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**The Impact of Northbound Cash Flows on the Investor Sentiment
of Mainland Chinese A-share Investors**

In Partial Fulfillment of the Requirements
for the Bachelor of Science in Finance

by

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Abstract

Nowadays, Shanghai Hong Kong Stock Connect and Shenzhen Hong Kong Stock Connect have run smoothly for many years. Overseas capital is increasingly widely used in Chinese mainland stock market. Some ordinary investors will choose northbound cash flow (overseas capital) as the wind vane to guide their investment behavior. This study will analyze whether northbound cash flow impacts investor sentiment in China's stock market combined with market data in recent years. Moreover, this paper will classify the data from different kinds of markets and different market sentiment conditions. Analyze the impact of changes in market investor sentiment by northbound cash flow under different circumstances.

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1 Introduction

For developing countries, the opening of financial markets is conducive to broadening the financing channels of enterprises and plays a very positive role in national economic growth (Gaies & Nabi, 2019). As the second largest economy in the world after the United States, China has been actively improving the openness of its financial market in recent years. Two typical examples are Shanghai Hong Kong Stock Connect (SH-HK-SC) opened on November 17, 2014, and Shenzhen, Hong Kong stock connect (SZ-HK-SC) opened on December 5, 2016. These two signifies those overseas investors and Hongkong investors can participate in the A share trading in Chinese mainland through the interoperability mechanism. Moreover, Northbound Cash flow usually refers to the A-share purchased by overseas investors through the Shanghai-Hong Kong stock connect and Shenzhen-Hong Kong stock connect. In many Chinese news media and financial publications, northbound cash flow is always called "smart capital." Due to the relatively stable long-term investment style of northbound cash flow, the return rate of northbound funds is often higher than the market return rate (Gu, 2019). Some nonprofessional investors tend to regard northbound cash flow as a wind vane to guide their investment behavior due to the relative lack of information and the lack of ability to analyze the company's financial indicators independently. This paper will analyze whether the change of northbound cash flow will affect the extensive Imitation Behavior of investors from the perspective of investor sentiment.

This study can effectively fill the gap on the impact of foreign capital on investor sentiment in China's stock market and has the following signs for future research. Firstly, the

results of this research may help me make better investment decisions when I invest in the future. If the quantitative relationship between the inflow proportion of northbound and the rise and fall of stocks on the second day is found in this study, it will help me control my cost price in short-term trading. Secondly, Chinese mainland stock investors are mainly nonprofessional retail investors. When the hype behavior blindly follows the trend, it will have a significant impact on the stability of the financial market. Influential investors may try to control these market indicators and affect the behavior of retail investors to achieve profit. This study may help analyze the risk that China's stock market is facing "holding the market" by some investors. Thirdly, this study will help to explore how to continuously improve the maturity of the stock market in the future and improve the level of independent analysis of investors.

Based on the research of Baker and Wurgler (2007), this study takes the stock turnover rate as the proxy variable of investor sentiment to build a vector autoregressive (VAR) model and a linear regression model, respectively. The daily market transaction data of SH-HK-SC and SZ-HK-SC from the establishment date (due to the lack of previous data at wind financial terminal, the data of SH-HK-SC began on January 4, 2016) to September 10, 2021, were used for linear regression. Combined with the loss aversion theory, this study classifies the primary sentiment conditions of the market by using the ISI comprehensive investor sentiment index data and exploring the impact of northbound cash flow on investor sentiment under different market basic sentiment conditions. In addition, considering the differences between Shanghai and Shenzhen markets, this paper will explore whether there are

differences in the sensitivity of investor sentiment affected by events in the large-cap stock market and small and medium cap stock market.

This paper will involve three main hypotheses: 1. Northbound Cash Flow has a positive correlation with investor sentiment in the Chinese mainland. 2. When the overall market sentiment is negative, the impact of northbound cash flow on investor sentiment will be more obvious than when the overall market sentiment is positive. 3. The investor sentiment of the Shenzhen Stock Exchange, a market dominated by medium and small-cap stocks, is more sensitive to the changes of northbound cash flow than that of the Shanghai Stock Exchange dominated by large-cap stocks. In the second section of this paper, the literature related to the above factors will be reviewed. In the third section, the above assumptions will be described in more detail, as well as the research methods and data will be introduced in detail. The fourth section will show the results of data processing and research. The fifth section will conclude the study and a series of problems existing in the study.

2 Literature Review

At present, there is a considerable body of literature on Shanghai-Hong Kong & Shenzhen-Hong Kong Stock Connect (SH-HK-SC & SZ-HK-SC) programs. However, most of them focus on the impact of the connect program on the effectiveness of China's stock market and AH share premium. Few papers focus on the inflow of northbound cash flow. In addition, there are abundant papers on stock investor sentimental measures. This paper will measure the impact of the inflow of northbound cash flow on investor sentiment in the A-share market based on previous literature.

2.1 Shanghai-Hong Kong & Shenzhen Hong Kong Stock Connect programs

Existing studies have found that Shanghai-Hong Kong Stock Connect (SH-HK-SC) programs have significantly strengthened mainland China's stock market (Huo and Ahmed, 2017). Ma et al. (2019) used a series of GARCH models to study the market linkage between SH-HK-SC and Hong Kong and Shanghai. They found that the period during the stock market crash mainly reflects the market linkage between the two places after the launch of SH-HK-SC. Other researchers use the panel data of listed companies to find that SH-HK-SC reduces the A-H Share Premium and strengthens the effectiveness of China's stock market (Fan and Wang, 2017). Another study uses multifractal cross-correlation analysis (MFCCA) to find that there is a solid continuous positive correlation between the inflow of northbound and the return of stocks (Ruan et al., 2017). Through research, Jiang et al. (2020) found that implementing SH-HK-SC and SZ-HK-SC strengthens the freedom of China's stock market and reduces the tax avoidance phenomenon of Chinese enterprises.

