DOES PAKISTANI INVESTOR EXHIBIT HERDING BEHAVIOR DURING FINANCIAL CRISIS?

Zuee Javaira1, Arshad Hassan2 and Syed Zulfiqar Ali Shah3

Abstract

This paper investigates the presence of the time-varying herding behavior and its existence under both normal and crisis situation at the Pakistan stock market. For this purpose, this study utilizes the return dispersion models based on the aggregate market returns. Unlike previous research, this study not only confirms the existence of herding but also observe time variation in this behavior. This time variation in herding behavior was examined by applying Kalman filter estimation to the return dispersion model. Furthermore, all three domestic crisis amplified herd intensity. However, of the two major international crisis, only global financial crisis significantly affect the behavior of Pakistani investor. Evidence suggests that tests for herding behavior should consider its dynamic nature. Crisis in domestic and global markets play a significant role in modeling the structure of the dynamic behavior of Pakistani investors.

Keywords: Stock Return Dispersion, Herding Behavior, Kalman Filter, Financial Crisis.

JEL Classification: G010

Introduction

Herding behavior in financial markets is an abstract phenomenon in which investors imitate the action, feelings, and thoughts of others and ignore their personal belief intentionally. The market agent is defined as an individual who bases his decisions on the actions of others rather than on the fundamental information (De Bondt, 1998). Nofsinger and Sias (1999) state herding as “a group of investors trading in the same direction over a period of time”.

The standard view of finance is constructed on the paradigm of the efficient market hypothesis

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(EMH). The investors are rational economic agents according to the standard view and irrationality in asset prices is caused by the exploitation of arbitragers. Behavioral finance view assigns irrationality of agents to restrained cognitive power and emotions. Barberis and Thaler (2003) state that the arbitrage opportunity available to the irrational investor cannot be manipulated in a simple manner if limits to arbitrage exist. The traditional finance view fails to explain certain anomalies, which can only be answered through behavioral finance view. As a consequence of several financial crises, and the failure of traditional models to explain the underlying behavioral factors raised the importance of behavioral finance. One of the behavioral anomaly is herding behavior and is often linked to the volatility of equity returns and can be easily observed in extreme returns and fragile financial environment (Christie & Huang, 1995).

Bikhchandani and Sharma (2001) describe herding as a state in which investors follows the market consensus by keeping aside their own set of information. Chiang and Zheng (2010) suggest this behavior as rational if in order to avoid the cost of obtaining information and knowledge individual follow the step of successors in the market. Aggarwal (2014) discusses several reasons for this behavioral dispersion from rational decision making. One of them is the role of Psychological biases that is specifically linked to the heuristics and framing effects and particularly based on the notion of irrationality.

The existence of this behavior is important from two aspects. First is the implication of asset pricing mechanism, it is believed that herd formation is an outcome of irrational response instead of the rational decision based on market fundamentals. In the presence of herding, prices are driven away from their equilibrium value, causing instability and often creates bubbles that result in sudden fall of prices (DeMarzo, Kaniel, & Kremer, 2007).

Second, is the episodes of reappearing financial crisis that raised several questions against market efficiency and asset pricing models and provides concern about the sensitivity of asset prices to market sentiments. According to the rational asset pricing model, during the period of market stress, substantial changes in market returns reflected in augmented dispersion (Christie and Huang, 1995). The aggregation of information can be viewed through the lens of herding behavior where information may (or may not) be incorporated in security prices. This information will only generate trading and will be higher when returns are higher (Welch, 2000).

The stock market in Pakistan is highly sensitive to unanticipated shocks and news (Malik & Shah, 2017). These shocks are rapidly reflected in the market activities but surprisingly markets recover easily soon after these turbulences. The major reasons behind this inefficient market behavior are poor administrative laws and the governance of weak institutional structures (Shah & Khan, 2016). Pakistani stock market has a characteristic of intensified participation of concentrated corporate ownership. Their perceptions, actions, and behavior have a continuous impact on stock market functioning and asset pricing mechanism (Hussain & Shah, 2015). Fan and Wong (2002) states that
in the presence of concentrated ownership, the reliability of reported earnings and information content shrink for the outside investors. These impacts cannot be solely explained through the traditional models of finance as these behavioral traits dominate the overall stock market activity. In the presence of such an environment, it is deemed necessary to study the herding behavior of Pakistani investor.

