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Herding behavior levels in the Chinese stock market: A temporal comparison for the past ten years

In Partial Fulfillment of the Requirements

for the Bachelor of Science in Finance

by

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May, 2020

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December, 2019

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ABSTRACT

Herding behavior describes that investors follow others' investing patterns or external information rather than use their own rationalities. It is a crucial part of behavioral finance and could lead to equity market breakdown or even serious financial crises. This study aims to compare herding behavior levels in the Chinese stock market from 2007 to 2017. It employs the cross-sectional standard deviation (CSSD) and cross- sectional absolute deviation (CSAD) to quantify the herding behavior degrees and construct timeframes including pre-crisis, during crisis and post-crisis to draw a temporal comparison for past ten years. Empirical results suggest that generally, herding is more pronounced after the financial crisis than that before or during the financial crisis and investing patterns are increasingly diversified. The study also investigates the correlation between the market return and herding behavior levels and reveals the herding extinctions of particular industries.

Keywords: Herding Behavior, Behavior Finance, CSSD, CSAD, Financial Crisis, Efficient Market Theory, EMH, Chinese Stock Market, Shanghai Exchange Market, Investor Decision Making

Acknowledgements: I would like to thank my thesis advisors I-Wei Cheng for his advice and support throughout the thesis writing process. I would also like to thank other faculty and friends for their helpful guidance.

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Introduction:

In a stock market, herding behavior describes that investors blindly follow the authority or other investors rather than using their rationalities. This behavior is an important cause of the market inefficiency and accelerates the collapse of the stock market especially during financial crisis periods. The occurrence and variance of herding behaviors are relevant to complex market environments and financial crises generally represent extreme and turbulent markets. Therefore, to measure the change of herding behaviors in the Chinese stock market, the paper regards the financial crisis in 2008 as the milestone and defines three sub-periods following Vo and Phan (2019): (1) The period before the financial crisis (BFC); (2) The period of the financial crisis (FC);(3) The period after the crisis (AFC). According to the relevant study in the Vietnam market (Vo, Xuan Vinh; Phan, Dang Bao Anh, 2019) and the background in the Chinese stock market, I hypothesize that herding behavior is stronger after the financial crisis than before the financial crisis or during the financial crisis.

Measuring the extent of herding behavior is mainly based on Cross-Sectional Standard Deviation (CSSD) Model. (W.G. & R.D., 1995) According to the efficiency theory, investors' concerns and sensitivities to stocks vary from person to person. Therefore, investors will disperse in purchasing stocks and the stock returns will deviate significantly from the market return. However, on the condition of the turbulent market, investors tend to exhibit herd behavior imitating others irrationally. In this case, the divergence between individual stock returns and the market returns should be small. (Ramadan, 2015) The data are collected from all firms listed on the Shanghai

Exchange Market over the period from 2007 to 2017 and they consist of individual stocks and the Shanghai Exchange Index as a proxy for market returns.

To compare the herd behavior changes in China, we could have an insight into Chinese investors' mentality changes and provide support to increase market efficiency. Current studies have thoroughly examined the existence of herding behavior in different countries, but the studies comparing the extents of national herding behavior in different periods are relatively scarce. This comparison enables us to understand the circumstance of herding behavior in the Chinese stock market, raise investors' awareness of rational investing, and offer suggestions to build a healthy stock market.

The whole background in the Chinese stock market has greatly changed due to the emerging of the Internet and the rapid development of the Chinese equity market. For the past ten years, the Chinese stock market also suffers a serious financial crisis. Since the study has shown that herding behavior is pronounced under the financial crisis or less developed stock market, I hypnotize that herding is stronger after the financial crisis than before or during the financial crisis.

Literature Review

The Essential Features of Herding Behavior

The prevalence of studying herding behavior in the stock market origins from researching the impact of investors' sentiment on future stock prices. Researchers find that investors' sentiment influences the stock prices asymmetrically and significantly and it becomes more important to evaluate stocks especially when there is a highly uncertain market. (Zhu & Niu, 2016) With more paper emphasizing the role of investors' psychology in the stock markets, an increasing number of researches shed a light on behavior finance particularly herding behavior in financial markets. Herding behavior describes that investors tend to imitate others' investing patterns rather than use their rationalities or personal information. (Chen, Wu& Huang, 2017) Generally, herding behavior could be divided into two branches: rational and irrational herding behavior. Rational herding behavior refers to investors react similarly to the same external information while irrational herding behavior is investors' blindly following other investors without rational analysis. (Chen, Wu& Huang, 2017) Both of the behaviors reveal that investors' psychology influences their decision making and reflects the price volatility in the financial markets.

