TESTING FOR THE PRESENCE OF HERDING BEHAVIOR IN THE NIFTY 50

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Abstract : This paper seeks to test the presence of Herding in the 'S&P CNX NIFTY 50' Index of the 'National Stock Exchange of India' (NSE). Two models, as proposed by Christie and Huang (1995) and Chang, Cheng, and Khorana (2000), are employed to capture this phenomenon. Both the models make use of the changes in the Cross Sectional Returns Distribution, and seek to capture herding during extreme market movements only. However, they differ in their orientation, as the Christie and Huang (1995) model is 'linear' in nature, while the Chang, Cheng, and Khorana (2000) model is 'non-linear'. Results obtained have been depicted in tabular form, and have also been discussed and explained briefly. Furthermore, a general review of herding, along with the findings of previous researches done in various countries, has also been mentioned.

People, in general, have been following each other in almost everything they do. A child, in nursery, chooses his favorite cartoon character after seeing what his friends take, a boy chooses to play the sport that most of his friends play, people in society keep up with fashion fads and trends based on what their favorite movie star is doing. Even in the late 1990s, similar behavior patterns was exhibited when private investors and venture capitalists put in huge amounts of investments into internet-related companies, some of which did not even have a sound business structure or plan in place. The driving force that compelled the investors to sink their money into unfamiliar territory was based on the actions of others, who were doing something similar. This, in crux, is was what led to the dotcom bubble burst.

The aforementioned examples are what are referred to as 'Herding Behavior'. Herding is just following what your predecessors did, without using one's own knowledge or set of information. It is like a group mentality, where everyone thinks collectively but not individually.The 1980s saw the emergence of behavioral finance as an area of research, and Herding is one of the many topics that grabbed significant attention and consideration. Herding is studied as a part of the behavioral finance arm of the finance field of study. Herding in finance is nothing but individuals, investing in securities and assets, by not using their knowledge and available information, but rather by copying or following what others are doing. Put it simply, 'investors following other investors'. Herding is

however much more complex and goes deeper than the aforementioned simple explanations. The same has been discussed in the literature review section.

When we talk about 'Herding', many questions and theories have come up, and many concepts have been proposed as well. Some of these have even been so bold to attempt answering questions, such as, How does herding take place? Why does it take place? Why don't people use their own knowledge sets? But albeit countless research papers and theories, not a single simple answer exists. Herding is related to humans - the most complex beings on the planet - and therefore the answer to what 'Herding' is, is itself very complex to understand and difficult to answer, let alone interpret.

Our paper is aimed at 'Testing for the presence of herding in the 'NIFTY 50' Index', during extreme market conditions. This has been done using two models, which are the most popular ones present to capture herding – The Christie and Huang (1995) model and the Chang, Cheng, and Khorana (2000) model. As Caporale et al (2008) has rightfully said, "Analyzing herding in the stock market during period of significant changes in stock prices is a growing body of literature". Therefore, basing our research on the current literature study and knowledge available will provide more details and depth regarding herding in the 'NIFTY 50' Index.

Devenow and Welch (1996), say that, "Imitation and mimicry are perhaps among our most basic instincts. There is an especially prominent belief, not only among practitioners but also among financial economists, that investors are influenced by the decisions of other investors and that this influence is a first-order effect. In financial realm, herding could be potentiallyuniversal".

LITERATURE REVIEW

Herding

"Men nearly always follow the tracks made by other and proceed in their affairs by imitation..." – (Niccolo Machiavelli, The Prince,1998 Ch.6, 15-14).

The first question, that arises as we look at the context of our research, is that, what is Herding? To define it, herding is the act in which "Individuals form herds when they align their behavior to a mode of collective conduct following he "interactive observations" of the actions and payoffs (arising from those actions) of their peers" (Hirshleifer and Teoh, 2003).

Herding can also be safely coined as 'Intentional Correlated Trading'.

But what exactly does transpire when potential investors, by a random chance of luck, buy or sell the same stocks at the same moment, or when all the investors have the same private signal and proceed to make similar investments without ever discussing or observing each other?

