

Investor Sentiment and Stock Returns during the COVID-19 Pandemic: Evidence from Chinese Stock Market

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Abstract. After decades of development, China's stock market is now at a critical stage of scale expansion. However, China's stock market is dominated by retail investors. Such an immature market is vulnerable to investor sentiment. Based on the current realistic background, this paper studies the relationship between investor sentiment and stock returns in The Chinese market and forecasts the development trend of the future market. This paper firstly combs the literature on investor sentiment at home and abroad and adopts the classical research method of investor sentiment index & principal component analysis. The investor sentiment index was constructed using weekly data of the Shanghai composite index from 2020 to 2021. Select the turnover rate, China SSE 50ETF turnover ratio, closed-end fund discount, Teng Fall Index (TFL) and financing net buying turnover ratio of these five variables to construct. Finally, the multiple linear regression is used to analyze the relationship between investor sentiment and returns. We find that the yield of Shanghai composite index is positively correlated with investor sentiment, which will affect the return of stock market. The significance of this conclusion lies in that it can help to understand the interaction between investor behavior and market activities after the COVID-19 and help to test whether the use of investor sentiment indicators can provide guidance for investors' decisions.

Keywords: Investor sentiment; Stock returns; The COVID-19 pandemic

1. Introduction

In recent years, The Chinese market is expanding, the economic environment is becoming more and more stable, and the securities market is becoming more and more perfect [1]. And between January 2020 to December 2021, COVID-19 had a severe impact on China's economic operation and capital market. Major stock indexes all fell, with the Shenzhen Composite Index, CSI 300 Index and ChiNext all falling by more than 3%. That has largely dented investor confidence, and investors have cut back on investment activity. This series of phenomena led to the depression of Chinese stock market.

China's stock market is currently flooded with a large number of retail investors [2]. Judging from these negative phenomena, the majority of small and medium investors in China's stock market today are very vulnerable to changes in the social environment. When the international environment is stable and the bull market is coming, small and medium investors are very active in investing, and only a few can stop investing in time when the stock market reaches its peak. There are also plenty of people who don't get out of the market after a bull market. They see the market as temporary and invest most of their money in stocks. Due to their speculative psychology, follow-up behavior, information asymmetry and lack of financial knowledge, these small and medium investors are prone to make regretful decisions in the turbulent stock market. This phenomenon can easily affect the healthy development of China's stock market and seriously hinder the healthy development of the stock market to a certain extent [3].

This paper uses 102 sets of weekly data from 2020-2021 to construct investor sentiment index through principal component analysis. Five variables including volatility index, turnover rate, China Se 50ETF turnover rate, closed-end fund discount rate and financing net buying rate were used to

construct the index. After successfully constructing proxy index of investor sentiment, the relationship between investor sentiment and stock returns is studied through multiple linear regression. Finally, this paper draws the conclusion that investor sentiment index is positively correlated with stock returns, and investor sentiment directly affects stock returns. Therefore, it is hoped that the stock market can improve the information disclosure system and suggest investors to form a rational investment philosophy.

This paper consists of five parts: the first part is an overview, the second part is an introduction, the third part is the construction of investor sentiment index, the fourth part is to study the relationship between investor sentiment and return, and the fifth part is the conclusion of this paper.

2. Literature review

The current research mainly elaborates and analyzes the impact of investor sentiment on stock market returns from different perspectives. This paper is based on behavioral finance research and found that the factor of investor sentiment can play a good role in explaining some abnormal phenomena in the stock market. As a result, some research directions on investor sentiment have been derived and incorporated into the study of the stock market. Lai believes that investor sentiment factors play the most important role in explaining stock market returns [4]. Sang believes that mispricing caused by intraday sentiment will not be immediately corrected; however, after 30 minutes, investor sentiment can have a negative impact on stock earnings, suggesting that mispriced stocks are at least partially, if not entirely, adjusted back to their basic value [5]. In addition, for these companies, the difference in one-minute returns between companies with high and low sentiment is almost zero, which means that any mispricing caused by intraday sentiment in this group of companies is immediately corrected. Chen proposes that investor sentiment, i.e. the willingness of market participants to invest, is a difficult concept to measure [6]. Exploring the relationship between investor sentiment and stock returns can reveal the impact of investor sentiment on the operation of the stock market. Such an understanding can help market participants make more rational investment decisions based on market laws. This understanding can also help regulators play a role in monitoring and policy-making.