Moreover, this phenomenon is significantly reflected in non-state-owned enterprises and companies with weak external supervision, low transparency, and strong financial constraints. Another group of researchers found that the government can use foreign investors to help screen out companies with more development potential through SH-HK-SC (Chen et al., 2020). According to these studies, I think SH-HK-SC and SZ-HK-SC are indeed beneficial to improve the effectiveness of China's stock market and play a very positive role in the rationality of stock price pricing. The positive correlation between the inflow of northbound cash flow (foreign capital) and income has not been proved. Compared with local investors, foreign capital has disadvantages in information acquisition capability because of language time differences. Therefore, I guess the reason why northbound cash flow can bring benefits may be reflected in the positive change of northbound cash flow's investor sentiment in the Chinese mainland. My research aims to fill the gap in the impact of northbound cash flow on investor sentiment in SH-HK-SC and SZ-HK-SC.

2.2 Investors Sentiment and Stock Return

At present, there has been pervasive research on the relationship between stock investor sentiment and return. Through Granger causality tests, Kling and Gao (2008) found that the emotions and noise of small investors will significantly affect the fluctuation of stock prices. In addition, they also found that the positive feedback of emotions to the stock price is mainly reflected in the short-term dynamics. This has played an excellent guiding significance for my research. I will focus on the observation of short-term indicators in my research. In addition, Yang and Zhou (2016) combined the crowded trading of individual stocks and investor sentiment. They found that the combined effect of the two has a highly significant

impact on the yield of individual stocks. Li, Guo et al. (2017) used the quantitative Granger non-causality test to find that investor sentiment can provide incremental predictability for stock returns and explained this finding with loss aversion and herd behavior. Ahmed (2020) used EGARCH parameter estimation in his research. He found that investor sentiment in the market played a significant role in promoting the change of stock price and found that the driving of sentiment on the market was asymmetric in a bull market and bear market. The emotion-driven trading behavior would be more significant in a bear market. Zhu and Niu's (2016) research also proves that the impact of investor sentiment on the market will be much weaker under optimism. In addition, Ni et al.'s (2015) research show that investor sentiment's impact on the return of stocks of small and medium-sized growth enterprises is more significant than that of value stocks. In this study, I will focus on observing the short-term indicators of the overall market and study the short-term investor sentiment of the market and the short-term fluctuations of the Shanghai index and Shenzhen index. Furthermore, considering the asymmetry of the impact of investor sentiment on stock prices and the differences between Shanghai and Shenzhen markets (Shanghai Stock Exchange is dominated by large-scale value stocks and Small and medium-sized growth stocks dominate Shenzhen stock exchange), I need to analyze the investor sentiment in different markets and different market situations respectively in this study. This will help to reconfirm the relationship between investor sentiment and stock market returns.

2.3 Measure of Investors Sentiment

On the measurement of investor sentiment, the existing literature and have conducted extensive research. The research of Baker and Wurgler had a broad impact on the later

research. Baker and Wurgler (2007) analyzed six emotional indicators, including closed-end fund discount, stock trading volume, number of initial public offerings and average first-day return, shares of newly issued shares, and dividend premium, to form a comprehensive emotional indicator. This also has great reference value for my research. However, because the object of this research is investor sentiment in China's stock market, some sentiment indicators will no longer be effective in China's stock market because of some institutional differences. According to the research mentioned by Yao and Zheng (2021), in 2012, the regulatory authorities restricted the IPO issue price not to exceed 125% of the average P/E ratio of the same industry and the strict issuance ceiling of 23 times the P/E ratio. The direct result is that the return on the first day of IPO is maintained at a very high level. Therefore, it is challenging to measure investor sentiment in China's stock market effectively. In addition, Liang et al. (2020) Studied social media, newspapers, and Internet media news and found that the index constructed by social media and Internet media news can effectively predict the volatility of the Shanghai stock index and Shenzhen stock index. Other researchers try to use the users' comment data on the stock market social networking website to analyze the sentiment of stock market investors (Guo, Sun, & Qian, 2017). According to the above existing studies, considering that this study uses the daily data of northbound cashflow inflow to study the short-term impact on investor sentiment, I will exclude other indicators that cannot be quickly reflected in the market and select the variables directly related to trading, namely stock trading volume (stock turnover ratio) as the ultra-short-term proxy variable of investor sentiment. The closed-end fund discount, number of initial public offers & average first-day return, shares of newly issued shares, and divided premium are effective only on a

monthly or longer time scale and cannot accurately reflect the changes in investor sentiment on an ultra-short time scale of days. This study takes the ISI comprehensive sentiment index, including these factors as a medium- and long-term measurement index as control variables in the linear regression model.

2.4 Vector Autoregression (VAR)

VAR model was originally proposed by Sim (1980) to capture the relationship between multiple variables over time and is widely used in economic research. Based on the VAR model, the Granger causality test can usually be used to predict the future values of another time series through the prior values of one-time series, to judge whether the two variables statistically reflect causality (Granger, 1969). In addition, the Impulse response function (IRF) can be used to measure the response of other variables when one variable in VAR is impacted (Pesaran et al., 1998). This study will use the net inflow of northbound cashflow and sentiment to construct a VAR model and conduct a Granger causality test to explore whether there is a certain correlation between the two variables. In addition, IRF will be used to quantitatively detect the response of investor sentiment when the net inflow of northbound cash flow is impacted.

