# Does Momentum Investing Works in Chinese Stocks？
## From the Perspective of Momentum Investing, What are the Factors That Determine the Volatility of Stock Prices?

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**ABSTRACT**

In this paper, we first used the 12-minus-1-month, 6-minus-1-month, and 3-minus-1-month momentum strategy to analyze the stock price of the SSE Composite Index (000001.SS) and created scatter plots to show the negative linear relationship between different momentum period's return and subsequent one-year returns. Our result suggests an anti-momentum investing effect, that is, the higher the return is in a given year, the worse the return would be in the subsequent year. By creating residuals plots and cook's distances plots based on the linear regression, we inferred that the linear model is not enough for us to find a trend, and we doubted the feasibility of applying the traditional 12-minus-1-month or other different period momentum strategy on a stock market index of all stocks.

We then performed quadratic regression on the Gordon Model valuations of Shenzhen Clou Electronics Co., Ltd. (002121.SZ) and Sanquan Food Co. Ltd. (002216.SZ) to obtain their trends. Our results suggested these two stocks are severely overvalued, and their stock prices will fall in the future. We also employed Moving Averages, another critical momentum strategy, to show the successful prediction of stock price: A 5-day moving average crossing or exceeding the 30-day moving average is a buy signal; Conversely, it is a sell signal. Moreover, by using DuPont Analysis, Equity Analysis, and Credit Analysis, we found out that the company's operating conditions, the level of debt, and the risk of bankruptcy will affect investors' decisions and thus cause fluctuations in the stock prices. In general, we concluded that momentum investing can be applied to the Chinese stock market when the market is strictly supervised to avoid any insider trading or malicious capital operations. (*Abstract*)

*Keywords: Momentum investing, finance risk, quantitative finance, finance Analysis, Market risk*

## 1. INTRODUCTION

Momentum is a trend that securities performing relatively well tend to continue outperforming [1], while relatively underperforming securities tend to continue underperforming. The existence of momentum can be traced back to the Victorian age in U.K. equity data, its duration being more than 20 years [1]. Some evidence even shows that momentum premium existed in the market before any release of academic research in financial economics. Momentum investing is a strategy that aims to capitalize on the continuance of an existing market trend [1]. To be specific, it involves going long any assets with upward-trending prices while short assets with downward-trending prices.

After knowing the general mechanism behind momentum investing, we were curious about whether this powerful strategy frequently used in the United States can be applied to the Chinese stock market and what are the factors that determine the volatility of stock prices. With these questions in mind, we started this research. First, we chose SSE Composite Index (000001.SS) as a representative of the Chinese stock market because the SSE index, including both A shares and B shares, is the major stock market index in China. Then we chose two stocks randomly, Shenzhen Clou Electronics Co., Ltd. (002121.SZ) and Sanquan Food Co., Ltd. (002216.SZ).

We fetched their historical data from Yahoo Finance using Python and R. While there are different momentum investing methods adopted by investors, such as following price signals to go long or short sector ETFs or involving cross-asset analysis, we limited our approaches to 12-minus-1-month momentum strategy, Gordon model, and Moving Averages for regression analysis in this paper.

After implementing the momentum strategy by analyzing data, we did the financial analysis on the two stocks and one stock market index to figure out the factors influencing the stock price. This part included DuPont analysis with its five-part approach, Equity Analysis (including calculating Dividend Payout Ratio, Retention Rate, and Sustainable Growth Rate), and Credit Analysis using Z-score. After all the calculations and analyses, we derived our conclusion about whether momentum investing works in the Chinese stock market, and what factors can help us better estimate the stock price.

## 2. DATA ANALYSIS

### 2.1. Data Analysis for The Shanghai Composite Index

#### 2.1.1. Analysis method:

We analyzed the SSE Composite Index (000001.SS) traded at the Shanghai Stock Exchange. We used R to fetch the historical data of the index from Yahoo finance and displayed it with monthly frequency. Then we selected the time period between Aug 01, 1997, and Aug 01, 2021, to analyze the corresponding historical prices.

#### 2.1.2. Data Analysis:

Monthly Return equals the close price of the month plus any dividends received, divided by the previous month's close price, and subtract one from the ratio. The average monthly return of the SSE Composite index is 0.635%, the standard deviation is 0.0745, and the variance is 0.00555.

For the next step, we calculated the Compound annual growth rate (CAGR) of the index. The formula is shown below. EV represents Ending Value, BV represents Beginning Value, and n represents the Numbers of Years.

$$CAGR = \left(\frac{EV}{BV}\right)^{\frac{1}{n}} - 1$$

Using this formula, we got the CAGR of the SSE index, which is 0.358%. The number can be verified by comparing it to the average monthly return minus half of the variance, which is 0.358% in the context. These two numbers are equal, so we could proceed with our calculations.

At this time, a problem arose: the SSE index does not include any dividends; thus, we cannot estimate the value of the index with the Gordon model. After our discussion with the professor, we switched to the 12-minus-1-month momentum, the most common definition of momentum in financial literature, to analyze the effect of momentum investing on the SSE index. This strategy looks at a stock's return over the past 12 months while excluding the most recent monthi.

#### 2.1.3. Momentum Strategy:

According to Joachim Klement, an investment strategist working at Liberum Capital, "Traditionally, momentum strategies are based on 12-month trailing price momentum (typically calculated as 12-month minus 1-month to remove short-term reversals) for decades, that momentum is one of the best ways to systematically outperform the market [1]." The short-term reversal effect mentioned in the quote accounted for in part why researchers skip the most recent month when implementing the strategy. There is academic research showing that a reversal effect presents in short-term momentum: previous winners do badly in the next month, while previous losers do well [2]. As a result, most researchers ignore the recent month in the momentum calculation.

