An empirical analysis of herd behavior in the Singapore stock market

by

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A research project submitted in partial fulfillment of

the requirements for the degree of Master of Finance

Saint Mary's University

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Date: August 30, 2013

Acknowledgements

I would like to thank my supervisor, Dr. Colin Dodds, for his guidance and constructive suggestions with this study. I would also like to thank Dr. Francis Boabang for his advice in approving my topic.

My grateful thanks are also extended to all instructors in the Master of Finance Program for their help while studying in the program. I would like to thank my parents and friends for their generous support and encouragement.

Abstract

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This paper examines herd behavior in the Singapore markets by using daily data from January 2002 to December 2012. Evidence of herd behavior is found in the Singapore market and is present in both the bull and bear markets, but it is more significant in the falling market. During periods of financial crisis, I find particularly strong evidence of herd behavior in the Singapore market. Among 10 industries, the impact of herd behavior on the financial industry is the most significant, and that on the health care and consumer services is relatively significant.

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Chapter 1: Introduction

1.1 Purpose of study

In recent years, researchers are more interested in investors' behavior because changes in people's behavior can affect stock prices. Behavioral finance incorporates psychology and herd behavior as most interesting concepts. Herding focuses on the relationship of different investors' action during trading transactions.

Human beings like to mimic other people, no matter whether it is rational or irrational. That may be because people believe that a crowd could not make wrong decisions. Also, if someone does not follow most people, he/she will be considered as an outcast and 'everybody' wants to be accepted by a group. So herd behavior appears as a result of social pressure.

Herd behavior seems perfectly rational when others have perfect information, but the irrational decision can result in errors, inefficiencies, and instabilities. Herd behavior may be a key factor to the disproportionate ups and downs in stock market prices caused by the fickle nature of herds (Devenow and Welch, 1996). Especially when all people believe that a stock is going to rise and everyone want to hold it, its price will be very high. These irrationalities in investment behavior violate the Efficient Market Hypothesis (EMH). Based on EMH, investors can estimate their expected return from the Capital Asset Pricing Model (CAPM), and prices reflect all possible information, so

all securities are priced correctly, Prosad et al. (2012). However, herd behavior breaks this balance. Due to irrational decision making, the herding effect on stock price movements can result in mispricing of stocks (Hwang and Salmon, 2004; Tan et al., 2008).

The Singapore market is a good example of a well-developed global financial market, and it is very sensitive to global market movements and actions of investors. So herd behavior is potentially significant. Therefore, this paper will focus on examining the herd behavior in the Singapore equity market. The results about presence or otherwise of herd behavior will be very helpful for studying stock behavior and offering information to policymakers about whether or not they should be concerned about the potential effects of herd behavior (Demirer and Kutan, 2006).

1.2 Background: herd behavior in financial markets

There is early evidence of herding in financial markets. There was the tulip mania in Holland in the 17th century, which was the first major financial bubble. Investors followed others and purchased tulips irrationally, leading their prices to be unexpectedly high before the inevitable crash. More recently in the 1980s, Japanese stock and real estate markets were overvalued. Once more they fell and have still not reached the historic highs of this period. Also, the media and telecom bubble that occurred from 1997 to 2000 caused a rapid rise in equity values in the Internet sector. The most recent

case of course is the big stock market crash in 2008 in the U.S., which sent via contagion effects to other international markets.

1.3 Outline of the paper

This current chapter is a brief introduction of the research purpose and it outlines the herd behavior in financial markets and the importance to study the Singapore market. Chapter 2 discusses the existing literature and results. With the next chapter presenting the research methodology and the data employed in this paper. Chapter 4 provides an analysis of the results and Chapter 5 gives conclusions and discusses the implications of the study.

Chapter 2: Literature review

Previous studies have been done to analyze herd behavior of individual investors in stock markets. For example, Lakonishok et al. (1992) found that money managers did not have significant herd behavior by testing tax-exempt funds. According to Christie and Huang (1995), during periods of market stress, it is very likely that those individual investors suppress their own beliefs and follow the market consensus.