There are multifarious approaches to measure and examine herding behavior. For example, Christie and Huang (1995) create a cross-sectional standard deviation method (CSSD) to test the presence of herding behavior in the equity market. The mechanism behind it is that dispersions, quantified by cross-sectional standard deviation, would be

relatively lower when herding behavior is prevalent. The paper's result that returns accords with the herding behavior confirms the validity of the CSSD method in the equity market. Later, Chang et al. amplify the capital asset pricing model (CAPM) and propose a cross-sectional absolute deviation method (CSAD) to evaluate stock returns. According to the CAPM model which applies to the rational market, CSAD and market returns are supposed to exhibit a linear and positive relationship. In contrast, the negative relationship between these two variables supports the existence of an irrational market, particularly herding behavior. Through employing the CSAD method, Chang et al. (2000) find the occurrence of herding behavior in both South Korea and Taiwan. From then on, the CSSD method and CSAD method are two widely used methodologies for investigating the herding behavior in the financial markets. For instance, researchers demonstrate the existence of herding behavior in Vietnam from 2005 to 2015. (Vo & Phan, 2017) Also applying these two approaches, investigators compare the degree of herding behavior between the U.S. and the U.K. and find that U.S. investors are more easily influence by fundamentals and non-fundamentals while there is little herding behavior in the U.K. when there are only fundamentals. (C., Wu, & I., 2015) In addition to regional disparity, herding behavior also exhibits time varieties since different market conditions. The study has shown that herding behavior is more pronounced when there is a downside market than an upside market. (Vo & Phan, 2019)

The external market environment affects Investors' psychology and investment behavior. As for the external factors causing herding behavior, current studies have investigated economic events and non-economic events. In terms of non-economic events, Chen

(2018) chooses five representative political events and disaster events to test if those factors would influence the herding behavior and concludes that they would not. In contrast, economic events attract more researchers' attention and studies have shown that both of the increase in the interest rate and the depreciation of domestic currency would trigger and aggravate the herding behavior in a country. (Gong & Dai, 2017)

The Herding Behavior in China

The empirical results show that pronounced herding behavior exists in the Chinese stock market. (Zhang & Zhen, 2016) Furthermore, the current study shows that herding is stronger in the emerging Chinese market (Chen, Wu& Huang, 2017). However, this result contradicts the former study in the Vietnam market that herding behavior is more pronounced in the downside market. Therefore, more studies are in need to investigate and testify the herding behavior trends in various market conditions. Furthermore, Chen et al. (2017) emphasize that herding behavior in China is significantly obvious during financial crises. As representative events in the financial market, financial crises are of high research value and could function as milestones to make a temporal comparison of herding behavior in the stock markets.

The herding behavior in China shares the characteristics of that in other countries but also has its particularity because of the Chinese distinct background. On the one hand, with the development of social media, the interaction among Chinese investors becomes more frequent and convenient. For instance, the appearance of the Chinese social networking website Xueqiu allows Chinese investors to communicate and exchange their comments

on stock investment freely, aggregating the herding behavior in China. (Guo, Sun, & Qian, 2017) On the other hand, China has its special national conditions and economic systems. The market is a relatively lack of transparency, which is the primary factor causing herding behavior. (Vo& Phan 2019) Also, the Chinese market is relatively more influenced by the government policy and empirical results have shown that both the government intervention and the informational environment have an impact on the herding behavior in China. (Chong, Liu, & Zhu, 2017) Consequently, studying Chinese herding behavior trends in recent years is of significance and the financial crisis is a critical event to serve as a time division.

Methodology

Efficient Market Theory (EMH)

The efficient market theory fundamentally gives an explanation of how the equity market operates. It hypothesizes that stock prices reflect all the market external information exactly and correctly. According to the academics, the stock market has three sub-forms including weak-form efficient market, semi-strong form efficient market, and strong-form efficient market. Weak form efficient market theory assumes that stock prices only reflect historical information. In this way, investors are not able to exert technical analysis or investigate stocks' historical prices to predict stocks' future prices. The semi-strong form efficient market theory assumes that stock prices reflect both the historical and public information. Under this circumstance, investors cannot use fundamental analysis or study corporations' financial information such as financial statements to make a better investment. Last but not least, strong form efficient market theory argues that prices reflect historical information, public information, and insider information, which means that investors cannot use any of these pieces of information to help them gain profit in the equity market.