The phenomenon of herding behavior in Pakistan stock market has important implication for understanding the stock market functioning from investment as well as regulatory perspective. Trading in the similar direction can result in price fluctuation, increases volatility and can destabilize the market leading to price bubbles and crisis situations (Demirer & Kutan, 2006). Moreover, this correlated behavior in the market increases co-movement in asset returns. The emerging markets exhibit more herding tendency (Voronkova & Bohl, 2005) comparative to developed markets (Wermer, 1999). Most investors are unable to interpret given information set and follow the footsteps of large investors due to lack of adequate trading information.

The primary attempt of this study is to test the presence of herding behavior in Pakistani stock market. To meet this objective, this study focus on the aggregate market data and used the return dispersion model. All three models based on the cross-sectional dispersion of asset returns are employed (Christie & Huang, 1995; Chang, Cheng & Khorana, 2000; & Chiang & Zheng, 2010). Specifically, this research adds the literature by investigating the time-varying nature of Herding behavior using Kalman-filter-based model and the effect of certain domestic and global financial crisis. Previous studies examine herding behavior using a constant coefficient model that reflects the mean value of the functional relationship that remains unchanged over the entire sample. During the unstable period market faces certain structural transformations and these models fail to capture the market dynamics (Yang & Chen, 2015). The presence of time-varying herding exhibit a significant correlation with equity returns and is coherent with the hypothesis of positive-feedback trading (Chiang, Tan, Li, & Nelling, 2013).

The usefulness of this study is twofold. At first, this study analyzes the herding tendency of investor under country-specific characteristics that cause turbulence in the market. Secondly, it highlights the disturbance of global market environment that trigger this herding tendency in Pakistani market. In literature, the influence of the domestic and global crisis on herding behavior of Pakistani investor is novel, none of the previous studies reflected the intensity and magnitude of this crisis simultaneously. The primary concern of this paper is to consider the time-varying behavioral tendency of investors at the Karachi Stock Exchange under both normal and crisis condition. The Karachi Stock exchange is the oldest and largest Pakistani stock exchange based on stock market capitalization.

The remaining paper is structured as follows, section 2 offers an insight into the theoretical and empirical evidence on herding formation. Section 3 illustrates the data and methodology, section 4 provides empirical evidence of herding identified by different model and different market situations. Lastly, section 5 provides concluding remarks and future implications.
Literature Review

This study provides a brief understanding of the theoretical and empirical literature of investor herding behavior in financial markets. In the first subsection theoretical development on the idea of herding is discussed. The second section describes the empirical research and theoretical framework.

Theoretical Research on herding behavior

Theoretical research describes herding pattern in three distinct ways. First is the behavioral aspect of herding which is linked to the contagion of sentiment\(^4\). Goldbaum (2008) linked herding to the psychology of investor and argued that investors obtain a sense of security by mimicking the action of the majority. Lux (1995) argues that investors are least informed of market information. Therefore, they base their decisions solely on observation. The market is driven by optimistic traders and dominated by winners, and the pessimistic ones follow the actions of optimistic others.

The second strand considers herding as an information cascade where investors lack information and base their decision on others judgment with an assumption that they are better informed and make informational payoffs, they make an informational cascade\(^5\). Information revealed by the act of well-informed investors is valuable for the least informed investors as the process of information collection can be costly and time-consuming. Such investors solely rely on past information set and the whole process ends up into herd formation (Avery & Zemsky, 1998). Cipriani and Guarino (2014) empirically construct a model to test Informational herding and tested this theoretical model thorough financial data.

The third strand of research focused on herd formation caused by the reputational concern of manager that results in a principal-agent problem. The evaluation of a manager’s performance is based on the relative performance to overall industry and poor performance leads to the dismissal of top management (Morck, Shleifer, & Vishny, 1989). Therefore, a reputational concern manager completely follows other’s evaluation and forecast and shows their competence as an efficient agent by mimicking the action of the best performers. (Scharfstein & Stein, 1990; & Graham, 1999).

Theoretically, herding is classified as spurious and intentional herding (Bikhchandani & Sharma, 2000). Later form of herding is usually fundamental driven and often become a necessity rather than a choice where investors are forced to herd due to certain economic scenario (Spyrou, 2013). However, Intentional herding is where investors copy the behavior of others intentionally

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\(^4\) Asch (1952) studied the decision behavior of an individual in a social environment and conclude that investors in a group ignore given information set and their decision is a reflection of coordinating actions.

and suggest that investor can be rational or irrational agents. An investor can be irrational when the reason behind imitation is psychological reasons. Whereas, herding can be rational when investor lack confidence in his own judgment or he find him unable to process available information (Devenow & Welch, 1996). This paper makes an effort to examine irrational herding in the financial market of Pakistan.