So far, the goal of this study has become apparent. According to the existing research, optimistic investor sentiment has a positive relationship with the rise of stock price and increased return. In addition, among many panel indicators, stock trading volume (turnover rate) is an excellent indicator to measure investor sentiment. This study combines this to

study whether there is a specific relationship between northbound cash flow and Chinese A-share investor sentiment in SH-HK-SC and SZ-HK-SC.

3 Methodology

This study collects all the daily trading data of Shanghai index and Shenzhen index from the operation of mechanism SH-HK-SC and SZ-HK-SC to September 10, 2021 (All the data is collected from the Wind Financial Terminal. In addition, due to the limitation of data availability, the data of Shanghai market has been from January 2016 to now). According to the panel data of the Shanghai index and Shenzhen index and the daily flow data of northbound cash flow, this paper will test the impact of northbound cash flow on the sentiment of A-share investors.

3.1 Dependent Variable: $Sentiment_{t+1}$

This paper considers referring to the commonly used investor sentiment measurement model from Baker and Wurgler:

$$SENTIMENT_t = -0.241CEFD_t + 0.242TURN_{t-1} + 0.253NIPO_t + 0.257RIPO_{t-1} + 0.112S_t - 0.283P_{t-1}^{D-ND}$$

- *CEFD*: the closed-end fund discount
- *TURN*: the natural log of the raw turnover ratio
- *NIPO*: number of IPOs
- *RIPO*: the average first-day returns
- S_t : sentiment index
- P^{D-ND} : dividend premium

This study is based on daily data to study the ultra-short-term impact of the inflow of northbound cash flow on investor sentiment. Other variables lack statistical significance on the scale of day or are difficult to respond to quickly in the stock market. I choose turnover ratio as the proxy variable of investor sentiment (Monthly-data of other variables as the control variables in the regression). In addition, based on the research of Chen et al. (2014),

using the ratio of the daily turnover rate to the average turnover rate of the previous 100 days can better measure the relative size of the daily turnover rate data. In addition, multiplying this value by the rise and fall of the index on that day can better help us judge whether the short-term investor sentiment on that day is positive or negative.

$$\text{Market Turnover}_t = \frac{\text{Turnover}_t}{\text{Average Turnover for Previous 100 Trading Days}}$$

$$\text{Exchange Related Sentiment}_{t+1} = \text{Market Turnover}_{t+1} \times \text{Pct Chg}_{t+1} \times 100$$

(In the following, *Exchange Related Sentiment*_{t+1} will be abbreviated as *Sentiment*_{t+1})

3.2 Independent Variable: Net Inflow of Northbound Cashflow

The independent variable of this study is the net inflow of northbound cash flow, which is recorded in millions of yuan. After the closing of each trading day, the data will be reported in China's main financial databases.

3.3 Control Variables

Main Capital Inflow: In China's securities market, the securities trading software will classify the traded transactions according to the size of a single transaction. The transactions with a single comparison transaction of more than 500,000 yuan will be defined as main capital. Some ordinary individual investors will also consider this indicator as one of the criteria because they believe that the large proportion of main capital in the market means the entry of institutional investors. Therefore, in this study, I take this variable as the control variable, which is also conducive to the comparison with the net inflow of northbound cash flow.

Sentiment_t: Because the sentiment of one day and the sentiment of the next day are not independent of each other, the emotion of one day has a specific conduction effect on the emotion of the next day, so the sentiment_t is also included in the control variable.

ISI index (turnover ratio excluded, z-score normalization): ISI index is the monthly data of comprehensive investor sentiment index calculated based on Baker & Wurgler model and combined with the characteristics of the Chinese market. All original data are from the CSMAR database. In this study, the index is recalculated after excluding the influence of turnover ratio and doing Z-score normalization to the data.

$$ISI\ Index = \frac{turnover\ ratio\ excluded\ ISI\ index - \mu}{\sigma}$$

- μ : The mean value of turnover ratio excluded ISI index
- σ : The standard deviation of turnover ratio excluded ISI index

The normalized ISI index data can represent the basic investor sentiment within a certain time range in linear regression. This operation is conducive to separating the basic investor sentiment (including macroeconomic conditions) in a long time range from the investor sentiment fluctuations caused by transactions and capital changes in the ultra-short term. In addition, normalization divides ISI index into positive and negative parts, which is conducive to the classified discussion of the impact of northbound cashflow under different basic investor sentiment in linear regression.

3.4 Data sorting and summary

Based on the original data, I have processed and calculated various variables, and the results are summarized in the table1 below:

Table 1

| Date | Net Inflow of Northbound Cashflow (million) | Main Capital Inflow (million) | Sentiment _t | ISI Index | Sentiment _{t+1} |
|------------|---|-------------------------------|------------------------|-----------|--------------------------|
| 2021-09-09 | 2422.87 | -12179.5859 | 83.8905 | 0.79 | 48.5539 |
| 2021-09-08 | -2883.61 | -18403.6973 | -6.2930 | 0.79 | 83.8905 |
| 2021-09-07 | 3593.72 | 4615.7501 | 235.9468 | 0.79 | -6.2930 |
| ... | ... | ... | ... | ... | ... |
| 2016-01-05 | 1429.38 | -15200.2318 | -21.7164 | -0.84 | 169.8724 |
| 2016-01-04 | 31 | -27769.3721 | -394.6200 | -0.84 | -21.7164 |

Through Stata, the data of SH-HK-SC and SZ-HK-SC are summarized and sorted,

respectively. The results are shown in Table 2:

Table 2 Data summary of SH-HK-SC & SZ-SK-SC

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|-----------------------------------|------|-----------|-----------|------------|----------|
| Net Inflow of Northbound Cashflow | 1323 | 493.424 | 2261.624 | -10553.88 | 16811.77 |
| Main Capital Inflow | 1323 | -7316.743 | 8707.734 | -59001.163 | 26308.08 |
| Sentiment _t | 1323 | 4.058 | 150.098 | -1304.8 | 1841.663 |
| ISI Index | 1323 | .043 | 1.016 | -1.354 | 3.041 |

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|-----------------------------------|------|-----------|-----------|------------|-----------|
| Net Inflow of Northbound Cashflow | 1108 | 680.665 | 2068.863 | -12389.09 | 11615.65 |
| Main Capital Inflow | 1108 | -5972.854 | 8062.334 | -55338.216 | 21142.615 |
| Sentiment _t | 1108 | 7.521 | 184.006 | -973.444 | 1835.472 |
| ISI Index | 1108 | .052 | 1.048 | -1.354 | 3.041 |

The number of observations in the Shenzhen market is larger than that in the Shanghai market. This is mainly because SZ-HK-SC in the Shenzhen market was founded in December 2016, while the data of the Shanghai market compiled by me started on January 4, 2016 (in fact, SH-HK-SC was founded in 2014, but I can't obtain earlier data due to data availability problems). In addition, it can be clearly noted that the capital scale of net inflow of northbound cash flow and main capital inflow in the Shanghai market is significantly larger than that in the Shenzhen market. The main reason is that the overall scale of the Shanghai

market is relatively more extensive than that in the Shenzhen market, and the Shanghai market is also the main listing concentration of China's super-large companies. From the perspective of sentiment_t, the standard deviation of sentiment_t in the Shanghai market is less than that in the Shenzhen market, which also shows that the volatility of investor sentiment in the Shanghai market is also less than that in the Shenzhen market.

In addition, the line plot drawn according to the data of net inflow of northbound cashflow and investor sentiment in the two markets is shown in the figure below:

Figure 1 SH-HK-SC

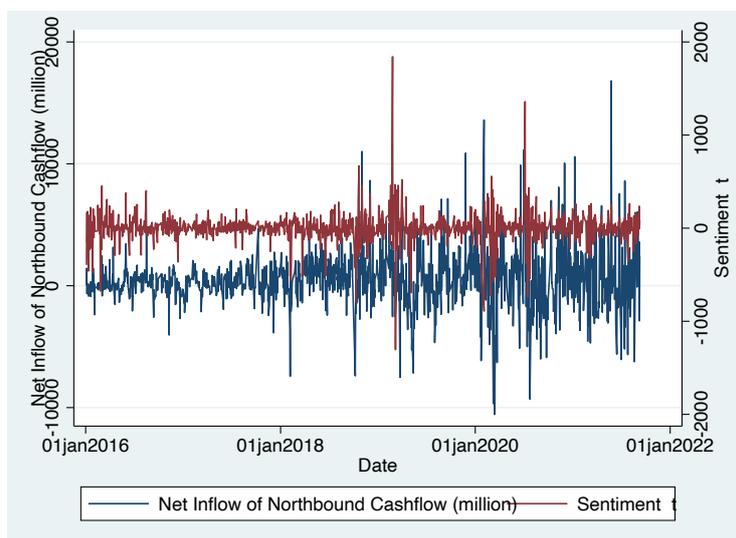
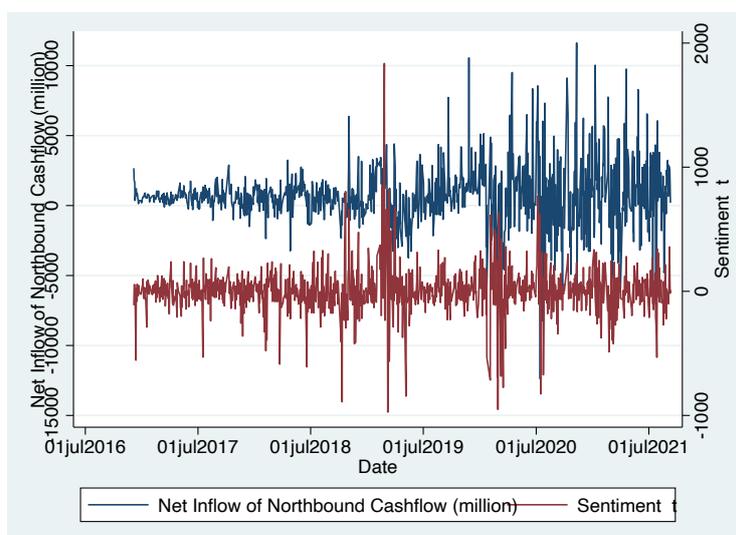


Figure 2 SZ-HK-SC



From the line plot, there is a certain correlation between the fluctuation of net inflow of northbound cash flow and the fluctuation of sentiment_t in the two markets. The period of sharp fluctuation of sentiment_t often occurs near the period of sharp fluctuation of net inflow of northbound cash flow.