Herding is an investors' irrational behavior and a fundamental cause of the inefficient market, which is perfectly the opposite side of the efficient market. In an inefficient market, stock prices do not reflect their own correct and intrinsic value and thus cause deadweight loss. Through herding, investors use the passive pattern to make an investment such as mutual funds and exchange-traded funds. This behavior seems to

decrease their possibilities of winning market performance and gaining a substantial amount of money. In terms of their interests, investors are supposed to eliminate herding behavior intentionally.

Method Used

There are three dominant approaches to research the herding behavior. Researchers use various methods because they possess different definitions of herding behavior. The first way is built by Lakonishok, Shleifer, and Vishny in 1992, that is, the LSV approach. The LSV approach defines the herding as a phenomenon that a group of investors buys and sells a certain kind of stocks simultaneously, which is in contrast to individual investors who invest independently. By using the LSV method, Chinese investors investigate the herding levels in the Chinese security market and support the existence of herding in China. (Zhang & Zhen, 2016) LSV method is of great value in analyzing the herding behavior in the whole market but it also has some drawbacks. Firstly, this approach does not provide information about the fundamental elements of herding behavior. Furthermore, the LSV method will lead to some statistical biases if the market prohibits or limits the short sell. (Zhang & Zhen, 2016)

Another method is the cross-sectional standard deviation of the returns (CSSD) method. It was created by Christie and Huang in 1995. Later Chang and so on find that this approach has the possibility to underestimate the herding behavior, so they make up with a more sensitive scale to measure the herding behavior, which is the cross-sectional

absolute deviation of returns (CSAD) method, an approach follows the framework of CAPM model.

To begin with, this paper employs the cross-sectional standard deviation (CSSD) method to measure the herding behavior in the Chinese stock market. This method is based on the efficiency theory mentioned above. If investors are rational enough, they will make the investment by using their concerns and their sensitivities and it varies from person to person. However, investors have a tendency to exhibit herding behavior when it comes to the volatile market. Under the circumstance, the difference between individual stock returns and the market returns should be small. (Ramadan, 2015) The larger the CSSD value is, the less pronounced the herding behavior is. The equation of CSSD is as follows:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N} (R_{i,t} - R_{m,t})^2}{(N-1)}}$$

where Ri, t is the observed individual stock return of firm i at time t and Rm, t is the cross-sectional average of N stock returns in the portfolio at time t. N is the number of individual stocks in the whole sample.

Furthermore, the paper uses the cross-sectional absolute deviation method (CSAD)as the alternative way to measure the herding. This method was developed by Chang and so on in 2000. They define CSAD ad follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N} |R_{i,t} - R_{m,t}|$$

where Ri, t is the observed individual stock return of firm i at time t and Rm, t is the cross-sectional average of N stock returns in the portfolio at time t. N is the number of individual stocks in the whole sample.

Both of the approaches employ the individual returns and market returns as variables, but the measuring equation is slightly different. They tend to confirm with each other and provide a more accurate view of herding behavior.

Data Collection

CSMAR provides the latest news, abundant data and professional analysis in the business field distinctly for China. The paper gets access to CSMAR by employing the intrinsic resource provided by WKU online library.

The data are collected from 48 most representative firms listed on the Shanghai Exchange Market covering the period from 2007.1.4. to 2017.5.26. They consist of 48 individual stocks and market return of the Shanghai security exchange composite index as the proxy for the market returns and the number of daily observations is 2477 in total.

To make a temporal comparison over the past ten years, the study creates the timeframe including three sub-periods as follows: (1) The period before the financial crisis (BFC)

from 2007. (2) The period of the financial crisis (FC) includes 2008, and (3) the period after the crisis (AFC) covers from 2009 to 2017.

The data are retrieved from the major global provider of financial information- CSMAR. It includes the historic price data and firms listed from 2007 to 2017. The individual stocks and daily market return are both retrieved from CSMAR.