#### 2.1.4. Momentum Data Analysis:

Being clear with the momentum strategy, we kept the time period between Aug 01, 1997, and Aug 01, 2021, and used R to create a scatter plot with 12-minus-1-month return as x-axis and subsequent one year return as y-axis. To calculate the independent variable, for example, the 12-minus-1-month return of 1998/8/1, we used the formula as shown:

$$12 \text{ } minus \text{ } 1 \text{ } month \text{ } return \text{ } of \text{ } 1998/8/1$$
$$= \frac{Close \text{ } price \text{ } of \text{ } 1998/7/1 - Close \text{ } price \text{ } of \text{ } 1997/8/1}{Close \text{ } price \text{ } of \text{ } 1997/8/1}$$
$$\times \text{ } 100\%$$

To calculate the dependent variable, for example, the subsequent one-year return of 1998/8/1, we used the formula as shown:

$$Subsequent \text{ } one \text{ } year \text{ } return \text{ } of \text{ } 1998/8/1$$

$$= \frac{Close \text{ } price \text{ } of \text{ } 1999/8/1 - Close \text{ } price \text{ } of \text{ } 1998/8/1}{Close \text{ } price \text{ } of \text{ } 1998/8/1}$$
$$\times \text{ } 100\%$$

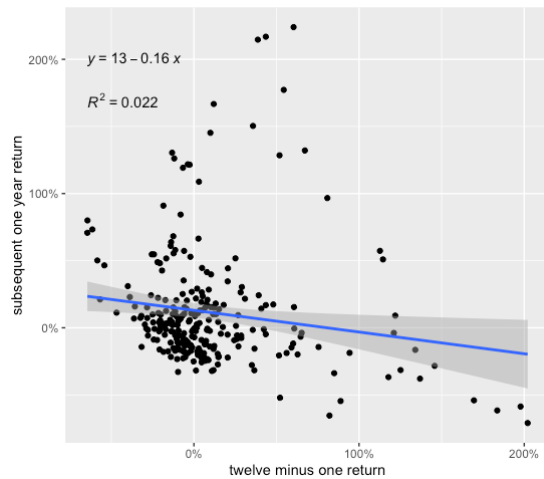Then the scatter plot is created as shown:

**Figure 1** Scatter Plot for Subsequent-one-year Return versus 12-minus-1-month Return.

The momentum strategy is to buy if the return is above some threshold value and to short if the return is below some threshold value. From the plot, we could know that when momentum is high, such as when the 12-minus-1-month return is greater than 100%, in all likelihood the subsequent one-year returns are below 0%, which means people lose money. On the other hand, when the return is below 50%, the next year's return tends to be relatively substantial.

When fitting a regression line to the dots, we got the equation for the average annual return on the SSE Composite index:

Return = 13% - 0.1619 × 12_minus_1_momentum

```
Residuals:
    Min      1Q  Median      3Q     Max
-65.125 -25.184 -12.397   6.917 220.734

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)            13.01604    2.77886   4.684 4.52e-06 ***
twelve_minus_one_return -0.16183    0.06588  -2.457   0.0147 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 44.03 on 263 degrees of freedom
Multiple R-squared: 0.02243,   Adjusted R-squared: 0.01871
F-statistic: 6.035 on 1 and 263 DF,  p-value: 0.01467
```

**Figure 2:** Statistic table for the linear model

This formula explains the trend of the scatters plot: The more momentum we got this year, the worse we would receive over the next year. On the contrary, if we got a bad year, we could expect a higher return next year. The t-statistics we calculated for this formula are significant: 4.684 on 13% and 2.457 on -0.1619, and the p-value for 12-minus-1-month return is 0.0147 which is less than 0.05. This means that there is a relationship between the 12-minus-1-month return and the subsequent one-year return.

However, it is notable that the linear model is not a good fit for the stock price data set. From the statistical summary information above, the Multiple R-squared is

0.02243, which means the model can only explain 2.2% of the data variability. We also plotted the residuals to show the problem of the linear model.
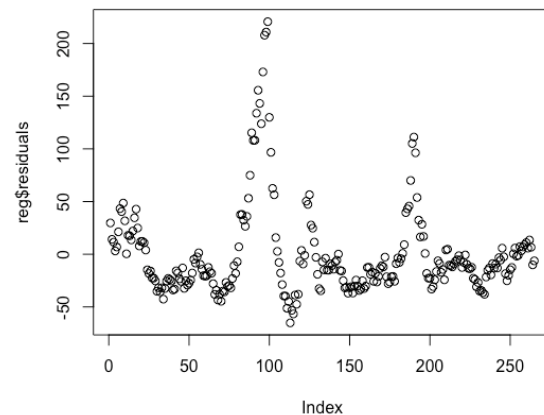


**Figure 3:** Residuals Plot for 12-1 Linear Model

From the picture above, we can see that there is a relatively obvious oscillating pattern, which is not random at all, which means there exists a hidden pattern that the linear model is not considering. After that, we plotted cook's distances to detect any influential points or outliers existing in the data set that may skew our linear model.
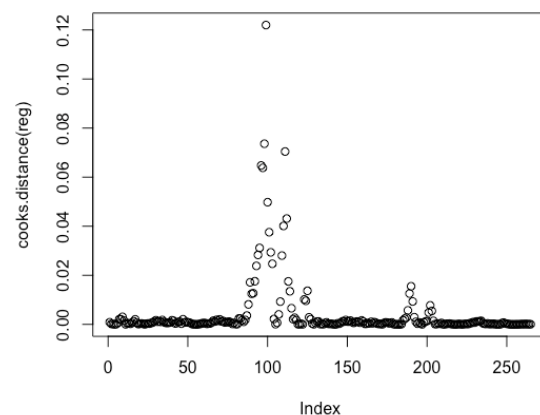


**Figure 4**: Cook's Distance Plot for 12-1 Linear Model

From the figure, several points around index 100 that do not follow the pattern, and they might be affecting the model. Since the data point is perfectly valid, in which case the model cannot account for the behavior. It is worth trying on a non-linear model rather than linear regression, but due to the length and subject matter of the article, we will not discuss them here.