Empirical research and Theoretical Framework

Empirical literature classifies herding estimation in two major categories based on investor type (Spyrou, 2013), the former grounded on the information cascade model and deals with the herding of specific investor class namely, institutional investors. Lakonishok, Shleifer and Vishny (1992) first proposed this measure and then Sias (2004) further enhanced it.

The latter set deals with the market activity data and relies on the aggregate prices to identify herding with respect to the market consensus. Christie and Huang (1995), Chang et al. (2000) and Hwang and Salmon (2004) proposes different measures to identify this type of herding activity in the market.

This paper identifies herding based on market activity data which has its theoretical foundation on behavioral aspects of herding. For this purpose, this study utilizes the return dispersion models. The Rational asset pricing models states that return dispersion should increase during extreme market stress as investor’s trade further away from the average market portfolio. But, in the presence of herding, this return dispersion decreases as investors track the market direction (Christie and Huang, 1995).


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6 According to Devenow & Welch (1996) theoretically herding may be seen as completely irrational (investors blindly follow the action of each other by ignoring rational analysis), a rational point of view (optimal decision making is an outcome of information asymmetry and herding is a result of payoff externalities), or a near-rational view (where investors can adopt heuristic rules). Recent insight into literature can be seen in Spyrou (2013).
the Taiwanese stock market, both sector wise and in the overall market. Hsieh, Yang, and Lee (2011) employ return dispersion model in 12 Asian stock markets and report a significant herding behavior.

In contrast, Henker and Mitsios (2006) employed dispersion models and find no support of herding using low frequency data in the Australian equity market. Garg and Gulati (2013) using the same model observe similar results in Indian stock market under normal market conditions. Similarly, Javaira and Hassan (2015) identify herding behavior in the Pakistani stock market using both models and report significant herding only in a crisis situation. Both models assume that herding is intense during extreme market movements and under market stress. Therefore, this study can hypothesize that

$H_1$: During extreme market stress stock prices exhibit significant herding behavior towards market returns.

$H_2$: In the presence of Herding a significant negative and nonlinear relationship exists between aggregate market returns and their cross cross-sectional dispersion.

The major contribution of this study is motivated by large literature that describes the movement of stock returns as time-varying (Sharma, Narayan, & Thuraisamy, 2015). If the moments in asset returns are time-varying, then the determination of herding behavior based on market returns and their dispersion should also be time-varying. More recently, Chiang et al., (2013) contributed to literature by examining a time-varying nature of return dispersion through a Kalman filter based model and estimated time varying herding in the Pacific- Basin and the US markets. The study finds significant herding behavior except for the US market. Yang and Chen (2015) examine time-varying herding behavior in Greater China stock markets during the global financial crisis period and find that stock market of China and Taiwan exhibit higher herding tendency during the turbulent period and also exhibit a greater response to the US market factor. This research is limited to a specific segment of economies and emerging market like Pakistan is completely ignored. According to literature, the Pakistani market exhibit higher volatility and highly sensitive to the news (Shah & Khan, 2016). Application of this dynamic model in Pakistani market can provide useful insight. Therefore, we can hypothesize that:

$H_3$: Herding behavior in Pakistani market is time-varying.

The financial crisis and herding behavior are closely linked, this motivation was derived from several studies. An increase in market uncertainty leads to form a market consensus. During the crisis period, the connection among investor’s increases due to pervasive speculation and investors recognize the shock of the crisis (Bikhchandani & Sharma, 2000). In the globalized world, such frictions in financial markets are not restricted to the national markets but have transmission effect around the globe. The trading activities of investors across the borders are in a synchronized manner

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8 See, Christie and Huang (1995); Bowe and Domuta (2004); Chiang and Zheng (2010)
or the presence of herding in a country upsurge the contagious crisis in other economies (Borensztein & Gelos, 2003).

Numerous studies investigate the idea that foreign investor plays a voluminous role in destabilizing national markets through herd formation (Choe et al., 1999; Kim & Wei, 2002). Bowe and Domuta (2004) observe the herding behavior caused by the foreign investor during or the post-Asian financial crisis of 1997. Some studies found a significant role of a global leader like the US in explaining the Asian market herding (Chiang & Zheng, 2010; Chiang et al., 2013). Economou, et al. (2011) observed the existence of herding behavior in four European markets of Spain, Greece, Italy, and Portuguese during the global financial crisis. The episode of the recent subprime crisis in the US market has a transmission effect around the globe (Chiang et al., 2007). Thus it is imperative to include the variable of crisis effect in order to avoid misspecification errors. Therefore, this study hypothesizes that;

\( H_4 \): Relative to normal market conditions stock prices usually exhibit significant herding behavior towards aggregate market returns during the domestic market crisis.

