sharp fluctuations only last for a certain period of time, investors can exploit model with a time interval of 30 minutes. When volatility data of historical stocks is in a small range, data with a time interval of 1 minute can be utilized.

3.3. Annual Interest Rate per day

Figure 5 demonstrates the curve of annual interest rate corresponding to times intervals. Curves in figure 5 show a positive correlation with curves in figure 3. The stock applies in this article is Hong Kong stock 08098. According to the rules of Hong Kong stock market, last trading time of each day is 16:00. The data is called for two time periods at 16:00 every day that exploited real-time profit-related data to call data. And corresponding real-time profit is calculated by substituting it into the annual interest rate formula. When data are located around 4500 data points, real-time profit changes drastically. The annual interest rate calculated using real-time profits has also changed drastically. Real-time profit is less than zero when time interval of about 4500 points is 1 minute about 4500-point. The annual interest rate falls into negative numbers with real-time profits. The model which avails data with 30-minute interval controls the loss in time. The corresponding annual interest rate has not changed significantly consequently.

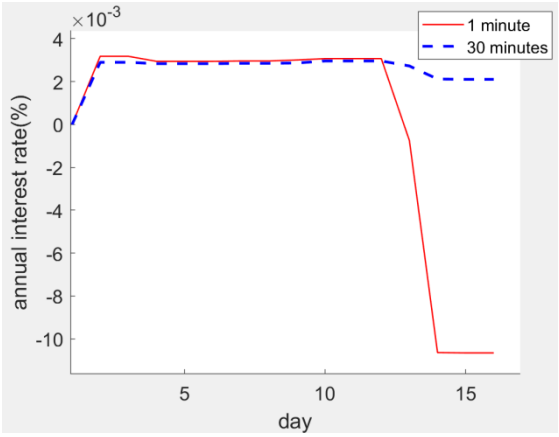

Figure 5: Curve of annual interest rate corresponding to times intervals.

3.4. Improve ideas

Deficiencies remain in this article. The data utilize in the report are not typical. In this report, the research analyses stock possessed certain reasonable fluctuations and the stock with certain fluctuations but final price still returns to the original data. These applied data are missing the situation in which the stock price has experienced sharp fluctuations and the price after the fluctuations is very different from the original price. In addition, two correlation coefficients of $k_1$and k_2 in the interval fluctuation model need to be modified accordingly in different models. The paper only provides corresponding data obtained when correlation coefficients k_1 and k_2 are equal. However, in actual situation, there are cases where correlation coefficients of k_1 and k_2 are not the same. The values of k_1 and k_2 need to be calculated on a stock-by-stock basis.

4.CONCLUSIONS

This paper proposes that data with a time interval of 30 minutes can better control risks and obtain certain benefits. The article utilizes the range breakout strategy to calculate relevant data for the corresponding time interval. In the results of the final program calculation, this article finds that the data with a time interval of 30 minutes can effectively control the risk. In the program, data with a time interval of 30 minutes is capable of control the maximum drawdown rate to 5% and at the same time to obtain an annual profit of 2%. The maximum drawdown rate for data with a time interval of 1 minute is 47%. However, when calculating the final gain, a certain loss is obtained. Experimental results show that the data with a time interval of 30 minutes are better than data with a time interval of 1minute. This study represents that when stock data is in a less volatile range, the correlation data of 30 minutes can maximize profits. The results of the experiment are instrumental for investors to select appropriate time interval data to ensure their profits maximization.

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