Table 3 Correlation Matrix of SH-HK-SC

| Variables | (1) | (2) | (3) | (4) | (5) |
|---------------------------------------|----------|-----------|--------|-------|-------|
| (1) Net Inflow of Northbound Cashflow | 1.000 | | | | |
| (2) Main Capital Inflow | 0.399*** | 1.000 | | | |
| (3) Sentiment _t | 0.376*** | 0.696*** | 1.000 | | |
| (4) ISIIndex | -0.055** | -0.242*** | 0.046* | 1.000 | |
| (5) Sentiment _{t+1} | 0.140*** | 0.055** | 0.017 | 0.035 | 1.000 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 4 Correlation Matrix of SZ-HK-SC

| Variables | (1) | (2) | (3) | (4) | (5) |
|---------------------------------------|----------|-----------|--------|-------|-------|
| (1) Net Inflow of Northbound Cashflow | 1.000 | | | | |
| (2) Main Capital Inflow | 0.519*** | 1.000 | | | |
| (3) Sentiment _t | 0.427*** | 0.694*** | 1.000 | | |
| (4) ISIIndex | -0.042 | -0.265*** | 0.011 | 1.000 | |
| (5) Sentiment _{t+1} | 0.142*** | 0.094*** | 0.054* | 0.004 | 1.000 |

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

According to the two correlation matrices, there is always a very significant relationship between net inflow of northbound cashflow and sentiment_t, sentiment_{t+1}, and main capital inflow. The main capital inflow is more closely related to ISI Index.

3.5 Regression

3.5.1 VAR Model

In this study, sentiment_t and the net inflow of northbound cash flow are used as two variables of a vector autoregression. The regression models of these two-time series are as follows:

$$\begin{bmatrix} N_t \\ S_t \end{bmatrix} = a_0 + A_1 \begin{bmatrix} N_{t-1} \\ S_{t-1} \end{bmatrix} + \dots + A_k \begin{bmatrix} N_{t-k} \\ S_{t-k} \end{bmatrix} + \begin{bmatrix} \epsilon_1, t \\ \epsilon_2, t \end{bmatrix}$$

- N_t : The net inflow of Northbound cashflow at t
- S_t : The sentiment at t

Since the basic assumption of the VAR model is based on stationary time series, for these data, we must prove that sentiment_t and the net inflow of northbound cashflow are stationary time series. Therefore, we carry out unit root tests for these two-time series.

Table 5 The net inflow of Northbound cashflow (Shanghai)

| Dickey-Fuller test for unit root | | Interpolated Dickey-Fuller | | |
|----------------------------------|----------------|----------------------------|-------------------|--------------------|
| Test Statistic | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -25.495 | -3.430 | -2.860 | -2.570 |

MacKinnon approximate p-value for Z(t) = **0.0000**

Table 6 Sentiment_t (Shanghai)

| Dickey-Fuller test for unit root | | Interpolated Dickey-Fuller | | |
|----------------------------------|----------------|----------------------------|-------------------|--------------------|
| Test Statistic | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -39.655 | -3.430 | -2.860 | -2.570 |

MacKinnon approximate p-value for Z(t) = **0.0000**

Table 7 The Net inflow of Northbound cashflow (Shenzhen)

| Dickey-Fuller test for unit root | | Interpolated Dickey-Fuller | | |
|----------------------------------|----------------|----------------------------|-------------------|--------------------|
| Test Statistic | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -26.893 | -3.430 | 2.860 | -2.570 |

MacKinnon approximate p-value for Z(t) = **0.0000**

Table 8 Sentiment_t (Shenzhen)

| | Dickey-Fuller test for unit root Test Statistic | Interpolated Dickey-Fuller | | |
|------|--|----------------------------|-------------------|--------------------|
| | | 1% Critical Value | 5% Critical Value | 10% Critical Value |
| Z(t) | -35.124 | -3.430 | 2.860 | -2.570 |

MacKinnon approximate p-value for Z(t) = **0.0000**

The results of the unit root test show that both time series are stationary time series, so the VAR model is effective in this situation.

3.5.2 Linear Regression Equation Model

$$\text{Sentiment}_{t+1} = \beta_1 \times \text{Net Inflow of Northbound Cashflow}_t + \beta_2 \times \text{Main Capital Inflow}_t + \beta_3 \times \text{Sentiment}_t + \beta_4 \times \text{ISI}_t + \varepsilon$$

The purpose of this model is to test the impact of net inflow of northbound cash flow on investor sentiment the next day. Since the data of main capital inflow, like northbound cash flow, will appear on the pages of major securities trading websites, it is also used as a control variable. Moreover, due to the continuity of investor sentiment, I also consider the investor sentiment of the day, the overall market sentiment of the month, and the sentiment affected by macroeconomic conditions in the model.

Table 9 Collinearity Diagnosis

| SH-HK-SC | VIF | 1/VIF |
|-----------------------------------|-------|-------|
| Main Capital Inflow | 2.350 | 0.425 |
| Sentiment _t | 2.180 | 0.458 |
| Net Inflow of Northbound Cashflow | 1.220 | 0.822 |
| ISIIndex | 1.170 | 0.853 |
| Mean VIF | 1.730 | |

Table 10 Collinearity Diagnosis

| SZ-HK-SC | VIF | 1/VIF |
|--------------------------------------|-------|-------|
| Main Capital Inflow | 2.560 | 0.390 |
| Sentiment _t | 2.110 | 0.474 |
| Net Inflow of Northbound Cashflow | 1.400 | 0.716 |
| ISIIndex | 1.180 | 0.849 |
| Mean VIF | 1.810 | |

According to the collinearity diagnosis in Table 9 and Table 10, the VIF values of all variables in the two markets are less than 5; that is, there is no multicollinearity between the variables in the linear regression model. Then the regression equation can be effective.