In such cases, it is essential to bring about the different classifications of herding. Herding is mainly of two types:

- 'Rational Herding' ('Intentional Herding'); and
- 'Irrational Herding' ('Non-Rational Herding')

Rational Herding is when investors, for their own benefit, engage in the process of herding. Rather than using information available with them, they are dependent on the information possessed by others. It is 'Rational' only from the viewpoint of the investor - as he would be gaining something.

"Irrational Herding refers to the same action taken by investors due to similar input of information" (Do et al, 2006). Unlike rational herding, there are usually no conflict of interests in irrational herding as managers and investors take similar action based on their own and publicly available information. They are not mimicking other investors' action. Bikhchandani and Sharma (2000) call this as "Spurious Herding".

It is very difficult to distinguish between 'Rational' and 'Irrational' herding. The results tell us whether herding exists or not, but they cannot tell us whether herding exists because of intentional or unintentional herding.

Models of Rational Herding

Why do individuals engage in 'Herding'? Why is it that investors try and imitate what fellow investors are doing and instead of relying on their own information, tend to depend on what information others have? "Deciphering the causes of imitation is not always possible, as it can be ascribed to a variety of motivations of both psychological as well as rational background" (Kallinterakis, 2007). The answers have been categorized in the following three models:

1. ***Information Based Herding Model.*** Bikhchandani et al (1992), Banerjee (1992) and Welch (1992) brought about the existence of the 'Information Based Herding Model' through the concept of 'Informational Cascade' in their respective papers.

Bikhchandani et al (1992) define Informational Cascade as a situation, in which, "it is optimal for an individual, having observed the actions of those ahead of him, to follow the behavior of the preceding individual without regard to his own information".

An investor can only observe another investor's actions and not their signals. He / She deem the information set possessed by the previous investor, based on the latter's signal and also the publicly available information, to be more reliable and accurate than their own set. The investor, therefore, values the previous investor's actions over information available with oneself and hence chooses to follow it. The subsequent investors, following the current individual investor, will follow this behavior pattern and as they get more information, the more confidence they emanate and thus are able to draw similar inferences. This leads to a series of information cascades turning into herding behavior. Overwhelming of public information over private signals leads to Herding in the market.

Bikhchandani et al (1992), Banerjee (1992) and Welch (1992) say that presence of Informational Cascade in the market causes herding. Informational cascade applies to a single individual whereas herding implies when every individual investor is caught up in an information cascade.

Bikhchandani et al (1992), Banerjee (1992) and Welch (1992) in their respective papers use the term 'informational cascade' and 'herding', interchangeably. The main difference between the two is that information cascade causes herding, and not the other way around. Herding can also be caused by other factors, a few of which are discussed in the subsequent models below.

2. ***Reputation Based Herding Model.*** Scharfstein and Stein (1990) were the first to bring about the concept of 'Reputation Based Herding'. To put it as a simple definition, reputational based herding model is any individual wanting to protect and maintain his reputation in the eyes of his employer, peers and the market.

Bikhchandani and Sharma (2000) say that the basic idea that Scharfstein and Stein (1990) say about Reputation based herding is that "if an investment manager and her employer are uncertain of the managers' ability to pick the right stocks, conformity with other investment professionals preserves the fog – that is, the uncertainty regarding the ability of the manager to manage the portfolio. This benefits the manager and if other investment professionals are in a similar situation then herding occurs".

3. ***Compensation Based Herding Model.*** Compensation based herding model predicts that an investment manager engages in herding if his level of compensation depends upon his performance Vis-à-vis to that of his peers and other professionals.

According to Bikhchandani (2000) - Brennan (1993) and Roll (1992) imply that, "If an investment manager's (i.e., an agent's) compensation depends on how her performance compares with that of other similar professionals, then this distorts the agent's incentives and she ends up with an inefficient portfolio". It may also lead to herd behavior.

The crux of the above statement lies in the principal-agent relationship where the agent is the manager and the principal is the client or the employer. The agent in order to receive the same level of compensation will herd along the lines of the benchmark portfolio. This is because a lower level of performance by him would result in getting a low level of compensation. On the other hand a higher performance would result in getting a high level of compensation, but the manager will not choose to do so as the high returns means higher risk which can jeopardize his compensation, thereby forgoing the principal-agent relationship. Hence the manager will herd on the benchmark portfolio, even if it means having an inefficient portfolio (subjective to the need of the agent) but with a surety of the same level of compensation.