Rational asset pricing demonstrates that if the exposure of stock prices to systematic factors is constant, large market price fluctuations will be related to a large dispersion of single stock returns around the market aggregate. In comparison, stock prices will be closely together around the market aggregate. Their methodology examined whether single stock return dispersion around the market aggregate is in fact lower with abnormal price changes. They measured herding behavior of US investors based on cross-sectional standard deviation (CSSD) of individual stock returns in regard to market returns. From their results, there is no evidence to support herding behavior by US investors.

Grinblatt et al. (1995) applied 274 mutual fund data that existed on December 31, 1974, and was bought from CDA Investment Technologies Inc, Maryland. They tested the herding behavior of fund managers and the relationship of this behavior with momentum investment strategies and performance, and found herding behavior at a low

level. Avery and Zemsky (1998) found that investors may observe and follow others since they did not have enough information. Chordia and Swaminathan (2000) proved that low trading volume stocks reacted more slowly to information on NYSE/AMEX firms. Gregroriou and Ioannidis (2006) found that high trading volume stocks had more accessible information by using FTSE 100 data.

Chang et al. (2000) examined the stock markets in US, Japan, Hong Kong, South Korea and Taiwan by using Christie and Huang's methodology from 1963 to 1997. But their results showed evidence of significant herding only for South Korea and Taiwan markets and partly herding behavior in the Japan market. This may be because of more government intervention, less reliable company information and the existence of more speculators. Gleason et al. (2003) also presented empirical results against herding in their study of thirteen commodity futures contracts traded on three European exchanges. Their results indicated that herding behavior did not exist in these futures markets.

Caparrelli et al. (2004) analyzed herding behavior in the Italian stock market from September 1988 to January 2001 by using Christie and Huang's measure, but their results did not show evidence of herding. However, herd behavior exists under extreme markets from the conclusion of the non-linearity test of Chang et al. (2000). According to Gleason et al. (2004), there was no herd behavior under extreme market conditions using Exchange Traded Funds (ETFs). They tested whether traders had herd behavior

during extreme market conditions by using intraday data in nine sector ETFs which were traded on the American Stock Exchange and using the measures of Christie and Huang (Chang et al. (2000)).

Demirer and Kutan (2006) used the Christie and Huang (1995) measure to analyze herd behavior in the Chinese stock market: Shenzhen and Shanghai stock markets. They used daily stock return data to analyze single firm returns and sector returns from 1999 to 2002, and did not find evidence of herding. Additionally, the Asian crisis did not have a significant effect on cross-sectional standard deviations from their studies. Tan et al. (2007) also studied herd behavior of Shenzhen and Shanghai stock markets, but their results were different from Demirer and Kutan's. Farber et al. (2006) applied the Christie and Huang (1995) measure to examine herd behavior in Vietnam and its equity market-Ho Chi Minh City Securities Trading Center (HSTC) from 2000 to 2006. Their results verified herd behavior existed under extreme market conditions, the same as the conclusions of Christie and Huang demonstrated before.

Henker and Mitsois (2006) examined whether herding behavior existed in the Australian equity market and in different sectors by using the Christie and Huang and the Chang et al. methods. They chose 160 most actively traded stocks on the Australian Stock Exchange from 2001 to 2002, but their results showed that herding did not occur in either market wide or industry sector. Demirer et al. (2007) tested herding behavior in

African, Asian, Eastern-Western-Central European, Central Asian, and Latin American markets, but there was no evidence of herding in any of the markets, except for Asian and Middle Eastern markets.

As mentioned earlier, the Tan et al. (2008) study did find evidence of herding in both the Shanghai and Shenzhen A-share markets. Markets which are dominated by domestic individual investors. They found that the evidence of herding was stronger in the Shanghai market at the time of rising stock markets, high trading volume, and high volatility. However, they claimed that there is no herd behavior in the B-share market. Caporale et al. (2008) used stocks from the Athens Stock Exchange to test whether herd behavior existed in extreme market conditions. From their results, herd behavior existed from 1998 to 2007. If this testing period is divided into semiannual sub-periods, herd existed in 1999, which experienced a stock market bubble.