Therefore, from our calculation, it seems that anti-momentum investing works on the SSE index instead of momentum investing people should buy when the index is doing badly and sell when the index is doing well.

To make our conjecture more reliable, we decided to try different momentum periods. Specifically, we decided

to perform a 6-minus-1-month and 3-minus-1-month momentum strategy on the given data set.

We used the same calculation method: For the 6-minus-1-month strategy, ignore the recent month and focus on earnings from six months ago; For the 3-minus-1-month strategy, ignore the recent month and focus on earnings from 3 months ago. Here are the scatter plots and corresponding residuals and cook's distances plots.
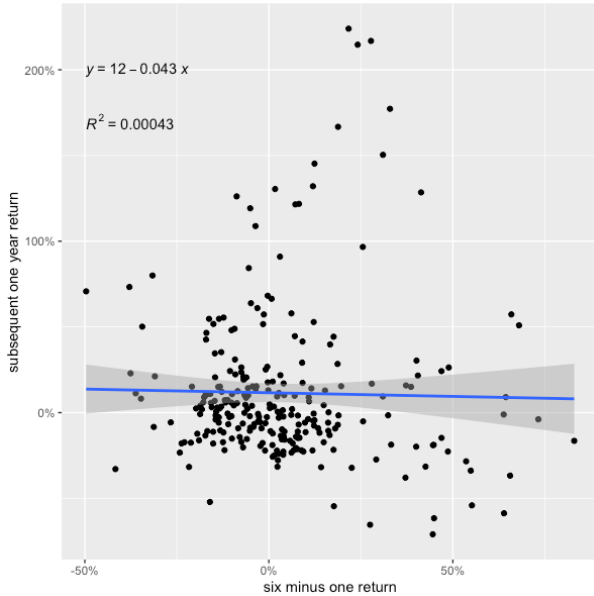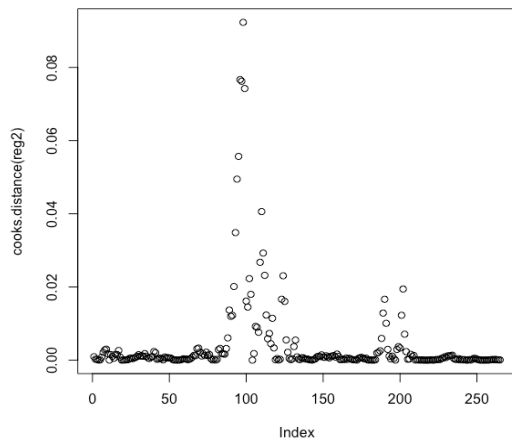


**Figure 5:** 6-minus-1-month momentum



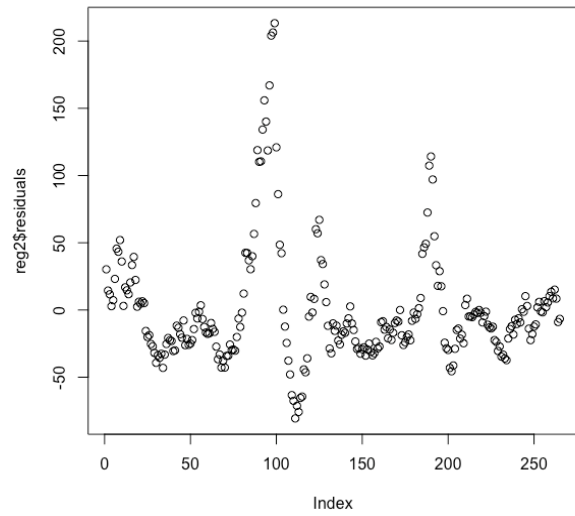**Figure 6**: Cook's Distance Plot for 6-1 Linear Model



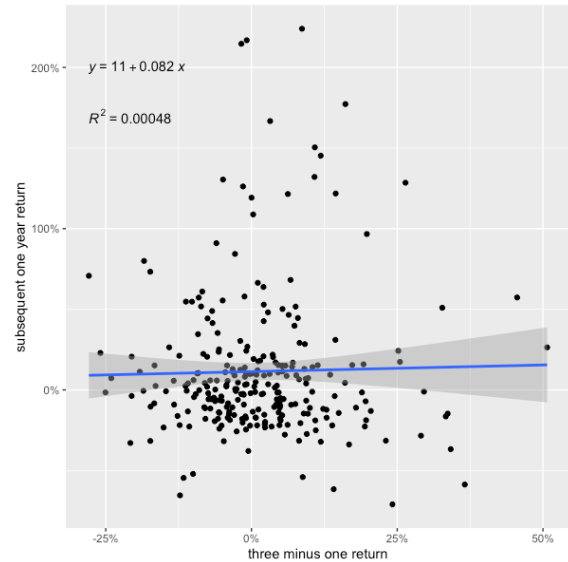**Figure 7:** Residuals Plot for 6-1 Linear Model



