Sectoral Analysis of Herding Behaviour in the Indian Stock Market

A dissertation submitted to the University of Hyderabad in partial fulfilment of the requirements for the award of the degree of

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IN
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BY

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UNDER THE SUPERVISION OF

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DECLARATION

I **Prakash Kumar Hati,** hereby declare that the research embodied in the present discussion entitled, **"Sectoral Analysis of Herding Behaviour in the Indian Stock Market"** is an original research work carried out by me under the supervision of **Dr. Motilal Bicchal**, School of Economics, for the award of M.Phil. from University of Hyderabad.

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Dean

School of Economics

Dr. Motilal Bicchal

Supervisor

Dedicated

To My

Parents

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Prakash Kumar Hati

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ABBRIVIATIONS

ADF	: Augmented Dicky Test
BAPM	: Behavioural Assets Pricing Model
BAPT	: Behavioural Assets Pricing Theory
BPT	: Behavioural Portfolio Theory
BRVM	: Bourse Régionale des Valeurs Mobilières
BSE	: Bombay Stock Exchange
BOLT	: BSE On-Line Trading
CAPM	: Capital Assets Pricing Model
CH	: Christie and Huang
CCK	: Chang, Cheng, Khorana
CSSD	: Cross Sectional Standard Deviation
CSAD	: Cross Sectional Absolute Deviation
CSMMD	: Cross Sectional Mean Median Difference
EMH	: Efficient Market Hypothesis
FII	: Foreign Institutional Investor
FPI	: Foreign Portfolio Investment
FMCG	: Fast Moving Consumer Goods
GCC	: Gulf Cooperation Council
HOSE	: Ho Chi Minh City Stock Exchange
IPO	: Initial Public Offering
IT	: Information Technology
ISO	: International Standar Organisation
NIFTY	: National Stock Exchange Fifty
NSE	: National Stock Exchange
NYSE	:New-york Stock Exchange

PSU	: Public Sector Undertaking
PP	: Phillips Pheron
QFI	: Qualified Foreign Investor
SDL	: State Development Loan
SEBI	: Security Exchange Board of India
STAR	: Smooth Thresold Auto-Regressive
VAR	: Vector Auto Regression
WFE	: World Federation of Exchange
WDM	: Wholsale Debt Market

Chapter 1
INTRODUCTION

1. Introduction

Neoclassical investment theories postulate that economic agents are rational who make a decision to maximize the returns. However, investors are not always rational and their actions are often based on emotions, irrational sentiments and motives particularly during the times of uncertainty; Chang *et al*. (2000). The absence of these aspects in the modelling of investment decisions has resulted in an incomplete analysis of the market and thus inability to explain the market anomalies and fluctuations related to that; Kumar and Bharti (2016).

The study of investment behaviour is broadly classified into traditional finance and behavioural finance. The traditional finance emphasizes its thrust upon the efficient market hypothesis (EMH) which assumes investor rationality. Fama (1970) in his work showed that if prices always reflect all the information available in the market then the market is said to be efficient. On the contrary behavioural finance is based on investor psychology (Barberis and Thaler, 2003). A lot of anomalies are found in the stock market and it is believed that the emergence of behavioural finance is to deal with these anomalies that exist in the market.

Herding is considered as common phenomenon in the financial market and equity. This is generally defined as the tendency of investors to imitate the actions of others; Al-Tamimi (2006). It broadly implies that investors imitate other investment decisions instead of using own information. In general herd behaviour is the collective behaviour of the individuals in a group with no centralized direction. In other words, it is described as the correlations in trade due to interactions between the investors; Chiang & Zheng (2010).

An investor usually makes a detailed analysis of the market before taking any investment decision. This task becomes more challenging whenever such a decision has to be taken in a short span of time to obtain the optimal return. The situation of this kind leads the investor to be entangled with the biased decision which is said to be an irrational one. Consequently, the

investor ends up with imitating the investment behaviour of the other market participant or the investment decision of the crowd to cover the risk. Such kind of behavioural pattern is identified as herding behaviour. Further, investors often get influenced by others and make a decision accordingly, for example, market participants while investing in the market often follow actions of the market pandit and the market direction. Such an investment strategy increases the volatility of stock prices in the market, see, for example, a Morris and Shin (1999) and for both developed and developing countries, see, Tan *et al*. (2008). Moreover, the literature suggests that herding behaviour is more pronounced during the market stress period and its extreme form is found to be a cause for the financial crisis, see, for instance, Prosad *et al*. (2012) and Balcilar *et al*. (2014).

1.1 Statement of the Research Problem

Traditional finance assumes rationality behaviour and market efficiency, which put a limit on the study of investor behaviour. Behavioural finance lifted the rationality assumption by incorporating psychology in the study of finance. According to Statman (1999), the efficient market hypothesis (EMH) says that an individual cannot beat the market but it ignores the psychological aspects of investor's sentiment. In the late 1970s, the EMH was popular and its validity was tested in several empirical studies. However, the frequent emergence of the financial crisis in different countries raised the question on the validity of EMH. Consequently, the study of finance has increasingly been using the principles of psychology. The psychological behavioural biases such as cognitive, emotional and heuristic are increasingly observed in the study of investment. Among these, herding behavior found to be a prominent anomaly in investment behaviour.

Emperical studies on herd behaviour indicate that this unusual behaviour is more intense in developing countires than the developed countries. A possible reason for such a finding is less educated investor found in the stock market. Nonetheless, the empirical evidence provides the mix results as some developed countries exhibit herding behaviour while others do not. The similar finding is found in the developing countries market. It is also evident from the literature that behaviour of this kind gets more intense at the time of extreme market period. Further, some studies find that trading volume is one important cause of herding behaviour. Some other

studies, however, assert that finding of herding behaviour is sensitive with respect to the extreme trading volume in the market.

India being a developing country is considered to have a less developed financial market and hence is likely to be exhibit herd behavior in the market. Nevertheless, past studies on herding behaviour in India have been inconclusive. Further, most studies have focused on examining market-wide herding. In this study, an attempt is made to study herding behavior at the sectoral level market. In doing so, the study uses different sectorial indices of NSE and its constituent individual stocks to examine herding behavior in the Indian stock market.

1.2 Research Questions

Considering the research problems of the study, the following research questions have been formed.

1. Does the different sector of NSE indicate the prevalence of herding behaviour?
2. Do increase and decreasing market movements provides evidence for herding behaviour in different sectors?
3. Does trading volume trigger herd behaviour in different sectors of the market?
4. Whether herding behaviour is there in different sectors in the course of the crisis period?
5. Does the extreme trading volume of the different sectors indicate herd behaviour?

1.3 Objectives of the Study

Followings are the purpose of the study:

- To make an analysis of herding behaviour for the different sectors of the Indian stock market.
- To examine herding behaviour in the context of the trading volume.
- To explore the existence of herding behaviour at the time of the crisis period.
- To examine the asymmetric effect of herding behaviour during both extreme market fluctuations and extreme trading volume.

1.4 Contribution of the Study

To the best of my knowledge, there are very few studies examine herding behaviour at the sectoral level. Barring the Ashish and Bharti (2016) who use information (IT) sector index, most of the studies based in India have focused on the Nifty market index and its constituent stocks. Further, a small number of studies consider the trading volume into analyzing behavioural anomalies. The present study aims to contribute to the existing literature by analyzing herding behaviour at the sectoral level and by incorporating the trading volume into the analysis. In doing so it provides a firm conclusion relating to herding behaviour in the stock market of India.

1.5 Chapter Scheme

The second chapter discusses the theoretical background of herding behaviour and provides a brief summary of the Indian stock market. The third chapter briefs the survey of literature regarding herding behaviour observed in the financial market with a focus on the literature on the Indian scenario. The fourth chapter elaborates the methodology adopted for the study and provides empirical analysis and interpretation. The last chapter summarizes the study and concludes.

Chapter 2

THEORETICAL BACKGROUND AND AN OVERVIEW OF THE INDIAN STOCK MARKET

2.1 Introduction

The current chapter is divided into five sections. The chapter is intended to shed some light towards the theoretical backgrounds of the behavioural finance to attain a better picture of herding behaviour. In doing so, we attempt to explain the concepts of herd behaviours, investor's behaviour, and different behavioural anomalies that are related to herding behaviour. We also explain the types and reasons of the herding behaviour, as shown in the literature. As we consider the Indian market for our empirical exercise, we brief the Indian stock market in the following section.

2.2 Tradition Finance

There are two schools of thoughts with regards to the investment behaviour of the investors in financial markets, i.e., traditional finance and behavioural finance. Before delving into the domains of behavioural finance, we brief a little about traditional finance. At the beginning of the classical era, the concept of utility came into force, which was measured by the satisfaction level of the individuals. J. S. Mill (1844) provided the concept of a rational economic man. The main assumptions of rational agents were perfect rationality, perfect information, and self-interest. Later on, these assumptions emerged as a foundation to the traditional finance, which explains about equilibrium in the financial market with maximization of marginal utilities given the situational constraints. Standard finance was designed to deal with the real-life problem related to finance. The assumption on which this theory revolved around was that investors or market participants are rational. The chronology of theories of traditional finance is given in Table 2.1. The pillars on which the traditional finance stands are:

i. Rationality of investor
ii. Efficiency of market
iii. Investor while designing their portfolios follows mean-variance portfolio theory
iv. Investors act according to the CAPM

Table 2.1: The Chronology of Theories of Traditional Finance

Contribution	**Authors**	**Year**
Concept of *homo economicus* (economic man)	J.S Mill	1844
Expected Utility theory	Bernoulli Von Neumann and Morgenstern	1738,1954, 1994
Mean-variance portfolio theory	Harry Markowitz	1952
The capital assets pricing model	Treynor, Sharpe and Lintner	1962, 1964, 1965
Efficient market hypothesis	Eugene Fama	1970

2.3 Behavioural Finance

Behavioural finance is considered to be formed after the contribution of sciences like psychology, finances and sociology as is evident from the work of Ricciardi and Simon (2000). Shefrin (2001) opined that behavioural finance is the fields which explain the effect of psychology on investors in making a financial decision in the market. The work on behavioural finance almost originated in the eighteenth century with the significant work like Theory of Moral Sentiments (1759) and Wealth of Nations (1776) provided by Adam Smith. Smith (1998) was of opinion that behavioural elements like pride, disgrace, insecurity and egoism represent the action to be taken by a man and the chances of profits to be accrued. But the study on behavioural finance came to focus when the work of Kahneman and Tversky (1979) was awarded Nobel Prize in economics. The prospect theory provided by Kahneman and Tversky (1979) is considered to be an important contribution to the field of behavioural finance. This theory explains how individuals perceive the gain or losses.

The work on behavioural finance gives rise to the emergence of theories like behavioural asset pricing model (BAPM) by Sherfin and Statman (1994), behavioural portfolio theory (BPT) by Sherfin and Statman (1999) . The BAPM talks about the interaction of two groups traders that

are informational traders and noise traders and the BPT tell that investors design their portfolio like the pyramids of assets consisting of different layers where the level of risk is different for the different layer. The literature attacking the theory of traditional finance tells that traditional finance cannot alone deal with the anomaly observed in the financial market, so to analyse anomaly of the market the concepts of behavioural finance is necessary.

2.4 A Comparison between Traditional and Behavioural Finance

Traditional finance revolves around the assumptions that investors are rational and markets are efficient. On the contrary, behavioural finance provides another framework for traditional finance. It assumes that (i) the investors are normal and they are not rational (ii) though it is difficult to beat the market, market is not efficient (iii) the investors follow behavioural portfolio theory while designing portfolios instead of mean-variance portfolio theory, and finally (iv) the investors calculate expected returns based on behavioural assets pricing model rather than CAPM.