Results

Daily Herding Behavior Changes

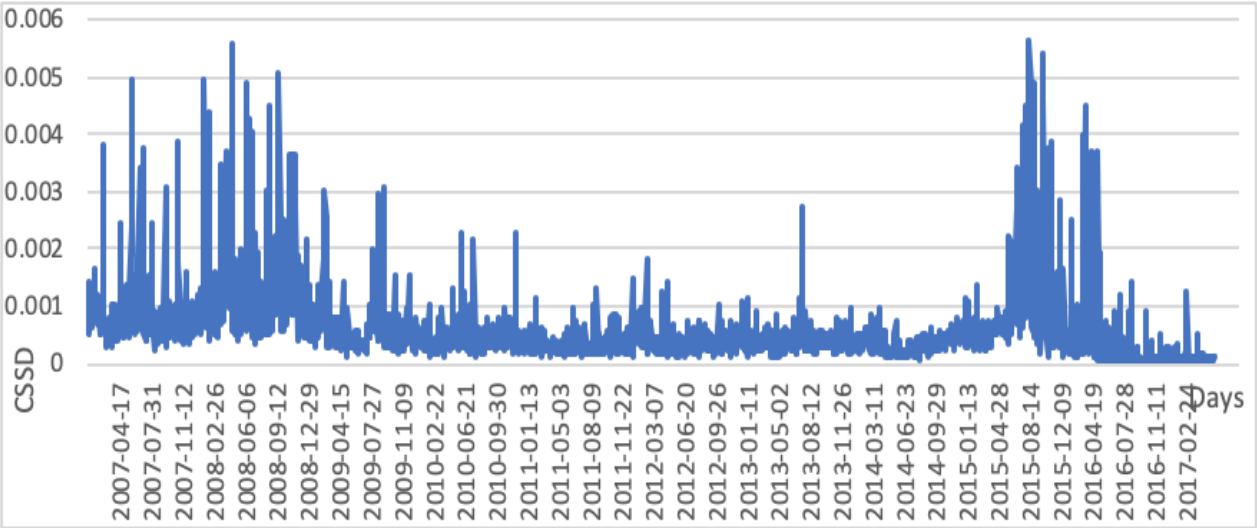
	Mean	Std. Dev	Min	Max	Obs.
Full sample period					
CSSDt	0.0060	0.0066	0.0002	0.0565	2476
CSADt	0.2473	0.1376	0.0280	1.0056	2476
BFC period					
CSSDt	0.0100	0.0076	0.0027	0.0142	116
CSADt	0.3429	0.1276	0.3555	0.9126	116
FC period					
CSSDt	0.0114	0.0087	0.0026	0.0559	369
CSADt	0.3673	0.1486	0.1867	0.0988	369
AFC period					
CSSDt	0.0048	0.0055	0.0002	0.0565	1991
CSADt	0.2195	0.1206	0.0280	1.0056	1991

Table 1- Descriptive Data of CSSD and CSAD In Three Sub-Periods

The table shows the descriptive data of CSSD and CSAD including four sub-periods: full sample period, before financial crisis period (BFC), financial crisis period (FC) and after financial crisis period (AFC). In the table, mean indicates average CSSD, Std. Dev represents standard deviation, Min and Max are minimal value and maximal value. The

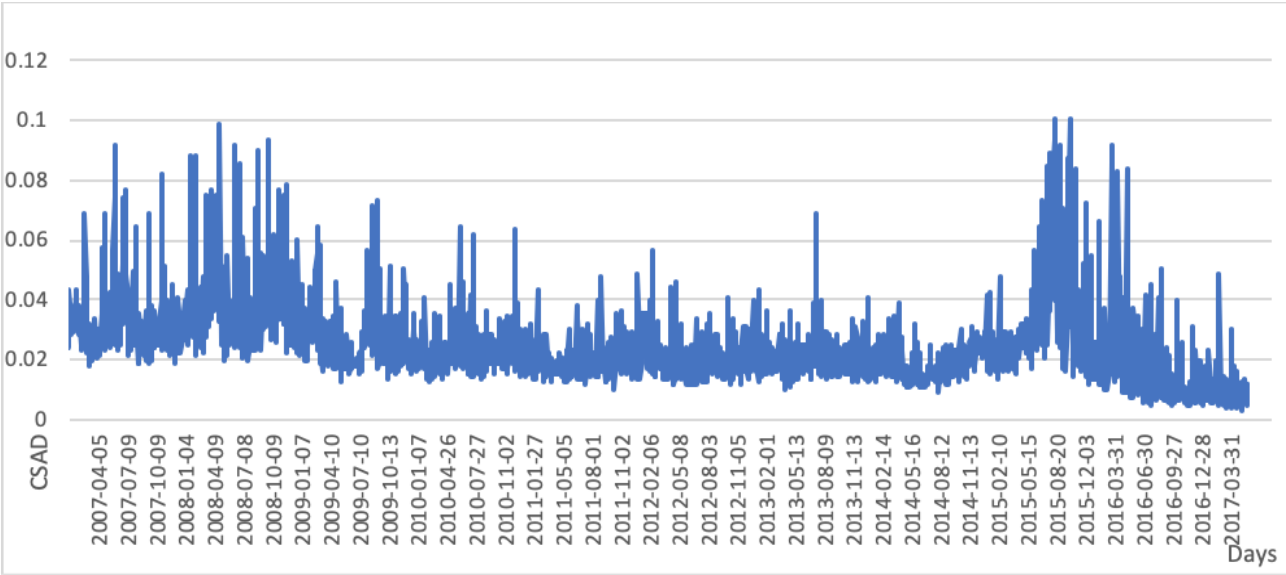
obs. is the observation value of trading periods from 2007 to 2017, which contains 2476 days in all.