Altay (2008) demonstrated that there was herding behavior in the ISE from 1997 to 2008, and his study also showed all sectors had herding behavior, but the herding influence varied among each sector. Kallinterakis and Lodetti (2009) found there was no effect of low trading volume on herd behavior in the Montenegro New Securities Exchange from 2003 to 2008.

Tessaromatis and Thomas (2009) found no evidence of herd behavior in the Athens

stock market from 1985 to 2004, but after they shortened the period to 1998-2004, there was significant evidence of herd behavior in both bull and bear markets. They also found that herd behavior was present in some years and antiherding in others when they tested on a yearly basis. In addition, their results indicated that firm size had nothing to do with herd behavior.

In contrast to Tan et al. (2008), Fu and Lin (2010) found that there was no evidence of herd behavior in China stock market, but herd behavior was more significant for low turnover stocks than high turnover stocks. Their results partly proved that low turnover stocks diverged more to market return compared to high turnover stocks.

Herding behavior of 18 global stock markets was examined by Chiang and Zheng (2010) from 1988 to 2009. According to their results, herding existed in advanced stock markets (except the US market) and in Asian markets. There was no evidence of herding in Latin American markets. In addition, stock return dispersions in the US played a significant role in explaining the non-US market's herding activity. Even though herding was stronger in Asian markets during rising markets, it existed in both up and down markets (except the US and Latin American markets).

Kapusuzoglu (2011) examined herd behavior in the Istanbul Stock Exchange to find that cross sectional volatility increased significantly when the market was up along with

an increased index return rate. Also, the relationship between herd behavior and the Istanbul Stock Exchange National 100 index was present and nonlinear.

Monthly returns of 100 stocks were chosen from the Karachi Stock Exchange (KSE) as a sample and the results showed that there was no evidence of herding with insignificant values (Javed et al., 2013). Prosad et al. (2012) studied the impact of herd behavior in the Indian equity market, and their conclusion indicated that there was no significant evidence of consistent herd behavior, but herding existed when the market was bull from 1st April 2006 to 31st March 2011.

Chapter 3: Methodology and Data

3.1 Model

Cross-sectional analysis of stock returns was expressed in two studies: Christie and Huang (1995), and Chang et al. (2000). Christie and Huang (1995), a study widely cited by others in the literature as Chapter 2 illustrated. They proposed that how market participants used the investment decision-making process depends on the whole market conditions. In normal periods, rational asset-pricing models estimate that because individual investors trade according to their own information, and the dispersion in cross-sectional returns will rise with the absolute value of the market returns. However, investors are likely to suppress their private information under extreme market conditions, so they would like to imitate others' behavior. Single stock returns will be inclined to aggregate around the overall market return (Chiang and Zheng, 2010).

Christie and Huang (1995) predicted the cross-sectional standard deviation (CSSD) of individual stock returns with market returns, which is expressed as Equation 3.1:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N_t} (R_{i,t} - R_{m,t})^2}{N_t - 1}} \qquad 3.1$$

Where $R_{m,t}$ is the cross-sectional average return of the N returns in the market portfolio at time t, $R_{i,t}$ is the observed stock return of firm i at time t, and N is the number of firms in the market portfolio.

They claimed that herd behavior will be more obvious when the market is sharply up or down. They also proposed the regression model to examine herd under extreme market conditions:

$$CSSD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t \quad 3.2$$

Here *a* is a coefficient which represents the average dispersion of the sample excluding the regions corresponding to the two dummy variables. D^U_t is a dummy variable at time t; if the market return on time t lies in the extreme 1% and 5% upper tail of the return distribution, D^U will be equal to 1 and zero otherwise. D^L_t is a dummy variable at time t; if the market return on time t lies in the extreme 1% and 5% lower tail of the return distribution, D^L will be equal to 1 and zero otherwise. If herd behavior exists, it will be found when CSSD is smaller and under market stress. Based on the Equation 3.2, there is evidence of herd behavior when β_1 and β_2 are statistically significantly negative.