The Normal Investor and Rational Investor

Miller and Modigliani (1961) asserted that investors are rational beings. They argue that normal investor does not worry about the form of wealth; rather they choose more wealth to less wealth. Barberies and Thaler (2005) point out that the rationality in the financial market refers to two things that, first, investors update their decision to take action when they come across with new information. Second, a market participant takes actions which are normally acceptable not a biased one.

Though we are not rational as stated by Miller and Modigliani (1961), we are not fooled. According to this framework, a normal investor makes investment decision some times out of excitement and emotion, and they are not like a utility maximizing machine that always makes a decision based on wellbeing.

Efficient Market Hypothesis

The standard finance assumes investors and market participants to be rational who take unbiased decisions when there are risk and uncertain situations. The assumptions of rational investor and

the actions of such investors in the financial market hold the concepts of efficient market hypothesis. According to the efficient market hypothesis market price "fully reflect" all the information available in the market. Fama (1991) from very early stated that the efficiency of a market itself is not testable; it must be tested along with an assets pricing mechanism like the CAPM. It is logically asserted that the efficient market based on the equality between stock price and its intrinsic value, is one that cannot be beaten. A wrong notion, according to the proponents of behavioural finance regarding the efficient market, is that when one becomes unable to beat the market by getting excess returns, then that market is said to be efficient. For earning an excess return, one has to identify and purchase the stock whose value is less than its intrinsic value and to sell the overvalued securities. Consider the period of bubble-like situations in which there arises significant difference between stocks' intrinsic value and its price; still one cannot beat the market as the investors become unable to take advantage of purchasing the undervalued stocks and selling the overvalued one. Herding behaviour is in direct contrast to the efficient market hypothesis, so let us discuss the efficient market in details.

Fama (1970), considering the information levels available in the market divided the form of market efficiency into three, viz., weak form, semi-strong form, and strong form. Weak form efficiency talks about the random walk nature of security prices, for which predicting the future securities prices based on the past information does not give fruitful results. Everyone, according to this form of efficiency is entitled to normal profits and not more than that as all the investor have the same set of information. In semi-strong form efficiency, security prices reveal the information publicly available in the market through annual reports of the companies, corporate announcements, etc. According to this form of efficiency forecast of the market analysis does not play a great role as the available public information is processed very quickly.

In strong form, efficiency security prices reflect all the public and private information available in the market. However, despite this also the investors do not get a chance to earn supernormal profits. This form of efficiency is available in two forms one is basic form, and the other is extreme form, the first one corresponds to the portfolio analysis by the analysts and the other one deal with an inside expert. Strong form market efficiency implies that the market is already efficient in weak form and semi-strong from a parameter of market efficiency.

The literature on market efficiency shows that most of the study supported the weak form efficiency, and a few supported the semi-strong form efficiency, but the strong form efficiency did not seek much attention.

Mean-variance Portfolio Theory and Behavioural Portfolio Theory

The traditional financial theories explain that investors for designing their portfolio follow the mean-variance portfolio theory. It was designed by Harry Markowitz, for which he was awarded the Nobel Prize in Economics. This portfolio theory refers to a process of collecting a portfolio of assets in such a manner that for a given level of risk expected return is maximized. It explains the diversification in investing because financial assets of different kinds in a portfolio are less risky than that of only one type in the portfolio. This theory makes the investor smarter as it says the investor should assess the overall risk and return of a portfolio rather than the risk and return of particular assets included in it. This theory treats variance of assets as a risk factor; it means higher the variance higher the risk and vice-versa.

Shefrin and Statman (2000) introduced a goal based theory called Behavioural Portfolio Theory. According to this theory, investors do not view their portfolios as a whole as given by the mean-variance portfolio theory but as a pyramid of assets consisting in various mental account layers with the respective goals for each layer. Here investors' risk attitude is different for different layer because an investor may act as risk lover in downside layer, and he may be risk-averse in upside layer. However, recently Das, Markowitz, Scheid, and Statman (2010) combined both the theory and form mental accounting portfolio theory.

CAMP Model and Behavioural Assets Pricing Model

The capital assets pricing model treats beta as the only factor to determine the expected stock return. As a result, traditional finance switch towards the behavioural assets pricing model (BAPM). In the model of standard finance, there are characteristics of stock like market capitalization, a book to the market ratio, which add to beta for determining expected returns. However, BAPT (Behavioural Assets Pricing Theory) treats similar features as a reflection of representativeness and emotions effect.

2.5 Different Behavioural Biases

Behavioural biases observed in the financial market are capture by behavioural finance. Behavioural biases can be classified into two types, one is heuristic driven and the other is frame dependent.

2.5.1 Heuristic Driven Biases

Tversky and Kahneman introduced the behavioural concept of heuristics in the year 1974. It refers to the mental shortcuts which are adopted by the people for making a decision very quickly. These shortcuts though seem to be helpful but sometimes it provides the decisions which are erroneous. Some other biases under this head were identified by Shiller (2000) like overconfidence and excessive optimism.

2.5.2 Frame Dependent Biases

The footprint of these behavioural biases is also found in the work of Kahnemann and Tversky (1979), which was further expanded by Shefrin (200). The biases included under this head are mental accounting, loss aversion, disposition effect and narrow framing.

Besides these behavioural biases, there are others like herding. It refers to the imitating behaviour of the individuals who reject their private information. Some of the past studies on herding behaviour reveal that this behaviour gets intensified when there is market stress like situations and consequently leads to pricing bubbles and crisis.

2.6 Types of Herding Behaviour

A review made by Bikhchandani and Sharma (2000) on the theoretical and empirical aspects of herding behaviour identified *two* types of herding behaviour witnessed in the market, first one is intentional herding behaviour and the second one is unintentional herding behaviour. Intentional herding often gives rise to an inefficient outcome and become the cause for the fragility in the market. As a consequence to which market participants encounter systematic risk and excess volatility in the market, so it is necessary to identify which one is intentional and which is one is unintentional herding. When the investor purposefully follows the investment behaviour of the other market participants, it is termed as intentional herding behaviour. This kind of herding behaviour is inefficient, and it becomes the reason for the fragility in the market.

However, unintentional herding behaviour is accidental; such kind of herding pattern is observed when an investor takes a similar decision independently with a given set of information. Unintentional herding behaviour is also called as spurious herding. As an independent decision-making procedure is there in unintentional herding behaviour, it is considered to be rational herding. However, intentional herding may fall into the category of rational or irrational herding. Intentional herding becomes rational when investor follows others by considering that they are better informed than them. However, when investor blindly follows their fellow, it is identified as irrational herding.

From the above, it is clear that unintentional herding behaviour is inefficient and it brings disturbances in the market. However, it very challenging to differentiate the types of herd behaviour empirically like which one is intentional and which one is unintentional.

2.7 Reasons of Herd Behaviour

There are different reasons why investors herds while making an investment decision in the financial market. According to Bikchandani and Sharma (2000), followings are the factors that cause rational herd behaviour in the financial markets.

2.7.1 Information Based Herding

Individuals, while deciding in the financial market, face similar situations with a given level of risks and uncertainty. Provided the public information, they have their assessment with regards to the availability, reliability, quality of the information. This private information of the individuals generally concludes the decision to invest or not in a particular asset. The quality assessment of the information observed is privately known to the particular individual based on his knowledge regarding the market.

While deciding in a financial market, investors cannot observe each others' private information but can observe the publicly available information. If one investor acknowledges his private information to others, then others may not follow the information rather follow their actions. Because if an individual has to judge the private signal of others, he observes the actions of the

concerned individual and from that, he gets the clue regarding the private signals. From the observed actions, investors follow the other individual to whom they considered better informed. This kind of behaviour is fragile, with the arrival of new information.

Herd behaviour generated due to inefficient information may give rise to mispricing, and situations like price bubbles. This may be due to the absence of accurate information among the market participants. When there is a question only on the certainty of the investment decision to be made, the stocks price seems to be informationally efficient, and thereby there is an absence of herding behaviour in the market. If there is uncertainty regarding the accuracy or quality of the information possessed by investors, stock price becomes inefficient, which leads to herd behaviour.

2.7.2 Reputation-based Herding

There is another theory of herd behaviour based on the reputational concern of the analysts or fund manager. It was propounded by Scharstein and Stein (1990), Zweibel (1995), Prendergast and Stole (1996), and Graham (1999). Herding behaviour of such kind is most likely to occur when there is doubt regarding the ability of the fund manager. The work on herding behaviour by Scharfstein and Stein(1990) make it clears that if the employers and investment manager are not sure of the fund managers' ability to pick up the right stocks, then they conform with the other fund manager decision to avoid the risk and uncertainty situations, and if both of the fund managers are having similar situations then there arise herding behaviour.

When there are more than one managers who take the investment decision sequentially, most of the manager follows the decision taken by the first manager. Consequently, the fund manager will follow (will not follow) the first manager if the investment decision taken by the first manager is profitable (not profitable). However, this information of profitability (not profitability) will not be made public, as all the managers, regardless of their beliefs will be following the investment decision made by the first manager. Hence herd behaviour of such kind will be inefficient.

2.7.3 Compensation Based Herding

When an investors' compensation depends on the relative performance of the others similar professionals, then the investor lands himself in an inefficient decision, as the compensation structure of such kind distorts the incentive of the investor to invest (see Brennan (1993) and Roll (1992)). Sometimes the compensation nature of this may results in herd behaviour by the investor. If an investor compensation is conditioned on the performance of a benchmark.

2.8 An Overview of the Indian Stock Market

Capital market refers to the institutional arrangements where long-term and medium-term funds are raised for the companies. In this market, one can employ his idle money into some productivities activities without involving himself into the process of production but by facilitating the money capital to the market in the form of investment. It provides for the liquidity and marketability of the investment made by the market participants. The market rates the financial positions and performance of an industry. For an economy to develop, it is indispensable to have a well-organized capital market. The capital market includes the primary market and the secondary market. The primary market is also recognized as the new issues market as the new securities are issued in this market. In the secondary market, the securities issued in the primary markets are traded. The stock market and bond markets come under the secondary market.

The stock market refers to a loose network consisting of buyers and sellers of stocks, which corresponds to the ownership claim on the businesses. In the stock exchange stockbroker and traders buy and sell the shares of stocks and other securities. There are large companies which are listed on various stock exchanges. Trade in the stock markets refers to the transfers of stocks between the buyers and sellers to earn money. So in the stock market trading happens, which help the corporates giants and industries to raise fund for the productive investment from the public who are having idle cash balance. The stock market is considered to be the barometer of an economy in which the corporate sector and various industries of the economy depends. There are various indexes and various indicator of the stock market, which helps in measuring the growth of the market, and it also provides what the status of the various industry and corporate sector in an economy is.

The existence of the stock market is considered to be one of the features of the free market economy because company utilizes the idle money of the individual by giving them the opportunities to become a part of institutions. In this market, a small amount of money of the public becomes large ones which enable the entrepreneur, investors to make their business possible. By supplying the funds to the company in the form of shares and equity, the market participants earn a certain sum of money in the form of return to the investment made.

Therefore for an economy to develop and prosper it becomes the pre-conditions to have a well-organized stock market with the regulating agency. India is very much dependent on the stock market as it facilitates the capital need of the country.