Domestically, scholars have also defined the impact of investor sentiment on stock market returns from different perspectives. Yin and Qiu took the stock market crisis experienced by the Chinese stock market in the second half of 2015 as the background, and selected 60 stocks in the constituent stocks of the CSI 300 Index as a sample through hierarchical sampling, and found that investor sentiment in the stock market crisis indirectly affected the stock market by influencing market cognition, of which positive emotions played a positive role in adjusting market cognition, while the negative high awakening emotions represented by "anger" would worsen market cognition and thus aggravate the impact of the crisis [7]. Based on the perspective of investor sentiment, Li selected the data from June 2003 to June 2015 to conduct a study and found that the impact of US investor sentiment on the yield of the Chinese stock market is generally positive, but there is a "reversal" phenomenon, that is, the sentiment of us investors will first have a negative impact on the yield of the Chinese stock market, and then turn to a positive impact, and the larger the scale of the "securities investment liabilities" item in the balance of payments, the stronger the influence of US investor sentiment on the yield of the Chinese stock market [8]. It shows that capital inflows and cross-border asset allocation are one of the mechanisms by which U.S. investor sentiment affects our market. The research results of Ma Yong, Yang and Jiang show that after adding investor sentiment, the effectiveness of the pricing model has improved to a certain extent, indicating that in China's market, stock prices are not completely determined by factors such as the company's financial information, and emotions also play a certain role in it [9].

Looking back on previous papers, we can see that scholars have made some achievements in the study of investor sentiment and stock returns, but most of them only considered the impact of investor sentiment before the epidemic on stock returns, the outbreak heightened fears and anxiety among

investors, and caused stocks to deviate more sharply from their intrinsic value [10]. This paper is to see whether investor sentiment has a profound effect on stock returns after the outbreak.

3. Investor sentiment measurement and stock return measurement

3.1 Investor sentiment

This paper draws on the research results, methods and ideas of previous literatures in related fields, uses the principal component method to extract several indicators in the Shanghai Composite Index from 2020 to 2021, and considers the relationship between the variables' advance and lag in reflecting emotions. Construct investor sentiment that represents the Shanghai Index.

3.1.1 Selection of proxy indicators

Selecting proxy index is the first and important step to construct investor sentiment index. In this paper, the turnover index, turnover rate, number of newly opened accounts and the proportion of the turnover of China SSE 50 are selected as proxy index of investor sentiment. Data were measured in weeks to ensure the rationality and stability of research results. The five proxy variables are described as follows.

I. Teng Fall Index (TFL)

TFL will fall index refers to the daily closing price rising stock minus the closing down of stocks (no price) of the total value, is often used to reflect the outcome of market sentiment, considering the number of shares and weekly trading day is different, therefore, this paper converts it to a week time increase or decrease in the number of inventory, and the average ratio of the sum, in this use ADL said, the specific calculation formula is as follows:

$$ADL_t = [\sum_{i=1}^{N_t} UP_{ti} / (UP_{ti} + DOWN_{ti})] / N_t \quad (1)$$

Where, N_t is the number of trading days in week t , UP_{ti} is the number of shares closing at the i trade day in week T , and $DOWN_{ti}$ is the number of shares closing at the i trading day in week T .

II. Discount of closed-end fund

The discount of closed-end funds used to be a puzzle for the financial market, but with the deepening of the research, scholars find that this phenomenon is more caused by investor sentiment, resulting in the low net value of closed-end funds, rather than the problem of the transaction structure itself. Some scholars have tested the VAR model and conclude that it is precisely because investor sentiment affects investment strategy that there will be discount [11]. This indirectly represents investor sentiment to some extent, so closed-end fund discount is selected as one of the proxy variables in this paper. This paper selects Shanghai Closed-end funds from January 2020 to December 2021 as samples. The calculation method is as follows:

$$DCEF_t = \sum_{i=1}^n (P_{it} - NV_{it}) * N_i / \sum_{i=1}^n (N_i * NV_{it}) \quad (2)$$

Where, $DCEF_t$ represents the discount rate of the closed-end fund at t ; if it is greater than 0, it represents the premium; if it is less than 0, it represents the discount; n represents the number of funds, P_{it} is the closing price of the i -th fund at T , NV_{it} is the net value of the i -th fund at T , and N_i is the share of fund i .

