Analysis of the Influence of Investor Sentiment on Enterprise Investment Redundancy

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Abstract—Based on the relevant panel data of Listed Companies in China's A-share market from 2010 to 2021, this paper studies the impact of investors' irrational emotions on enterprise investment redundancy and its mechanism. The empirical results show that under the control of time fixed effect and industry fixed effect, investors' irrational emotions have a significant positive impact on enterprise investment redundancy. Further research results show that from the perspective of enterprise organization form, the investment redundancy of state-owned enterprises is not significantly affected by investor sentiment, while the investment redundancy of non-state-owned enterprises is significantly positively affected by irrational investor sentiment.

Keywords: Investor sentiment, Enterprise investment redundancy, Principal component analysis, Panel regression

1.   Introduction

The research of Lee, Shleifer & Thaler [1] shows that investor sentiment will lead to cognitive bias, because investors are not completely rational actors, so their investment decisions are not optimal; Brown, Christensen & Elliott [2] proposed that investor sentiment is defined in behavioural finance theory as "the systematic deviation between the subjective expectation of investors on the future performance of the company and the basic value of the company"; The empirical research of Polk & Sapienza [3] shows that when the investor's mood changes, rational enterprise managers will adjust the investment arrangement to meet the investor's mood, thus discovering another important mechanism of investor's mood affecting enterprise investment - "rational catering channel"; Other scholars have studied the impact of investor sentiment on earnings management and the risk of stock price collapse [4] [5].

Due to the complexity of the market, a single index can not represent investor sentiment very well. Therefore, this paper still refers to the four classical emotion proxy indexes of the Baker & Wurgler model [6] and constructs a comprehensive index to measure investor sentiment through principal component analysis. Considering that the constructed comprehensive index of investor sentiment includes both rational and irrational factors, we refer to Richardson's (2006) investment expectation residual model to conduct panel regression with each financial index representing the real enterprise performance and separate the irrational part from the comprehensive index through the regression residual, which is used as the explanatory variable of the study. After that, considering the nine representative control variables, we analyze whether

irrational investor sentiment has a significant impact on enterprise investment redundancy and its impact direction.

2. Research Design

2.1 Data

This paper uses the financial data terminal of Choice to obtain the relevant panel data from 2010 to 2021. the data were preliminarily processed by eliminating the financial listed companies and the abnormal samples that were treated by ST and ST* during the sample period. After removing the missing values and outliers, 7132 effective annual observations were left for our study.

2.2 Construction of regression model

According to the main purpose of this paper, we establish the following model 1:

$$I\_over_{i,t} = \beta_0 + \beta_1 Senti_{t-1} + \gamma \times ControlVariable_{i,t-1} + \mu_k \sum_{k=1}^{m} Ind_k + \lambda_l \sum_{l=1}^{n} Year_l + \varepsilon_{i,t} \quad (1)$$

Where $I\_over_{i,t}$ refers to the redundancy of enterprise investment. After panel regression of many variables representing investment information, the regression residual is greater than 0 in all panel data sets; $Senti_{t-1}$ represents a comprehensive emotion index, which is composed of four proxy emotion indexes after dimension reduction and excluding the rational part contained therein; $ControlVariable_{i,t-1}$ represents a series of selected control variables, and industry (*Ind*) and time (*Year*) factors are also considered.

Through descriptive statistics, correlation tests, and panel data regression analysis based on the above models, this paper explores the phenomenon of investor irrational emotion and enterprise investment redundancy in China's A-share market, as well as their interaction and interaction mechanism.

2.3 Variable definitions

2.3.1 Dependent Variable

Firstly, this paper uses the following formula to measure the investment level:

$$I_{i,t} = (CP_{i,t} - NTR_{i,t})/ TAB_{i,t} \quad (2)$$

CP represents cash paid for the purchase and construction of fixed assets, intangible assets and other long-term assets; *NTR* represents pure cash recovered from the disposal of fixed assets, intangible assets and other long-term assets; *TAB* represents the total assets at the beginning of the sample year.