2.8.1 Stock Market in India

In India, two major stock exchanges are BSE (Bombay Stock Exchange) and NSE (National Stock Exchange) in which most of the trading takes place. The BSE is the oldest stock exchange in Asia started in 1875, currently has 5000 listed firms. The NSE came into existence in 1992, and the trading started in 1994, now there are 1600 firms listed on this platform. From the domestic market capitalization viewpoint, these two stock exchanges remain in top 10 exchanges among all the World Federation of Exchanges (WFE) member exchanges in 2018. These stock exchanges are having their respective index, namely Sensex and Nifty, which represents the performance in Indian stock markets. Sensex is considered to be the oldest among the market index designed for equities, which include 30 stocks of different firms listed on BSE. 45% of the index's market capitalization measured by free-float market capitalization method is represented by Sensex.

Besides domestic investors, there are foreign investors in the stock market who contribute to the capital market in the form of investment in different shares of the primary and secondary market. In the 2011-12 budget speech, it was mentioned that Qualified Foreign Investors who fulfil the provision of "Know Your Customer" are allowed to invest in Indian equity directly. SEBI introduced foreign Portfolio Investors (FPI) in 2014, which is a newly designed class of investors from foreign. It came into existence by merging the class of investors, these are FIIs, QFIs, and

the rest were sub-accounts of FIIs. FPI in Indian stock market captures significant shares, about 28.9% in the year 2018-19. Due to high growth and potential in the economy, net capital inflows were positive during the period 2011-15. However, in 2015-16, the inflows became negative as the economy appeared to move downward. This was the third time that the net-inflow became negative after the Asian crisis (1998-99) and the Global Financial Crisis (2008-09).

The stock markets in India are like the driver of the Indian economy, which facilitates the capital need of the country. Indian stock market is considered to be the most developed stock market in the world. The origin of the Indian stock market is found to be in the later part of the 18th century. There are two major stock exchanges in India.

Bombay Stock Exchange

This stock exchange was propounded by Premchand Roychand. It came into existence in the year 1875, earlier it was named as Bombay Stock Exchange Ltd. (BSE Ltd.). It is one of the leading stock exchanges in India which is claimed to be the first stock exchange in Asia. It is claimed that BSE holds No. 1 positions for listing largest No. of firms. Currently, there are 5619 firms are listed on BSE as of March 2018. BSE had overall market capitalization of 1,42,24,997 cr. last year.

While it comes to ISO certification BSE becomes the first in India and seconds in the world to get an ISO 9001; 2000 among the other stock exchanges. Initially, the trade was going on the open trade floor but in 1995 it adopted the electronic trading system. It took only five days to make the transition. The online trading system of BSE BOLT which is automated facilitates screen based trading capable of processing 8 million orders in a day. Trading in stocks, derivative, debenture, equities etc becomes transparent and efficient on the BSE.

National Stock Exchange

This stock exchange was formed in the year 1992 and identified to be a stock exchange in 1993 under the Securities Contracts Act 1956. This is the first stock exchange in India which facilitated the screen based trading and thereby started promoting transparency in Indian the market. NSE started its operation in a different segment in a different time period. For Wholesale Debt Market (WDM) and Capital market section it facilitated trading from June 1994 and

November 1994 respectively. While this stock exchange started providing a trading facility in the derivative market from June 2000.

This stock exchange is considered to be the world's 11th largest stock exchange based on the aggregate market capitalisation of 1,40,44,152 cr... The NIFTY index is the benchmark index of this stock exchange. Based on the benchmark index of NIFTY the analysts predict where the Indian stock market is moving. There are various indices in NSE based equity and fixed income. The indices based on equity are sectorial indices, thematic indices, strategy indices and board market indices and the indices based on a fixed income are government securities indices, corporate bond indices, money market indices, SDL(State Development Loan) indices, aggregates indices.

2.8.2 Sectoral Indices of NSE:

The National Stock Exchange of India is having eleven sectoral indices in the NSE but out of this one index is desegregated into various industry groups, so there are 10 sectoral indices which represent different sectors of India. The 10 sectors in NSE are an automobile, bank, financial service, FMCG, IT, Media, Pharma, Private bank, PSU bank, reality. The firms listed in these indices represent the respective sector of the economy. The firms to be listed in these sectors should possess certain characteristics according to the sectors. Following are some of the common characteristics.

- A company should rank itself in the top 800 in terms of average daily market capitalization and turnover during the last 6 month.
- Companies to be listed in a sector should belong from that sector
- Trading frequency of the firms should be 90% for the last 6 months.
- The company must have listing history for at least 6 months. But for IPO it is reduced to 3 months if it covers other criteria during the 3 months.
- Final selections of the companies are done on the basis of the free-float market capitalisation of companies to be listed.
- Weighted for each stock in the index is assigned on the basis of the free-float market capitalisation calculation such that not a single stock gets more 34% and the weighted for top 3 companies must not exceed 63% while rebalancing.

2.9 Conclusion

This chapter provided the theoretical understanding of the herding behaviour by focusing on traditional finance, behavioural finance and different behavioural biases. It presented concepts like causes and types of herding. After that, it provided an overview regarding the Indian stock market by discussing the BSE and NSE. In the later part, it elaborated the details regarding the sectoral indices of NSE. From this, it is clear that herding behaviour is behavioural biases which is contributing to the inefficiency of the market. This kind of behaviour also leads to pricing bubbles.

Chapter 3

REVIEW OF LITERATURE

3.1 Introduction

There has been an increasing number of studies in the field of herding behaviour, especially in the last two decades. However, relatively more studies have been related to developed countries than with developing countries. Among the studies that concern the developing countries, a major share is of China. This chapter sheds light on the various studies made in the context of herding behaviour existing in the financial market. For the convenience of our study, we categorize the literature on herding behaviour in the financial market into two — (i) the studies in the global context and (ii) the study made for the Indian context.

3.2 Studies in the Global Context

Detection of herd behaviour in the financial market has been a major concern of researchers and policymakers as it poses the challenge to alter the behaviour of the market, especially in a stress period. The studies conducted by Lakonishok *et al.* (1992) and Christie and Huang (1995) (CH model hereafter) are considered to be among the pioneering works in this area.

Lakonish *et al.* (1992) analysed the role of institutional investors in destabilizing stock prices from the perspective of herding and feedback trading. To accomplish this work they relied on quarterly portfolio holdings of the all-equity pension funds during the time period 1985 to 1989. They encountered two types of trading strategy by the money managers one is herding and the other one is positive feedback trading. In this work, the authors proposed a measure of herding H for a given stock in a given quarter. The study reported not so strong evidence of herding on small stocks but high positive feedback trading on small stocks. This work concluded that there is no market-wide herding by the money managers.

Christie and Huang (1995) examined herd behaviour throughout the period of market stress by analysing the equity returns dispersion. They calculated Cross-Sectional Standard Deviation (CSSD) of equity returns as a proxy for examining herding behaviour. The authors made use of

both monthly and daily data to detect herd behaviour in the US stock market for the period of market stress. The study reported that stock return dispersion is increasing during the period of extreme price changes and told that at the time of market stress herding is not a crucial feature which will help control equity returns.

Avery and Zemsky (1998) studied the relationship existed between the assets prices and investors rational herding, as the past studies on rational herding did not address this relationship adequately. According to the general model produced in this work, the price mechanism suggests choices made in long runs as efficient, which was supposed to be accompanied by simple information structures, and these facts prevent herding behaviour. It was revealed that complex information structures lead to herd behaviour, and when it becomes severe, it results in price bubbles. They explain multiple dimension of uncertainty may bring uncontrollable situations to price mechanism at the time of extreme trading, and it may account for shot run behaviours like herding, contrarian behaviour, and price bubbles.

The study of Chang *et al.* (2000) (CCK hereafter) made use of both developed and developing countries to study the herd behaviour from an international perspective. They selected the US, Japan, Hong Kong, among the developed stock markets and South Korea and Taiwan among the emerging stock market. This paper is supplementary to that of Christie and Huang (1995). This work reported that equity return dispersion increased for the U.S., Japan, and Hong Kong stock market during the extreme market situation providing the evidence against herding behaviour. However, for South Korea and Taiwan, they reported the low dispersion of equity returns during the up and down market situations providing the evidence supporting herding behaviour.

An extensive assessment of the literature on herding behaviour in the financial market has been carried out by Bikhchandani and Sharma (2000). This work provided the precise meaning of herd behaviour and its causes. It provided a review of both the empirical study and theoretical study on herd behaviour which presented different methods of measuring herding behaviours like the herding measures developed by Lakonishok *et al.* (1992) and CH model.

Advancement in the field of examining herding behaviour was from Hwang and Salmon (2004), who proposed a new method which is derived from the equilibrium norms of CAPM. This methodology is believed to be similar to the CH model to the point where this methodology used the information inherent in the cross-sectional market movements. However, this approach gave importance to the cross-sectional variance of factors sensitivities. They applied this method to the stock market of both US and South Korean country. For examining herding behaviour in these stock markets, they relied on daily data during the year 1993 to 2002. The sample period covers events like the Asian crisis of 1997 and the Russian crisis of 1998. The authors calculated the herding measures for the US and South Korean markets using the stocks (500) listed on the S&P500 index and the ordinary stocks(657) listed on the KOSPI index, respectively. The study reported that market wide herding exhibited the significant movement considered to be persistence separately given by the market situations reflected in the return volatility and level of mean return. The work asserted that herding behaviour was not explained by macros factors. However, the results revealed herding for the market portfolio when the market witnessed both upward and downward movements, and it also reported the turning points in the herding behaviour during the period of Asian Crisis and particularly the Russian Crisis.

Further advancement in the method of detecting the herding behaviour was to consider trading volume in the estimations. Tan *et al.* (2008) while examining the herd behaviour in the Chinese stock markets made use of daily, weekly and monthly firms level data of stock prices, trading volume and earnings per shares of entire companies registered on the Shenzhen Stock Exchange and in the Stock Exchange of Shanghai during 1994 to 2003. They also included A- shares firms and B- shares firms in this work. It was reported in this study that the Asian crisis was not influenced by herding behaviour in these four markets studied. The daily data revealed that both A shares and B shares market of both the exchanges showed herding behaviour by the investor. The weekly and monthly data produced evidence supporting much weaker herding behaviour. All the fours markets were evident in herd behaviour when there is a rising market scenario, corresponding to the higher volume and volatility.

Chiang and Zheng (2010) in their paper, tried to examine the herding behaviour in a global context using panel data of the stock markets of different countries. They took the daily data of

industry as well as market price index for 18 countries during the period 1988 to 2009. The data consisted of advanced markets, Latin American markets, and Asian markets. For industrial stock returns, they reported herding was significant for each national market with an exception to the US and Latin America. This result was *in contrast to* the findings of Chang *et al.* (2000) and Demire and Kutan (2006), which revealed that herding was absent in advanced markets. It was also reported that investors investing in the Latin American markets acted according to the US markets movements. Except the Latin American Markets and the US, this study produced results supporting herding in all other markets both in up and down market situations. It also revealed that herding was there in the US and Latin countries at the time of crises.