III. Market turnover rate

Market turnover rate is a direct indicator of investor activity in the market. The higher the turnover rate is, the more frequent the market activity is in the trading month, which can not only improve market liquidity but also stimulate investors' investment enthusiasm. He proposed that investors' trading decisions would be directly affected by turnover rate in the absence of clear trading objectives [12]. In this paper, the ratio of monthly trading volume and circulating market value of Shanghai Composite Index is used to represent the turnover rate of the market. The formula is as follows:

$$TUR_t = \frac{TN_t}{CMV_t} \quad (3)$$

Where, TUR_t represents the turnover rate in month T , TN_t represents the transaction amount, and CMV_t represents the sum of the current market value.

IV. Ratio of net financing purchase to turnover (NIAH)

Net financing buying is a common method in stock trading. And the proportion of net financing purchase to turnover reflects investors' enthusiasm for the market. In China's relatively immature stock market, the ratio of net financing purchases to turnover plays an obvious role in measuring investor sentiment [13]. Therefore, this paper chooses this data as one of the variables to construct investor sentiment index.

V. Ratio of huaxia SSE 50ETF turnover

Hua Xia Shanghai 50ETF is China's first the market index fund, the scale has been expanding, clinch a deal the active, good liquidity, its market value index of Shanghai and Shenzhen two city market value is higher, the volume of activity can effectively reflect market investors to participate in [13], this article selects the Shanghai Chinese turnover ratio and the Shanghai index to characterize the market mood, the specific formula is as follows:

$$ETF_t = SWETF_t / SW_t \quad (4)$$

Where, $SWETF_t$ represents the turnover of 50ETF in the week t , and SW_t represents the turnover of SSE 50 index in the week T .

Determine the relationship between advance and lag of five proxy variables, ADL_1 , $DCEF_1$, TUR_1 , NIA_1 and ETF_1 represent variables with one stage lag. ADL_t , $DCEF_t$, TUR_t , NIA_t , ETF_t represent the advance variables. Descriptive statistics were conducted before the study, and the results are shown in Table .1.

Table 1. Descriptive statistics of proxy variables

	TUR	ETF	DCEF	ADL	NIA
The mean	0.049	0.004	0.076	1.841	0.0034
Standard error of	0.001	0.0001	0.0032	0.320	0.001
The median	0.049	0.004	0.073	0.856	0.004
The standard deviation	0.014	0.001	0.032	3.238	0.010
The variance	0.0002	1.77 e-06	0.001	10.49	0.0001
The minimum value	0.016	0.002	0.169	0.141	0.026
The maximum	0.099	0.010	0.0537	26.098	0.039
poor	0.083	0.007	0.223	25.956	0.065

Ten variables of current period and lag period were standardized. Then, principal components were extracted from the processed variables. The first four principal components were extracted according to the principle that the eigenvalue was greater than 1 during the analysis, and the cumulative interpretation of the four principal components reached 71.005%.

Table.2 shows the distribution of eigenvalues.

Table 2. Principal Component analysis of advance and lag variables

Feature vectors	Eigenvalue	Percentage	Cumulative percentage
1	2.593	25.928	25.928
2	1.752	17.525	43.453
3	1.557	15.573	59.026
4	1.198	11.979	71.005
5	0.958	9.576	80.581
6	0.668	6.676	87.257
7	0.488	4.878	92.136
8	0.355	3.55	95.685
9	0.233	2.326	98.011
10	0.199	1.989	100

Considering that only extracting the first principal component may be one-sided, this paper conducted correlation analysis on the constructed variables and 10 variables and selected the first four variables with strong correlation for the second principal component extraction to prepare for the construction of the final sentiment index.

Table.3 show the correlation coefficient between $INSI_1$ and variables.