Secondly, this paper uses model 3 established by Yulian Zhang and others for reference to measure enterprise investment expenditure:

$$I_{i,t} = \alpha + \beta_1 Growth_{i,t-1} + \beta_2 LEV_{i,t-1} + \beta_3 CF_{i,t-1} + \beta_4 Age_{i,t-1} + \beta_5 A_{i,t-1} + \beta_6 ROA_{i,t-1} + \beta_7 I_{i,t-1} + \mu_k \sum_{k=1}^{m} Ind_k$$
$$+ \varepsilon_{i,t} \quad (3)$$

Among them, *Growth* represents the growth of the company, which is the year-on-year growth of operating revenue; *LEV* represents the corporate debt liability ratio, which is the ratio of total liabilities to total assets; *CF* means cash flow from the company's sales activities, which is the ratio of cash flows to the total assets of the company from the activity to the beginning of the year; *Age* refers to the age of the enterprise, which is the difference between each time point and date of the company; *A* represents the size of a company, and the calculation method is the logarithm of the total assets; *ROA* represents the total return of assets. Certain calculation methods are the square of net profit before profit, and tax divided by the sum of total assets at the beginning and end of the period. $\varepsilon_{i,t}$ is the residual term, the residual greater than 0 indicates the investment redundancy *I_over*, less than 0 means insufficient *I_under*, and *I_over* is our final explanatory variable.

2.3.2 Explanatory Variable

Four proxy indicators *BM*, *Tobin Q*, *Ri* and *Turnover* are selected for preliminary construction of a comprehensive investor emotion index, referring to the classic emotional proxy index of the B&W model. Here, *BM* represents the book ratio of the stock market value, and the calculation method is to take the reciprocal of *PB*. *Tobin Q* represents a book on the market share of assets, the calculation method $(MVE + PS + DEBT) / TA$. Here, *MVE* represents the value of the circulating stock market of the company, *PS* represents the value of the preferred stock, *DEBT* represents the total liabilities, and *TA* represents the total value of the company's total assets. In addition, *Ri* represents the historical monthly return rate, Turnover represents the average annual daily Turnover rate. Except that *Ri* is the monthly frequency data, other proxy indicators are the annual data of the calendar day. After that, the first four principal components were selected from the four emotion proxy indicators by the PCA dimension reduction method, and the percentage of variance contribution rate of each principal component in the cumulative contrast contribution rate was taken as the weight to synthesize the emotion comprehensive indicators ($E_{i,t}$).

Since the above proxy indicators usually also include the company's basic information and investment opportunity information, the following model 4 is constructed by referring to the research of Goyal & Yamada, etc., and selecting some factors that can reflect the company's basic information and investment opportunities information, such as *Growth, ROE, Return, LEV, A, CF, GPR* and *TAT*:

$$E_{i,t} = \alpha + \beta_1 Growth_{i,t} + \beta_2 ROE_{i,t} + \beta_3 Return_{i,t} + \beta_4 LEV_{i,t} + \beta_5 A_{i,t} + \beta_6 CF_{i,t} + \beta_7 GPR_{i,t} + \beta_8 TAT_{i,t} + \varepsilon_{i,t} \quad (4)$$

Where, *ROE* represents the return on net assets; *Return* represents the stock return, which is the annual increase or decrease of the stock; *GPR* represents the gross profit rate of sales, which reflects the profitability of the enterprise; *TAT* refers to the total asset turnover rate, which is used to reflect the operating capacity of the enterprise. See the above for the explanation of the other four variables of *Growth*, *LEV*, *A* and *CF*.

Panel regression was conducted between the above 8 variables and the preliminarily constructed sentiment index ($E_{i,t}$) to eliminate the rational factors contained in the sentiment index and only retain the irrational investor sentiment part *Senti* ($\varepsilon_{i,t}$), and ultimately constitute a comprehensive index of investors' irrational emotions.

2.3.3 Control Variable

In this paper, the difficulty of obtaining data and the adequacy and repeatability of information contained in the indicators are integrated. At the same time, considering the impact of the indicators on the investment level, nine indicators (Table 1) are selected as control variables and added to the established model 1. Finally, investment efficiency is measured together with the comprehensive indicators of irrational investor sentiment.