\( H_5 \): Stock prices exhibit significant herding behavior towards aggregate market returns during the international financial crisis.

**Data and Methodology**

**Data**

The dataset consists of closing values of the sector and national level indices (Data Stream Global Indices level 1 and 2, respectively) dominated in national currencies and trading on Pakistani stock exchange covering a period of January 1995 to December 2015. The daily returns of all industrial indices are utilized and obtained from Datastream (Thomson Financial). The percentage change in natural logarithmic values of stock price index is used to calculate daily returns. Table 1 present the descriptive statistics of each sector returns trading in Pakistan Stock market.
Table 1
Descriptive statistics of market and industry Index returns in Pakistan Stock exchange

<table>
<thead>
<tr>
<th>Index</th>
<th>Observation</th>
<th>Mean</th>
<th>St. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>5406</td>
<td>0.03%</td>
<td>1.88%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>5406</td>
<td>0.03%</td>
<td>1.73%</td>
</tr>
<tr>
<td>Construction &amp; Materials</td>
<td>5406</td>
<td>0.04%</td>
<td>2.88%</td>
</tr>
<tr>
<td>General Industries</td>
<td>5406</td>
<td>0.04%</td>
<td>2.38%</td>
</tr>
<tr>
<td>Auto &amp; Parts</td>
<td>5406</td>
<td>0.07%</td>
<td>2.49%</td>
</tr>
<tr>
<td>Food Producers</td>
<td>5406</td>
<td>0.09%</td>
<td>1.74%</td>
</tr>
<tr>
<td>Personal Goods</td>
<td>5406</td>
<td>0.01%</td>
<td>2.60%</td>
</tr>
<tr>
<td>Tobacco</td>
<td>5406</td>
<td>0.04%</td>
<td>2.70%</td>
</tr>
<tr>
<td>Pharm &amp; Biotech</td>
<td>5406</td>
<td>0.04%</td>
<td>1.69%</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>5406</td>
<td>-0.02%</td>
<td>2.51%</td>
</tr>
<tr>
<td>Electricity</td>
<td>5406</td>
<td>0.02%</td>
<td>2.54%</td>
</tr>
<tr>
<td>Banks</td>
<td>5406</td>
<td>0.04%</td>
<td>2.02%</td>
</tr>
<tr>
<td>Insurance</td>
<td>5406</td>
<td>0.07%</td>
<td>2.91%</td>
</tr>
</tbody>
</table>

It can be observed that food producer yields the highest mean returns of 0.09% followed by insurance and auto parts 0.07% respectively. Whereas, telecommunication sectors earn the lowest average returns of -0.02%. The pharmaceutical and biotechnology sectors display lowest volatility of 1.69% and Insurance is the most volatile at sector in the sample.

Methodology

The empirical test is based on the return dispersion model and classified into two categories. Former is the Constant coefficient models and later is the time-varying models of herding behavior. There is sound empirical research available on constant coefficient return dispersion models but very few studies discuss a non-time varying response of herding formation with the change in stock market portfolio returns. Whereas, it is observed that many structural changes are likely to occur during the period of extreme stress and the constant parameters fail to answer these market dynamics. The time-varying response of herding behavior in the equity market of Pakistan remained largely unexplored. Therefore, there is an immense need to identify this dynamic herding behavior.

Estimation using Cross-sectional standard deviation

The foundation of these models is based on the rational Asset pricing model. Christie and Huang (1995) propose that the stock returns dispersion can be used to identify herding in a specific market. They argue that in extreme markets, investor herd towards market portfolio and this effect
can be captured through a decrease in return dispersion. The basic idea behind this argument is the assumption that investors usually make decisions by following the market consensus and suppress their own belief and information based on fundamental factors. Christie and Huang (1995) suggested a cross-sectional standard deviation.

\[
\text{CSSD}_t = \sqrt{\frac{\sum_{i=1}^{n}(r_{i,t} - r_{m,t})^2}{n-1}} \tag{1}
\]

Where \(n\) represent a number of industries in the cumulative market portfolio, \(r_{i,t}\) are the observed returns on industry \(i\), \(r_{m,t}\) is a cross-sectional average returns \(m\) of \(n\) industries in the market on day \(t\).

This behavior is likely observed during periods of excessive market stress, as the possibility of mimicking the action of others and correlated behavior probably occur during such period. Therefore, this behavior can be examined through the following regression.

\[
\text{CSSD}_t = \alpha + \beta_1 D_{t}^U + \beta_2 D_{t}^L + \epsilon_t \tag{2}
\]

Where, \(D_{t}^U = 1\), represent the possibility of market portfolio returns in the extreme upper tail, and 0 for the rest of observations in a given time period. \(D_{t}^L = 1\), represent the possibility of aggregate market portfolio returns in the extreme lower tail, and 0 for the remaining observations in a given time period. Therefore, the presence of herding behavior can be assessed by negative and significant \(\beta_1\) and \(\beta_2\) coefficients.