**Figure 8:** Scatter Plot for Subsequent-one-year Return versus 3-minus-1-month Return
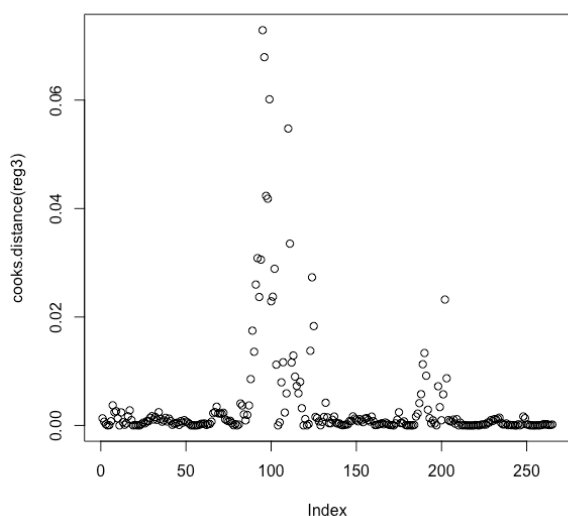
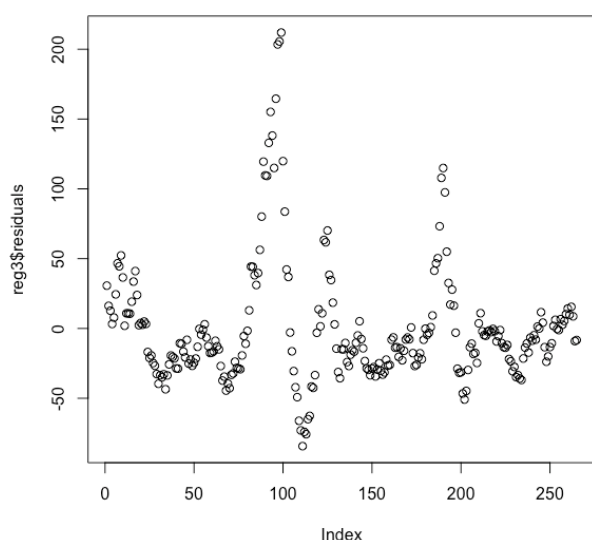**Figure 9**: Cook's Distance Plot for 3-1 Linear Model



**Figure 10**: Residuals Plot for 3-1 Linear Model

6-minus-1-month scatter plot still conveys a negative linear relationship, while the 3-minus-1-month scatter plot shows an almost horizontal positive trend. From the two residual plots on the top right corner, we can figure out that the linear model is not enough for the data set to generate a trend; In the cook's distance plots, there exist some real data points around index 100 skewing the formulation of the general model.

## 2.2.Data Analysis for The Two Stocks

### 2.2.1. Analysis method:

We then randomly selected two stocks listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange, namely Shenzhen Clou Electronics Co., Ltd. (002121.SZ) and Sanquan Food Co., Ltd. (002216.SZ). We first used Python to obtain the data of these two stocks from Yahoo Finance from August 1, 2008, to August 1, 2021. We replaced August 1, 2021, as it is a Sunday when the stock market is closed, with 2021. Data on August 2. Our data type is Monthly, and we use the data of Monthly Close price for data analysis.

### 2.2.2. Data Analysis:

First, we used the closing price of the month plus any dividends received, dividing it by the closing price of the previous month, and then used the ratio method to calculate the monthly returns of the two stocks. Then we calculated the average of the obtained Monthly Return, which is the Average Monthly Return. The Average Monthly Return of 002121.SZ is **1.94%**, and that the value of 002216.SZ is **1.68%**. Afterward, we calculated the standard deviation of Monthly Return, the value of 002121.SZ being **0.166**, and the value of 002216.SZ being **0.1204**. Finally, we calculated the Compound annual growth rate (CAGR) for the two stocks, the formula being

$$\text{CAGR} = \left(\frac{\text{EV}}{\text{BV}}\right)^{\frac{1}{n}} - 1$$

where EV is Ending Value, BV is Beginning Value, and n is Number of Years. The CAGR of 002121.SZ is **10.11%**, and that of 002216.SZ is **13.41%**. After that, we used the method of average returns minus half of the variance to verify that Compound growth rates are approximately equal to average returns minus the half of variance.

### 2.2.3.Dividends Analysis:

After that, we obtained the dividend data of these two stocks from Yahoo Finance and used it to calculate the Gordon Model. We first perform linear regression on the dividend data of 002121.SZ

The intercept $\beta_0$ and slope $\beta_1$ in the regression model

$$y = \beta_0 + \beta_1 x + \varepsilon$$

Using the above formula, we obtain the Dividends linear regression formula of 002121.SZ where 0.0012 is the dividend growth rate of 002121.SZ, as is shown in the graph below.
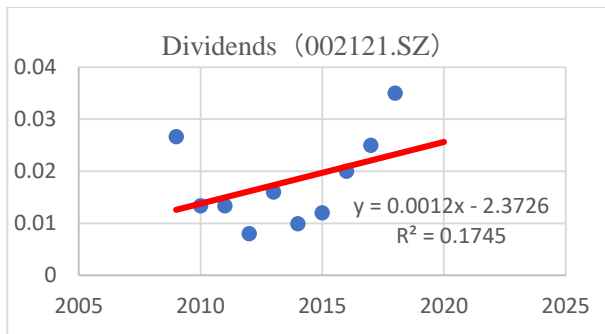
**Figure 11**: Scatter Plot and linear regression for 002121's dividends

After doing the same data analysis on 002216.SZ; we got the Dividends linear regression formula of 002216.SZ as $y = 0.0165x - 33.277$ . 0.0165 is the dividend growth rate of 002216.SZ is shown in the graph below.
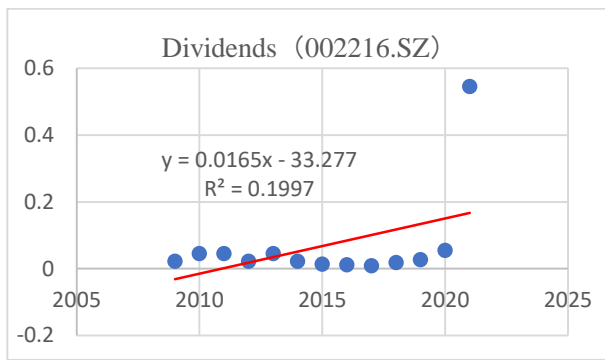


**Figure 12**: Scatter Plot and linear regression for 002216's dividends

We found the dividend growth rate by doing linear regression on the dividend data of the two stocks, the time interval being between 2008 and 2021. Since this is only a single data, we subdivided its dividend growth rate. In other words, we have calculated the growth rate of the dividend growth rate of the two stocks.