Table 1. Specific Description of Control Variables

Variable Name	Symbol of Variable	Definition
The Enterprise Scale	A	Ln (total assets)
Financial leverage	LEV	Asset-liability ratio
Cash Flow from Operations	CF	The ratio of cash flow from operating activities to total assets at the beginning of the year
Management Stock Ownership	MGR	Executive ownership ratio
Fixed Assets	FA	The ratio of fixed assets to total assets at the beginning of the year
Average Return on Total Assets	ROA	Net profit before interest and tax*2/total assets at the beginning and end of the period
Book to Market	BM	Book value of all assets/asset value
Enterprise Growth	Growth	Year-on-year growth in operating revenue
Firm Age	Age	The corresponding date-date of listing of the Company

In addition, during the regression analysis, this paper also added industry dummy variables and time dummy variables (Table 2) to control the impact of industry and list time differences.

Table 2. Specific Description of Dummy Variables

Variable Name	Symbol of Variable	Definition
Industry Dummy	Ind	Use 1 for the current industry and 0 for other industries
Time Dummy	Year	Use 1 for the current time point and 0 for all other time points

3. Empirical Results and analysis

3.1 Descriptive statistics

The descriptive statistical results of the main variable (Table 3) indicate that the highest value is 43.396 from the viewpoint of an investment redundant variable, while the lowest value is close to 0; From the perspective of investors' irrational feelings, the average value is 0.0002 and the standard deviation is 0.118, reflecting a clear difference in the irrational changes in market investors.

Table 3. Descriptive Statistics Analysis

count=7132	senti	I_over	A	LEV	ROA	CF	Growth	FA	BM	MGR	Age
mean	0.0002	0.078	9.728	0.428	0.061	6.610	16.803	27.624	0.436	18.852	10.569
std	0.118	0.532	0.604	0.206	0.111	29.517	126.221	54.352	0.289	22.192	7.468
min	-1.537	0.000	7.019	-0.195	-0.794	-177.137	-91.834	0.003	-0.375	0	1
25%	-0.067	0.012	9.285	0.263	0.032	1.659	-0.438	11.846	0.227	0.098	3.885
50%	-0.010	0.034	9.636	0.427	0.056	5.945	9.236	24.208	0.369	7.100	8.673
75%	0.054	0.085	10.072	0.582	0.090	10.676	24.668	37.663	0.570	36.620	16.573
max	3.108	43.396	12.437	1.280	7.108	2159.996	8748.366	3089.016	2.291	100	30.055

3.2 Correlation analysis

The following Table 4 shows the correlation coefficients between the comprehensive indicators of investment level and irrational investor sentiment and all control variables:

Table 4. Relative Coefficient

	I	senti	MGR	A	Growth	FA	LEV	ROA	CF	BM	Age
I	1										
senti	0.301	1									
MGR	0.007	0.012	1								
A	-0.079	-0.033	-0.279	1							
Growth	-0.006	0.010	0.021	-0.003	1						
FA	0.057	-0.019	-0.024	0.014	0.010	1					
LEV	-0.042	-0.015	-0.239	0.588	0.036	0.012	1				
ROA	0.223	0.260	0.031	-0.027	0.037	0.065	-0.175	1			
CF	0.058	-0.007	-0.006	0.001	0.025	0.830	-0.059	0.129	1		
BM	-0.032	-0.184	-0.161	0.476	-0.064	0.008	0.237	-0.157	-0.051	1	
Age	-0.016	-0.015	-0.528	0.474	-0.005	0.021	0.390	-0.066	-0.003	0.301	1

The correlation analysis between variables results shows that there is no significant multicollinearity between each variable. Thus all the control variables are retained. In addition, it also indicates that there is a significant positive correlation between irrational investor sentiment and enterprise investment redundancy.