Among the studied that attempted to learn an emerging stock market was Demirer *et al.* (2010) who analysed the herd behaviour of investors in the stock markets of Taiwan. They selected Taiwan market because of its interesting institutional characteristics like dominated mostly by an individual investor, though it is an emerging stock market, it is highly developed. The authors looked into the sector level perspective of the stock market by analysing the firms level data. Here I found the application of the model based on return dispersion measures of herding like CH model and CCK models[1] and the state space model suggested by Hwang and Salmon (2004). For examing herding behaviour, they used the daily returns of the 689 firms registered on Taiwanese stock exchange during the period 1995 to 2006. In this study, it was observed that the linear models rested on CSAD (Cross-Sectional Absolute Deviation) produced no significant result indicating herd behaviour in the market excluding the electronic sector. The significant results from the state space model and nonlinear models indicated the sign of herding behaviour among all the sectors. The study asserted that herding behaviour gets intensified when there are situations like market losses.

Balcilar *et al.* (2014) examined herding behaviour in the oil-rich developing countries of the Gulf Cooperation Council (GCC) with a purpose to show the link between volatility and herding. They opted to study Abu Dubai, Dubai, Sauf Arabia, Kuwait, and Qatar in the study for different time periods for each country. In doing so, they looked at how volatility affects herding behaviour when global factors were in a controlling state. They proposed a smooth transition

[1] Models developed by Chang, Cheng and Khorana (2000)

regime-switching method (STR)[2] in this work. The markets of the GCC countries like Dubai, Qatar, Kuwait and Saudi Arabia revealed herding behaviour which was found to be strong and persistent during all periods. In Abu Dhabi, which is assumed to be conservative in an economic sense, the herding behaviour was less pronounced except for the period 2005-2009. This study provided evidence that there was a *direct* relationship between herding behaviour and market volatility. This study produced similar results to that of Christie and Huang (1995) and Chang *et al.* (2000) which state that investors suppress their private information and go with crowd when the market situations were in stress. Further, this study reported that the shock originated in the global market significantly influenced herd behaviour captured in the stock market of GCC countries.

Cipriani and Guarino (2014) tried to develop a theoretical model with which one can estimate herding behaviour by using financial transaction data of the market. They asserted that this method permit acknowledging the quantifiable significance of herding, to know when it occurs, and to evaluate the inefficiency of information generated by herding. They estimated the model by taking data of an NYSE stock i.e., Ashland Inc. in 1995. The study revealed the presence of herding in the market for some trading days and it also generated significant 'informational inefficiencies'. The main contribution of this work to the literature was its methodology which shows how to analyse herding within a structural estimation framework. The methodology developed by them is for an empirical implication of herd behaviour in the markets.

Yao *et al.* (2014) tested the herding behaviour in the different segment of the Chinese stock market following the approach of the CH model. In doing so, they estimated the return dispersion of the Chinese stock market segmented as A and B share market to show is there any sign of herd behaviour in the segmented market. This work used the modified to deal with the multicollinearity and autocorrelation problems[3]. They witnessed the presence of herd behaviour across the B share market during 1999-2008. This study reported that herding behaviour to be more common at an industry level than compared to the market level. This kind of behaviour

[2] STR refers to a specification which identify herding and non herding during different market phases consistantly way with the return and volatility structure of return.

[3] The modification was in the form of including the lagged value of the dependent variable and inclusion $(R_{m,t}-R_m)^2$ to take care of multicolinearity.

was also high in case of stock having the smallest and the largest market capitalisation, among the growth stock and during the downswing of the stock market. From the robustness test, the author came to know that herd behaviour persists despite the changing condition of the market liquidity.

BenSaïda *et al.* (2015) analysed the volume – herding interaction in order to develop a robust analysis of herding for the US market considering the trading volume as a control variable in the model. Their purpose was also to see whether the trading volume is fuelling herding behaviour or not. The authors used the modified version of the models suggested by the CH model and CCK models. The modified version includes the trading volume in these models to examine herding behaviour. VAR and Granger causality test was employed to show the nature of causality relationship between the trading volume and herding behaviour. The study reported that the correlation between herding behaviour and market trading volume to be negative and significant. From the causality test, it concluded that market trading volume and herding can be influenced by one another.

Litimi *et al.* (2016) in their work on herding behaviour and excessive risk in the U.S. stock market they tested whether herding behaviour is a causal factor to market volatility and increasing bubbles or not. Here they also looked for the factors affecting herdings like investor sentiments and trading volume turnover. The sample considered for the study are all the domestic companies listed on the American stock market. The sample periods i.e., 1985 to 2013 this covered the four major turmoil periods. This study focused on the sectoral analysis of herding behaviour for which all the companies considered for the study was classified into 12 sectors according to the NASDAQ classification. Here the authors applied the CH and CCK. models to identify herding behaviour and they added trading volume and investor sentiment to the model and also used that modified version. To show the link between other major indicators they used VAR model and Granger causality test. Finally, this study invested what effect do have trading volume and herding on volatility. This work provided evidence supporting herding behaviour in the stock market of the U.S., which contributed to the financial bubbles and crises. The CSAD modified model showed the presence of herding behaviour in 8 sectors out of 12.

They also revealed that herding behaviour got intensified by factors like investor sentiment, market return and volume turnover.

An attempt to empirically study the herding behaviour in the Vietnam stock market has been taken up by Bui Nha *et al.* (2017). This work concentrates market-wide herding and as well as industries wise herding. 772 firms registered on HOSE and HNX during the period 1/1/2007 to 10/7/2014 were taken into account. For examining the herding instances, authors followed Chang *et al.* (2000) and to deal with the heteroscedasticity and autocorrelation problem besides using Newey and West consistent standard error they followed the regression model suggested by Yao *et al*. (2014). The study reported the existence of herding behaviour for all the sectors under study. It further revealed that investors exhibited herding in both up & down market scenarios and this unusual behaviour was stronger in the market of the portfolio.

The study conducted by Guney *et al.* (2017) was influenced by limited evidence supporting herding behaviour in the frontier stock markets. They made an effort to examine the existence of the behavioural bias called herding in the frontier market. For this work, daily closing prices and market capitalisation of various firms registered on eight African equity market viz., Kenya, Nigeria, Tanzania, Ghana, Botswana, Zambia, Namibia, and BRVM exchange were used from 2002 to 2005. This work reported the sign of herding behaviour in the eight markets considered, and it also revealed that herding behaviour was more pronounced for smaller stocks. An interesting result reported was that investor's behaviour of African frontier market was not affected significantly by non-domestic factors.

Omay and Iren (2019) investigated the reactions of foreign investors and domestic investors in the stock market of Malaysia during crises. For examining investors behaviour during crisis situations, they mostly focused on the 1997 Asian financial crisis and the 2008 Global financial crisis. The results from the nonlinear model like SSTAR-STGARCH model and impulse response function showed that foreign investors' reaction to the Asian Crisis was quicker than that of the domestic investor, but foreign investor exhibited herding behaviour. Similarly, the results from the LSTAR-GARCH model revealed that foreign investors were the victims of

herding behaviour along with positive feedback trading during the Asian Crisis. However, during the Global financial crisis, foreign and domestic investors' behaviour was not different.

3.3 Indian Studies

One among the early literature on herding behaviour in the context of India is Bhaduri and Mahapatra (2010) who proposed a different approach to examine herding behaviour in the Indian stock market. This method is similar to that of Chang *et al.* (2000) but the conclusions from both the model differed. To examine herding behaviour in the Indian stock market, this work used the daily closing price of stocks listed on BSE-500 over a period of 5 years from 2003 to 2008. Here they showed the symmetry of return distribution by taking the cross-sectional absolute mean-median difference (CSMMD) denoted as $\gamma_t$to detect herding behaviour. By examing the relation between this $\gamma_t$and the average market return $R_{m,t}$ they provided the presence of herding behaviour if the relation was nonlinear. This work revealed the sign of herding behaviour in the Indian stock market and also disclosed that during the crash periods herding was very intensive among the market participants.

An attempt to examine and compare herding behaviour in the stock market of China and India was taken up by Lao and Singh (2011). The authors took the top 300 firms from both the Shanghai A-share index (SHA) and the Bombay Stock Exchange (BSE) based on market capitalisation. For examine the herding behaviour, they used trading volume and calculated stocks returns of these top 300 firms of both the countries. From this, the authors found the existence of herding behaviour in the stock market of both the country. The herding behaviour in the stock market was identified during upswing market situations for India, and for the Chinese stock market, it was captured during falling market situations combined with high trading volume. The negative impact generated by the Global financial crisis of 2008 intensify the presence of herding behaviour in the stock market of China.

Prosad *et al.* (2012) conducted a study about herding behaviour for the Indian stock market with the purpose to show, is there any evidence of herding behaviour in the stock market of India? For investigating herding behaviour they used stock price data of the firms registered on NIFTY 50. To detect this behavioural anomaly the cross-sectional standard deviation of equity return

approach suggested by the CH model was used. To show the non-linear relations between cross-sectional absolute deviation and market return, the approach pioneered by Chang *et al.*, (2000) was followed. The current work examined herding during the bearish and bullish situations of the market. From this study, they concluded that there is no substantial herding though they captured herding in market stress period when there is a bull phase.

An industry-wise analysis of herding behaviour in the Indian stock market has been carried out by Ganesh *et al.* (2016). For measuring herding behaviour they used the model developed by Christe and Huange (1995), which was used to detect the herding pattern for extreme price movement situation. To check the same during the normal period, they made use of the model by Chang, Cheng, and Kohruna (2000). In this study, they used the 50 Stocks of the Nifty50 index and clubbed these stocks into the fourteen industrial sectors. Here the extensive herding analysis for each year and each quarter for a period of 10 years ranging from 2005 to 2015 was done. The author applied the CH model to the ten industrial sectors because the other four sectors comprised of the one stock only. There was evidence of herding in 2009-10 in the cement and energy sector and automobile sector during the period 2012-13. Eventually, they found a lack of substantial evidence supporting herding behaviour.

Kumar and Bharti (2016), investigated herding behaviour observed in the stock market of India for which they made an analysis of market participants and investor. The study focused on the possibility of herding behaviour for the IT sector by considering the sectoral index. To accomplish this study, the author used the daily closing price of CNX Nifty IT index and the stocks of the constituent companies. CSAD models of measuring herding behaviour suggested by Chang *et al*. (2014) was employed to detect herding pattern in the bullish and bearish phases in the IT sector. The result reported the absence of herding behaviour in the IT sector.

3.4 Conclusion

In short, the brief literature suggests that the models like return dispersion and the state space are considered to be among the main models to detect heading behaviour. Most of the studies in global context indicate the existence of herding behaviour in the stock markets of developed

countries, especially in the periods of market stress. However, the models measuring herding behaviour have bettered after considering the trading volume.

Hence we come to know that the studies in the context of India present mixed results. On one side, it is evident of intensive herding among market participants in the Indian stock market during the crash periods. Instead, herding behaviour was identified during upswing market situations. On the other hand, the studies carried out industry-wise analysis using the CH model could only submit evidence for the existence of herding in selected sectors at a specific time period. Furthermore, a sectoral analysis of IT sector using the CSAD model also suggested the absence of herding behaviour in the stock market of India.

Chapter 4

METHODOLOGY AND EMPIRICAL ANALYSIS

4.1 Introduction

Several researchers have studied to investigate the herding behaviour pattern in the financial market. Scharfstein and Stein (1990) presented a model which stipulates how money manager due to their reputations imitate the investment patterns of others. Banerjee (1992) devised a model which excludes the effect of the incentive problem witnessed in the principal-agent relationship. Scharfstein, Froot, and Stein (1992) showed how speculators herd on the same information. Hence, Different approaches have been proposed to identify herding behaviour. Among these, methods proposed by CH and CCK are popular in the literature for examining herding in the financial market. Several works have used these methods to study herding behaviour in developed and developing countries' stock market. The current study on herd behaviour made use of both these methods, considering the research problems and objectives of this work.