According to the table, all of the mean values of these four periods are greater than zero, which means that returns in the individual stock and returns in the whole exchange market do not move at the same time. Moreover, the standard deviation from the BFC period to the AFC period is decreasing, showing that investing patters are less diversified recently. Furthermore, both the CSSD and CSAD values from the BFC period to the AFC period are decreasing, which reveals that herding behavior is getting more and more pronounced in the past ten years. Also, at the FC period, both of the CSAD and CSSD values come to the largest, which means the herding is least pronounced during the financial crisis.



Graph 1- Daily CSSD values changes in The Chinese Stock Market from 2007 to 2017

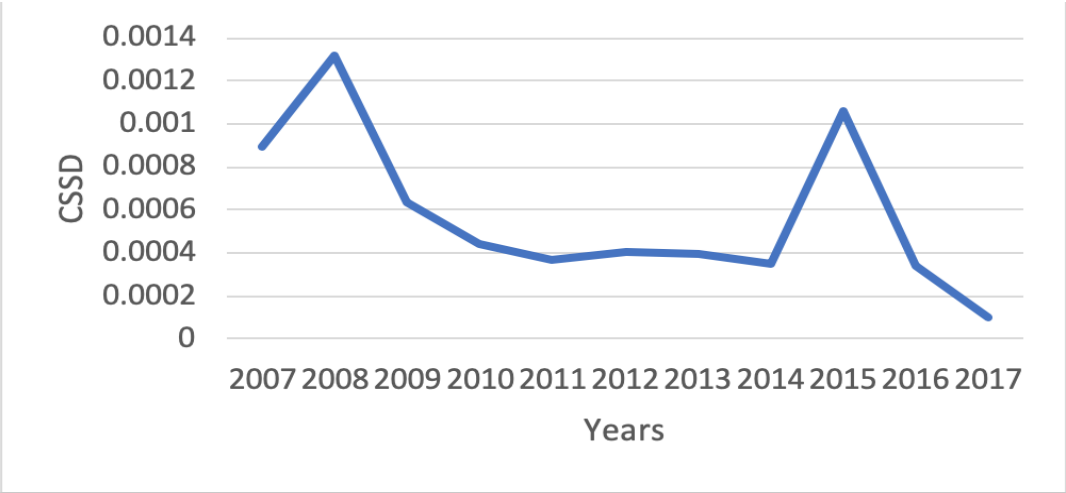
The graph shows the line diagram of CSSD value changes from 2007 to 2017. From this graph, we can conclude that generally, the herding behavior is getting more and more obvious. When it comes to the financial crisis, there is a peak of herding behavior levels. Also, herding comes to another peak around 2015. After the peak, heading will become more pronounced than before. From 2009 to 2014, the CSSD value maintains a relatively low level, which means the herding behavior is pronounced stably.



Graph 2- Daily CSAD values change in The Chinese Stock Market from 2007 to 2017

Through the CSAD method, the herding behavior changes are similar to the result using the CSSD method. From the graph above, we can have an overall review of the herding behavior in the past ten years. The graph of CSAD method confirms the former analysis of CSSD method because they have a similar fluctuation trend, which also confirms the hypothesis.

Annual Herding Behavior Changes



Graph 3- Annual CSSD and CSAD Value Changes in The Chinese Stock Market from 2007 to 2017

Compared with daily value graph, annually value paraph is considerably concise and better shows an overall trend in the Chinese equity market. The variance of the annual CSSD values not only shows the change of herding behavior in the Chinese stock market but also reveals a more profound result- the background transformation in the Chinese stock market. There are different reasons to explain the change of herding behavior in different time periods.