In order to find their trends, we performed a quadratic regression on their data. As shown below
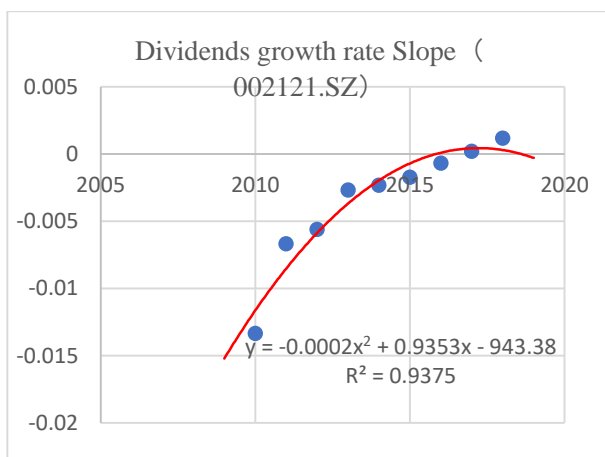


**Figure 13**: Scatter Plot and quadratic regression for 002121's dividends growth rate
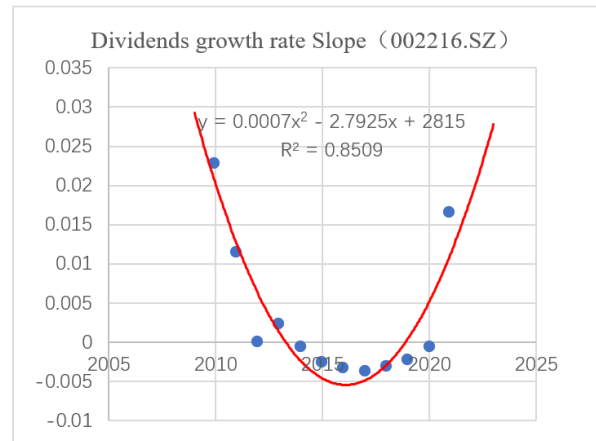


**Figure 14**: Scatter Plot and quadratic regression for 002216's dividends growth rate

We may conclude that although the dividends of the two stocks will continue to increase, the growth rate of dividends for 002121.SZ will decrease, and the growth rate of 002166.SZ will increase, which also corresponds to the growth rate of dividends for the two stocks.

### 2.2.4.Gordon Model:

Having found the dividend growth rate of the two stocks and their exact dividend amount, we only need to find the expected return rate of the market and use the Gordon Model to calculate the valuation of the two stocks and compare the result with their stock prices so as to conclude whether the value of the stock is overvalued or undervalued.

We used the 10year Return in iShares MSCI China ETF (MCHI) as our market expected return rate, which is 7.02%. After obtaining these data, we calculated the valuation of these two stocks according to the Gordon Model formula.

$$P_0 = \sum_{i=1}^{\infty} D_0 \frac{(1+g)^i}{(1+r)^i}$$
$$P_0 = \frac{D_1}{r-g}$$

Based on the available data, the valuations of these two stocks were calculated for each year. Using 2018's data as an example; 002121.SZ was valued at 0.51 yuan per share in the 2018 Gordon Model, but its average closing price in 2018 was 4.28 yuan, meaning that 002121.SZ is seriously overvalued. Similarly, 002216.SZ was valued at 0.25 yuan per share in the 2018 Gordon Model, and its average closing price in 2018 was 14.30 yuan, meaning that 002216.SZ is seriously overvalued.

Based on the above data, we concluded that these two stocks are severely overvalued and projected their stock prices would fall in the future. In order to verify this inference, we observed the trend of these two stocks since

January 2018; 002121.SZ had continued to fall since January 2018, and 002216.SZ had continued to rise since January 2018. This seems unreasonable based on the data obtained, so we believed that there are other factors determining the fluctuation of stock prices. We have another speculation: if the Gordon Model reflects the valuation of the company's stock, then we can calculate a sequence of the company's valuation and analyze the sequence. As shown below:
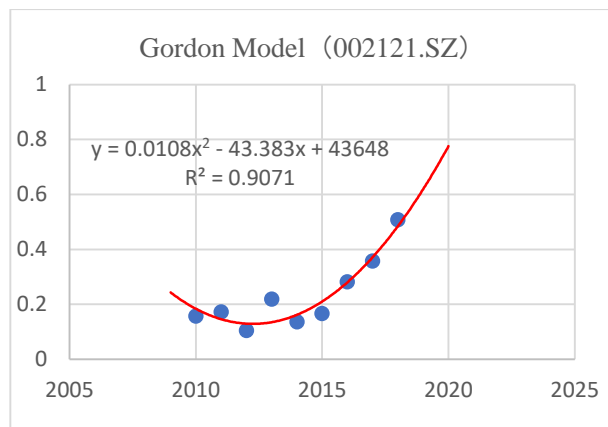


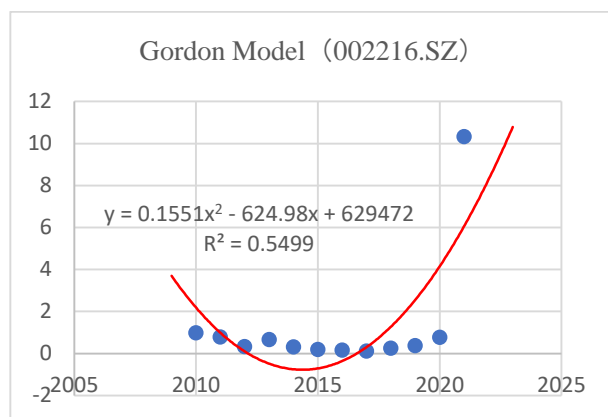**Figure 15**: Scatter Plot and quadratic regression for 002121's Gordon Model outcome



**Figure 16**: Scatter Plot and quadratic regression for 002216's Gordon Model outcome

We performed a quadratic regression on the Gordon Model valuations of the two stocks to obtain their trends. It can be concluded that the market value of these two companies is demonstrating an upward trend. At the same time, in conjunction with the previous data regression analysis, the dividend growth rate of 002121.SZ has shown a downward trend, while the dividend growth rate of 002216.SZ has shown an upward trend. However, the market value of their company has shown an upward trend, so the conclusion from the last paragraph is a reasonable explanation.

