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Does the Investor Sentiment Affect the Stock Returns in Taiwan's Stock Market under Different Market States?

Yu-Hong Liu[1], Syuan-Rong Dai[2], Fu-Min Chang[3], Yih-Bey Lin[4] and Nicholas Rueilin Lee[5]

Abstract

Climatic change and epidemic disease could influence the investor sentiment. Under such circumstances, how to invest the stock market in different stock market states (bull, bear or neutral) is an important topic for investors. To capture the investor sentiment more precisely, we use principal component analysis to analyze some investor sentiment indicators, and then form a composite index of investor sentiment. These investor sentiment indicators include the turnover rate, the percent change in margin borrowing, the percent change in short interest, net buy/sell, the turnover ratio of major institutional investors, psychological line, and advance decline ratio. Then we construct regression models to investigate the influences of investor sentiment on the current returns and on the near-term future returns in the different market states, respectively. The empirical results revealed that investor sentiment indicators have significantly positive effect on stock returns during total period, bull market and neutral market. Among these market states, bull market has the greatest influence. When the market is an upward tendency, investors will be willing to put funds into the stock market. When the funds flow in, it occurs Bandwagon effect easily, so that the stock price deviates from the reasonable price.

JEL classification numbers: E22, G30, P34
Keywords: Investor Sentiment, Principal Component Analysis, Stock Returns, Market states.

[1] PhD Program in Strategic Development of Taiwan's Industry, Chaoyang University of Technology, Taichung, Taiwan.
[2] Department of Finance, Chaoyang University of Technology, Taichung, Taiwan.
[3] Department of Finance, Chaoyang University of Technology, Taichung, Taiwan.
[4] Department of Finance, Chaoyang University of Technology, Taichung, Taiwan.
[5] Corresponding Author. Department of Finance, Chaoyang University of Technology, Taichung, Taiwan.

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1. Introduction

Climate change is particularly important for our overall sustainable investment strategy given that it is a key material issue across a wide range of sectors. According to the latest USSSIF report published in October 2018, it is the single most important ESG (environment, social responsibility and corporate governance) issue considered by asset managers in asset-weighted terms. Managers responsible for USD 3.0 trillion cited climate as their number one ESG concern-a doubling compared to 2016. Besides, US institutional investors reflected that sentiment in the same report. They also regarded climate change and carbon emissions as the most important environmental issue. On the other hand, climatic change and epidemic disease could influence the investor sentiment. Under such circumstances, how to invest the stock market in different stock market states is an important topic for investors.

Efficient Market Hypothesis (EMH), proposed by Fama (1970), indicated that investors are rational and stock prices will reflect all public information. By EMH, market investors cannot shake the stock price, but someone can find that the market prices of securities do not follow the EMH and sometimes would deviates from the reasonable state. The reasons for this anomaly can be found from the behavioral finance. Prospect Theory (PT), proposed by Kahneman and Tversky (1979), indicated that traditional expected effect would not explain investor's decision-making behavior as investors facing uncertainty. Making decisions with irrational emotions could lead to over-reaction or under-reaction in the market. Although individual investors may not really influence the stock prices, but through the Bandwagon effect, the stock price may obtain the abnormal returns with the investor sentiment. On the other side, Shiller (1984) considered that investors will change their investment decisions when the market is in different states. In addition, most of the previous literature showed that investor sentiment correlated negatively with the near-term future returns, such as Baker and Wurgler (2006). However, Liu et al. (2017) showed the different results.

This study divides the stock markets into three states, bull, bear and neutral, and aims to investigate how investor sentiment influences stock returns in different stock market states under climate change circumstance. The purpose is to observe whether the impact of the sector returns will be the same as the market is in different market state or not. Will the investor sentiment have a more dramatic impact in different market states? By using principal component analysis (PCA), we analyze some investor sentiment indicators to form a composite index of investor sentiment. These investor sentiment indicators include the turnover rate, the percent change in margin borrowing, the percent change in short interest, net buy/sell and turnover ratio of three major institutional investors, psychological line, and advance decline ratio. Then we construct regression models to investigate the influences of investor sentiment on the current returns and on the near-term future returns in the different market states, respectively.

The rest of this paper is organized as follows. Section 2 describes the sentiment

indicators and gives some literature review. Section 3 introduces the sample data, market states and research models. The empirical results are shown in section 4. Finally, we make a conclusion in section 5.

2. Sentiment Indicators and Literature Review

There are two kinds of sentiment indicator, direct and indirect. The direct sentiment indicator is a data survey of public investor sentiment. It measures the investor's sentiment and the trend of the future. Indirect sentiment indicator is more objective and easier to obtain as compared to direct sentiment indicator. Most scholars measure investor sentiment through indirect sentiment indicator. Hirshleifer and Shumway (2003) proposed the sunshine effect. Through the evidence of psychology and casual intuition, they verify the impact of weather on stock returns by using cloudiness as sentiment proxy variables. Their results revealed that a significant correlation exists between sunshine and stock returns. Brown and Cliff (2004) used a composite index of investor sentiment obtained from PCA and then studied the impact of investor sentiment on near-term stock market returns. The result showed that the investor's sentiment has a positive impact on the current stock returns and has no significant effect on the near-term future stock returns. Therefore, the sentiment index has little predictive power for stock returns.