Table 3. Correlation of $INSI_1$ with various proxy indicators

Variable	$INSI_1$	
	The correlation coefficient	Significance level
ADL	647 **	0
DCEF	0.133	0.183
TUR	704 **	0
NIAH	584 **	0
ETF	477 **	0
ADL_1	482 **	0
DCEF_1	0.125	0.212
TUR_1	455 **	0
NIAH_1	216 **	0.029
ETF_1	268 **	0.007

Notes: ** means significant at the 5% significance level.

From Table.4, we know that the current variables of five variables can reflect investor sentiment, so we select the variables marked in red: *ADL*, *DCEF*, *TUR*, *NIAH* and *ETF*, which are highly correlated, for standardized processing, and extract principal components 1 and 2 according to the above method to construct $INSI_2$. In order to verify whether these five variables can represent the index, correlation analysis will be conducted for $INSI_1$ and $INSI_2$, and the results are shown in Table.4.

Table 4. Correlation analysis of $INSI_1$ and $INSI_2$

		$INSI_2$	$INSI_1$
Pearson correlation coefficient		1	0.822 ***
Two-tailed significance	$INSI_2$		0.000
N		102	102
Pearson correlation coefficient		0.822 ***	1
Two-tailed significance	$INSI_1$	0.000	
N		102	102

Verification found that the correlation coefficient of $INSI_1$ and $INSI_2$ reached 0.822, which indicated that the extracted variables could well reflect the changes of investor sentiment.

Therefore, $INSI_2$ can be used as the investor sentiment index of this paper. The final investor sentiment index $INSI_2$ equation is:

$$INSI_2 = 0.055TUR_t + 0.223ETF_t + 0.352DCEF_t + 0.323ADL_t + 0.210NIAH_t \quad (5)$$

Table.5 shows the correlation coefficients between $INSI_1$ and normalized variables.

Table 5. Correlation between $INSI_2$ and variables

0	Variable	TUR_t	ETF_t	$DCEF_t$	ADL_t	$NIAH_t$
$INSI_2$	The correlation coefficient	0.247 **	0.294 *	0.757 **	0.798 **	0.609 ***
	Significance level	0.012	0.003	0	0	0

3.1.2 Consistency analysis of investor sentiment index

In order to verify whether the constructed investor sentiment index is appropriate and representative, we make a comparative analysis of its trend with the Shanghai Composite Index. $INSI_2$ can be concluded from Table.6 that the maximum value of investor sentiment is 4.993185 and the minimum value is -1.28243, which shows that the market investor sentiment fluctuates greatly within the survey range.

Table 6. Descriptive statistics for $INSI_2$

Descriptive statistics	$INSI_2$	Number of samples
Average	2.5 e-08	102
Standard	0.730	102
Kurtosis	20.976	102
Partial degrees	3.254	102
Minimum	1.282	102
Maximum	4.993	102

Figure.1 said investor sentiment index and Shanghai composite index, the trend of the research scope of contrast figure, the movement has a certain relevance, in 2020, the eighth week with the 10th week overlap between investor sentiment index and Shanghai composite index, and the overall trend is consistent, so build investor sentiment index is basically no problem, can reflect investor sentiment.