### 2.2.5. Stock Momentum Analysis:

In stocks Technical Analysis, a very used technique

is the plot of Moving Averages in the price's graphs. This momentum indicator is useful for our analysis because it helps to identify trends and smooths noises from prices. That is, the bigger the days window for the MA calculation, the smaller is the MA responsiveness to price variation. The smaller the window, the faster MA adapts itself to changes.

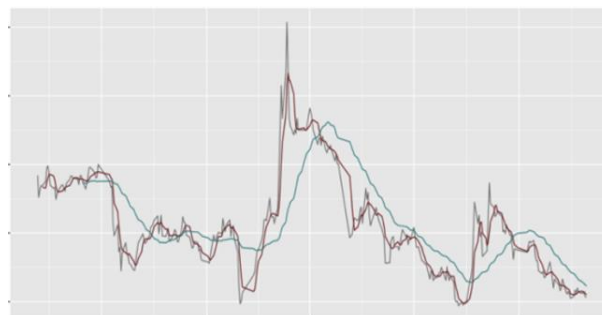### 2.2.5.1.Momentum Analysis for 002121.SZ



**Figure 17**: MA model for 002121

We collected price data from 2018/08/05 to 2019/12/01. During this time period, the price of 002121 had huge fluctuation, which we can analyze and see the relation between the MA 5 and MA 10 clearly. Following the plot of moving average, we found that the one that when two MAs of short- and long-term crosses each other, there is an indication of buying or selling the stock. When the short-term MA cross the long term upwards, there's a buy a signal. When the opposite happens, there's a sell signal.

As we can see, it's possible to notice that there were 9 points in which the series crossed themselves and 1 point where they overlapped. Following the buy signal, we'd have been successful in 3 of 4 times. Following the sell indication, we'd have done right 4 in 5 times. In total, we'd be 7/9, that is 78% of success with a MA momentum indicator.

In order to make the testing more accurate, we collected the longer time period price data, which was from 2014/09/12 to 2018/10/28.
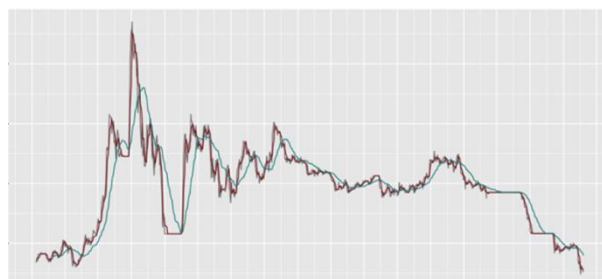


**Figure 18**: MA model for 002121

To verify the plot, it's possible to notice that there were 42 points in which the series crossed themselves and 5 points where they overlapped. Following the buy signal, we'd have been successful in 10 of 19 times.

Following the sell indication, we'd have done right 17 in 23 times. In total, we'd be 27/42, that is 64.3% of success with a MA momentum indicator.
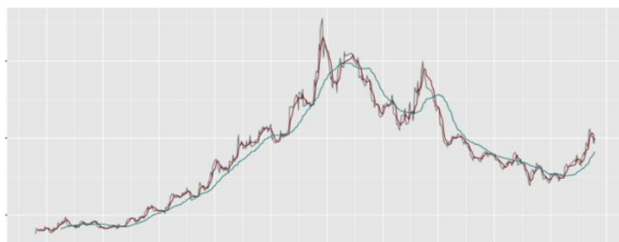
### 2.2.5.2.Momentum Analysis for 002216.SZ



**Figure 19**: MA model for 002216

We collected the data from 2019/05/12 to 2021/11/14. As we can see, it's possible to notice that there were 30 points in which the series crossed themselves and 5 points where they overlapped. Following the buy signal, we'd have been successful in 9 of 14 times. Following the sell indication, we'd have done right 11 in 16 times. In total, we'd be 20/30, that is **67%** of success with a MA momentum indicator.

Let's try another time period to verify the plot and our strategy. We collected the data from 2015/09/27 to 2019/05/12.
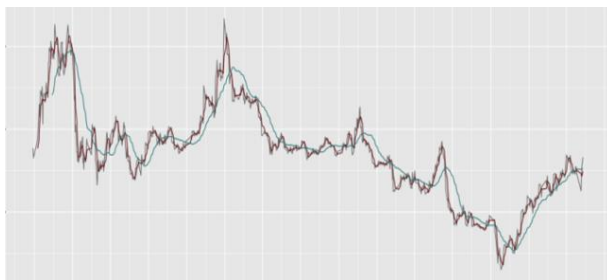


**Figure 20**: MA model for 002216

It's possible to notice that there were 49 points in which the series crossed themselves and 8 points where they overlapped. Following the buy signal, we'd have been successful in 15 of 25 times. Following the sell indication, we'd have done right 16 in 24 times. In total, we'd be 31/49, that is 63.3% of success with a MA momentum indicator.

In these four testing of MA momentum trading strategy, our average success rate is **68.15%**

## 3. FINANCIAL ANALYSIS

We believed that the content obtained by data analysis alone is not complete, so we analyzed the financial reports of the two stocks. We hoped that through the DuPont analysis method and equity analysis method, those factors that affect stock price volatility could be obtained.