Effects of Herding on the Stock Market

What are the consequences of engaging in herding? Is such behavior beneficial or injurious for market? What are its effects on the market? Bikhchandani and Sharma (2000) say that "herding by market participants exacerbates volatility, destabilizes markets, and increase the fragility of the financial systems".

According to Hirshleifer and Teoh (2003) - Froot et al (1992) say that "investors with exogenous short horizons find it possible to herd by investigating the same stock". They do this by tactically employing a manipulation strategy in which they all buy stocks together and later, sell them at high prices. This enables them to make huge profits, but at the same time this also can lead to the creation of a bubble, thus causing excess volatility in the market. Volatility causes the stocks to not reflect their true prices. Lux (1995) also points out that conformity can lead to people copying those around them.

Bikhchandani and Sharma (2000) say that "informationally inefficient herd behavior may occur and can lead to price bubbles and mispricing...". Hirshleifer and Teoh (2003) say that, "even within a fully rational setting, cascades or herding

can have the serious effect of blocking information aggregation". The presence of herding will not allow the individual investors private information to reflect on the current prices. Herding will also cause the investors to reduce or completely forgo their investigation regarding the market that will cause a stagnation of the publicly available information. Hirshleifer and Teoh (2003) also say that, According to Vives (1995) 'informed trader does not internalize the benefit that other traders have from learning his private information as revealed through trading. This applied in the case of herding causes the rate of convergence of price to efficiency to be slow'. This leads to the market destabilization as no new information is being made available and the traders are undertaking very specific trading.

Eguiluz and Zimmermann (2000) imply that herding increases the probability of a large crash taking place in the stock market. Lobao and Serra (2002) say that, "herding behavior may lead to errors and misevaluation of assets". This mispricing of assets, due to excess herding, leads to the formation of bubbles, which make the financial system very fragile. Once the bubble expands to its zenith, it finally bursts, thus bringing everything down with it.

Prior Research

Over the past two decades, a considerable amount of research has been carried out to capture the presence of herding. Both developed and emerging economies have been explored in great detail regarding the existence of herding behavior. While, evidence of herding has been less in the case of developed market, the reverse is true for most of the emerging markets.

Kallinterakis et al (2009) say that, "evidence has indicated that investors tend to herd more significantly in emerging (Choe et al, 1999; Kim and Wei, 2002a; 2002b; Bowe and Domuta, 2004; Voronkova and Bohl, 2005; Lobao and Serra, 2006) compared to developed (Lakonishok et al, 1992; Grinblatt et al, 1995; Wermers, 1999; Wylie, 2005; Walter and Weber, 2006) capital markets".

Gelos and Wei (2003) say that 'institutional structures in the emerging markets innately facilitate the breeding of herd behavior as there is a low level of transparency in them which causes doubts in the publicly available information'. Antoniou et al (1997) say that the 'operating framework of these markets is also irregular and incomplete'. Such doubtful information and irregular operating frameworks can lead to 'Rumor-Mongering' (Van Bommel, 2003) and 'Manipulation' (Allen and Gale, 1992) amongst the investors. Emerging markets also have a higher level of risk associated with them, Siriopoulos et al (2001). This leads to the investors actively seeking refuge by engaging in herding.

Given below are a few successful researches carried out by employing the Christie and Huang's (1995) as well as the Chang, Cheng and Khorana's (2000) models to capture the presence of herding. These examples have been specifically chosen to show the existence of herding in developed markets, as well as, to show the absence of it in developing markets.

1. ***Italy(Italian Stock Exchange).*** Caparrelli et al (2004) obtained results that proved the existence of herding in the Italian Stock Market. They found statistically significant and negative values for the $\gamma_2\gamma_2$ 'UP' and $\gamma_2\gamma_2$ 'DOWN' coefficients of the Chang, Cheng and Khorana's (2000) regression model. They concluded by stating that 'herding is present in the extreme market conditions, both in terms of sustained growth rate and high stock levels'.

2. ***Greece (Athens Stock Exchange).*** Caporale et al (2008) made use of daily data, weekly and monthly data for the years 1998 till 2007. They found no evidence of herding by using the Christie and Huang (1995) model, however herding is found when the Chang, Cheng and Khorana (2000) model was used. In all three - daily, weekly and monthly data, the Chang, Cheng and Khorana's (2000) regression model revealed a statistically significant and negative value of the $\gamma_2\gamma_2$ coefficient. Their results also brought into light a very important observation that the presence of herding is much stronger in the case of daily data, than it is in both weekly and monthly data. This indicates that herding is a phenomenon of a short-term nature.