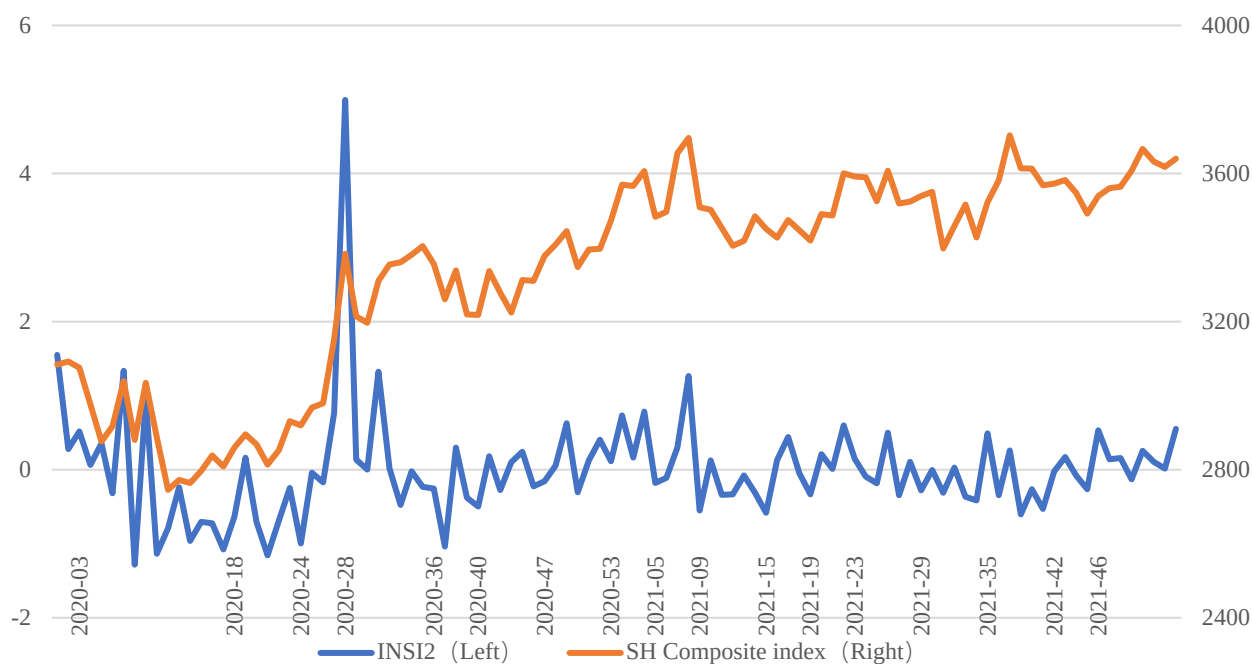


Figure 1. $INSI_2$ and the trend of Shanghai Composite Index

4. Income calculation and analysis

4.1 Earnings estimates

For the calculation of the return rate, we calculated the return rate from the first week of 2020 to the last week of 2021. A total of 102 sets of data were collected on a weekly basis. We first calculate the average, median and variance of the returns of 102 groups of data. We get that the average of the monthly returns of 102 weeks is 0.002307, the median is 0.002377, the maximum is 0.01032, the minimum is -0.05007, and the variance is 0.000538. It can be seen from the variance of the return rate that the 102 weekly returns fluctuated little.

4.2 Regression model of investor sentiment and yield

First we calculated according to the definition of investor sentiment before the 102 weeks of investor sentiment, we not only choose the investor sentiment as explanatory variables, we also use the issue of the Shanghai composite index on yields, FAMA than market value and book value of the three factor model in factor as control variables, we make regression model equation is:

$$RM = 0.00329 + 0.02098INSI - 0.3070 SMB + 0.199 HML - 0.1769 L_RM \quad (6)$$

The RM represents the return rate of the Current period of Shanghai Composite Index, SMB represents the market value factor and HML represents the book-value factor, and $L-RM$ represents the return rate of the last period of Shanghai Composite Index

Table 7. The value of S, R-sq, R-sq(adj), Press and R-sq(pre)

S	R-sq	R-sq(adj)	Press	R-sq(pre)
0.0177764	44.65%	42.35%	0.0349083	36.31%

Table 8. The value of coefficient, standard error of coefficient and 95% confidence interval.