4 Results

4.1 VAR

4.1.1 Granger Causality Test

This study uses the Granger causality test program in Stata to test and obtains the following two Tables:

Table 11 Granger causality Wald tests (SH-HK-SC)

| Equation | Excluded | chi2 | df | Prob>Chi2 |
|-----------------------------------|-----------------------------------|---------------|----------|--------------|
| Sentiment _t | Net Inflow of Northbound Cashflow | 12.293 | 1 | 0.000 |
| Sentiment _t | ALL | 12.293 | 1 | 0.000 |
| Net Inflow of Northbound Cashflow | Sentiment _t | 2.4864 | 1 | 0.115 |
| Net Inflow of Northbound Cashflow | ALL | 2.4864 | 1 | 0.115 |

Table 12 Granger causality Wald tests (SZ-HK-SC)

| Equation | Excluded | chi2 | df | Prob>Chi2 |
|-----------------------------------|-----------------------------------|---------------|----------|--------------|
| Sentiment _t | Net Inflow of Northbound Cashflow | 16.706 | 1 | 0.000 |
| Sentiment _t | ALL | 16.706 | 1 | 0.000 |
| Net Inflow of Northbound Cashflow | Sentiment _t | 30.784 | 1 | 0.000 |
| Net Inflow of Northbound Cashflow | ALL | 30.784 | 1 | 0.000 |

The results of these two tables are obtained according to the Akaike Information Criterion (AIC) minimization principle to ensure the optimal statistical model fitting. The lag orders selected for the Shanghai market and Shenzhen market are 2 and 1, respectively. According to the results, the net inflow of northbound cash flow is the Granger cause of sentiment_t in both markets. In both Shanghai and Shenzhen markets, changes in investor sentiment will be affected by northbound cash flow.

4.1.2 Impulse response function (IRF)

This study uses the impulse response function in Stata to export the following two

figures:

Figure 3 IRF of SH-HK-SC

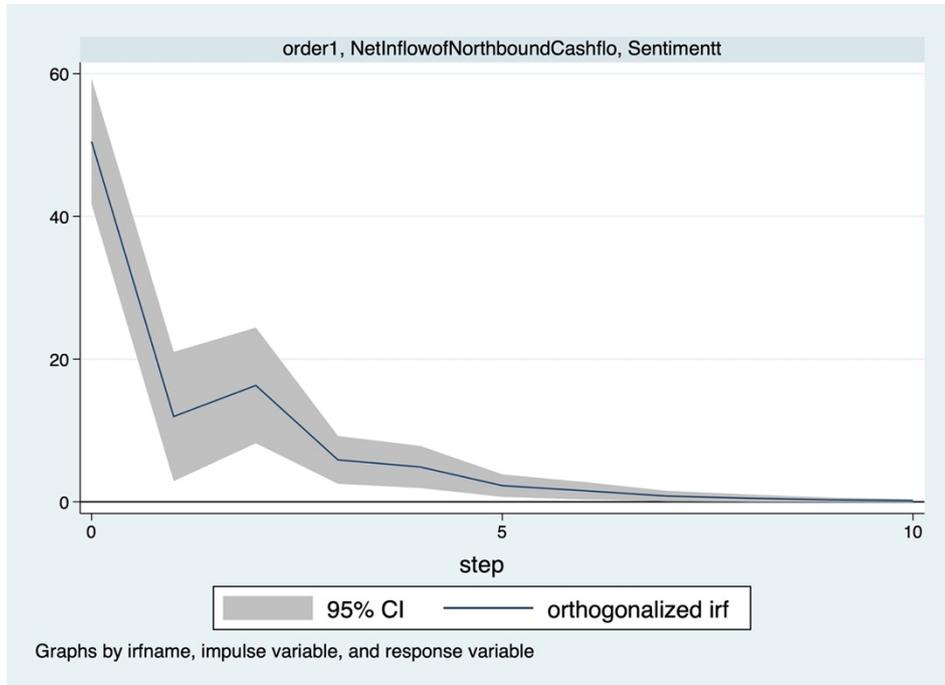
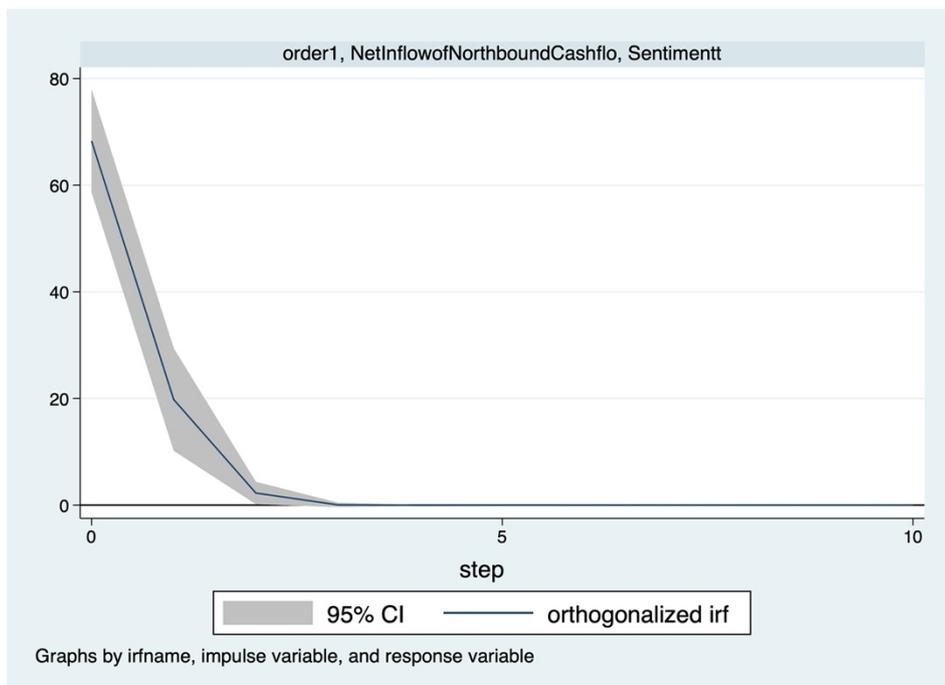