In 2007, the CSSD value maintains a relatively high value for the past ten years, indicating the less pronounced herding behavior in Chinese equity market. It can be explained that ten years ago, investors tended to use their own information and rationalities more often. Since the Chinese equity market was rapidly emerging and stocks were still a new concept for the many, a large number of potential investors had

not stepped into the equity market. The existing investors in the equity market usually had their own distinct information and sufficient expertise in the stocks. Under this circumstance, investors would not follow others' opinions when making an investment but use their own rationalities and judgment. Therefore, in the early period, herding behavior was not that obvious or strong.

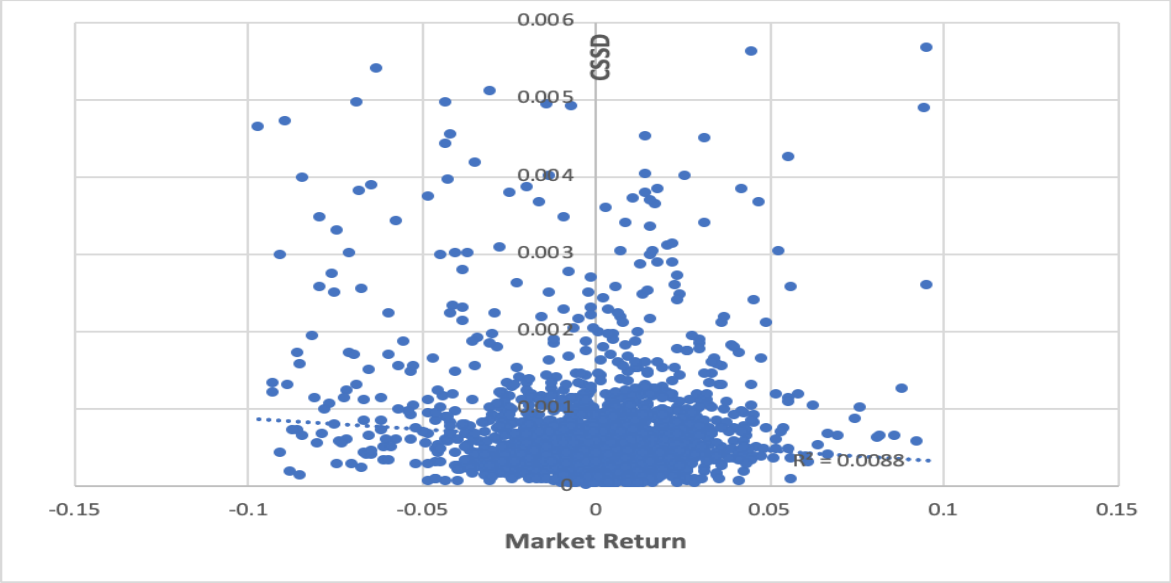
In 2008, the CSSD value comes to a peak, which means that herding behavior is least pronounced during the 2008 international financial crisis. With the development of Chinese equity market, more investors poured into the market. The main reason for naïve investors entering the market was the enormous profit and they attempted attain it through following the authority or other investors. Therefore, when it came to the financial crisis, investors gained considerably less profits than before, which discourages naïve investors' enthusiasm with the equity market. They decided to leave the market and it naturally decreases the herding behavior levels at that time.

According to the business cycle, the whole market starts to recover after a breakdown and investors enter the equity market again. From 2009 to 2014, with the number of investors increasing, herding behavior was pronounced again because most of the new investors were still irrational. Moreover, the herding was companied by the new situation of the Chinese equity market. On the one side, the mutual funds and ETFs grew unprecedentedly. With the prevalence of Alipay, plenty of investors tended to use the mobile payment and saved the majority of money in the bank account. This trend bled the popularity of a new investing pattern purchasing mutual funds. Since the fund has a lower

risk but a little bit higher returns than depositing, it is an investing pattern that attracts a lot of investors' attention. Those investors had less knowledge or even did not know how the market works, but they were willing to invest their capital in the funds. On the other side, rapid growing social networking boomed many investing websites. For example, Xueqiu was one of the most famous social networking websites in the financial field. It allowed investors to communicate about their judgment and information directly and conveniently. There was no doubt that those two aspects both contribute to herding behavior greatly. In 2014, the CSSD value became the lowest during the ten years, which shows that herding behavior peaked. The majority of investors who followed the information and authorities aggregated the collapse of the market. In 2015, the Chinese stock market suffered a domestic stock disaster and many stock prices shrunk dramatically. Chinese equity market repeated the phenomenon happened in 2008. As a result, many irrational investors chose to leave the market and herding behavior was relieved again.