3. ***China (Shanghai and Shenzhen Stock Exchange).*** Demirer and Kutan (2006) analyzed the Shanghai and Shenzhen Stock Exchanges and failed to find any evidence of herding in both the stock exchanges. They got statistically significant and positive coefficients for both the 'up' and 'down' variables in the regression, which allowed them to make the conclusion that there is no herding present in the two stock exchanges. Their findings supported the rational asset pricing theory, and also the fact that investors in the market made their decisions rationally. They also found that the investors in both the Shanghai and Shenzhen stock exchanges were equally informed.

METHODOLOGY

Data and Stock Exchange (NSE)

'Standard & Poor's CRISIL NSE Index 50' or *'S&P CNX Nifty'* is an Index which is listed on the '*National Stock Exchange of India (NSE)'*. It is also known as the 'NIFTY 50' Index, as it comprises of 50 diversified stocks from 22 sectors of the Indian economy.[1] The NIFTY 50 is owned and managed by 'India Index Services and Products Ltd.' (IISL), which is a joint venture between 'NSE' and 'CRISIL'. 'IISL' has a marketing and licensing agreement with 'Standard & Poor' (S&P).

The needed data comprises of closing price of companies that are currently listed as part of the NIFTY 50, as well as, of companies that were ever listed as part of the index for the period considered (April 1, 2003 – March 31, 2013). The said data has been primarily sourced from the '*National StockExchange of India Website'*[2]*, with a few points being sourced 'Yahoo Finance'*[3]*, and 'Money Control'*[4]. The historical constituents list has also been sourced from the National Stock Exchange of India website[1].

This historical constituent list is being considered so as to negate the effects of any 'Survivorship Bias', regarding the data. We have also employed the use of the 'NIFTY 50 Market Index' to ensure that all the considered stocks are being given equal weights – resulting in an equally weighted portfolio.

We have directly gone to the source to gather the data, namely, the National Stock Exchange. Few values of stocks have been cross checked with Yahoo Finance and Money Control to get the missing figures; i.e. missing stock prices of companies which have been merged with each other or have been privatized as a result of which have been de-listed from the index.

1. http://www.nseindia.com/products/content/equities/indices/cnx_nifty.htm
2. http://www.nseindia.com/products/content/equities/indices/cnx_nifty.htm
3. http://www.nseindia.com/products/content/equities/indices/historical_index_data.htm
4. http://in.finance.yahoo.com/q/hp?s=%5ENSEI
5. http://www.moneycontrol.com/stocks/hist_stock_result.php

Empirical Models of Herding – Variables and Hypothesis

A number of models have been created over the years that measure herding. The model to be chosen from, depends upon the data one has in hand (micro or macro), along with the specific area or market condition where one is focusing to find herding (extreme market conditions or the overall market distribution).

For our study, we are employing two models, which will check for the presence of herding, during extreme market conditions of the 'NIFTY 50' Index. The first being a linear model developed by William G. Christie and Roger D. Huang (1995) and the second being a non-linear model developed by Eric C. Chang, Joseph W. Cheng and Ajay Khorana (2000).

These models have been selects as they are best able to capture the presence of herding during extreme market movements. The Christie and Huang (1995) model assumes that extreme market returns create a linear relationship between the Market Returns and the Cross Sectional Standard Deviation (CSSD) of returns, while the Chang, Cheng and Khorana Model (2000) assumes that a non-linear relationship is formed between the Market Returns and the Cross Sectional Absolute Deviation (CSAD) of returns. In both the cases, the relationship between Market Returns and Cross Sectional Deviations of returns indicate the presence or absence of herding. Thus, we are employing both of these models.

Additionally, the two models also make use of macro data, which is more easily available and accessible. Models that use micro data (e.g. Lakonishok, Shleifer, and Vishny (1992) Model) are not very reliable as micro data is subjective to manipulation and bias along with being both difficult and expensive to obtain.