Figure 6 IRF of SZ-HK-SC



The ordinates of the two figures represent a percentage, while the abscissa represents time in days. The two figures show that when the northbound cash flow is impacted, investor

sentiment will produce a response in the same direction, and the overall trend of this response will decline over time. However, there are some differences in the specific responses in the two markets. In the Shanghai market, when the northbound cash flow is impacted by a standard deviation, investor sentiment will immediately respond with about 50% standard deviation, while in the Shenzhen market, this data is 70% standard deviation. In addition, there are some differences in the duration of response after the impact of northbound cash flow in the two markets. In the Shanghai market, the response after the impact can last for more than five days, while in Shenzhen, the response caused by the impact will completely disappear after three days.

4.2 Linear Regression Equation Model

The linear regression results of the Shanghai market and Shenzhen market are derived as shown in the tables below:

Table 13

| SH market | (Overall) Sentiment _{t+1} | (ISI +) Sentiment _{t+1} | (ISI -) Sentiment _{t+1} |
|-----------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|
| Net Inflow of Northbound Cashflow | .01*** (.002) | .006** (.003) | .015*** (.003) |
| Main Capital Inflow | .001* (.001) | .001 (.001) | .002 (.001) |
| Sentiment _t | -.097** (.04) | -.04 (.065) | -.133*** (.051) |
| ISI Index | 9.854** (4.337) | 15.501* (8.851) | 21.895 (15.802) |
| cons | 9.563 (6.888) | -.802 (12.679) | 18.818 (14.073) |
| Observations | 1323 | 593 | 730 |
| R-squared | .026 | .018 | .043 |

Standard errors are in parentheses

**** $p < .01$, ** $p < .05$, * $p < .1$*

Table 14

| SZ market | (Overall) | (ISI +) | (ISI -) |
|-----------------------------------|--------------------------|--------------------------|--------------------------|
| | Sentiment _{t+1} | Sentiment _{t+1} | Sentiment _{t+1} |
| Net Inflow of Northbound Cashflow | .011*** (.003) | .008** (.004) | .019*** (.006) |
| Main Capital Inflow | .002 (.001) | .001 (.001) | .002 (.002) |
| Sentiment _t | -.049 (.043) | -.021 (.07) | -.09 (.057) |
| ISI Index | 4.861 (5.672) | 13.338 (10.942) | -1.27 (20.542) |
| cons | 9.334 (9.358) | -.895 (16.446) | 3.664 (19.378) |
| Observations | 1108 | 508 | 600 |
| R-squared | .022 | .024 | .028 |

Standard errors are in parentheses

**** $p < .01$, ** $p < .05$, * $p < .1$*

For the two markets of Shanghai and Shenzhen, the same linear regression equation is used three times, respectively. The regression data in the first column is the regression result of the overall data, while the second and third columns are based on the positive or negative classification discussion of the overall market sentiment considering the macroeconomic situation.

Firstly, in all classification discussions, the impact of net inflow of northbound cash flow on sentiment is always significant, and the value of the coefficient is always greater than 0. This proves that the inflow of Northbound Cashflow by the Chinese mainland stock market will play a positive role in promoting investor sentiment in the whole market. In addition, comparing the impact of northbound cash flow with that of main capital inflow, we can find that the impact of main capital inflow on sentiment is not significant. This also means that judging the trend of market investor sentiment through the data of main capital inflow is of little significance. The possible reason is that the real main capital, that is, large professional

investors or institutional investors, use the program to split a transaction into multiple small transactions with an amount of less than 1 million yuan today, to hide their real large-scale buying or selling behavior.

Secondly, compare the difference of results brought by the positive and negative of basic investor sentiment (ISI Index), including macroeconomic conditions, over a period. In Shanghai and Shenzhen stock markets, the impact of northbound cash flow on sentiment is stronger than that in the period of high market sentiment. From the perspective of efficiency, the value of efficiency under negative sentiment in the Shanghai market is 150% higher than that under the positive sentiment, while in the Shenzhen market, the figure is 137.5%. This result can be explained by the theory of myopia loss aversion of Thaler et al. (1997). Thaler pointed out that when investors do not often evaluate their investments, it often means that they are more willing to accept risks. When the overall market sentiment is high, most investors benefit from the stock market, and investors will show confidence in their investment decisions. At this time, investors are often more willing to accept risks and pay less attention to external information. When the market sentiment is depressed, and investors suffer losses, investors are more likely to doubt their investment decisions, reassess their investments frequently, and hope to rely on external information to make trading decisions. In this case, the change of northbound cashflow data is more likely to attract the attention of investors, thus more significantly affecting investor sentiment.

Thirdly, compare the regression results of the Shanghai and Shenzhen markets. Under the regression of three different categories, the investor sentiment in the Shenzhen market is more sensitive to northbound cash flow than that in the Shanghai market. According to the

research results of Ni et al., the stock prices of enterprises with large scale, strong profitability and long profit history, especially state-owned enterprises, are not easy to be affected by the sentiment of market investors. The Shanghai Stock Exchange happens to be the main position for the listing of China's large state-owned enterprises and giants in traditional industries such as banking, oil, and mining. There are many innovative enterprises with a relatively small market value on Shenzhen Stock Exchange. Therefore, we can also judge that the investor sentiment of large companies and state-owned enterprises in traditional industries is also relatively weak affected by northbound cash flow. On the contrary, the investor sentiment of innovative growth enterprises will be more sensitive to the impact of northbound cash flow.