Since the cross-sectional standard deviation of returns is significantly influenced by outliers, Chang et al. (2000) proposed the cross-sectional absolute deviation (CSAD), which is measured by:

$$CSAD_t = \frac{1}{N_t} \sum_{i=1}^{N_t} \left| R_{i,t} - R_{m,t} \right| \quad 3.3$$

Here $R_{m,t}$ and $R_{i,t}$ are defined as in $CSSD_t$ above. The equation for the CSAD corresponding to Equation 3.2 as follows:

$$CSAD_t = \alpha + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t \quad 3.4$$

Chang et al. (2000) suggested a nonlinear regression model for examining herd behavior. This model is made under CAPM assumptions of rational asset pricing models with the equity return dispersions an increasing function of the market return and the relation is linear as well. When investors imitate market behavior, herding behavior exists and the relation will be nonlinear and increasing or even decreasing. Chang et al. (2000) proposed another measure which is followed by using the distribution of market returns:

$$CSAD_t = \theta + \gamma_1 \left| R_{m,t} \right| + \gamma_2 R_{m,t}^2 + \varepsilon_t \quad 3.5$$

They may have inconsistent results relative to the existence of herding compared to Christie and Huang's. A statistically significantly negative value for γ_2 indicates that there is herd behavior. In the presence of herd behavior, CSAD will increase at a decreasing rate or even decline when the absolute market return is large enough. When there is no herd behavior, the relationship will be linear, and the dispersion increases proportionately with the returns.

In up and down markets, the degree of herding may be asymmetric, so Chang et al. (2000) predicted the following two models:

$$CSAD_t^{UP} = \alpha + \gamma_1^{UP}\left|R_{m,t}{}^{UP}\right| + \gamma_2^{UP}(R_{m,t}{}^{UP})^2 + \varepsilon_t \quad 3.6$$

$$CSAD_t^{DOWN} = \alpha + \gamma_1^{DOWN}\left|R_{m,t}{}^{DOWN}\right| + \gamma_2^{DOWN}(R_{m,t}{}^{DOWN})^2 + \varepsilon_t \quad 3.7$$

Here $CSAD_t$ is the average cross-sectional absolute deviation of each stock relative to the return of the equally-weighted market portfolio, $R_{m,t}$ in period t, and $|R_{m,t}{}^{UP}|$ or $|R_{m,t}{}^{DOWN}|$ is the absolute value of an equally-weighted realized return of all stocks on day t when the market is up or down. To compare the coefficients of the linear term, they used absolute values in Equations 3.6 and 3.7.

3.2 Data

The daily data employed in this study consist of total returns of individual stocks. The data range is starting from January 2002 to December 2012 and all the daily stock returns are obtained from Bloomberg. For the Singapore stock market, I collected a sample of individual stocks, which are the most actively traded and together accounts for over 60% of total market capitalization, totaling 2682 observations.

The dataset for the Singapore Stock Exchange consists of 10 sectors: Basic Materials, Consumer Goods, Consumer Service, Financials, Health Care, Industrials, Oil, Technology, Telecommunication, and Utilities.

Chapter 4: Empirical results

4.1 Descriptive statistics

Table 4.1 provides a summary of statistics for the cross-sectional standard deviation of daily individual companies' stock returns, and daily equally weighted market portfolio return $R_{m,t}$ in the Singapore market for a 10-year period (from 2002 to 2012) and 2008 .

The daily equally weighted market portfolio returns range is from -3.194% to 4.032% in 2002-2012, and average equally weighted market portfolio return is 0.083%. Compared to this 10-year period (2002-2012), the average equally weighted market portfolio return is greater in 2008, which is 0.149% more than that in 2002-2012. Market portfolio returns have higher volatility with a standard deviation of 0.797% in 2008 and 0.578% in 2002-2012. Due to the 2008 global financial crisis, the Singapore stock market is quite risky, but compensated with a higher return.