Baker and Wurgler (2006) used six sentiment proxy variables to study the impact of investor sentiment on cross-sectional returns. The empirical results revealed that a significant negative relationship exists between sentiment and subsequent returns for small stocks, young stocks, high volatility stocks, unprofitable stocks, non-dividend-paying stocks, extreme growth stocks, and distressed stocks. Tsai et al. (2009) collected the listed company stocks in Taiwan from March 1993 to June 2008 as sample data and used a composite index of investor sentiment obtained from PCA. They divided the stock market into high investor sentiment and low investor sentiment. Additionally, the authors added firm characteristics to explore the impact of firm characteristics and investor sentiment on stock returns. The results revealed that when the investor sentiment is high or low, the impact of the firm characteristics on the stock returns is different. In addition, the current sentiment index has a positive impact on stock returns, and the lagged sentiment index has a negative impact on stock returns.

Cheng and Lin (2010) used the listed company stocks in Taiwan from January 2002 to June 2008 to study on stock speculation based on the volatility of stock returns. They also studied the impact of investor sentiment on speculative stock returns. The authors used three different investor groups, such as entire investor sentiment index, large-sized investor sentiment index and small-and-median-sized investor sentiment index to form a composite index, and then explored the relationship between investor sentiment and speculative stock returns. The empirical results showed that the current sentiment index has a positive impact on stock returns, and the lagged sentiment index has a negative impact on stock returns. The price deviation is a temporary phenomenon, and the stock price will return to the real

price in the future. Mo et al. (2016) attempted to capture the investor's psychological sentiment from the perspective of technical indicators and used nine technical indicators as the indirect variables of investor sentiment. The empirical results showed that psychological line and relative strength index are most effective.

3. Data, Market States and Research Model

3.1 Sample data collection and investor sentiment variables

Except for the companies of finical related or the companies of incomplete data, this study collected the listed companies of Taiwan market as sample data, which include 27 industries and are total 662 stocks. The sample data collected from the Taiwan Economic Journal (TEJ) and the data period was from January 2010 to June 2018, which are total 102 months. We use individual investor sentiment indicators, institutional investor sentiment indicators and technical indicator to form a composite index of investor sentiment. In this study, the proxy variables of individual investor sentiment indicator include the turnover rate (TURN), the percent change in margin borrowing (ΔMGR) and the percent change in short interest (ΔSIR). The proxy variables of institutional investor sentiment indicator consist of net buy/net sale (NBNS) and institutional investors turnover rate (ITOR). The proxy variables of technical indicator include psychological line (PSY) and advance decline ratio (ADR). It is noted that institutional investors include foreign investors, investment trusts and security dealers. The measurements of proxy variables are described in the following.

TURN: It represents the turnover rate and can be obtained by

$$Turnover\ Rate_t = TOR_t - ITOR_t \tag{1}$$

where TOR_t is the stock market turnover rate in *t* th month, and $ITOR_t$ is the institutional investors turnover rate in *t* th month.

ΔMGR: It represents the percent change in margin borrowing and is given by

$$\Delta MGR_t = \frac{Margin_t - Margin_{t-1}}{Margin_{t-1}} \times 100 \tag{2}$$

where $Margin_t$ is the total amount of all listed stock margin borrowing in *t* th month and $Margin_{t-1}$ is the total amount of all listed stock margin borrowing in (t-1) th month.

ΔSIR: It means the percent change in short interest and can be obtained by

$$\Delta SIR_t = \frac{Shortir_t - Shortir_{t-1}}{Shortir_{t-1}} \times 100 \tag{3}$$

where $Shortir_t$ is the total amount of all listed stock selling short in *t* th month and $Shortir_{t-1}$ is the total amount of all listed stock selling short in *(t-1)* th month.
NBNS: It represents the net buy/net sale and is given by

$$Net\ Buy/Net\ Sale_t = ln(n_t^{Buy}) - ln(n_t^{Sale}) \quad (4)$$

where n_t^{Buy} means the total number of shares bought by the three institutional investors in *t* th month and n_t^{Sale} represents the total number of shares sold by the three institutional investors in *t* th month.
ITOR: It represents the institutional investor turnover rate and can be obtained by

$$Institutional\ Investors\ Turnover\ Rate_t = \frac{(n_t^{Buy}+n_t^{Sale})}{N_t} \times 100 \quad (5)$$

where n_t^{Buy} is the total number of shares bought by the institutional investors in *t* th month, n_t^{Sale} is the total number of shares sold by the institutional investors in *t* th month and N_t is the total number of outstanding shares in the market in *t* th month.
PSY: It represents the psychological line and can be obtained by

$$PSY_t = \frac{TRD_t}{Day_t} \times 100 \quad (6)$$

where TRD_t is the total number of rising days in *t* th month and Day_t is the total number of market operation in *t* th month.
ADR: It represents the advance decline ratio and is given by

$$ADR_t = \frac{ADV_t}{DEC_t} \quad (7)$$

where ADV_t is the total number of advancing in *t* th month, and DEC_t is the total number of declining in *t* th month.