Christie and Huang (1995) Model

Christie and Huang's (1995) model focuses on finding the presence of herding in extreme markets, using the Cross Sectional Standard Deviation of Returns (CSSD) of stocks in the market index. CSSD is a tool that captures dispersion / deviation and difference between individual stock returns and market returns**.** It is a linear model that derives its roots from the Rational Asset Pricing Model.

The degree of Dispersion (CSSD) is measured by the following formula:

$$S = \sqrt{\frac{\sum_{i=1}^{n}(r_i - \bar{r})^2}{n-1}}$$

Where:

'ss' is the Cross Sectional Standard Deviation of Returns (CSSD),
'$r_i r_i$' is the return on stock 'ii'and
'$\bar{r}\bar{r}$' is the average of the 'nn' stocks in the entire market portfolio.

During periods of market stress, the rational asset pricing models predict an increase in dispersion of equity returns because assets differ in their sensitivity to the market returns. Whereas herding theory says that, in the presence of herding the equity returns dispersion will not deviate from the market returns. As Christie and Huang (1995) say that, "herding mainly takes place during periods of market stress. This is because individuals suppress their beliefs in favor of that of the market consensus".

Measuring the dispersion of Cross-Sectional Standard Deviation of Returns (CSSD) around the Market Return, during extreme market movements, concludes presence of herding. Higher concentration of dispersion amounts to herding.

Two hypotheses are formed in the case of CSSD during periods of market stress. The first one predicts that the level of dispersion is caused by the 'Rational Asset Pricing Models' while the second one predicts it to be caused by the 'Herding Theory'.

$$H_1 = Rational\ Asset\ Pricing\ Model\ Holds$$
$$H_2 = Herding\ Theory\ Predictions\ Hold$$

Further, to test if the dispersion above is caused by rational asset pricing or herding we run the following linear regression:

$$S_t = \alpha + \beta_1 D_t^L + \beta_2 D_t^U + \epsilon_t$$

Where:

$s_t s_t$ is the dispersion (CSSD) caused by the extreme returns in the entire distribution of returns (dispersion in extreme market), $\alpha\alpha$ is the average dispersion $\beta_1\beta_1$ and $\beta_2\beta_2$ are the coefficients of the two dummy variables. The dummy variables D_t^L D_t^L and $D_t^U D_t^U$ are present in the equation to account for returns during extreme market conditions. "Dummy Variables capture differences between in investor behavior in extreme up or down versus relatively normal markets" (Chang et al. 2000).

The measures of the dummy variables are defined as follows:

$D_t^L D_t^L$ = **1** - When the market return on day tt are lower in extreme market conditions, i.e. the market returns lie in the extreme lower tail of the distribution of returns.

$D_t^L D_t^L$ = **0** - Otherwise

and,

$D_t^U D_t^U$ = **1** - When the market returns on day t are higher in extreme market conditions, i.e. the market returns lie in the extreme upper tail of the distribution of returns.

$D_t^U D_t^U$ = **0** = Otherwise

As per Christie and Huang (1995), the "Rational asset pricing theory predicts significantly positive coefficient for $\beta_1\beta_1$and $\beta_2\beta_2$ and negative estimates of $\beta_1\beta_1$ and $\beta_2\beta_2$ would be consistent with the presence of herd behavior".

Based on the aforementioned regression, we run three similar regressions to capture the presence of herding behavior during extreme market conditions. We do these as the extreme market returns are spread out over the entire distribution of returns, and these three regressions are designed to capture them.

Chang, Cheng and Khorana (2000) Model

The Chang, Cheng and Khorana (2000) model is an extension of the Christie and Huang (1995) model. Chang et al (2000) extend the model by converting the linear herding model of Christie and Huang (1995) into a model of a non-linear regression specification. They also make use of the Cross-Sectional Absolute Deviation of Returns (CSAD) instead of the Cross-Sectional Standard Deviation of Returns.

Chang et al (2000) say that "the rational asset pricing models predict that the equity return dispersions are an increasing as well as a linear function of the market returns. If investors follow aggregate market behavior during large price movements, then the linear and increasing relationship between dispersion and market returns will no longer hold. Instead the relationship will become non-linearly increasing or even decreasing".