Minimum and maximum values of CSAD are also reported, CSADs in 2008 are relatively larger than those in 2002-2012, which indicate that individual stock returns deviate much more from market portfolio returns in 2008. The average daily CSAD in 2008 is 1.931%, and ranges from a low of 0.904% to a high of 4.944%. However, there is a higher volatility with a standard deviation of 0.632% during 2002-2012, compared to that of 0.631% in 2008. Because of heteroskedasticity and auto-correlation, all the

standard errors of the regression coefficients are regressed based on the Newey and West approach.

Table 4.1. Descriptive statistics of CSAD and $R_{m,t}$.

	2002-2012		2008	
	CSAD	MARKET	CSAD	MARKET
Mean	1.833201	0.082932	1.931398	0.2320119
Median	1.731995	0.0586721	1.80552	0.180877
Maximum	7.574819	4.032403	4.94378	2.56035
Minimum	0.5699593	-3.194139	0.904357	-1.86318
Std. Dev.	0.6315868	0.7603743	0.6313692	0.7967137
Observations	2682		246	
Number of stocks	58		36	

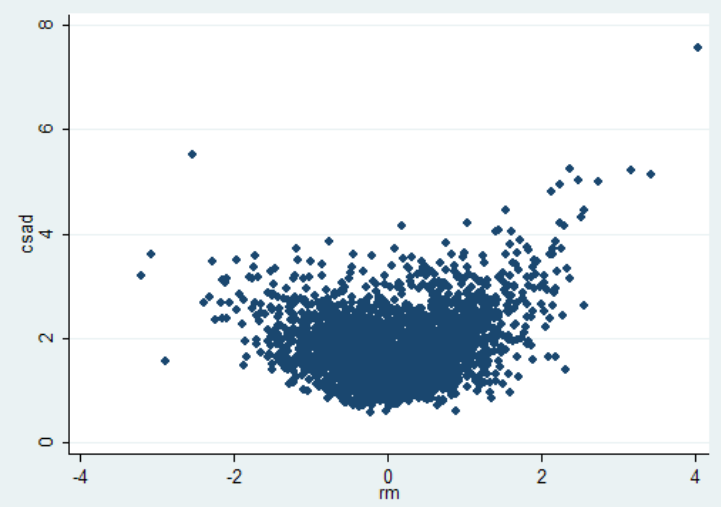
Note: This table lists descriptive statistics of daily, equally weighted CSADs and market return for Singapore market from January 1, 2002 to December 31,2008. The equation is Equation 3.3 from Chapter 3.

4.2 Total market regression results

Equation 3.5 that was proposed by Chang et al. (2000) is used to test the relationship between cross-sectional standard deviation and the daily equally weighted market portfolio returns. From Figure 4.1, the relationship between $CSAD_t$ and daily equally weighted market portfolio return Rm,t seems linearly positive for the Singapore

stock market from 2002 to 2012.

Figure 4.1. Relationship between $CSAD_t$ and daily equally weighted market portfolio return Rm,t for the Singapore stock market from 2002 to 2012



From Table 4.2, the constant term θ is positive and statistically significant when the significance level is less than 0.1%, which indicates that when $R_{m,t}$ is zero, the average cross-sectional return dispersion is positive. Moreover, coefficients of the absolute value of $R_{m,t}$ and the nonlinear term $R^2_{m,t}$ are both positive and significant when the significance levels are less than 5% and less than 0.1% respectively. The results suggest that there is evidence of herd behavior in the Singapore market, the average market returns tend to be great under absolute value, and average level of equity return dispersions increase at an increasing rate.

Table 4.2. Total market regression results from 2002 to 2012

θ	γ_1	γ_2	Adjusted R^2
1.590***	0.171*	0.245***	27.15%
(69.73)	(2.36)	(5.61)	

t statistics in parentheses based on the Newey-West standard errors

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.3 Up and down market comparison

Equations 4.6 and 4.7 are used to examine herd behavior in bull and bear markets. Table 4.3 reports the regression results for up and down markets. When comparing the bull and bear markets, γ_1^{DOWN} is statistically significant when the significance level is less than 1%, but γ_1^{UP} is statistically insignificant, so there is no evidence of linearity in the relationship between CSAD and daily equally weighted market portfolio return, CSAD increases non-linearly with the average market return. γ_1^{DOWN} is a little greater than γ_1^{UP}, which indicates that cross-sectional dispersions are larger in the bear market. However, γ_2^{UP} is statistically significant when the significance level is less than 0.1%, and γ_2^{DOWN} is not statistically significant, so there is no evidence of any non-linearity. Therefore, herd behavior is present in both up and down markets, but in the up market, returns seem to follow a rational pricing model.