Obviously, Chinese investors and government had not realized the seriousness of herding behavior. From 2016 to 2017, the herding behavior levels came back to the normal level. Also, the fast development of network determined to continue the scale of herding behavior. If they keep going that state, the collapse of Chinese stock market will reoccur soon.

Correlation Between Herding and Market Return



Graph 4- The Scatter Diagram Between CSSD and Market Return

The scatter diagram above shows a basic relationship between CSSD and market return in the Chinese equity market. It demonstrates that herding exhibits an asymmetry sensitivity to the market return. CSSD gather around the zero point, in other words, CSSD goes down when there is a lower market return. It points out that, when the market is less turbulent, investors are more likely to exhibit herding. When the Chinese stock market is volatile, investors tend to have irrational investing behavior more often when the market is upside instead of downside. As the trend line in the graph shows, there is a slightly positive relationship between herding and market return. That is, investors tend to follow others frequently when it comes to a bull market.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.145302315
R Square	0.021112763
Adjusted R Square	0.020708722
Standard Error	0.00088724
Observations	2476

ANOVA

	df	*SS*
Regression	1	4.20214E-05
Residual	2475	0.001948309
Total	2476	0.001990331

	Coefficients	*Standard Error*
Intercept	0	#N/A
0.002319	-0.00583202	0.000798225

MS	*F*	*Significance F*
4.20214E-05	53.3811105	3.68792E-13
7.87196E-07		

t Stat	*P-value*	*Lower 95%*
#N/A	#N/A	#N/A
-7.30623778	3.68749E-13	-0.007397277

Upper 95%	*Lower 95.0%*	*Upper 95.0%*
#N/A	#N/A	#N/A
-0.004266763	-0.007397277	-0.004266763

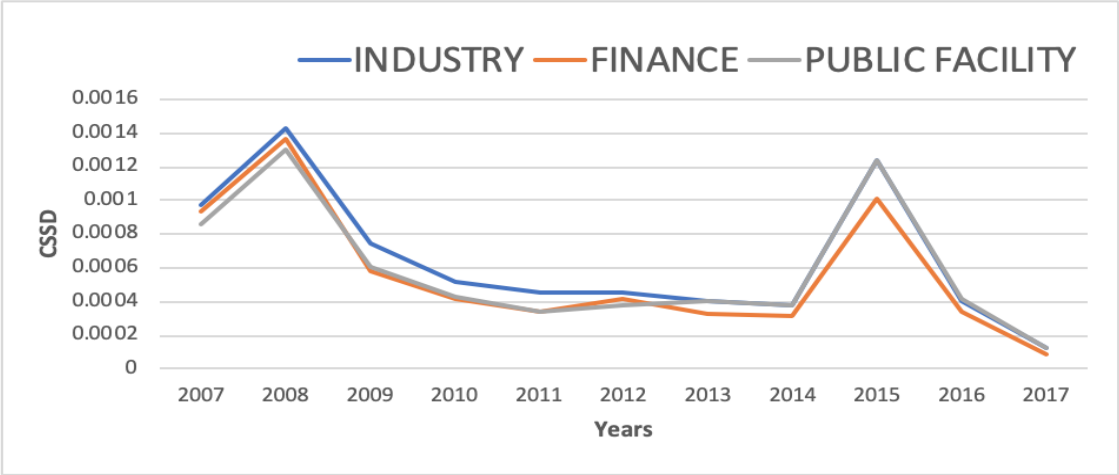
Table 2- The Regression Result between Market Return And Herding Behavior Level

The regression result shows a more precise relationship between the CSSD and the market returns for the past ten years. The multiple R is larger than zero, which means there is a positive relationship between CSSD and market returns. In other words, if the market return is larger, the herding behavior is less pronounced. Obviously, P value is

smaller than 0.05, which shows the highly significance of the correlation. Admittedly, the R square is quite small, but it is related to the small value of market return and CSSD. Therefore, R value will not diminish the significance of the study.

Herding Behavior Levels in Different Industries

To investigate whether herding levels are different for various kinds of industries, the study divides 48 individual stocks into three categories, which includes pure industry, financial industry and public facility. Those industries contain 16, 18 and 14 listed companies respectively. Then the paper calculates annual CSSD value for each type of industry.



Graph5- Annual CSSD Value Changes in Three Types of Industries.