There are a large number of study on herding behaviour in developed countries and very few numbers of studies has been done in India. Most of the studies made in the Indian context do not incorporate the use of trading volume, the past studies for which address herding behaviour. Study like Ganesh *et al*. (2017) made use of the NIFTY index for analysing herding behaviour indifferent industry. The sectoral indices have been rarely used to study herding behaviour in India.

Considering the research problems this study examines herding behaviour in the stock market of India for making a sectoral analysis of herding behaviour, incorporating trading volume in the analysis of such behavioural anomaly in the Indian context. Further to investigate herding in the different sector during the crisis period and extreme market conditions.

4.2 Data and Methodology

Several studies in India have generally examined herding behaviour using market index. The present study, however, uses sectoral indices of the national stock exchange (NSE) and its constituent stock to examine herding at the sectoral indices level. For this, the daily data of different sectorial index and individual stocks prices and also trading volume turnover of different sectors are put into use over for twelve years from January-2006 to November-20018. The chosen sample period covers the events like 2008s financial crisis, oil price fluctuations, and structural changes like demonetization and GST. The data has been extracted from *yahoo finance* and *www.nseindia.com*. There are twelve sectoral indices available at NSE website. However, after consideration of the availability of data, seven sectorial data are used in the analysis.

The study employs the cross-sectional standard deviation (CSSD) measure and the cross-sectional absolute deviation (CSAD) method suggested by CH and CCK, respectively, to analyse herd behaviour across the different sector of the Indian equity market. These methods have been used to examine herding behaviour as these are based on equity return dispersion. Further, we consider the trading volume turnover data as a control variable in the analysis of herd behaviour. The study also uses a model suggested by Yao *et al*. (2014), which was designed to tackle the multicollinearity and autocorrelation problem of the model suggested by CCK. The study also discusses the asymmetry effect of herding behaviour for market return and excessive trading volume. The methods employed in the analysis are discussed in the following sections.

4.2.1 CSSD Measure of Herding Behaviour

CAPM model which assumes investor is rational and believes that investors' action in the stock market reflect all the information available tells that there remains greater dispersion of stock return when there arises an increment in overall market return. It also stipulates regarding the linear relationships between market return and the dispersion of stock return when the overall market return rises. However, if an investor decides to go with the crowd or tries to imitate the actions of others, then the return of the individual stock will come closer to the average market return. Due to this, there will be less dispersion between individual stock return and average market return, when there is imitating behaviour in the market. Herding behaviour is captured

when an individual investor moves along with the market consensus. The CSSD measure is used as a proxy to identify herding behaviour, and the equity return dispersion itself does not suggest anything regarding the presence or absence of herding behaviour. So according to the CSSD method herding behaviour is measured by looking into the cross-sectional dispersion of market return and individual stock return but the assumption made by Christie and Huang (1995) is that in a group of investor herding is identified by the indirect relation between extreme market moments and CSSD measure. It also indicates that lower the divergence of stock return from the mean value, the higher the chances of capturing herd behaviour. The CSSD is estimated as follows:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(R_{it}-R_{mt})^2}{N-1}}$$

In which R_{it} refers to the stock return of a firm i at t time, R_{mt} is the average return of equally weighted individual stocks of a sector index. Among others, Tan *et al*. (2008) reported that the use of average market return and equally weighted average market return gives the same results. Hence, we use an equally weighted average market return in calculating R_{mt}.

Following CH, the indirect relation between cross-sectional standard deviation and market return can be expressed as follows:

$$CSSD_t = \alpha + \beta_1 D_t^u + \beta_2 D_t^l + \varepsilon_t \qquad (1)$$

where, D_t^u=1 when the average market return at t lies in the upper tail of the return distribution and D_t^u = 0 otherwise;

D_t^l = 1 if the market return at time t lies in the extreme lower tail of the return distribution, and D_t^l = 0 otherwise.

The top and bottom tails of the distribution of returns show the duration of the extreme market. Upper tails refer to the bullish period, and lower tails refer to the bearish periods. These extreme tails of the return distribution have been calculated on the basis of quartiles. If the average return on the market is below the first quartile, it is in the lower tails of the return distribution, and if the

average return on the market is higher than the third quartile, it is in the upper tails of the concerned distribution.

In the equation, α explains the average dispersion between the market return and individual stock return during the periods which does not fall under the bullish period and bearish period. The indirect relation between CSSD and the extreme market period is captured by the coefficient $\beta_1$and β_2. If these coefficients are significant and negative it implies the presence of herding behaviour in extreme market situations. If these two coefficients happen to be positive, it then provides the evidence against the existence of herding behaviour and it indicates that there is a prevalence of rational assets pricing in the market.

In their research, Chuang and Lee (2006) and Tan *et al.* (2008) point out that excessive quantity of trading can be an indication of herding existence as it is often produced by overconfidence. Hence, when there is market stress like situations, investors going through the fears of losses very often follows the trading activity of the institutional investors to whom they consider well informed. The herding behaviour influenced by high trading volume causes a low equity return dispersion. Yao et al. (2014) and Chiang and Zheng (2010) discovered, among others, that the CSSD indirectly linked to the quantity of trading and thus indicated the existence of herding behaviour.

The work of Shiller (2007) provides the facts that investor usually acts out of emotions and psychological pitfalls while trading on a particular stock. The heavy trading on a specific stock gives rise to that stock's elevated liquidity. Because of the elevated quantity of trading followed by high uncertainty, these stocks attract the attention of other market members, who in turn ignore their private information and investment strategies. This type of standardized collective action by the investor contributes to market herding behaviour, and if there is such herding behaviour, an inverse relationship arises between the spread of market return and the quantity of trading. Hence, to study the effect of trading activity on herding, the trading volume is added to the equations (1) as follows,

$$CSSD_t = \alpha + \beta_1 D_t^u + \beta_2 D_t^l + \beta_3 Vol_{m,t} + \varepsilon_t \qquad (2)$$

where Vol_{mt} is the market trading volume turnover at date *t,* if the coefficient β_3 is found to be negative and significant ; It can then be found that the market has herding behaviour.We estimate equation (2) to examine the effect of trading activity on herding.

4.2.2 CSAD Measure of Herding Behaviour

The CSSD models discussed above have demerits, as it is valid only during the turmoil period, and it does not include the asymmetric property of return dispersion. The CSSD model is also criticized on the ground that there may be outliers in the model. CCK proposed an alternative measure of return dispersion, namely the CSAD, which is inspired by the Capital Assets Pricing Model. The CSAD is defined as follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N} |R_{it} - R_{mt}|$$

where, *N* is the number of securities, R_{it} is the return of individual stock (of a sectorial index) at time *t,* R_{mt} is the market (or sector index return) return calculated on daily basis at time *t.*

Larger value of $CSAD_t$ indicates a diveragence betweeen the individual stock return and market *t* trend that measure is used as a proxy for identifying herding; this measure itself doesn't provide any evidence if herding behaviour is present or not. According to the capital assets pricing model (CAPM) the relation between $CSAD_t$ and r_{mt} should be linear. The dispersion between stock return and average market return is anticipated to be small if there is a herding behaviour. Further, the presence of non-linear negative relationships between the $CSAD_t$ and the average market return is captured with term R_{mt}^2 in the following equation.

$$CSAD_t = \alpha + \gamma_1|R_{mt}| + \gamma_2 R_{mt}^2 + \varepsilon_t \qquad (3)$$

where R_{mt}^2 is the squared average market return.

A significant and negative coefficient γ_2 suggests the presence of a non-linear relation between *CSAD* and the average market return; this indicates the presence of herding behaviour.

Some investors observe a trading pattern of other investors, and then blindly follow their investment. The imitator invests in a particular stock in which a large volume of trading would

take place. It is therefore suspected that the trading quantity could fuel the motion of the herd. A modified model of CCK which incorporate a trading volume variable is expressed as follows:

$$CSAD_t=\alpha + \gamma_1|R_{mt}| + \gamma_2 R_{mt}^2 + \gamma_3 Vol_{m,t} + \varepsilon_t \quad (4)$$

The herding behaviour can be identified with a negative $\gamma_2 < 0$ and a negative $\gamma_3 < 0$.

However, equation (3) and (4) has potential falls due to the high level of multicollinearity between the two explanatory variables namely, $R_{m,t}$ and R_{mt}^2. In order to overcome such problem, Yao *et al*. (2014) suggested a modified version of equation (4) as follwos:

$$CSAD_t=\alpha + \gamma_1|R_{mt}|+\gamma_2(|R_{mt}| -R_m)^2+\gamma_3\ CSAD_{t-1}+ \varepsilon_t \quad (5)$$

Herding behaviour is detected if the coefficient $\gamma_2$is found to be negative and significant. In the equation (5), R_m refers to the mean value of the $|R_{m,t}|$, while the term_$|R_{m,t} -R_m|$ is included to remove multicollinearity among regressors. Herding behaviour if examined with high-frequency data, there arises a high level of autocorrelation. Hence, to circumvent this problem, Newey-West (1987) heteroscedasticity autocorrelation corrected standard error is used in the stastical inference. Finally, as before the equation (5) is added the volume variable as below:

$$CSAD_t=\alpha + \gamma_1|R_{m,t}|+\gamma_2(|R_{mt}| -R_m)^2+\gamma_3\ CSAD_{t-1}+ \gamma_4 Vol_{mt} + \varepsilon_t \quad (6)$$

In this equation negative coefficient of γ_2 and $\gamma_3$indicates the presence of herding behaviour.

4.2.3 Measuring Asymmetric Herding Behaviour

In this section, we describe models that study whether herding behaviour varies or not under different market conditions. There may remain asymmetries in herding behaviour under a different trading environment like high market return and low market return. Similarly, this asymmetry may occur when there is a small volume of trading and an elevated volume of trading. It is evident from CH and CCK study that herding behaviour might be more severe during periods of extreme movements of the market. Also, a study by Venezia *et al*. (2011) explained that investor's actions are according to the market movement when there is an excessive amount of trading in the market.

(i) Asymmetric effects of market return

Herding behaviour can be affected by the asymmetric direction of market returns. We, therefore, examine herding behavior in both increasing and falling market scenario. Equations for calculating herding at rising and falling market situations are expressed as follows:

$$CSAD_t^{up} = \alpha + \gamma_1^{up}\left|R_{mt}^{up}\right| + \gamma_2^{up}(R_{mt}^{up})^2 + \varepsilon \quad (7)$$

If $R_{mt} > 0$

$$CSAD_t^{down} = \alpha + \gamma_1^{down}\left|R_{mt}^{down}\right| + \gamma_2^{down}(R_{mt}^{down})^2 + \varepsilon \quad (8)$$

If $R_{mt} < 0$

where $\left|R_{mt}^{up}\right|$ and $\left|R_{mt}^{down}\right|$ refers to the absolute value of equally weighted market portfolio returns of the respective sector during the rising and falling market conditions. $(R_{mt}^{up})^2$ is the squared returns. $CSAD_t^{up}$ and $CSAD_t^{down}$ corresponds to the value of *CSAD* when the market is rising and falling, respectively.