To confirm the statistical equivalence of the coefficients in bull and bear markets, an F-test is used. To be specific, F_1 tests the null hypothesis that $\gamma_1^{UP}=\gamma_1^{DOWN}$, F_2 tests the null hypothesis that $\gamma_2^{UP}=\gamma_2^{DOWN}$. From the results, the difference between γ_1^{UP} and γ_1^{DOWN} is not significantly different from zero and the same for the difference between γ_2^{UP} and γ_2^{DOWN}. This indicates that the effect of herd behavior is similar no matter whether the market is up or down.

The following three tables report the regression results of up and down market, equations are followed:

$$CSAD_t^{UP} = \alpha + \gamma_1^{UP}\left|R_{m,t}{}^{UP}\right| + \gamma_2^{UP}(R_{m,t}{}^{UP})^2 + \varepsilon_t \quad 3.6$$

$$CSAD_t^{DOWN} = \alpha + \gamma_1^{DOWN}\left|R_{m,t}{}^{DOWN}\right| + \gamma_2^{DOWN}(R_{m,t}{}^{DOWN})^2 + \varepsilon_t \quad 3.7$$

Table 4.3. Up market regression from 2002 to 2012

A	**γ_1^{UP}**	**γ_2^{UP}**	**Adjusted R^2**
1.613***	0.137	0.292***	0.61%
(55.66)	(1.89)	(7.88)	

t statistics in parentheses based on the Newey-West standard errors

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.4. Down market regression from 2002 to 2012

A	γ_1^{DOWN}	γ_2^{DOWN}	Adjusted R^2
1.553***	0.287**	0.120	17.54%
(50.92)	(2.87)	(1.87)	

t statistics in parentheses based on the Newey-West standard errors

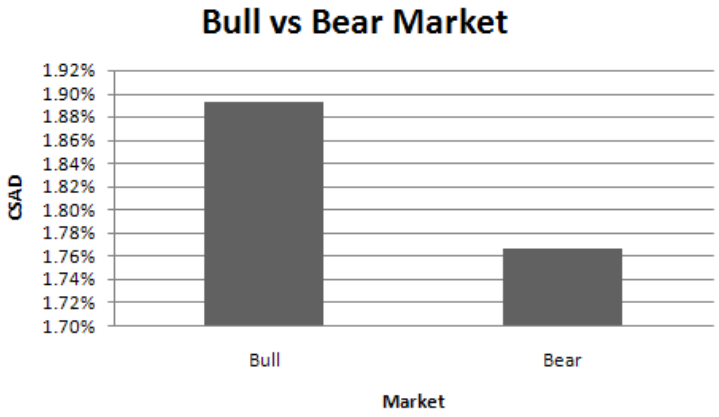
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.5. F-test for equivalence in Bull and Bear markets from 2002 to 2012

Statistics	
F_1	F_2
0.7802	0.6002

However, the results of a two-sample T-test which is used to examine the differences of average daily CSADs in bull and bear market differ from those of the F-test. From the Figure 4.2, the average daily CSAD of a down market is 1.77%, which is less than that of the up market (1.89%). Also, the T-statistic is -5.1715 and statistically significant when the significance level is less than 5%. The result indicates that herd behavior is significantly stronger in a bear market rather than that in a bull market.