Kallinterakis and Lodetti (2009) say that "Chang et al (2000) argued that this relationship is of a nonlinear nature, since herding can give rise to dynamics not predicted by rational asset pricing models". They further argue by saying that the relationship between CSAD and market returns may be asymmetric. This gives rise to the following null hypothesis:

$H_1: \gamma_1^{UP} = \gamma_1^{DOWN}$
$H_1: \gamma_2^{UP} = \gamma_2^{DOWN}$

$\boldsymbol{\gamma_1^{UP}\gamma_1^{UP}}$and $\boldsymbol{\gamma_2^{UP}\gamma_2^{UP}}$ are the coefficients of the endogenous variable. $\boldsymbol{\gamma_1\gamma_1}$ represents the coefficient of the linear term and $\boldsymbol{\gamma_2\gamma_2}$ represents the coefficient of the nonlinear term.

The CSAD helps analyze the relation between market returns and equity returns better than the CSSD. CSAD is calculated by the following formula as proposed by Henker et al. (2006), which is a simplified version of the original formula as made by Chang et al (2000):

$$CSAD = \frac{1}{N}\sum_{i=1}^{N}|r_{i,t} - r_{p,t}|$$

Where:

$\boldsymbol{r_{i,t}r_{i,t}}$ is the individual security return at time $\boldsymbol{tt}$, $\boldsymbol{r_{p,t}r_{p,t}}$ is the market portfolio return at time $\boldsymbol{tt}$ and $\boldsymbol{NN}$ is the number of securities in market portfolio. The market portfolio return $\boldsymbol{r_{p,t}r_{p,t}}$ additionally act as a proxy for the Expected Market Portfolio Return, $\mathbf{E}_t(\boldsymbol{R_{m,t}})\mathbf{E}_t(\boldsymbol{R_{m,t}})$, as the latter is unobservable in nature.

To test, both the null hypotheses and the presence of herding, Chang et al (2000) proposed running the following two regressions:

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

Where: $\boldsymbol{CSAD_t^{UP} CSAD_t^{UP}}$ and $\boldsymbol{CSAD_t^{DOWN} CSAD_t^{DOWN}}$ are the Cross Sectional Absolute Deviations of Returns during 'UP' and 'DOWN' market respectively, $\boldsymbol{\alpha\alpha}$ is the average dispersion, $\boldsymbol{\gamma_1^{UP}\gamma_1^{UP}}$and $\boldsymbol{\gamma_2^{UP}\gamma_2^{UP}}$ are the coefficients of the endogenous variable. $\boldsymbol{\gamma_1\gamma_1}$ also represents the coefficient of the linear term and $\boldsymbol{\gamma_2\gamma_2}$ represents the co-efficient of the nonlinear term. $\boldsymbol{\gamma_2\gamma_2}$ has to be given special consideration as herding is caused by a nonlinear relationship between average market returns and CSAD during large market swings. A negative and statistically significant $\boldsymbol{\gamma_2\gamma_2}$ coefficient would indicate the presence of herding. $\boldsymbol{R_{m,t}^{UP}R_{m,t}^{UP}}$ and $\boldsymbol{R_{m,t}^{DOWN}R_{m,t}^{DOWN}}$ represent the equally weighted market portfolio returns, and respectively stands for the 'UP' and 'DOWN' days during extreme market returns. Signs are ignored as size is under consideration, and not sign. This also facilitates comparison of up market and down market movements.

These two regressions help to check if herding is asymmetric to market movements. The 'CCK Model' is an improvement over the 'CH Model' as it adds an additional regression parameter to capture the nonlinearities between the equity returns dispersion and the market returns.

RESULTS

Descriptive Statistics

'Table-1' reports the univariate statistics for the 'Market Returns', the 'CSSD' and the 'CSAD'. As per the table, the average return on the NIFTY 50 Index-portfolio is around 0.031% with the maximum return of 14.84% being obtained on the 18th of May 2009, while the minimum return of -14.20% being obtained on the 24th of October 2008.

With respect to CSSD and CSAD, we observe that both the mean and variance values for the CSAD (1.521% and 0.005%) are lower than the values of CSSD (2.155% and 0.042%) respectively - conforming to the findings of Granger and Ding (1995), that CSSD is more sensitive to outliers than CSAD.