3.2 Market states

In this study, the market states were divided into three states, bull, bear, and neutral. By following the method of Pagan and Sossounov (2003), we first find out the relative high and low points of the Taiwan Capitalization Weighted Stock Index (TAIEX) during from May 2009 to February 2019, and confirm the trough and peak. A bull (bear) market state is a continuous uptrend (downtrend) on stock index levels, more than a 20% cumulative change range and the uptrend (downtrend) should be longer than six months. Besides, Katsenelson (2007) suggested that when the fluctuation of stock index is narrow, such state is called range bound market. In this study, we simply call it a neutral market. Figure 1 shows the market states of sample data period, where the orange part is the bull market, the green part is the neutral market, and the blue part is the bear market.

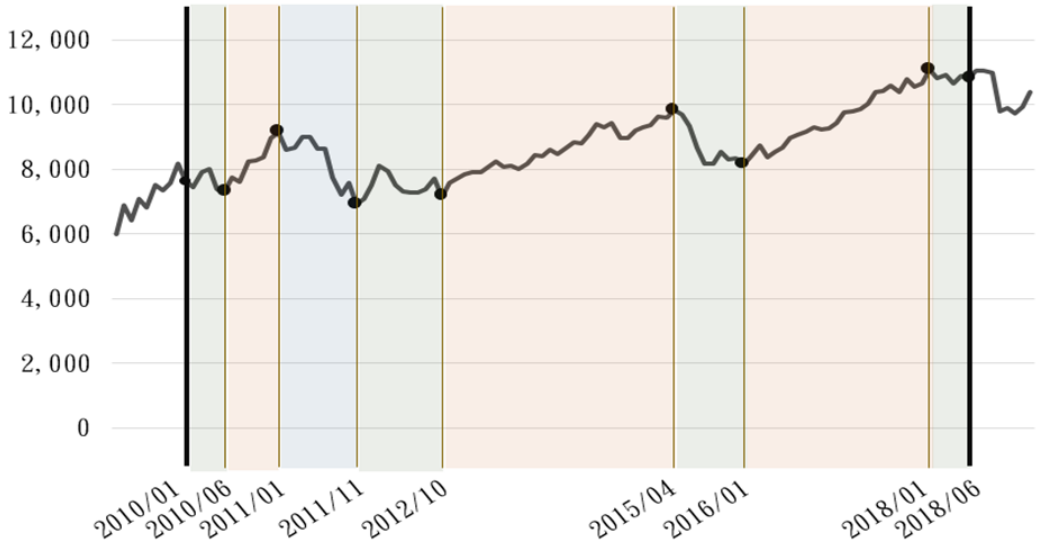

Figure 1: Market states of sample data period

3.3 Regression model

In the study, we explore the impacts of investor sentiment on the current returns and on the near-term future returns in the different market states, respectively. To represent the different market states, we set two dummy variables D_t^1 and D_t^2, where D_t^1=0 and D_t^2=0 is the bull market, D_t^1=1 and D_t^2=0 is the neutral market, $D_t^1 = 0$ and $D_t^2 = 1$ is the bear market. In addition, we use the comprehensive sentiment indicator as the independent variable and the industry returns as the dependent variables. Firstly, we construct a regression model to study the impact of investor sentiment on the current returns, as shown in equation (8).

$$R_t = \alpha_i + \beta_i IS_t + \varepsilon_{i,t} \tag{8}$$

where R_t is the industry stock returns ratio in *t* th month and IS_t is the composite index of investor sentiment in *t* th month.
We also develop a regression model to study the impact of investor sentiment on the current returns in different market states, as shown in equation (9).

$$R_t = \alpha_i + (1 - D_t^1 - D_t^2)(\beta_{i1})(IS_t) + (D_t^1)(\beta_{i2})(IS_t) + (D_t^2)(\beta_{i3})(IS_t) + \varepsilon_{i,t} \quad (9)$$

where R_t is the industry stock returns ratio in *t* th month and IS_t is the composite index of investor sentiment in *t* th month.
Secondly, we construct a regression model to investigate the impact of investor sentiment on the near-term future returns, as shown in equation (10).

$$R_t = \alpha_i + \beta_i IS_{t-1} + \varepsilon_{i,t} \quad (10)$$

where R_t is the industry stock returns ratio in *t* th month, and IS_{t-1} is the composite index of investor sentiment in *(t-1)* th month.
We also develop a regression model to study the impact of investor sentiment on the near-term future returns in different market states, as shown in equation (11).

$$R_t = \alpha_i + (1 - D_t^1 - D_t^2)(\beta_{i1})(IS_{t-1}) + (D_t^1)(\beta_{i2})(IS_{t-1}) + (D_t^2)(\beta_{i3})(IS_{t-1}) + \varepsilon_{i,t} \quad (11)$$

where R_t is the industry stock returns ratio in *t* th month and IS_{t-1} is the composite index of investor sentiment in (t-1) th month.