Figure 4.2. Difference of average CSADs in Bull and Bear Markets from 2002 to 2012



4.4 The influence of the financial crisis on herd behavior

To test the impact of the recent financial crisis, I applied Equation 3.5 by using daily stock returns during the financial crisis of 2008. Table 4.6 reports the results of the impact of this financial crisis on the Singapore market. Herd behavior exists in Singapore market in 2008 according to the Table 4.6, since the coefficient γ_2 is positive and statistically significant. However, from Figure 4.3 (Page23), average daily CSAD in 2008 (0.23%) is the lowest, compared to that in 2002-2007 (1.99%) and 2009-2012 (1.57%). This indicates that herd behavior is more significant during a financial crisis than during normal periods, as confirmed above that herd behavior is stronger when CSAD is smaller.

As Tables 4.5 and 4.7 show below, the coefficient γ_2 is positive and statistically

significant, which indicates that there is evidence of herd behavior before and after the financial crisis. However, the coefficient γ_2 is higher during 2002-2007 than that during 2009-2012, indicating that the effect of financial crisis on herd behavior had a declining effect before the crisis. Although the impact had diminished before the crisis, it was still significant before the crisis. After the crisis, investors seemed to be more rational, and herding level gradually reverted to pre-crisis level.

Table 4.6. Regression results before the financial crisis from 2002 to 2007

The table reports the regression results of pre-crisis period, the equation is followed:

$$CSAD_t = \theta + \gamma_1 \left| R_{m,t} \right| + \gamma_2 R_{m,t}^2 + \varepsilon_t \qquad 3.5$$

α	**γ_1**	**γ_2**	**Adjusted R^2**
1.664***	0.346***	0.235***	37.25%
(59.75)	(4.75)	(6.05)	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.7. Regression results during the financial crisis in 2008

The table reports the regression results during the financial crisis period, Equation 3.5 is from Chapter 3.

α	γ_1	γ_2	Adjusted R^2
1.664***	0.020	0.371***	45.01%
(26.47)	(0.12)	(3.76)	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4.8. Regression results after the financial crisis from 2009 to 2012

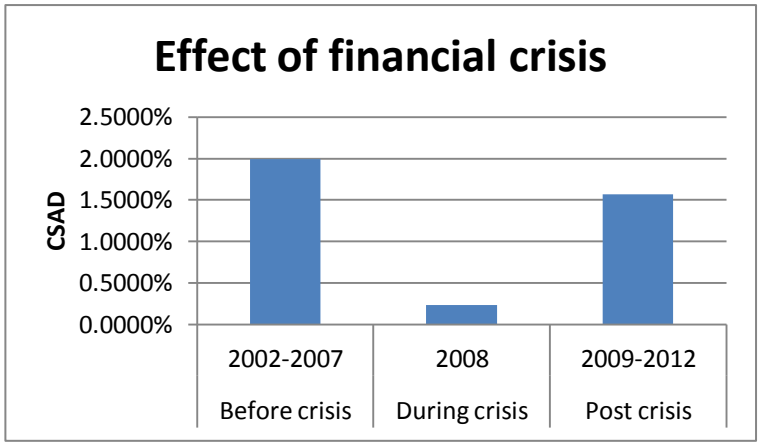
The table reports the regression results of post-crisis period, once more using Equation 3.5.

α	γ_1	γ_2	Adjusted R^2
1.435^{***}	0.0182	0.206^{***}	18.17%
(45.08)	(0.19)	(3.59)	

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4.3. Difference of average CSADs before/ during/ after the crisis



4.5 Herd behavior in different industries in the Singapore market

Equation 3.5 is applied by using stock returns among different industries to compare herd behavior in various business environments. Table 4.8 reports the regression results of different industries. The entire constant terms α are positive and statistically significant when the significance level is less than 0.1%, which indicates that when $R_{m,t}$ is zero, the average cross-sectional return dispersion is positive. All the coefficients of the absolute value of $R_{m,t}$ γ_1 are positive and statistically significant for all industries.

Moreover, coefficients of the nonlinear term $R^2_{m,t}$ are positive and significant when the significance levels less than 0.1% except for 7 industries: Basic Materials, Consumer Service, Financials, Health Care, Industrials, Oil and Telecommunication. The results confirm that there is evidence of herd behavior in the Singapore market, when the average market returns tend to be larger under absolute values and average level of

equity return dispersions increase at an increasing rate only for Consumer Goods, Technology and Utilities. However, results for those 7 industries are consistent with the predictions of rational asset pricing from 2002 to 2012.