(ii) Asymmetric effects of the trading volume

It is evident from the literature that herding behaviour can arise during excessive trading in the market. Hence, it is possible that the herding may produce asymmetric effects during high and low trading volume. The trading volume is considered to be high when it lies in the upper 10^{th} percentiles, and it is identified to be low when it lies in the lower 10^{th} percentile. The asymmetric effect of herding during high as well as low trading volume is captured as follows:

$$CSAD_t = \alpha + \gamma_1|R_{mt}| + \gamma_2 R_{mt}^2 + \theta_1 Vol_H R_{mt}^2 + \theta_2 Vol_L R_{mt}^2 + \varepsilon_t \quad (9)$$

where, Vol_H and Vol_L represent high trading volume and low trading volume, respectively. Negative and significant coefficients of θ_1 and $\theta_2$capture herding behaviour during the sample period.

4.2.4 Herding Behaviour During the Crisis Period

From the literature, it is evident that herding behaviour becomes more severe in the period of uncertainty. There are various studies which examine herding behaviour at the time of crisis period, but the results are not uniform. Some studies report herding behaviors during the crisis era, while others do not. Considering the demerits of the CSSD measures for examining herding behaviour at the time of crisis period, we use the CSAD metric to assess herd behaviour during the period of the 2008s financial crisis.

4.2.5 Robustness Analysis of Herding Behaviour

In order to have the robustness in the analysis, we divide the whole period into six parts, each part consisting of two years considering the ups and downs in the benchmark index Nifty during the sample period. Then calculation was made in the each sub sample part to examine the presence of herding behaviour.

4.3 Results and Discussion

Table 4.1 Descriptive Statistic of CSSD variable

Sector	***Mean***	***Max***	***Min***	***SD***	***Skew***	***Kurt***	***Jarque-Bera***
Automobile	2.323	45.360	0.013	1.782	12.293	247.122	7921370.***
Bank	2.288	53.207	0.000	2.260	14.268	304.916	12239421***
Fin. Service	2.286	69.216	0.007	2.065	20.299	608.680	48718368***
IT	2.177	37.055	0.004	1.779	9.36	162.040	3404316***
Pharma	2.050	24.102	0.000	1.124	4.224	55.507	376528.2***
FMCG	15.522	199.40	0.747	13.411	2.665	23.318	58321.13***
PSU	12.855	193.45	0.466	11.571	3,533	40.753	194614.3***

Note: *,**,*** represent statistical significance at 10%, 5% and 1% level of significance respectively.

4.3.1 Results from CSSD Measure

Table 4.1 reports the descriptive statistics and Jarque-Bera test statistics of the variable $CSSD_t$ for each sector of the Indian equity market. The mean and standard deviation of the $CSSD_t$ variable is highest for FMCG sector followed by PSU. The minimum value of $CSSD_t$ is found to be zero for banking and pharmaceutical sector. The Jarque-Bera test statistics found to be significant, suggesting the rejection of the normality[4].

Table 4.2 Unit Root Test of the $CSSD_t$ for Different Sectors for the Period 2006-2018

Sector	*ADF test*		*PP test*	
	t-statistic	*p-values*	*t-statistic*	*p-values*
Auto	-10.3987	0.0000	-54.4675	0.0001
Bank	-10.7798	0.0000	-40.9569	0.0000
Fin. Service	-11.2217	0.0000	-39.1135	0.0000
IT	-9.0375	0.0000	-47.8408	0.0001
Pharma	-13.5176	0.0000	-58.1794	0.0001
FMCG	-26.9697	0.0000	-47.5821	0.0001
PSU	-15.4674	0.0000	-52.1130	0.0001

Before using the $CSSD_t$ variables into the regression, we conduct the unit root test, and the results are produced in Table 4.2. For testing stationarity, both ADF (Augmented Dicky Fuller) test and PP (Phillips-Perron) test are employed. From the estimates, it can be seen that *p*-values of ADF and PP tests for all sectors are statistically significant, suggesting the absence of unit root in the $CSSD_t$ series. Therefore, the $CSSD_t$ series can be assumed as a stationary variable for all sectors.

Similarly, the results for the unit root test for the trading volume variable are stated in Table 3. The *P*-values of ADF and PP test statistic suggests the absence of unit root in the trading volume

[4] The central limit theorem states that even in the lack of normal error, the test statistics will follow suitable distributions asymptotically.

series for all sectors. Consequently, we can conclude that it is a stationary variable at the level for all sector.

Table 4.3 Unit Root Test of the Trading Volume Turnover

Sector	*ADF test*		*PP test*	
	t-stastistic	p-values	t-stastistic	p-values
Auto	-14.2518	0.0000	-33.1744	0.0000
Bank	-12.8823	0.0000	-48.1519	0.0000
Fin. Service	-10.8814	0.0000	-35.1650	0.0000
IT	-12.7263	0.0000	-49.7307	0.0000
Pharma	-11.6825	0.0000	-59.0782	0.0000
FMCG	-8.4230	0.0000	-44.2202	0.0000
PSU	-12.1224	0.0000	-38.8477	0.0000

Table 4.4 Regression Results of CSSD Measure from Equation (1)

Sector	*Constant*	D^l	D^u	$Adj.R^2$
Auto	2.0749*** (46.6873)	0.4801*** (6.2403)	0.5145*** (6.6866)	0.0188
Bank	1.4989*** (28.2745)	1.4717*** (16.0341)	1.6835*** (18.3411)	0.1223
Fin. Service	1.6958*** (34.1732)	1.0135*** (11.7972)	1.3469*** (15.6708)	0.0849
IT	6.3510*** (25.8885)	17.5429*** (41.2862)	19.1433*** (45.0526)	0.4692
Pharma	1.4779*** (36.0721)	1.2934*** (18.2346)	1.5027*** (21.1850)	0.15564
FMCG	1.5957*** (62.0576)	0.8322*** (18.6879)	0.9867*** (22.1575)	0.1653
PSU	6.1577*** (25.977)	12.6703*** (30.8730)	14.1029*** (34.3637)	0.3361

Note: *,**,*** denotes statistical significance corresponding to 10%, 5% and 1% level of significance respectively.

It is to be noted that we use high-frequency daily time series data; hence, it is expected that such data exhibits a serial correlation in the data. To overcome this problem, we apply Newey and West (1987) heteroscedasticity and autocorrelation consistent standard errors in the estimation of

all regression equation. Table 4.4 reports the estimated regression results of equation (1) for all sectors. The value within the parentheses is *t*-statistic values. From these estimates, it is clear that the coefficient of D^l and D^u is positive and highly significant across the entire sector. Hence, these results do not show any evidence supporting herding behaviour during the market stress period across the different sectors of the Indian equity market. However, this positive effect suggests that the return dispersion increases during the bearish and bullish period, which is indicative of the presence of the rational assets pricing behaviour. Indeed, these findings are compatible with Christie and Huang (1995) findings.

The CSSD measure has demerits as it is valid only during the market stress situations and this measure is very much sensitive to outliers. So this study employed the other measure of herding CSAD. The model measuring for herding through CSAD approach has been presented on equation (3).

Nevertheless, when we add trading volume to an equation (1), the estimate produces evidence for herding in some sector. This can be seen from the output of the regression (2), reported in Table 4.5. The negative and significant coefficient of the trading variable for the automobile and FMCG sector suggest herding behaviour in these two sectors.

However, no other sector exhibits the herding behaviour during extreme market situations. It is believed that when there is a high trading volume, there is more liquidity in the market. With the availability of such information and situations, it is handy for investors to make a quick return. This kind of situations enhances the informed investor to better process their knowledge and information, and also promote the uninformed one to follow them, which gives rise to a high market volume of trading.

From the herding analysis during the extreme market scenario, it is clear that herding behaviour is captured in the extreme trading volume. But the extreme market conditions indicated by market return are not showing any evidence of herding. The reasons may be the presence of a large number of intuitional insvestors in the market and less number of retail investor and individual investor in the market. An Institutional investor makes a good decision during rising and falling market situations as they are well aware of the market conditions.

Table 4.5 Regression Results of CSSD Measure with Trading Volume from Equation (2)

Sector	*Constant*	D_l	D_u	Vol_m	*Adj.R*
Auto	2.0938*** (36.4900)	0.1316*** (2.9763)	0.1352*** (3.0585)	-0.000146*** (-4.2113)	0.0228
Bank	1.2815*** (11.5324)	1.4752*** (12.8768)	1.5597*** (23.1962)	0.000117** (2.0208)	0.1718
Fin. Service	1.0432*** (14.2668)	0.4946*** (11.3918)	0.8103*** (15.4530)	0.000194*** (6.47	0.2901
FMCG	7.2356*** (20.1697)	17.3418*** (40.0268)	19.1706*** (44.4148)	-0.001401*** (-3.4467)	0.4689
IT	1.3098*** (24.2266)	1.2831*** (13.3284)	1.4029*** (20.3877)	0.000168*** (3.4901)	0.1951
Pharmaceutical	1.5890*** (50.7651)	0.8292*** (12.6635)	0.9824*** (17.3629)	2.5455# (0.7633)	0.1641
PSU	5.4032*** (16.9403)	12.6478*** (27.7642)	13.9275*** (26.9061)	0.000894*** (3.0961)	0.3336

Note: *,**,*** denotes statistical significance corresponding to 10%, 5% and 1% level of significance respectively.

4.3.2 Results from CSAD Measure

Table 6 presents descriptive statistics and Jarque-Bera test results for CSAD*t* and $R_{m,t}$ for all sector. The results suggest that the descriptive statistics of $CSAD_t$ and $R_{m,t}$ are highest for the FMCG and PSU sector, and also these sectors relatively show a high standard deviation. While the PSU and automobile sector shows a relatively low average market return. The results of Jarque-Bera test statistics are statistically significant, rejecting the normality assumption. The unit root test results of CSAD*t* and $R_{m,t}$ are reported in Table 7. The *p*-values of ADF and PP test for all sectors confirm the stationarity of both the series.

Table 4.6 Descriptive Statistics of $CSAD_t$ and $R_{m,t}$ for the Period 2006-2018

Sector	*Var.*	*Mean*	*Max*	*Min*	*SD*	*Skew*	*Kurt*	*Jarque-Bera*
Auto	CSAD	1.7050	13.4864	0.0132	0.9577	4.3898	39.6865	187241.4***
	R_m	0.0060	1.0064	-0.8222	0.1063	-0.1245	12.8647	12813.05***
Bank	CSAD	1.7316	21.8759	0.0000	1.2728	5.1516	56.2616	391658.9***
	R_m	0.0083	1.6662	-1.3538	0.1990	0.1632	10.6490	7800.6***
Fin. Service	CSAD	1.5612	26.40	0.0064	1.0166	8.3985	163.4088	3439152.***
	R_m	0.0217	3.6128	-1.3015	0.1322	6.1001	178.2797	4081511***
IT	CSAD	1.6027	20.1087	0.0038	1.1786	5.6844	66.8532	558412.3***
	R_m	0.0093	2.1612	-2.0136	0.2170	0.0386	16.2222	23209.20***
Pharma	CSAD	1.5055	8.7405	0.0000	0.7615	2.5299	15.4581	24070.21***
	R_m	0.0076	0.8830	-0.9711	0.1293	-0.4388	7.5232	2826.288***
FMCG	CSAD	5.5343	68.9947	0.5145	4.0180	3.1839	34.9585	140347.8***
	R_m	0.0066	3.6528	-3.6731	0.4768	0.3758	5.9340	1212.417***
PSU	CSAD	5.1259	69.8932	0.3128	3.6688	3.7459	47.9524	273971.1***
	R_m	0.0019	5.0626	-3.3240	0.4531	0.7806	9.6530	6160.508***

Note: *,**,*** denotes statistical significance corresponding to 10%, 5% and 1% level of significance respectively.