The 'Augmented Dickey Fuller (ADF) Test' was performed on the 'Market Return', 'CSSD' and the 'CSAD' to check whether the series are stationary or not. Results shown in 'Table-1' reveal that the null of 'no unit root' was rejected in all three cases – confirming that unit root was present in all three cases – implying that the series are 'Non-Stationary'. The returns of the series are unpredictable as they follow a 'Random Walk'.

This is, thus, aligned with the theories and predictions of both the 'Efficient Market Hypothesis (EMH)' and the 'Capital Asset Pricing Model (CAPM)'. Furthermore, tests for serial correlations between the three variables and their respective lags show that they are not serially correlated.

RESULTS

Christie and Huang (1995) Model

The results obtained from the three regressions of the Christie and Huang (1995) model show no signs of herding in the 'NIFTY 50' Index during the extreme market movements. The results, shown in 'Table-2' of the appendix, provide evidence against the presence of herding.

In all the three regression, the '$\alpha\alpha$' coefficient, which measures the average level of dispersion, is positive and significant at the 1% level. The coefficients of the two dummy variables ($D_t^L D_t^L$ and $D_t^U D_t^U$) are both positive and significant at the 1% level in the three regressions and thus, providing evidence against the presence of herding in the 'NIFTY 50' Index.

The significant and positive coefficients indicate that the Cross Sectional Standard Deviation (CSSD) increases during periods of large price changes - consistent with the predictions of the 'Rational Asset Pricing Model', which can now safely be assumed to hold.

Out of the three regressions, two of them – which uses extreme returns that are one and two standard deviations away from the mean – have higher coefficient values for the 'Up Market' dummy ($D_t^U D_t^U$) as compared to the 'Down Market' dummy ($D_t^L D_t^L$). This indicates a 'flight to safety', i.e. a consensus, between investors when the market is going up.

Chang, Cheng and Khorana (2000) Model

Consistent with the model above, the Chang, Cheng and Khorana (2000) model indicate no presence of herding. The results, as shown in 'Table-3', show that the '$\alpha\alpha$' coefficient is positive and significant, at the 1% level, in both the regressions. Chang et al (2000) say that, "the $\alpha\alpha$ coefficient measures the average level of equity return dispersion in a stagnant market where $R_{m,t}R_{m,t}$ is equal to zero".

The coefficient $\gamma_1\gamma_1$ of the linear terms $\left|R_{m,t}^{UP}\right|\left|R_{m,t}^{UP}\right|$ and $\left|R_{m,t}^{DOWN}\right|$ $\left|R_{m,t}^{DOWN}\right|$ are positive and significant at the 1% level - implying a positive and linear relationship between the CSAD and the 'Up' ($\left|R_{m,t}^{UP}\right|\left|R_{m,t}^{UP}\right|$) and 'Down' ($\left|R_{m,t}^{DOWN}\right|\left|R_{m,t}^{DOWN}\right|$) 'Market Return'. In line with the findings of Chang et al (2000) and Gleason et al (2004), it is safe to say that the CSAD of equity returns will increase with the absolute value of the 'NIFTY 50' stock returns.

Additionally, the table shows that the value of $\gamma_1^{UP}\gamma_1^{UP}$ is less than the value of $\gamma_1^{DOWN}\gamma_1^{DOWN}$, implying that the Cross Sectional Absolute Dispersion (CSAD) increases at a faster rate when the market is going down than when the market is going up. The null hypothesis of $\gamma_1^{UP} = \gamma_1^{DOWN}\gamma_1^{UP} = \gamma_1^{DOWN}$ is therefore rejected.

Furthermore, the coefficient $\gamma_2^{UP}\gamma_2^{UP}$and $\gamma_2^{DOWN}\gamma_2^{DOWN}$ check for the presence of herding during the 'UP' and 'DOWN' extreme market conditions, respectively. As per 'Table-3', the value of the $\gamma_2^{UP}\gamma_2^{UP}$ coefficient is negative, but it is **statistically insignificant** (1% level) as well, confirming the fact that herding does not exist in the extreme 'UP' market movement. The value of the $\gamma_2^{DOWN}\gamma_2^{DOWN}$ coefficient is positive and statistically significant, confirming that herding is not present in the extreme 'DOWN' market movements. As no evidence of herding has been found, we can safely conclude that the predictions of the 'Rational Capital Asset Pricing Model' hold. These results also provide a strong support to a linear relationship between the 'CSAD' and the 'Market Return', implying the non-existence of a non-linear relationship between them.