4.3 Robustness

In this study, the residuals of the linear regression model were suppressed, and OLS regression was performed again as the robustness test. Results as shown in Table 15 and Table 16, the positive and negative and relative size relationships of all coefficients remain unchanged, so the model passes the robustness test.

Table 15

| SH market | (Overall) Sentiment _{t+1} | (ISI +) Sentiment _{t+1} | (ISI -) Sentiment _{t+1} |
|-----------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|
| Net Inflow of Northbound Cashflow | .011*** | .006** | .015*** |
| | -0.002 | -0.003 | -0.003 |
| Main Capital Inflow | 0.001 | 0.001 | 0.001 |
| | 0 | -0.001 | -0.001 |
| Sentiment _t | -.068** | -0.041 | -.111** |
| | -0.034 | -0.06 | -0.049 |
| ISI Index | 8.257** | 15.251* | 5.168 |

| | | | |
|--------------|--------|--------|-------|
| | -4.183 | -7.916 | -9.66 |
| Observations | 1323 | 593 | 730 |
| R-squared | 0.025 | 0.019 | 0.041 |

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

Table 16

| SZ market | (Overall) | (ISI +) | (ISI -) |
|-----------------------------------|--------------------------|--------------------------|--------------------------|
| | Sentiment _{t+1} | Sentiment _{t+1} | Sentiment _{t+1} |
| Net Inflow of Northbound Cashflow | .013*** | .008** | .02*** |
| | -0.003 | -0.004 | -0.005 |
| Main Capital Inflow | 0.001 | 0.001 | 0.002 |
| | -0.001 | -0.001 | -0.002 |
| Sentiment _t | -0.03 | -0.022 | -0.088 |
| | -0.038 | -0.066 | -0.055 |
| ISI Index | 3.36 | 13.088 | -4.23 |
| | -5.469 | -9.924 | -13.285 |
| Observations | 1108 | 508 | 600 |
| R-squared | 0.023 | 0.025 | 0.031 |

Standard errors are in parentheses

**** p<.01, ** p<.05, * p<.1*

5 Contributions and Limitations

5.1 Conclusion

Based on the daily trading data of northbound cash flow in Hongkong and Shanghai Stock Exchange, the paper explores the impact of northbound cash flow's change on short-term investor sentiment in the Chinese mainland market based on the Shanghai and Shenzhen two cities. According to the results of the Granger causality test and impulse response function, it is confirmed that there is a specific causal relationship between northbound cash flow and investor sentiment from a statistical point of view. And when the northbound cash flow is impacted, the impact on investor sentiment may last for several days. Based on the linear regression function constructed according to northbound cash flow and sentiment, it is proved again that there is a positive correlation between northbound cash flow and sentiment. In addition, according to the normalized ISI data, this study found that when the overall market investor sentiment is depressed, sentiment is more significantly affected by the change of northbound cash flow. The sentiment is more sensitive to the change of northbound cash flow. Finally, this study also found differences in the stability of investor sentiment in different markets. Compared with the Shanghai market dominated by large enterprises and state-owned enterprises, the investor sentiment in the Shenzhen market is more sensitive to the changes of northbound cash flow. This study fills the gap in the study of the impact of a unique cash flow in securities trading on ultra-short-term investor sentiment in the market. This has a specific reference significance for ordinary investors to trade in the A-share market. When we decide to buy stock shortly, we may have a greater probability of obtaining a favorable purchase price by buying the stock one day after the outflow of northbound cash

flow. On the contrary, when deciding to sell stocks, it may be more appropriate to sell at the time point after the capital inflow to the north.

5.2 Limitations & Future Steps

There are still many defects in this study. Firstly, to simplify the classification and discussion of the study on the overall investor sentiment of different societies, I simply divide the data of the normalized ISI index into positive and negative parts. In future research, we should make a more refined classification. Alternatively, you can choose to filter out the data of some abnormal periods for separate analysis. For example, the A-share market plunged in 2015. In future research, we should try to screen out some data of abnormal periods and analyze them separately. For example, the A-share market plunged in 2015. Or since 2019, the global economy has been influenced by COVID-19 and the quantitative easing policy of central banks. In addition, in dealing with the overall market sentiment, this study simply substitutes the monthly data of the data into the daily model. An important problem brought about by this is that there will be a sudden change in the data of the overall economic situation from the end of each month to the beginning of the next month, but there will be no change in each month. This is different from the actual situation. I hope to find a better model to measure the daily socio-economic and investor sentiment in the future.

Secondly, this study takes the whole market as the research object to analyze investor sentiment. In the real market, the investor sentiment of individual stocks is likely to deviate from that of the whole market. Moreover, northbound cash flow's shareholding ratio in the overall A-share market is not significant. In addition, northbound cash flow is not balanced

for the inflow of Chinese mainland stocks. When the concentration of funds into several stocks leads to high investor sentiment in some stocks, the impact is likely not enough to cause significant changes in investor sentiment in the whole market. In future research, I may try to select some stocks to study the relationship between northbound cash flow and investor sentiment.

Thirdly, the linear regression model of this study selects the relationship between the inflow day of northbound cash flow and the 2nd-day investor sentiment as the research object. According to the conclusion of the impulse response function, the impact of northbound cash flow on investor sentiment will last for several days. In future research, different hysteresis periods can be used for testing.

6 References

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