Table 4.7 Unit Root Results test of $CSAD_t$ and R_{mt} for the Period 2006-2018

Sector	ADF test				PP test			
	CSAD		Rmt		CSAD		Rmt	
	t-statistics	p-values	t-statistics	p-values	t-statistics	p-values	*t*-statistics	p-values
Auto	-8.4463	0.0000	-49.1367	0.0001	-52.9254	0.0001	-49.2375	0.0001
Bank	-8.1377	0.0000	-51.1141	0.0001	-55.2056	0.0001	-50.9525	0.0001
Fin. Service	-8.5639	0.0000	-55.8962	0.0001	-48.6267	0.0001	-55.8998	0.0001
IT	-7.8064	0.0000	-55.4444	0.0001	-52.6902	0.0001	-55.4388	0.0001
Pharm	-11.5543	0.0000	-50.6312	0.0001	-56.5541	0.0001	-50.6159	0.0001
FMCG	-26.2183	0.0000	-25.4564	0.0000	-48.7451	0.0001	-137.8750	0.0001
PSU	-15.2979	0.0000	-35.6610	0.0000	-52.4144	0.0001	-82.5718	0.0001

Table 4.8 Regression Results of CSAD Measure from Equation (3)

Sector	*Constant*	*|Rmt|*	$R^2_{m,t}$	*Adj.* R^2
Auto	1.4146*** (38.7857)	2.8063*** (3.6474)	7.2924*** (2.6283)	0.2470
Bank	0.8025*** (32.2533)	5.8189*** (20.6256)	3.1008*** (5.5485)	0.8478
Fin. Service	0.8817*** (24.1444)	8.1820*** (15.6189)	-0.2106 (1.3399)	0.6560
FMCG	1.6303*** (21.7073)	9.8395*** (24.8689)	1.6654*** (4.6827)	0.9096
IT	0.8400*** (42.6792)	4.7618*** (30.1984)	1.7330*** (8.7023)	0.8039
Pharmaceutical	0.9878*** (48.6971)	4.5601*** (14.5488)	5.3897*** (6.1634)	0.65532
PSU	1.9132*** (20.4236)	9.0516*** (26.3550)	0.8487*** (3.7047)	0.7431

Note: *,**,*** represent statistical significance at 10%, 5% and 1% level of significance respectively.

The results from equation (3) are presented in Table 4.8. From the table, it is clear that the coefficients $\gamma_1$of the $|R_{m,t}|$ for all sector are positive and significant. The coefficient γ_2 also found to be positive and significant for all sector barring the FMCG sector. The negative coefficient γ_2 of FMCG sector is not significant; hence we cannot infere that there is herding behaviour. Overall, the findings from the CCK model indicate the absence of herding behaviour in the different sector of the Indian equity market.

Chang *et al*. (2000) and Yao *et al*. (2014) suggested the inclusion of the trading volume turnover in the model, as it attributes to the presence of herding behaviour. We, therefore, estimate a modified equation (4) for CSAD measure, which incorporates the trading volume turnover ($Vol_{m,t}$). The results in Table 4.9 presents the coefficient of $Vol_{m,t}$ which is negative and significant for the automobiles sector, indicating the only sector which consistently exhibits herding behaviour among the different sector of the Indian equity market. The coefficient of volume for the pharmaceutical sector is negative but insignificant. It is also observed that the coefficient values of the variable $Vol_{m,t}$ is small in case of PSU and FMCG sector.

As mentioned above, both the equation (3) and (4) have the potential problem of multicollinearity. We, therefore, proceed to estimate equation (5) which include term $|R_{m,t} - R_m|$

to address the problem of multicollinearity among regressors. The estimated results from equation (5) are presented in Table 4.10. The estimated results do not indicate herding behaviour in any sectorial index. However, we can observe a slight improvement in the adjusted R^2 due to the inclusion of the one period lagged dependent variable in the model.

As before, we include the trading turnover variable in equation (5) to study the effect of trading activity on herding. The estimated results of equation (6) are produced in Table 4.11. The results show the statistically significant negative coefficient of trading volume for the automobile sector and FMCG sector, and consistent with previous results, the pharmaceutical sector shows a statistically insignificant, but negative coefficient. Overall, the results of equation (2), (4) and (6) reinforces the finding that under the condition of large trading volume the herding behaviour can be traced in the auto and FMCG sector. Interestingly, both these sectorial index are based on domestic consumption.

Table 4.9 Regression Results of CSAD Measure from Equation (4)

Sector	*Constant*	$\|R_{m,t}\|$	$R^2_{m,t}$	$Vol_{m,t}$	*Adj. R*
Auto	1.5325*** (33.8808)	1.5041*** (3.1967)	-2.6169** (-2.1489)	-9.7701*** (-3.7585)	0.0177
Bank	0.7318*** (13.6940)	5.6625*** (11.2714)	3.3781*** (3.1791)	4.2991** (2.2479)	0.8359
Fin. Service	0.6618*** (14.0385)	5.8058*** (12.7857)	-0.3611 (-0.2194)	9.7271*** (5.2973)	0.5030
FMCG	1.7281*** (6.9061)	9.9515*** (15.7798)	1.0753*** (2.2269)	0.001035 (1.5293)	0.8406
IT	0.7768*** (29.0416)	4.6076*** (19.0906)	1.9259*** (3.5289)	7.2571*** (3.9962)	0.7775
Pharmaceutical	1.0018*** (45.4969)	4.5652*** (14.1781)	5.3808*** (6.0757)	-1.9371 (-1.2869)	0.6564
PSU	1.7103*** (14.0661)	8.9999*** (27.1153)	0.8248*** (3.7349)	0.000261*** (2.3924)	0.7435

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

Table 4.10 Regression Results of CSAD Measure from Equation (5)

Sector	*Constant*	$\|R_{m,t}\|$	$(\|R_{m,t}\|-R_m)^2$	$CSAD_{m,t-1}$	*Adj.* R^2
Auto	0.8919***	1.6326**	7.6442***	0.3590***	0.3678
	(12.3550)	(2.4018)	(2.7659)	(12.3550)	
Bank	0.5884***	5.4663***	3.0507***	0.1569***	0.8699
	(13.4277)	(24.5418)	(6.4142)	(0.1569)	
Fin. Service	0.5189***	6.8301***	0.0847	0.3014***	0.7362
	(15.1901)	(27.3317)	(1.1288)	(14.9507)	
FMCG	1.4695***	9.8390***	1.6109***	0.0327***	0.9106
	(14.4796)	(26.2170)	(4.5935)	(3.5188)	
IT	0.6279***	4.4685***	1.6237***	0.1644***	0.8276
	(15.7067)	(29.0989)	(8.1004)	(5.9738)	
Pharmaceutical	0.9027***	0.2405***	12.7546***	0.2687***	0.6449
	(29.0169)	(2.0486)	(11.3680)	(11.4468)	
PSU	1.5570***	9.0643***	0.6951***	0.6951***	0.7480
	(15.4754)	(24.5871)	(2.9085)	(2.9085)	

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

Table 4.11 Regression Results of CSAD Measure from Equation (6)

Sector	*Constant*	$\|R_{m,t}\|$	$(\|R_{m,t}\|-R_m)^2$	$CSAD_{t-1}$	$Vol_{m,t}$	*Adj. R*
Auto	1.0506***	1.1221***	-2.1166*	0.3088***	-6.4912***	0.1108
	(19.3983)	(2.7271)	(-1.8944)	(0.3088)	(-3.2698)	
Bank	0.5817***	5.3908***	3.4494***	0.1129***	4.1225***	0.8476
	(11.2773)	(11.8098)	(3.2805)	(8.7360)	(2.3887)	
Fin. Service	0.4964***	5.6631***	-0.3354	0.1628***	8.3025***	0.5278
	(11.3493)	(15.4152)	(-0.21011)	(5.4119)	(4.6123)	
FMCG	1.5974***	9.8279***	1.6212***	0.0301***	-0.000171***	0.9105
	(13.5506)	(26.0799)	(4.6299)	(3.2426)	(-3.2162)	
IT	0.6136***	4.3471***	1.9412***	0.1269***	7.3813***	0.7922
	(16.9587)	(20.8140)	(3.5079)	(6.5553)	(4.3528)	
Pharma	0.6677***	4.2891***	4.7821***	0.2458***	-9.6294	0.7176
	(22.0074)	(16.0486)	(5.4948)	(11.0297)	(-0.9896)	
PSU	1.4047***	9.0195***	0.6826***	0.0712***	0.000103**	0.7479
	(10.1426)	(25.2911)	(2.9291)	(3.2555)	(2.1407)	

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

4.4 Asymmetry Herding Behaviour

4.4.1 Asymmetry Effects of Market Returns

It is very often observed that herding behaviour is affected by various market conditions. For some countries, it becomes intense during falling market condition than the rising market condition and vice versa for some other countries. For instance, in a study by Lao P., Singh H., (2011) observed that herding behaviour was present in the rising market situation in India while for China it was observed during falling market situations.

We examine such asymmetric effect of market return in rising as well as falling market condition at sectoral indices in India. The estimated results of the regression equation (7) are reported in Table 4.12. The results show that the coefficient γ_2 to be positive and significant for the entire sector, indicating the absence of herding behaviour during the rising market condition. In other words, it suggests the existence of rational assets pricing during the upswing market scenario. Similarly, the results of the regression equations (8) for the case of falling market situations in Tabel 4.13 suggest the absence of the unusual herding behaviour.

Table 4.12 Regression Results of CSAD for Rising Market Condition

Sectors	Constant	$R_{m,t}^{Up}$	$(R_{m,t}^{Up})^2$	Adj. R^2
Auto	1.3897*** (25.5492)	3.2816*** (2.6565)	3.9272 (0.9425)	0.1667
Bank	0.7904*** (29.6904)	6.0711*** (24.6914)	2.4348*** (5.6920)	0.8735
Fin. Service	1.3761*** (34.6305)	9.4072*** (20.5236)	2.5901*** (21.6940)	0.8182
FMCG	1.4891*** (17.1575)	10.1562*** (25.4423)	1.3107*** (4.1535)	0.9247
IT	0.8421*** (32.1436)	4.7086*** (22.7614)	1.6451*** (16.8503)	0.8291
Pharmaceutical	0.9958*** (29.9683)	4.1326*** (6.5735)	7.0649*** (3.4720)	0.6341
PSU	1.9496*** (17.5236)	9.3831*** (35.2195)	0.3801*** (3.2512)	0.7655

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

4.4.2 Asymmetric Effects of the Trading Volume

Yao *et al*. (2014) have shown that herd behaviour will be intensified when the trading volume tends to be large or small. During a period of low trading volume and elevated trading volume, we examine this asymmetric pattern of herding behaviour.