As can be seen from Figure 4.4, the financial industry has the lowest daily average CSAD (0.91%), which shows that there is evidence of herd behavior and it is the most significant in this industry. In contrast, the utilities industry has the highest daily average CSAD (4.08%), indicating that herd behavior is the least significant in this industry.

Figure 4.4. Difference of average CSADs of 10 industries from 2002 to 2012

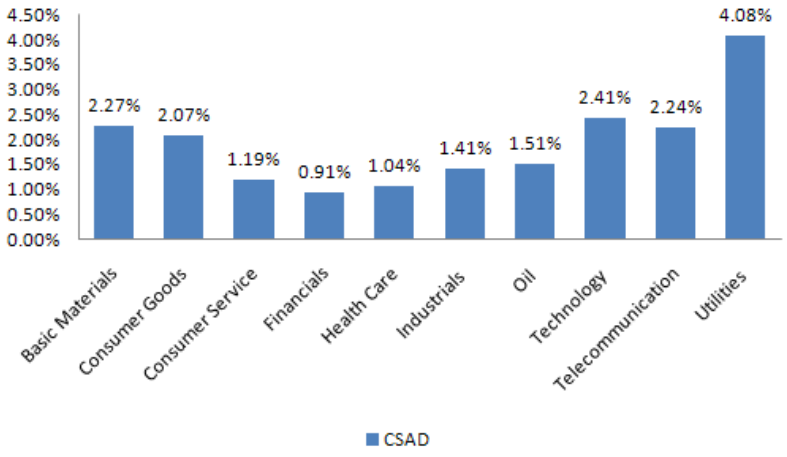


Table 4.8. Impact of herd behavior on 10 industries from 2002 to 2012

The table reports the regression results of 10 different industries (using Equation 3.5).

$$CSAD_t = \theta + \gamma_1 \left| R_{m,t} \right| + \gamma_2 R_{m,t}^2 + \varepsilon_t \qquad 3.5$$

Industry	θ	γ_1	γ_2	**Adjusted R^2**
Basic Materials	1.369*** (15.60)	0.582*** (4.37)	0.0323 (0.99)	43.26%
Consumer Goods	1.393*** (15.07)	0.420*** (4.36)	0.0502*** (5.17)	48.88%
Consumer Service	0.876*** (23.50)	0.291*** (3.46)	0.0338 (1.21)	27.48%
Financials	0.685*** (44.02)	0.205*** (7.98)	0.00939 (1.41)	26.03%
Health Care	0.786*** (22.37)	0.299** (2.89)	0.0772 (1.48)	24.98%
Industrials	1.008*** (35.75)	0.347*** (6.76)	0.0299 (1.92)	25.56%
Oil	0.867*** (9.66)	0.301* (2.57)	0.0308 (1.55)	38.31%
Technology	1.438*** (25.24)	0.415*** (5.57)	0.0696*** (4.89)	51.84%
Telecommunication	0.437*** (10.38)	1.284*** (19.73)	-0.0208 (-1.56)	73.29%
Utilities	0.853*** (9.24)	0.979*** (17.09)	0.0154*** (4.53)	83.69%

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Chapter 5: Conclusion

Understanding the influence of financial behavior within a country is very important which will increase the efficiency of financial markets and strengthen the availability of government policies.

This paper examines the presence of herd behavior in the Singapore stock market. By employing data from January 1, 2002 to December 31, 2012 for returns of 58 individual stocks, this paper presents that herding existed in Singapore stock market from 2002 to 2012. This result is similar to the study that was written by Loh and Araral (2013) for the same market. According to the up and down markets' regression results, herd behavior is found to be stronger in a bear market.

The impact of herd behavior during the financial crisis of 2008 is significant in the Singapore market, but investors' behavior appears to be rational after the crisis from 2009 to 2012. The results show that each industry is influenced by herding behavior at different levels, but the effect on the financial industry is strongly significant.

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