4. Empirical Results

4.1 Summary statistics

Table 1 showed the average rate of return of industries. From the table one can see that the minimum value is -21.366%, which is the value of the glass and ceramics industry in November 2011. The standard deviation of the glass and ceramics industry is 8.393%, and the volatility is significantly greater than other industries. It means that this industry is more sensitive to the market states. In addition, the maximum value is 31.649%, which is the data of the electronic parts and components industry in May 2018. This industry benefits from the development of emerging technologies and the innovation of consumer electronics at the time, coupled with the psychological state of consumers who like to chase new products. It is noted that the average value of comprehensive sentiment indicator (*IS*) is positive. It means that investor sentiment has been in high spirits over the years and is more optimistic about stock market expectations.

Table 1: Summary statistics of variables

Industry (Notation)	Mean	Med	SD	Min.	Max
Overall (OVA)	1.124	1.624	3.549	-8.900	9.201
Cement (CEM)	0.767	0.684	5.799	-15.786	15.388
Food (FOD)	1.420	1.744	4.264	-11.016	14.618
Plastic (PLA)	1.054	1.277	5.183	-13.824	11.360
Textile (TEX)	1.022	1.016	4.905	-13.312	12.657
Electrical machinery (EM)	1.331	1.193	4.540	-10.193	13.030
Electric appliance and cable (EAC)	0.932	1.079	6.591	-13.912	18.575
Chemical (CHE)	0.715	0.923	5.179	-15.760	14.484
Biotechnology (BIO)	1.038	0.609	6.325	-18.106	19.077
Glass and ceramics (GC)	0.207	-0.159	8.393	-21.366	29.289
Paper (PAP)	0.700	0.307	5.838	-12.540	25.056
Steel (STE)	0.378	0.062	3.986	-11.272	14.460
Rubber (RUB)	0.743	0.611	4.909	-10.170	17.605
Automotive (AUT)	1.475	0.834	7.108	-18.106	25.187
Semiconductor (SEM)	1.362	1.408	4.355	-8.826	11.305
Computer and peripheral (CP)	0.787	1.157	4.368	-11.512	12.051
Optoelectronic (OPT)	0.915	1.669	7.287	-15.105	17.423
Communication network (CN)	1.007	0.897	3.660	-7.293	19.021
Electronic parts and components (EPC)	1.528	1.592	5.664	-12.558	31.649
Electronic products distribution (EPD)	0.726	0.714	4.216	-11.365	11.670
Information service (INS)	1.026	1.186	5.487	-11.542	23.669
Other electronics (OE)	0.785	1.579	6.258	-17.110	16.432
Building material (BM)	0.941	1.343	5.669	-16.584	15.343
Shipping (SHI)	0.301	0.289	6.036	-12.860	23.926
Tourism (TOU)	0.193	-0.096	4.552	-9.962	15.623
Trading and consumers' goods (TCG)	1.380	1.504	4.841	-14.059	14.759
Gas and electricity (GE)	0.801	0.412	5.110	-20.989	16.609
Others (OTH)	1.262	1.266	3.752	-8.607	10.299
Composite index of investor sentiment (*IS*)	12.759	13.268	5.866	-3.901	22.179
All values are in percentage, %					

Next, we perform the unit root test for sample data and the results are shown in Table 2. From the table one can see that all variables are stationary.

Table 2: Unit test results

Industry	ADF	PP	Industry	ADF	PP
OVA	-10.6479***	-10.8869***	SEM	-10.4500***	-10.4593***
CEM	-10.6762***	-10.7949***	CP	-9.9974***	-10.0611***
FOD	-11.9646***	-12.1470***	OPT	-8.8392***	-8.8241***
PLA	-9.9999***	-10.0126***	CN	-10.1738***	-10.3527***
TEX	-9.6545***	-9.6550***	EPC	-9.1849***	-9.2092***
EM	-9.9928***	-10.0778***	EPD	-10.7434***	-10.8435***
EAC	-9.7495***	-9.7477***	INS	-9.6477***	-11.0036***
CHE	-9.0379***	-10.3792***	OE	-10.4424***	-10.4780***
BIO	-10.7718***	-11.7601***	BM	-8.7009***	-9.4188***
GC	-10.0521***	-10.0812***	SHI	-9.8909***	-9.8926***
PAP	-8.7648***	-8.7261***	TOU	-3.5061***	-8.6952***
STE	-9.5869***	-9.5876***	TCG	-10.0514***	-10.0514***
RUB	-9.9999***	-10.0009***	GE	-11.7872***	-12.0066***
AUT	-9.1472***	-9.1386***	OTH	-10.0123***	-10.0193***
IS	-9.5667***	-9.5545***			