Finally, the table also shows that value of the $\gamma_2^{UP}\gamma_2^{UP}$ coefficient is less than the value of the $\gamma_2^{DOWN}\gamma_2^{DOWN}$ coefficient, confirming that the rate of increase in CSAD during 'DOWN' markets, is more than the rate of increase during 'UP' markets. The null hypothesis of $\gamma_2^{UP} = \gamma_2^{DOWN}\gamma_2^{UP} = \gamma_2^{DOWN}$ is therefore rejected.

CONSLUSION / DISCUSSION

This paper examines 'the presence of herding in the '*S&P CNX Nifty'* Index of the 'National Stock Exchange of India' (NSE). The models employed aim to capture herding during extreme market movements, and are based on those proposed by Christie and Huang (1995) and Chang, Cheng and Khorana (2000). The results obtained indicate that herding is not present in the 'NIFTY 50' Index, thus consistent with the findings of Christie and Huang (1995) and Henker et al (2006). As per the results, there is an increase in equity return dispersion, rather than a decrease, hence concluding against the presence of 'Herding' during extreme market conditions. The predictions of 'Herding Theory' are rejected in favor of the 'Rational Asset Pricing Theory', as the latter is better in measuring and explaining the equity return dispersions of the 'NIFTY 50' Index.

There exists many a scope to build on our study. For starters, this paper can be extended to check for herding in specific industries and / or firms. While we have not incorporated the aspects of 'Thin Trading' (if it exists), one can extend such a research by checking and correcting for the same and measuring / understanding its impact on the' herding phenomenon. Another important area of research could be checking for Foreign Institutional Investors (FIIs) engaging in herding activities. Going a step further, specific models need to be developed which can tell the causes that have led to the presence of herding, i.e. to check if the 'Reputational Based Model' or the 'Compensation Based Model' etc. causes herding. Finally, micro data, if available, can be utilized with models such as the LSV Model (1992), to cross check for herding.

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APPENDIX (Tables)

Table 1 – Descriptive Statistics

Variables	Number of Observations	Mean	Variance	Maximum	Minimum	Serial Correlation at Lag			DF Test
						1	2	6	
Market Return ($R_{m,t}$)	2496	0.00031	0.00027	0.14845	-0.142	0.102716189	-0.0086639	-0.03960436	-45.057**
Cross Sectional Standard Deviation (CSSD)	2496	0.02155	0.00042	0.40795	0.00468	0.087475905	0.069583658	0.05370849	-16.283**
Cross Sectional Absolute Deviation (CSAD)	2496	0.01521	0.00005	0.12426	0.00359	0.42203352	0.363647212	0.29159078	-10.895**

Table 2 – Christie and Huang (1995) Model Results

Regression	α	β_1	β_2	Adjusted R^2
1st Regression – extreme market returns which are one standard deviation away from the mean.	0.01994	0.00558	0.0086	0.02163
	(43.30356)*	(4.26717)*	(6.73253)*	
2nd Regression – extreme market returns which are two standard deviations away from the mean.	0.02074	0.0143	0.01657	0.02806
	(50.0021)*	(5.05531)*	(7.09115)*	
3rd Regression – extreme market returns which are three standard deviations away from the mean.	0.02106	0.02074	0.04038	0.03882
	(52.01828)*	(4.36813)*	(9.18179)*	

The table reports the estimate coefficients of the Christie and Huang (1995) regression model; the *t*-statistics are presented in the parentheses. * indicates the coefficient is significant at the 1% level.

Table 3 – Chang, Cheng, and Khorana (2000) Model Results

Sample	Up – Market Model				Down – Market Model			
	α	γ_1^{UP}	γ_2^{UP}	Adjusted R^2	α	γ_1^{DOWN}	γ_2^{DOWN}	Adjusted R^2
Equally Weighted Portfolio	0.01162	0.29334	-0.08304	0.28586	0.01106	0.34294	1.45438	0.41832
	(55.11474)*	(14.63699)*	(-0.29668)		(32.63721)*	(11.71993)*	(3.89228)*	
The table reports the estimated coefficient of the Chang, Cheng, and Khorana (2000) regression model.								