### 3.1.Financial Analysis for 002216.SZ

#### 3.1.1.DuPont's analysis:

We first found the 2018 and 2020 financial report data of 002216.SZ in Yahoo Finance. According to DuPont's five decomposition formulas:

$$ROE = \frac{NI}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{Sales} \times \frac{Sales}{Asset} \times \frac{Asset}{Equity}$$

002216.SZ's Tax Burden Ratio in 2018 is 0.766; Interest Burden Ratio is 0.979. The operating net interest rate is 0.025; asset turnover ratio is 1.2; financial leverage ratio is 2.24; We got the ROE of 002216.SZ to be 0.05.

002216.SZ's Tax Burden Ratio in 2020 is 0.795; Interest Burden Ratio is 0.992. The operating net interest rate is 0.141; the asset turnover ratio is 1.155; the financial leverage ratio is 2.69; We got the ROE of 002216.SZ to be 0.345.

Compared with 2018 and 2020, the Tax Burden Ratio and Interest Burden Ratio of 002216.SZ are both at a relatively high level, which means that the company does not have huge tax pressure and interest debt. The asset turnover rate of this company is between 1-2, indicating that it is a normal operating company. 1.2 and 1.155 are close to 1, which indicates that the company's operating capabilities are average. The company's financial leverage ratio is 2.69; this shows that the company used lower debt financing when financing, which is why the company does not have huge debt pressure; the above data has not changed significantly from 2018 to 2020. Its operating net profit margin in 2018 was only 2.5%, and its operating net profit margin rose to 14.1% in 2020. This is also the factor that caused its ROE to rise from 5% to 34.5%. We looked back at the stock price of 002216.SZ; its stock price rose from RMB 7.51 per share on January 1, 2018, to RMB 22.62 per share on December 30, 2020.

#### 3.1.2.Equity analysis:

From the perspective of investors, we calculated the Dividend Payout Ratio, Retention rate, and Sustainable Growth Rate. These ratios can show the return performance of the company as an investor.

002216.SZ's Dividend Payout Ratio in 2018 is 0.159; Retention rate is 0.841; Sustainable Growth Rate is 0.042; Dividend Payout Ratio in 2020 is 0.062; Retention rate is 0.938; Sustainable Growth Rate is 0.324.

From the above data, it can be concluded that the company's Dividend Payout Ratio has decreased, and the Retention rate has increased. Combined with the company's low debt ratio, we can conclude that the company intends to keep more revenue in the company for development. We can also conclude from the growth of Sustainable Growth Rate that the company's dividends

will continue to grow in the future, which means that as an investor, there will be more income.

### 3.1.3. Credit risk

We used Altman Z-Score to measure the company's bankruptcy probability. If the Z-Score is less than 1.8, it means that the company is likely to go bankrupt, and if the score is higher than 3, it is unlikely to go bankrupt.

$$\text{Altman Z-Score} = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E$$

Where:

- A = working capital / total assets
- B = retained earnings / total assets
- C = earnings before interest and tax / total assets
- D = market value of equity / total liabilities
- E = sales / total assets

**Figure 21**: Altman Z-Score Formula

After calculation, the Z-Score of 002216.SZ in 2018 is 2.1; the Z-Score in 2020 is 2.89. According to the growth of Z-Score, we can conclude that the bankruptcy risk of this company is decreasing, which means that the company's assets are increasing, and liabilities are decreasing. In other words, there will be more investment security.

### 3.2. Data Analysis for 002121.SZ

After analyzing 002216.SZ, we followed the same procedure to figure out the factors influencing the stock price of 002121.SZ.

### 3.2.1. DuPont's analysis:

We used Python to fetch the Income Statement and Balance Sheet of 002121.SZ from *Yahoo Finance*. The formula of DuPont Analysis is shown below:

$$ROE = \frac{NI}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{Sales} \times \frac{Sales}{Asset} \times \frac{Asset}{Equity}$$

By plugging corresponding data into the formula, we did the calculation separately with data of 2018 and 2020. In 2018, the Tax burden Ratio is 0.956; the Interest Burden Ratio is 1.535; the Operating Net Interest Rate is -0.225; the Asset Turnover Rate is 0.27; the Financial Leverage Rate is 3.67. Multiplying them together, we got the ROE of -0.33. In 2020, the Tax burden Ratio is 0.802; the Interest Burden Ratio is 0.445; the Operating Net Interest Rate is 0.169; the Asset Turnover Rate is 0.33; the Financial Leverage Rate is 5.66. Multiplying them together, we got the ROE of 0.113.

Comparing data between 2018 and 2020, we found that the Tax Burden Ratio stays on a relatively high level, from 0.956 to 0.802, which means the company did not have a huge tax pressure in both two years. The Interest Burden Ratio undergoes a rapid decline from 1.535 to 0.445; It stands to reason that the Interest Burden Ratio should not exceed 1: if it exceeds 1, it means that the EBIT of the year is negative, which indicates that the company's performance in that year was very poor and that there were high-interest expenses. The Asset Turnover Rates of the company is below 1, which means the company's operating capabilities were below average. The Financial Leverage Rate increases from 3.67 to 5.66, which shows that the company used higher debt financing, and therefore the company had huge debt pressure. The Operating Net Profit Margin in 2018 was -22.5% and rose to 16.9% in 2020. This is one of the factors that caused ROE to rise from -33% to 11.3%. Looking back at the stock price of 002121.SZ, we found that the stock price fell from 8.67 RMB per share on January 1, 2018, to 3.44 RMB per share on December 1, 2020. This sharp decrease can explain the great deficit the company was enduring.

### 3.2.2. Equity analysis:

Secondly, we calculated the Dividend Payout Ratio, Retention Rate, and Sustainable Growth Rate to display the stock's return performance as an investor. In 2018, 002121.SZ's Dividend Payout Ratio is -0.0404; the Retention Rate is 1.04, but the net profit for the year is negative, which means the profit retention rate for this year is meaningless; the Sustainable Growth Rate is -0.343. In 2020, the stock's Dividend Payout Ratio is 0 due to zero dividends since 2019; the Retention Rate is 1; the Sustainable Growth Rate is 0.113.