*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively. ADF: Augmented, Dickey-Fuller, PP: Phillips-Perron

4.2 Principal component analysis (PCA)

To capture the investor sentiment more precisely, we use principal component analysis to analyze some investor sentiment indicators, and then form a composite index of investor sentiment. These investor sentiment indicators include the turnover rate, the percent change in margin borrowing, the percent change in short interest, net buy/sell and turnover ratio of major institutional investors, psychological line, and advance decline ratio. In particular, both current (t) and lagged (t-1) variables are considered. Note that we calculate the composite index of investor sentiment by weighted average with the eigenvalue of each principal component as the proportion of all eigenvalues.

Seven current variables and seven lagged variables are used for first PCA. After the PCA, we obtained the first five principal components, and the total variance explained was 71.72%. Then we calculate the first composite index of investor sentiment (IS_t^1) by weighted average, as shown in equation (12).

$$\begin{aligned} IS_t^1 = {} & 0.193TURN_t + 0.067TURN_{t-1} + 0.223\Delta MGR_t \\ & + 0.07\Delta MGR_{t-1} + 0.051\Delta SIR_t + 0.091\Delta SIR_{t-1} \\ & + 0.165NBNS_t + 0.126NBNS_{t-1} + 0.101ITOR_t \\ & + 0.003ITOR_{t-1} + 0.138PSY_t + 0.098PSY_{t-1} \\ & + 0.16ADR_t + 0.15ADR_{t-1} \end{aligned} \tag{12}$$

Next, we analyze the correlation between the first composite index of investor sentiment and the fourteen variables. The results are shown in Table 1. From Table 1 we can see that $TURN_t$, ΔMGR_t, ΔSIR_{t-1}, $NBNS_t$, PSY_t, and ADR_t are variables which are higher correlation with the first composite index of investor sentiment. With these five variables, we performed the second PCA. After the second PCA, we obtain the first three principal components and the total variance explained was 74.17%. Then we calculate the second composite index of investor sentiment (IS_t^2) by weighted average, as shown in equation (13).

$$IS_t^2 = 0.249TURN_t + 0.31\Delta MGR_t + 0.239\Delta SIR_{t-1} + 0.181NBNS_t + 0.165ITOR_t + 0.199PSY_t + 0.241ADR_t \quad (13)$$

After performing two principal component analysis, the number of variables are reduced and the total variance explained of the variables are increased. In addition, as shown in Table 4, the correlation coefficient between IS_t^1 and IS_t^2 is 0.852 which is a significant correlation.

Table 3. The correlation between the first composite index of investor sentiment and the fourteen variables.

	$TURN_t$	$TURN_{t-1}$	ΔMGR_t	ΔMGR_{t-1}	ΔSIR_t	ΔSIR_{t-1}	$NBNS_t$	$NBNS_{t-1}$	$ITOR_t$	$ITOR_{t-1}$	PSY_t	PSY_{t-1}	ADR_t	ADR_{t-1}	IS_t^1
$TURN_t$	1														
$TURN_{t-1}$	.662**	1													
ΔMGR_t	.306**	-.064	1												
ΔMGR_{t-1}	.272**	.327**	.163	1											
ΔSIR_t	-.136	-.044	-.041	-.183	1										
ΔSIR_{t-1}	.001	-.129	.129	-.036	.019	1									
$NBNS_t$	.112	-.177	.263**	.064	.035	-.019	1								
$NBNS_{t-1}$	.151	.164	.201*	.282**	-.017	.022	.056	1							
$ITOR_t$	.596**	.287**	.049	.062	-.038	.085	-.141	.034	1						
$ITOR_{t-1}$	.249*	.578**	-.210*	.049	.112	-.018	-.184	-.118	.388**	1					
PSY_t	.079	-.139	.370**	-.137	-.061	-.049	.543**	-.061	-.167	-.193	1				
PSY_{t-1}	.225*	.132	.221*	.387**	-.328**	-.075	.138	.550**	.102	-.143	-.013	1			
ADR_t	.104	-.195*	.414**	-.186	.028	.024	.553**	-.159	-.114	-.219*	.657**	-.081	1		
ADR_{t-1}	.377**	.174	.325**	.432**	-.334**	.016	.198*	.564**	.159	-.089	-.039	.664**	.005	1	
IS_t^1	.344**	.034	.619**	.153	.172	.599**	.393**	.274**	.124	-.096	.510**	.306**	.411**	.288**	1
*, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.															

Table 4: Correlation coefficient between the comprehensive sentiment indicators

	IS_t^1	IS_t^2
IS_t^1	1	0.852**
IS_t^2	0.852**	1
** denote significance at the 1% levels, respectively		

4.3 Empirical results for the impact of investor sentiment on the current returns

The empirical results for investigating the impact of investor sentiment on the current returns are shown in Tables 5-8. From Table 5 we can see that except for cement, food, biotechnology, and gas and electricity industries, all industries are positive and significant when the market is in the overall period. The results indicated that most industries in the overall market are affected by investor sentiment. These four industries are less affected by emotions during the overall period because they are closely related to people life.