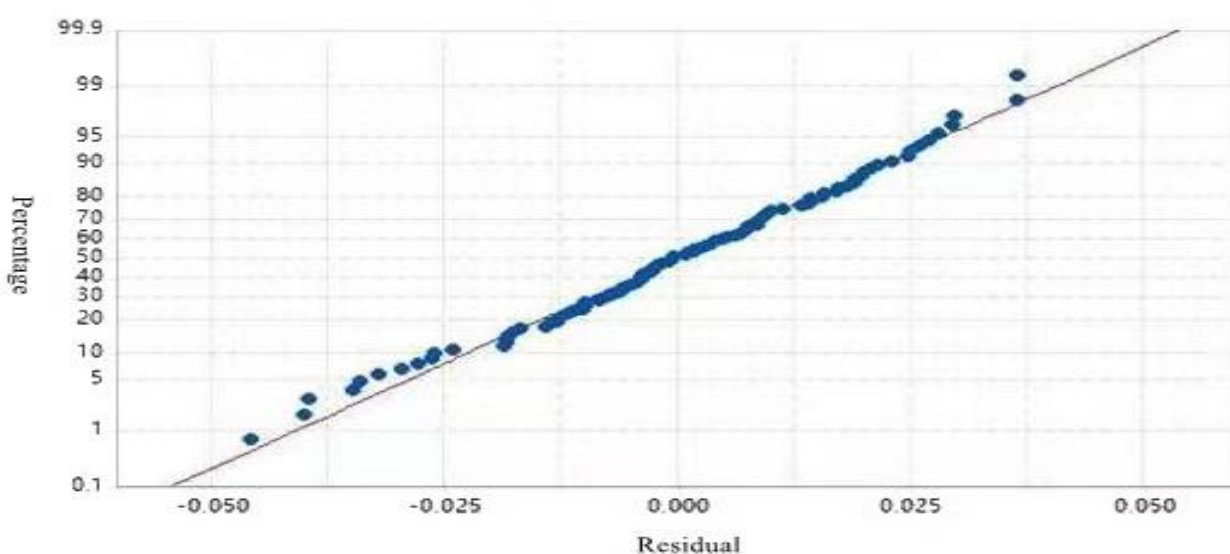
Item	Coefficient	Standard error of coefficient	95% confidence interval
Constant	0.00329	0.00179	(-0.0002, 0.0068)
Insi	0.02096	0.00255	(0.015, 0.026)

Smb	-0.3070	0.0955	(-0.496, -0.117)
Hml	0.199	0.108	(-0.015, 0.414)
L-rm	-0.1769	0.0769	(-0.326, -0.024)

Table 9. The value of T-value, P-value and 95% variance inflation factor.

	T-value	P-value	Variance inflation factor
	1.84	0.069	
Insi	8.21	0.000	1.06
Smb	-3.21	0.002	1.05
Hml	1.84	0.069	1.11
L-rm	-2.30	0.024	1.03

Based on the regression model of the return rate of Shanghai Composite Index and investor sentiment in the table above, we can clearly see that in the weekly data from 2020 to 2021, stock return rate is significantly positively correlated with investor sentiment, and the coefficient is 0.00329. Meanwhile, the R-sq and R-sq (adj) values are 44.65% and 42.35%, respectively. For the model of investor sentiment and return rate, the R-sq and R-sq (adj) values are large enough, which can explain the fitting ability of the model of return rate and investor sentiment of Shanghai Composite Index is more than 40%. Because the investor sentiment of P - value is less than 0.05, so we validate the assumption investor sentiment to influence stock returns, and investor sentiment will yield positive impact to the stock, is the investor sentiment to improve yield increase, reduce investor sentiment will also influence the yield of stocks which lead to the decline.

**Figure 2.** RM normal probability graph

Through the normal probability graph, we can clearly find that most points are on a straight line, although some points still deviate from the straight line. It can be concluded that there is indeed a positive correlation between the return rate of Shanghai Composite Index and investor sentiment, but there are still some anomalies, because the return rate of stock market is not only affected by investor sentiment, but also by other factors not included in the regression model.