Table 4.13 Regression Results of CSAD for Falling Market Condition

Sectors	Constant	$R_{m,t}^{Down}$	$(R_{m,t}^{Down})^2$	Adj. R^2
Auto	1.4767*** (28.8405)	1.4697** (1.9637)	12.9333*** (6.8418)	0.3569
Bank	1.4074*** (7.0493)	2.0010 (0.6360)	14.2325** (2.1046)	0.6311
Fin. Service	1.0199*** (29.9951)	6.7195*** (13.4589)	6.5000*** (16.9336)	0.7022
FMCG	1.9394*** (14.9273)	36.0266*** (65.9504)	4.4878*** (11.0731)	0.9371
IT	0.8466*** (32.5021)	4.7354*** (19.7951)	1.9177*** (3.5021)	0.7817
Pharmaceutical	0.9940*** (36.3334)	4.7335*** (12.7999)	4.6106*** (5.3127)	0.6775
PSU	2.2508*** (20.1530)	6.2423*** (15.4619)	3.9587*** (11.5464)	0.7596

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

Table 4.14 Results for the High and Low Trading Volume

Sector	*Constant*	*|Rmt|*	$R^2_{m,t}$	*Vol.Dl*	*Vol.Du*	*Adj.R*
Auto	1.4789*** (27.8171)	1.8386*** (1.8403)	-4.7852 (-1.1073)	0.1893 (1.4553)	0.0261 (0.4132)	0.0061
Bank	0.9289*** (20.3616)	5.7061*** (10.8287)	2.7397*** (2.7762)	-0.0310 (-0.4051)	-0.1353*** (-4.1775)	0.8677
Fin. Service	0.6897*** (8.3280)	6.1736*** (3.2645)	3.9607 (0.7245)	0.0201 (0.4391)	0.0884 (0.9830)	0.5389
FMCG	1.7451*** (20.3082)	9.6358*** (24.9707)	1.7598*** (5.3108)	0.2162* (1.6771)	-0.2122*** (-2.6474)	0.9091
IT	0.8976*** (32.2739)	4.5694*** (16.6738)	1.8680*** (3.3256)	0.0950* (1.6562)	-0.0226 (-0.6092)	0.7753
Pharmaceutical	1.0404*** (41.1911)	4.6209*** (12.5018)	5.2081*** (5.2698)	0.0032 (0.1008)	-0.1240*** (-3.4643)	0.6543
PSU	2.2122*** (16.6109)	6.5295*** (9.4872)	3.4478*** (5.1367)	-0.8507*** (-4.2724)	0.1807 (1.4176)	0.7685

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

The equation (9) incorporates a high and low trading volume turnover to look for evidence of herding behaviour. The results are produced in Table 4.14. it is clear that sectoral index the PSU exhibits herding behaviour when the trading volume low, as the estimated coefficient of the $Vol_{m,t}$. Dl variable is negative and significant. Likewise, the negative and significant coefficients of $Vol_{m,t}$. D^u for the pharmaceutical, FMCG, and banking sector provide evidence of herding behaviour for the high trading volume period. Overall, the results show the consistency in the finding of herd behaviour under condition of the high trading volume.

4.5 Herding Behaviour During the 2008s Global Crisis

We also investigate the existence of herding during the 2008s global financial crisis. The regression results of equation (3) for the CSAD for the crisis period are given in Table 4.15. It can be seen that none of the coefficients of $R^2_{m,}$ has a negative sign; instead, they are positive and highly significant for all sectors. The results suggest an absence of herding behaviour at sectorial indices in the crisis period.

Table 4.15 Regression Results of $CSAD_t$ During the Crisis Period of 2008

Sector	*Constant*	$\|R_{m,t}\|$	$R^2_{m,t}$	*Adj.* R^2
Auto	1.3817*** 19.1044	7.3352*** 9.6514	6.0941*** 4.5764	0.8012
Bank	1.3697*** (15.2594)	4..8429*** (9.1284)	2.9063*** (4.5918)	0.9259
Fin. Service	1.5958*** (12.1351)	5.4480*** (4.2415)	5.6804*** (2.2749)	0.5464
IT	1.3432*** (16.7065)	4.2394*** (10.0776)	2.0262*** (5.0564)	0.8684
Pharma	1.5244*** (20.4362)	3.8012*** (5.4093)	4.9181*** (4.5491)	0.6823
FMCG	2.4895*** (9.1697)	9.6771*** (9.0222)	1.0035 *** (1.1571)	0.7990
PSU	3.5808*** (12.0673)	5.0064*** (4.6083)	3.2032*** (4.1348)	0.7007

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

It is evident from the literature that the CSSD model is useful to check for herding in the stress period of the market. We, therefore, estimate the CSSD equation (1) for the crisis period. Table 4.16 presents the estimated regression outcomes for the different sectors of the NSE. The results again show that none of the coefficients of the D_l and D_u has a negative sign. Therefore, We can

conclude that no proof exists in support of herding behaviour during the crisis period at a different sector of the Indian equity market.

Table 4.16 Regression Results of the $CSSD_t$ During 2008

Sector	*Constant*	D^l	D^u	$Adj.R^2$
Auto	2.3578***	2.0866***	1.4887***	0.2716
Bank	2.5278***	2.6630***	2.3981***	0.4140
Fin. Service	2.8481***	2.3849***	1.8970***	0.1839
IT	2.4874***	2.6469***	2.0658***	0.3405
Pharma	2.3586***	1.6812***	1.0437***	0.2007
FMCG	9.4402***	18.4813***	20.9418***	0.5587
PSU	9.1688***	13.8380***	15.5568***	0.3336

Note: *, **, *** represent statistical significance at 10%, 5% and 1% level of significance respectively.

4.6 Robustness Analysis of Herding

Analysis of herding behaviour in the various Indian stock market industries indicates that there is a lack of herding behaviour in the whole industry regarded under the policies of CSSD and CSAD and Yao *et al.* (2014). The sample period taken into the analysis is so very large, so to search for herding behaviour during the shorter sample period the Yao *et al*. (2014) measure is taken into account as this measure excludes the demerits of the CSSD and CSAD measure.

The results from the Table 4.17 reports that there is evidence of herding behaviour in the IT sector during the year 2006 to 2007, in the automobile sector during the year 2013 to 2014 and 2015 to 2016 and in the FMCG sector during the year 2015 to 2016. No other sector in the Indian sector shows the presence of herding behaviour.

Table 4.17 Regression Results of Herding During Shorter Sample Periods

Sector	*2006-07*		*2009-10*		*2011-12*		*2013-14*		*2015-16*		*2017-18*	
	Coeff.	*t- Stat.*	*Coeff.*	*t- Stat.*	*Coeff.*	*t- Stat*	*Coeff.*	*t- Stast.*	*Coeff.*	*t- Stat.*	*Coeff.*	*t-Stat.*
Auto	6.811	3.219	-0.716	-0.583	5.285	0.871	-7.630*	-1.531	-0.087*	-0.057	4.134	0.651*
Bank	4.248	5.106	3.033	5.770	9.528	10.621	3.275	5.531	4.016	5.370	12.164	11.200
Fin. Services	6.805	1.423	0.013*	0.066	3.948*	1.052*	-1.760	-1.052	-1.841	0.786	6.394	2.453
IT	-0.063*	-0.193	1.255	5.640	5.903	6.767	6.979	8.494	3.300*	5.988	7.023*	6.672*
Pharma	8.376	4.599	4.286	5.701	9.813	4.909	9.200	4.082	5.920	5.461	7.109	6.491
FMCG	1.149*	2.230	2.078*	7.323	0.577*	2.189	0.033*	0.092	-1.831*	-2.906	0.665	1.959
PSU	0.781*	1.234	0.559*	1.828	3.362*	4.097	2.548	4.757	2.477*	3.131*	0.848*	0.011

Note: *, **, *** represent statistical significance at 1%, 5% and 10 % level of significance respectively.

4.7 Conclusion

This chapter provided the detail discussion regarding the herding measures like CH, CCK and the other one suggested by Yao *et al*. (2014) along with the sources of data and its frequency. It also incorporated the herding analysis during the extreme market situations and crisis period. After that, it reported the estimated results from these measures and its corresponding interpretations. It is evident from the assessment and interpretation that herding behaviour on the Indian stock market does not occur. But when the trading volumes enter into the analysis the result changes it indicates the existence of herding behaviour in some sector. Tough the asymmetric analysis of herding at the time rising and falling market returns show the absence of herding behaviour the extreme trading volume provides evidence of herding.

CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 Introduction

The failure of the efficient market hypothesis has given a lead to the concept of herding behaviour. Subsequently, an increasing number of studies has been made in the context of herding behaviour, providing mixed results. One of the pronounced results from the literature is the intensity of herding increased in the times of market stress and financial crisis. Our study focuses on herding at the sectoral level in India. The empirical analysis is conducted in the following four steps:

- The *CSSD, CSAD,* and Yao *et al*. (2014) models are used to examine herding at the sectoral level.
- Trading volume is incorporated the three model.
- Testing the CSAD approach in the crisis period.
- Taking up a Sub-sample analysis of the model.

5.2 Major Findings of the study

Major findings from the *CSSD, CSAD* and Yao *et al*. (2014) models are as follows:

- The CSSD approach, which examines herding behaviour during the market stress period, did not show any evidence supporting the existence of herding behaviour for the different sectors of the Indian stock market.
- The CSAD approach suggested by Chang *et al*. (2000) and Yao *et al*. (2014) did not indicate the presence of herding behaviour in the different sectors of NSE during the sample period.

Findings of the study in the presence of trading volume are as follows:

- The modified CSSD measures with trading volume variables suggested the existence of herding behaviour in the automobile sector.
- Similarly, the CSAD approach of Chang *et al*. (2000) and Yao *et al*. (2014) with trading volume variables point out the prevalence of herding in the automobile sector among the different sectors of the stock market of India

- Yao *et al*. (2014) model revealed the existence of herding behaviour for the FMCG sectors whereas the CSAD methods of Chang *et al*. (2000) failed to capture herding behaviour in any of the sectors except automobile sector with the presence of trading volume variable.

Findings of the study during the asymmetric market conditions are as follows:

- Herding behaviour is absent in all the sectors studied for both the rising and falling market situations during the sample period.
- Among the different sector of the Indian stock market, the PSU sector provided the results indicating herding behaviour during the low trading volume.
- Pharmaceutical, FMCG and Banking sectors have shown herding behaviour during the period of very large trading volume in the respective sector.

Findings from the CSAD approach of Yao *et al*. (2014) for the crisis period suggest the absence of the herding behaviour in the Indian stock market for a 2008s financial crisis.

Results from the sub-sample analysis provide the evidence in favour of herding behaviour in the different sectors of the Indian stock market. The automobile sector, FMCG and IT sector vitncesd herding in the sub-sample period.

5.3 Conclusion of the Study

The study broadly concludes the absence of herding behaviour in the different sectors during the sample period 2006 to 2018. However, the incorporation of trading volume into the analysis brought the presence of herding behaviour in the automobile and FMCG sector.

The analysis of herding behaviour during the asymmetric conditions concludes that herding behaviour is absent in the different sector of the market both during the rising market and falling market scenario. Herding behaviour analyzed for the high and low trading volume state concludes that there is the presence of herding behaviour in the PSU sectors when the trading volume is very low. Further, during the period of large the trading volume, the FMCG, Pharmaceuticals and Bank sectors indicates the presence of herding behaviour.

The automobile sector shows herding behaviour when the analysis considers trading volume variable. The findings form asymmetric analysis of herding concludes that none of the sectors studied capture herding behaviour during falling and rising market scenario. But when herding analysis takes place including the

extreme trading volume herding behaviour is captured in the Pharmaceutical, FMCG and Bank sectors of the Indian stock market.

Consequently, findings from the herding analysis during the crisis period conclude that none of the sectors exhibits herding behaviour. However, herding analysis during the shorter sample periods concludes herding in the automobile sector.

5.4 Scope for Further Research

1. The study of herding behaviour can be conducted in high-frequency data such as hourly data.
2. The sectoral analysis of herding can also be applied to the BSE sectoral indices.
3. The analysis of herding behaviour can be done during high volatile and volatile market periods.

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