Table 5: Relationship between sentiment indicator and current industrial returns in overall period

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	0.2186*** (0.000)	CHE	0.2147** (0.014)	SEM	0.2646*** (0.000)	OE	0.2307** (0.029)
CEM	0.1443 (0.143)	BIO	0.1644 (0.126)	CP	0.1770** (0.016)	BM	0.2617*** (0.006)
FOD	0.1119 (0.122)	GC	0.3158** (0.026)	OPT	0.2541** (0.039)	SHI	0.3138*** (0.002)
PLA	0.2240*** (0.01)	PAP	0.2607*** (0.008)	CN	0.1350** (0.029)	TOU	0.2418*** (0.001)
TEX	0.2618*** (0.001)	STE	0.2225*** (0.001)	EPC	0.2057** (0.032)	TCG	0.1464* (0.074)
EM	0.1902** (0.013)	RUB	0.1387* (0.096)	EPD	0.1866*** (0.008)	GE	0.1382 (0.111)
EAC	0.3429*** (0.002)	AUT	0.2963** (0.013)	INS	0.3650*** (0.000)	OTH	0.1371** (0.031)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

From Table 6, one can see that except for cement, food, biotechnology, rubber, and gas and electricity industries, all industries are positive and significant as the market is in the bull market. It showed that when the market shows a bullish trend, the industry returns is also vulnerable to investor sentiment. In other words, bullish trends will allow investors to be more optimistic about the future. When investors become more optimistic, the rate of returns of these industries also increase. It is

noted that rubber industry is also not affected by investor sentiment as the market is in the bull market. The reason is that the final demand side of the rubber industry is mostly automobile tires. However, the specifications for tires and the ages of changing tires are different according to different models. It will not increase the amount of tires used because of up or down market states.

Table 6: Relationship between sentiment indicator and current industrial returns in bull market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	0.2355*** (0.000)	CHE	0.2301*** (0.008)	SEM	0.2901*** (0.000)	OE	0.2373** (0.027)
CEM	0.1654 (0.102)	BIO	0.1513 (0.160)	CP	0.1939*** (0.009)	BM	0.2800*** (0.004)
FOD	0.0995 (0.179)	GC	0.3545** (0.014)	OPT	0.2848** (0.019)	SHI	0.3562*** (0.000)
PLA	0.2435*** (0.005)	PAP	0.2940*** (0.003)	CN	0.1474** (0.019)	TOU	0.2407*** (0.002)
TEX	0.2813*** (0.001)	STE	0.2509*** (0.000)	EPC	0.2036** (0.025)	TCG	0.1429* (0.087)
EM	0.2027*** (0.009)	RUB	0.1410 (0.101)	EPD	0.1973*** (0.006)	GE	0.1440 (0.108)
EAC	0.3635*** (0.001)	AUT	0.3014** (0.015)	INS	0.3538*** (0.000)	OTH	0.1432** (0.027)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

From Table 7 we can find that except for cement, glass and ceramics, paper, rubber, and gas and electricity industries, all industries are positive and significant as the market is neutral. The results point out that when the trend of market states is uncertainty, investors are not able to understand the market trend, so they are easily affected by their own subjective emotions. Among them, the glass and ceramics industry as well as paper industry are positive and significant in the bull market, but they have no significant in the neutral market. According to Chen and Ye (2012), using the sector rotation strategies can effectively defeat the market, it is recommended to invest in the glass and ceramics industry when overheating. This argument is also suitable for explaining the relationship between sentiment and returns. When the trend is upward, investors are optimistic about the glass and ceramics industry, which will also increase it returns. Another industry that has the same empirical results for the paper industry is a special finding of this study.

From Table 8 one can see that only the electronic parts and components industry is negative at 10% significant level as the market is in the bear market. The reason is that the electronic parts and components industry is widely used in smart phones, media tablets and automotive electronics, and the bear period appeared only in 2011. During this period, due to the development of electronic innovation, smart phones

and media tablets are gradually emerging. The strong demands of the downstream industry have driven the development opportunities of the electronic parts and components industry.