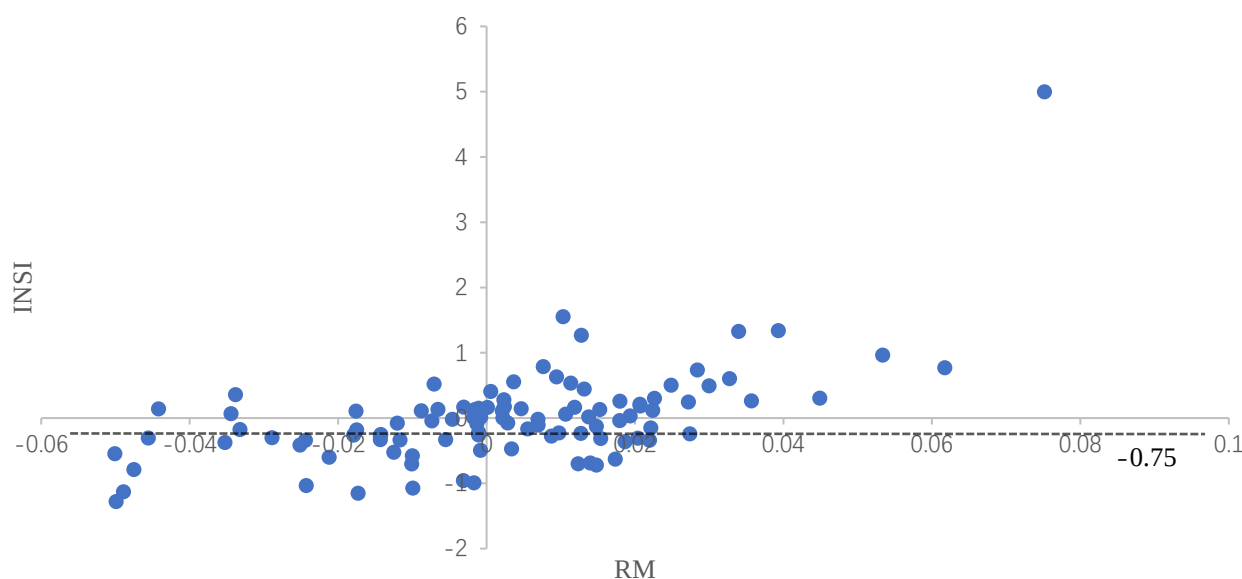


Figure 3. Scatter plots of RM and INSI

Through the scatter plots of RM and INSI, the investor sentiment index is divided into four parts: when the investor sentiment is greater than 1, when the investor sentiment is positive and less than 1, when the investor sentiment is negative and greater than -0.75 and when the investor sentiment is less than -0.75. When the value of investor sentiment is greater than 1, all of them present positive returns, however, it cannot reflect the higher investor sentiment, the higher the stock return will be. When investor sentiment is between -0.75 and 1, there are 89 sets of data. When the investor sentiment is positive and less than 1, the stock return rate is positive in most cases, but there are still more than 30% data showing negative stock return rate. Compared with the situation where investor sentiment is negative and greater than -0.75, more than half of the cases have negative stock returns. Although more than 40% of the data have positive stock returns, the returns are basically less than 2%. When investor sentiment is less than -0.75, all show negative stock returns, but these data do not show that the lower the sentiment, the lower the stock return. Based on the above situation, we make the conclusion that when investor sentiment is high enough, all of them show positive stock return rate; when investor sentiment is low, all of them show negative stock return rate. However, it is not proved that higher investor sentiment will lead to higher stock returns and lower investor sentiment will lead to lower stock returns. When investor sentiment is positive, but not pretty high, most stock return are positive. When investor sentiment is negative but not too depressed, most stock return are negative. Generally speaking, the stock return is significantly positively correlated with investor sentiment, but it cannot be proved that the higher investor sentiment is, the higher the yield will be, because there are many other factors affecting the yield in addition to investor sentiment.

5. Conclusions

This paper constructs investor sentiment index through principal component research method and then uses multiple linear regression analysis method to analyze the relationship between investor sentiment and stock returns. We selected 102 weekly data sets from 2020 to 2021 for analysis. Finally, it is concluded that for Shanghai Composite index, stock returns are significantly positively correlated with investor sentiment. When investor sentiment is high enough, stock returns are positive. When investors are depressed, stock returns are negative. When investor sentiment is positive, but not very high, most stocks have positive returns. When investor sentiment is negative, but not too pessimistic, most stocks return negatively. This paper puts forward two countermeasures and suggestions: perfecting the market system of Chinese stock market as soon as possible and guiding individual investors to establish correct and reasonable investment concept. However, the regression model

cannot prove that the higher the investor sentiment, the higher the stock return, and the lower the investor sentiment, the lower the stock return. It can only prove that there is a positive correlation between stock return rate and investor sentiment. In order to get a more accurate relationship between investor sentiment and stock return rate, we adopt two methods. First, we will collect more data, because the 102 sets of data we currently take are from the Shanghai Composite Index every week, and we will add data from other stock indexes. Second, we will continue to update the Shanghai Composite Index data for 2022, because more data will make the model more accurate. By using these two methods, we can improve the credibility of our model to produce a more accurate relationship between investor sentiment and stock returns.

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