Admittedly, it seems that there is no substantial distinction of CSSD values among three industries. Nevertheless, we can still sense the industrial difference and draw some conclusions. To begin with, the CSSD value of financial industry is always smallest among these industries, which means that people prefer to follow the authority or other

investors when they decide to invest on which financial institution such as bank or insurance company. Comparatively, investors have more sensitivity and personal stand when it comes to the pure industry. It could be explained that firms in pure industry is more diversified and closer to people's daily life, therefore, they are more familiar with those companies and possess distinct visions about it.

t-Test:

	Finance	*Industry*	*Public Utility*	*Market Return*
Mean	0.00055748	0.00064691	0.00058831	0.00134966
Variance	1.469E-07	1.6331E-07	1.4722E-07	5.7425E-06
Observations	11	11	11	11
Pearson Correlation	-0.0109374	0.02696207	0.04092496	
Hypothesized Mean Difference	0	0	0	
df	10	10	10	
t Stat	-1.0808026	-0.9633558	-1.0471906	
P(T<=t) one-tail	0.1525803	0.17904298	0.15983132	
t Critical one-tail	1.81246112	1.81246112	1.81246112	
P(T<=t) two-tail	0.3051606	0.35808596	0.31966263	
t Critical two-tail	2.22813885	2.22813885	2.22813885	

Table3- T-test results Between CSSD values and Market Returns

This research also investigates if there is a different correlation between particular industries and market return of Shanghai Exchange Stock Market. From this table, it is not hard to conclude that public utility has more obvious positive correlation with the market return in China. It means that when it comes to an upward market, investors tend to less exhibit herding in public utility industry. Furthermore, the table shows that financial industry is negatively related to the market return. In other words, when the market is going up, investors prefer to follow others and invest their capital in financial industry.

Conclusion

Investigating herding plays a significant role in market efficiency. This paper quantifies the herding behavior of Chinese equity market covering the period from 2007 to 2017. It employs two methods: cross-sectional standard deviation (CSSD) and cross-sectional absolute deviation (CSAD) and build a timeframe by setting financial crisis in 2008 as a milestone. The study shows that herding display differently in daily and annual scale under the condition of different markets. It indicates that generally herding is more pronounced after the financial crisis than before the financial crisis and during the financial crisis, which confirms the hypothesis. However, when combined the ever-changing background of Chinese stock market, herding level variances are much more complicated. Furthermore, the study reveals an asymmetry effect of market return on herding behavior changes, herding is more pronounced when there is a downside market. Also, the investigation of three industries proves the existence and propensity of herding. However, financial industry also displays herding in upward market.

Limitations and Contributions

Generally, the study has its own limitations and needs more advancements.

The first limitation is based on data collection. The data in the CSMAR are abundant. However, the listed companies are too vast to calculate one by one. Also, the number of listed companies varies from year to year. Therefore, the study only selects most

representative 48 companies as the sample. The number of companies is relatively small compared with the whole market so that it decreases the significance of the whole study.

There are many other minor limitations that need to be solved. For example, the time stone the author chooses, the financial crisis in 2008, is quite far away from now. Therefore, the time intervals in three sub-periods differs a lot. In this way, the observations before the financial crisis and that after the financial crisis differ so much that it is not fair to compare their standard deviations.

If other researchers are willing to do more studies on the Chinese stock market, they could investigate other stock markets such as the Shenzhen exchange market, which is another large equity market in China. Also, they could divide the firms according to their industries since different industries differ a lot in the market performance. Then the conclusion will be more accurate and provides more meaningful information.

Though the study has all the above-mentioned limitations, it is still of great implications. It is beneficial to academic researchers, Chinese investors, and the government. For the academic researchers, it provides an insight into Chinese investors' mentality changes and supports to emerging Chinese stock markets and increasing market efficiency. Current studies have thoroughly examined the existence of herding behavior in different countries, but the studies comparing the extents of national herding behavior in different periods are relatively scarce. In this way, it raises the awareness of researchers to shed a light on making the temporal comparison in other regions around the world.

For Chinese investors, it provides the knowledge and disadvantages of behavior finance in particular herding behavior in the equity market. Through data presented, they are able to have a brief view of the current and past conditions of the Chinese stock market, which helps to strengthen the consciousness of rational investing. For the government, the paper in some ways reveals the degree of market transparency and information symmetry. The government should make more policies to enhance it for domestic firms in order to build a healthy stock market. This will not create an equal investment circumstance but also attract more foreigner investments.

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