Table 7: Relationship between sentiment indicator and current industrial returns in neural market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	0.2094*** (0.003)	CHE	0.2330** (0.031)	SEM	0.2066** (0.019)	OE	0.2663** (0.047)
CEM	0.0746 (0.552)	BIO	0.2933** (0.030)	CP	0.1682* (0.066)	BM	0.2628** (0.027)
FOD	0.1761* (0.058)	GC	0.2255 (0.206)	OPT	0.2706* (0.072)	SHI	0.2319* (0.058)
PLA	0.2253* (0.037)	PAP	0.1930 (0.112)	CN	0.1289* (0.096)	TOU	0.2769*** (0.004)
TEX	0.2606*** (0.01)	STE	0.1404* (0.084)	EPC	0.3449*** (0.003)	TCG	0.2013* (0.054)
EM	0.1994** (0.037)	RUB	0.1239 (0.246)	EPD	0.2016** (0.022)	GE	0.1125 (0.311)
EAC	0.3795*** (0.005)	AUT	0.2783* (0.068)	INS	0.4856*** (0.000)	OTH	0.1491* (0.063)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

Table 8: Relationship between sentiment indicator and current industrial returns in bear market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	-0.0147 (0.878)	CHE	-0.0996 (0.500)	SEM	0.0784 (0.516)	OE	-0.0094 (0.960)
CEM	0.0715 (0.680)	BIO	-0.1127 (0.542)	CP	-0.0592 (0.638)	BM	-0.0344 (0.832)
FOD	0.0672 (0.597)	GC	0.0404 (0.869)	OPT	-0.2943 (0.155)	SHI	-0.0513 (0.760)
PLA	-0.0908 (0.538)	PAP	-0.0137 (0.935)	CN	-0.0407 (0.702)	TOU	0.1270 (0.331)
TEX	-0.0427 (0.755)	STE	0.0803 (0.472)	EPC	-0.2855* (0.066)	TCG	-0.0046 (0.975)
EM	-0.0425 (0.745)	RUB	0.1586 (0.282)	EPD	-0.0402 (0.739)	GE	0.1423 (0.354)
EAC	-0.1221 (0.502)	AUT	0.2838 (0.177)	INS	0.0901 (0.541)	OTH	-0.0056 (0.960)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

4.4 Empirical results for the impact of sentiment indicator on the near-future returns

The empirical results for investigating the impact of sentiment indicator on the near-future returns are shown in Tables 9-12. Table 9 revealed that the significant positive relationship between the lagged comprehensive sentiment indicator and the current industrial returns of plastic as well as gas and electricity industries in overall market. Table 10 revealed that the significant positive relationship between the lagged comprehensive sentiment indicator and the current industrial returns of plastic, electrical machinery, steel, and gas and electricity industries in bull market. Table 11 revealed that the significant negative relationship between the lagged comprehensive sentiment indicator and the current industrial returns of food and optoelectronic industries in neutral market. Table 12 revealed that the significant negative relationship between the lagged comprehensive sentiment indicator and the current industrial returns of optoelectronic, electronic parts and components, information service, shipping, and tourism industries in bear market.

Table 9: Relationship between lagged sentiment indicator and current industrial returns in overall period

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	0.0512 (0.396)	CHE	0.0870 (0.322)	SEM	0.0366 (0.622)	OE	0.0100 (0.926)
CEM	0.0239 (0.809)	BIO	0.0868 (0.420)	CP	0.0392 (0.598)	BM	0.0968 (0.315)
FOD	-0.0973 (0.178)	GC	0.0759 (0.595)	OPT	-0.1140 (0.357)	SHI	0.0238 (0.817)
PLA	0.1863** (0.033)	PAP	0.0523 (0.599)	CN	0.0517 (0.406)	TOU	-0.0416 (0.591)
TEX	0.0569 (0.495)	STE	0.1331 (0.048)	EPC	-0.0918 (0.340)	TCG	0.0302 (0.714)
EM	0.1080 (0.160)	RUB	0.0554 (0.507)	EPD	0.0365 (0.611)	GE	0.1649* (0.056)
EAC	-0.0026 (0.982)	AUT	0.0892 (0.460)	INS	-0.0529 (0.571)	OTH	0.0576 (0.366)

() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively

Table 10: Relationship between lagged sentiment indicator and current industrial returns in bull market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	0.0916 (0.122)	CHE	0.1276 (0.151)	SEM	0.0817 (0.263)	OE	0.0446 (0.682)
CEM	0.0673 (0.498)	BIO	0.0891 (0.418)	CP	0.0907 (0.210)	BM	0.1410 (0.145)
FOD	-0.0881 (0.234)	GC	0.1260 (0.386)	OPT	-0.0199 (0.866)	SHI	0.0810 (0.422)
PLA	0.2207** (0.013)	PAP	0.1047 (0.293)	CN	0.0735 (0.247)	TOU	-0.0059 (0.940)
TEX	0.1028 (0.216)	STE	0.1760*** (0.008)	EPC	-0.0425 (0.652)	TCG	0.0402 (0.636)
EM	0.1466* (0.057)	RUB	0.0830 (0.328)	EPD	0.0661 (0.363)	GE	0.1777** (0.045)
EAC	0.0632 (0.567)	AUT	0.1207 (0.324)	INS	-0.0122 (0.896)	OTH	0.0766 (0.239)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