As is shown in the data above, both the Dividend Payout Ratio and Retention Rate increase from 2018 to 2020. Also, the increase of the Sustainable Growth Rate from -0.343 to 0.113 is a good phenomenon. However, it is still not a good performance from the actual data. Although we can still remain optimistic and look forward to improving the company's performance and bringing benefits to investors, it will take a long time and the company also needs to deal with financial issues. Based on the above data, we can conclude that this company is trying its best to save its own performance; it has stopped paying dividends to shareholders since 2018, which shows that it cannot bear the pressure of dividends. At the same time, it seeks to reduce dividends and save more retained earnings for the company to pay debts and company development.

### 3.2.3. Credit risk

We used Altman Z-score to estimate the company's probability of bankruptcy. If Z-score is less than 1.8, there is a high probability of being bankrupt; If Z-score is higher than 3, then there needn't be worried about bankruptcy.

According to our calculation, the stock's Z-score is 2.69 in 2018 and is 0.112 in 2020. Due to the sharp decrease of Z-score, we can speculate an increasing probability to go bankrupt. This means that the company's asset is decreasing while liabilities are increasing, indicating low Investment security.

According to the data above, although the company's performance from 2018 to 2020 is improving, the potential risks are also increasing. This can be seen from the decrease in Z-Score and the increase in financial leverage, combined with equity analysis. As a result, we concluded that this is not a good phenomenon for investors.

# 4. CONCLUSIONS

## 4.1.Conclusion for Index Momentum Analysis:

Therefore, it seems that momentum investing does not work on SSE Composite Index(000001.SS), and we can only find an anti-momentum investing trend based on the provided data. Based on the residuals plots and cook's distance plots, we inferred that the linear model is not enough for us to find an obvious trend on the given data. There exist data points that heavily influence the model, but, at the same time, they are real data collected by the yahoo finance website thus cannot be removed.

The result provides us with two insights: (1) There is a possibility that some errors or bias occur when the data is collected and imported into the website, therefore the linear model cannot be applied and generate a trend. (2) We should doubt the feasibility of applying the traditional 12-minus-1-month or other different period momentum strategy on the SSE Composite Index, which is a stock market index of all stocks. It might be because of the weighted calculation of A shares and B shares that makes the data lose the trend to follow.

## 4.2.Conclusion for Stocks Momentum Analysis

At present, we are based on the data analysis of stock prices, dividends, and time; everyone knows that stock prices will not continue to grow over time. The stock price changes due to the country's economic conditions, the company's experience, and the market maker's control of the capital. So, we have calculated the 5-day average trend and the 30-day average trend of the two stock prices; we can analyze the momentum based on the five-day moving average and the 30-day moving average. When the five-day moving average and the 30-day moving average intersect and the five-day moving average appears to exceed the 30-day moving average, this is a buy signal; conversely, when the five-day moving average and the 30-day moving average intersect and appear below three When the ten-day moving average is trending, this is a sell signal.

## 4.3.Financial Analysis Conclusion

We can draw conclusions from the above data that changes in ROE, changes in shareholders' equity, and changes in company bankruptcy risks will all affect the fluctuation of the company's stock price. Through DuPont analysis, equity analysis, and Altman Z-Score analysis, we concluded that the factors affecting stock price fluctuations include the company's operating conditions, debt levels, and the size of financial leverage. First of all, the company's operating conditions will directly affect the company's profitability, thereby affecting the equity of shareholders. Shareholders will consider selling or buying, and the stock will affect stock price fluctuations. Secondly, the size of financial leverage will determine the size of the company's debt repayment pressure; if the company has an excessive debt level and bankruptcy risk, shareholders will choose to sell stocks out of their own interests. All in all, according to economic principles, the factors that affect stock price fluctuations are whether shareholders hold stocks or not. However, the factors that affect whether shareholders buy or sell stocks are related to all aspects of the company.

Through our data analysis on the Shanghai Composite Index and two stocks (002121.SZ, 02216.SZ), financial report analysis, and understanding of momentum investment, we can find stock price fluctuations by observing some market momentum, such as comparison, analyzing the five-day moving average and 30-day moving average of stock prices; when the five-day moving average crosses the 30-day moving average and the five-day moving average exceeds the 30-day moving average, it is a buy signal. On the contrary, when the five-day moving average crosses the 30-day moving average and the 30-day moving average exceeds the five-day moving average, it is a sell signal. Through our analysis, it is found that the stock price will change due to the change of the banker's chips. According to economic principles, the banker holds a lot of chips, then the stock price will rise; when the banker intends to sell the chips, the stock price will fall. However, all of this will be reflected in the stock price, so we can judge the distribution of chips by short-term moving average and long-term moving average. There is a certain lag in judging stock price fluctuations by the price moving average because there are more factors that affect stock price fluctuations. Through our analysis of the financial reports of the two stocks, we have concluded that the factors affecting the stock price are the company's operating conditions, the level of debt, and the risk of bankruptcy. We assume that insider trading and malicious capital operations are not considered, then these factors will affect investors' investment decisions in this company, which will cause fluctuations in the price of this stock. At the same time, according to the results of the Gordon Model, an important factor affecting the fluctuation of the company's stock price is the change in

the company's value; according to the two stocks we analyzed, the value of their company has been increasing in the long run, which is also reflected in the company's stock price. Finally, we believe that the momentum investment method can be applied to the Chinese securities market, but the premise is that the market supervision is strong enough to avoid the appearance of some insider trading or malicious capital operations.

Finally, according to the data analysis and financial report analysis of index data and stock data, we can conclude that the momentum investment strategy can be applied to the Chinese stock market. In different momentum tests, the conclusions are different, for example, the 12 months minus 1-month momentum test tests the stock returns. We can use the 12 months minus 1-month momentum test to test whether the stock is worth investing in, whereas the MA momentum test is used to test whether the stock has a buy or sell signal. It is far from enough to say that we simply rely on momentum investing for investment.

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