3.3 Panel data regression analysis

To study the relationship between irrational investor sentiment and enterprise investment redundancy, the regression results of model 1 are analyzed as follows (Table 5):

Table 5. Summary of Regression Results for Hypothesis Testing

	Whole Sample		SOE	NSOE
	without Control Variables	with Control Variables	with Control Variables	with Control Variables
const	0.123**	1.586***	0.015*	2.540***
senti	1.364***	0.624***	-0.017**	0.687***
MGR		0.000*	0.000*	0.000*
A		-0.220***	0.007***	-0.323***
Growth		0.000***	0.000*	0.000***
FA		0.001***	0.000*	0.001***
LEV		0.474***	0.012**	0.574***
ROA		3.646***	-0.192***	4.024***
CF		-0.002***	0.001***	-0.002***
BM		0.342***	-0.035***	0.522***
Age		0.003***	0.000*	0.006***
Time Effects	Yes	Yes	Yes	Yes
Industry Effects	Yes	Yes	Yes	Yes
No.Observations	7132	7132	2739	4362
R-squared	0.1018	0.6046	0.0630	0.6831

Note: the data in the table are the regression coefficients of each variable, ***, ** and * respectively indicating that they are significant at the significance level of 1%, 5% and 10%.

The results of regression analysis show that after including the time fixed effect and the industry fixed effect, whether a single regression or a regression after adding control variables, irrational investor sentiment always has a significant positive impact on enterprise over investment. The regression coefficient was 1.364 when regressing alone; after adding control variables, the regression coefficient was 0.624.

In addition, by analyzing the values of various variables in the regression model, the author draws the following conclusion: the scale of Listed Companies in China's A-share market is positively related to over-investment, which may be because companies with higher total assets have better investment opportunities or are more prone to impulsive investment. The proportion

of management shareholding has no significant impact on the company's investment level. The proportion of fixed assets and the asset-liability ratio is significantly and positively related to the investment redundancy of the enterprise next year. This may be because the higher the proportion of fixed assets or the lower the leverage risk, the less the company worries about investment, which is more likely to lead to investment redundancy. It is easy to understand that there is a very significant positive correlation between the total return on assets and the excess of the enterprise's investment. The higher the return on assets, the enterprise will have more capital to expand reproduction in the next year, thus further stimulating the investment behaviour of the enterprise. The proportion of cash flow from operating activities in total assets at the beginning of the year is positively related to the redundancy of enterprise investment. This may be because the higher the proportion of cash flow available to the enterprise, the easier it is to make an excessive investment. There is a significant positive correlation between the book value ratio and enterprise investment redundancy, which may be due to the higher investment demand of the company with higher potential investment capacity, resulting in excessive investment. There is also a positive correlation between the number of listed days and the expected investment redundancy of the company to a certain extent. This may be because the shorter the listed time of the company, the fewer good investment opportunities it will encounter, and the lower the possibility of overinvestment.

Based on the above results, this paper further tests state-owned enterprises and non-state-owned enterprises. The result shows that the investment behaviour of state-owned enterprises is not sensitive to investor sentiment, while the correlation coefficient between non-state-owned enterprises and investor sentiment is 0.687, showing a significant positive correlation. It shows that under the Chinese market economy system, the irrational emotions of market investors will significantly encourage non-state-owned enterprises to make excessive investments, while the executives of state-owned enterprises are unlikely to make excessive investment decisions in the face of irrational emotions.

4.   Conclusions

Based on the related panel data of Listed Companies in China's A-share market from 2010 to 2021, this paper conducts an empirical study on the relationship between investor sentiment and enterprise investment redundancy. The empirical research results suggest that, under the premise of controlling the time fixed effect and the industry fixed effect, there is a significant positive correlation between investor sentiment and the investment redundancy of Listed Companies in China, indicating that the higher the irrational investor sentiment, the more likely it is to cause enterprise investment redundancy. After that, all samples were classified according to the organization of the enterprise. Further research results show that the investment redundancy of state-owned enterprises is not significantly affected by investor sentiment, while the investment redundancy of non-state-owned enterprises is significantly positively affected by investor sentiment. The possible reasons are that state-owned enterprises are more competitive and have a stronger ability to resist risks since they often have access to greater policy support and credit support than non-state-owned enterprises. In addition, under the condition of insufficient salary incentives, the enterprise management may not be willing to carry out investment activities with too much uncertainty, and it is not easy to be confused by irrational investment and make a blind investment. For non-state-owned enterprises, the principal-agent problem is relatively light, and

the salary incentive is also sufficient. Under the fierce market competition, the irrational emotions of investors tend to lead to the blind self-confidence of the management, which leads to the management is more willing to take risks to increase investment and relying on continuous investment to win a better market competitive position.

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