Table 11: Relationship between lagged sentiment indicator and current industrial returns in neural market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	-0.0670 (0.364)	CHE	-0.0512 (0.644)	SEM	-0.0821 (0.369)	OE	-0.0954 (0.484)
CEM	-0.1626 (0.192)	BIO	0.1362 (0.323)	CP	-0.1057 (0.244)	BM	-0.0158 (0.896)
FOD	-0.1588* (0.088)	GC	-0.0684 (0.707)	OPT	-0.3625** (0.016)	SHI	-0.0976 (0.440)
PLA	0.0866 (0.429)	PAP	-0.1059 (0.395)	CN	-0.0181 (0.819)	TOU	-0.1357 (0.166)
TEX	-0.0664 (0.522)	STE	-0.0018 (0.982)	EPC	-0.1796 (0.130)	TCG	0.0014 (0.989)
EM	0.0117 (0.903)	RUB	-0.0649 (0.541)	EPD	-0.0464 (0.610)	GE	0.0900 (0.413)
EAC	-0.1703 (0.220)	AUT	-0.0874 (0.568)	INS	-0.1434 (0.223)	OTH	0.0114 (0.889)
() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively							

Table 12: Relationship between lagged sentiment indicator and current industrial returns in bear market

Industry	β_i	Industry	β_i	Industry	β_i	Industry	β_i
OVA	-0.1184 (0.238)	CHE	-0.0194 (0.897)	SEM	-0.1961 (0.115)	OE	-0.1222 (0.509)
CEM	0.0387 (0.818)	BIO	-0.1079 (0.563)	CP	-0.1971 (0.110)	BM	-0.1446 (0.378)
FOD	-0.0232 (0.853)	GC	-0.1409 (0.568)	OPT	-0.5965*** (0.004)	SHI	-0.3669** (0.034)
PLA	0.0396 (0.790)	PAP	-0.1513 (0.370)	CN	-0.0196 (0.855)	TOU	-0.2251* (0.091)
TEX	-0.1713 (0.225)	STE	-0.0170 (0.879)	EPC	-0.4851*** (0.003)	TCG	-0.0134 (0.926)
EM	-0.1074 (0.408)	RUB	0.0701 (0.627)	EPD	-0.0989 (0.423)	GE	0.2346 (0.117)
EAC	-0.3606 (0.057)	AUT	0.2350 (0.259)	INS	-0.3171** (0.048)	OTH	-0.0537 (0.626)

() is p-value. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively

From tables we can find that plastic industry in the overall period and the bull market, and electrical machinery and steel industries in the bull markets, the current and lagged comprehensive sentiment indicator have a positive and significant to the industrial returns. It reveals that the comprehensive sentiment indicators are good indicators in these three industries. They can predict their movements by observing sentiment indicators. It also shows that sentiment have a continuation effect in these three industries, which is enough to affect the near-term future returns.

The current comprehensive sentiment indicator of the gas and electricity industry during the overall period and the bull market have no significant impact on the returns, while the lagged comprehensive sentiment indicators are positive and significant, indicating that the comprehensive sentiment indicator can be regarded as a leading indicator in the gas and electricity industry. It is suitable to use the sentiment indicators to predict their returns. Therefore, if the investor's sentiment is high, the current returns were not be reflected immediately. Instead, we will see the effects of sentiment in the next time.

In the neutral market, the current comprehensive sentiment indicator of the food and optoelectronic industries are positive, while the lagged comprehensive sentiment indicators are negative. It means that there is no positive continuation effect for these two industries. The stock prices will return to the expected price level in the near-term future. Therefore, if assets are deployed in these two industries, the timing of entry should be carefully evaluated.

In the bear market, the current comprehensive sentiment indicator of the optoelectronic, information service, shipping, and tourism industries are not significant, while the lagged comprehensive sentiment indicators are negative and

significant effects on returns, indicating that the sentiment indicators can be regarded as the reverse leading indicator in these four industries. Therefore, if you want to deploy assets in these four industries, you should be able to conduct near-term future investment operations by observing investor sentiment through a reverse operation strategy. In addition, the current and lagged comprehensive sentiment indicator of the electronic parts and components industry have a negative and significant to the industrial returns, indicating that the returns will be affected by sentiment, and this effect has a continuation effect.

5. Conclusion

In the past, the empirical results of the investor's sentiment on the returns are not the same. This study analyzed the impact of investor sentiment on the returns in a more comprehensive way, by the method of dividing the market and using the principal component analysis. We combine seven sentiment proxy variables into a comprehensive indicator to explore the impact of investor sentiment under different industries. The results revealed that nearly 83% of the industries in the bull and neutral markets are affected by the investor's sentiment; most industries in the bull market have a more significant impact than the overall period, the neutral, and the bear markets. It shows that when the market shows an upward trend, investors are generally confident about the future prospects, so they are more willing to invest funds in the stock market, and hope that they can make profits by this upward trend. When investors invest in the stock market and produce a bandwagon effect, it is easy to raise the stock price and cause the stock market to generate abnormal returns, which in turn makes the stock price deviate from the reasonable state.

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