*Estimation using Cross-sectional absolute deviation*

Chang et al. (2000) further advanced the CSSD methodology in order to overcome the limitations. They assume that the dispersion in stock returns is a nonlinear function of aggregate market returns. They used absolute measure of dispersion instead of standard deviation, the cross-sectional absolute deviation (CSAD) can be modeled as follows.

\[
\text{CSAD}_t = \frac{1}{N} \sum_{i=1}^{N} |r_{i,t} - R_{m,t}| \tag{3}
\]

The general quadratic form model developed by Chiang et al. (2000) is used to identify nonlinear relationship between CSAD and \(R_{m,t}\) given below.
Where, CSAD measures cross-sectional return dispersion and $|R_{m,t}|$ is an equally weighted realized return of industry index in its absolute form on the day “t”. The existence of herding is explained by the negative relationship of CSAD and $R^2_{m,t}$. Significant negative coefficient $\gamma_2$ imply the presence of investor herding behavior.

In order to figure out possible asymmetry under diverse market conditions, a linear term $R_{m,t}$ is included by Chiang and Zheng (2010). Under distinct market conditions, this linear term captures the asymmetry in investor behavior. The relative asymmetry in returns and dispersion is calculated by the ratio $(\gamma_3 + \gamma_2) / (\gamma_3 - \gamma_2)$, where $\gamma_3 + \gamma_2$ represent relationship when $R_{m,t} > 0$, while $\gamma_3 - \gamma_2$ exhibit the relation when $R_{m,t} \leq 0$ (Duffee, 2001).

$$CSAD_t = \gamma_0 + \gamma_1 |R_{m,t}| + \gamma_2 R^2_{m,t} + \epsilon_t$$ .................................................... (4)

Robustness check-in crisis period

In this section, the effect of the different local and global financial crisis is tested. According to literature, it is evident that herding is more intense during crisis periods. For domestic crisis, this period is classified as the stock market crash of 2005 (March, 2005), market Crash of 2006 (second quarter of 2006) and most recent and prolonged one is of 2008 (May 2008 to January 2009). To explore the impact of the global crisis two major crisis are studied, Asian financial crisis of 1997 (July 1997 to January 1998) and the Global financial crisis of 2008 (August 2007 to April 2009). To investigate this particular impact, Eq (4) is extended by adding a slope dummy of the crisis period.

$$CSAD_t = \gamma_0 + \gamma_1 |R_{m,t}| + \gamma_2 R^2_{m,t} + \gamma_3 D_{\text{crisis}} R^2_{m,t} + \epsilon_t$$ .................................................... (5)

Time-varying Dispersion Models

The above-mentioned methodology is based on the constant coefficient model and static in nature. Chang et al. (2000) model demonstrate the average relation between the square term of portfolio market returns and cross-sectional dispersion. The Kalman filter approach can be used to obtain time-varying or dynamic relation. Chiang et al. (2013) utilize this approach in a sample of ten Pacific basin markets and find strong evidence of time-varying herding behavior in all markets with the exception of the US market.
This method is described as:

\[ CSAD_t = \gamma_0 + \gamma_1 |r_{m,t} | + \gamma_2 r_{m,t}^2 + \epsilon_t \]  \hspace{1cm} (7)

\[ \gamma_{i,t} = \gamma_{i,t-1} + v_{i,t}, \quad v_{i,t} \sim N(0, \sigma_v^2) \]  \hspace{1cm} where \( i = 0,1,2 \)  \hspace{1cm} (8)

Equation (7) is a measurement equation and \( \{\gamma_i r_i\} \) is a vector of state variables. Equation (8) is a transition equation where the random walk process is followed by the state variables. The error terms are assumed to be time-independent and follow a Gaussian noise processes. State series \( Y_{2,t} \) calculated by kalman filter estimation examines the time variation of herding formation in a particular market during a period.

**Results and Discussion**

**Descriptive statistics**

Table 2 presents descriptive statistics of the equally weighted portfolio market returns, CSSD, and CSAD in industrial returns of Pakistani market. The time span of study spreads from 1995 to 2015 with 5406 daily observations. The range of daily market portfolio returns is from -1.645% to 10.6161%. Market portfolio returns have an average value of 0.041% with a total deviation of 1.3128%. According to the assumption of CAPM both CSSD and CSAD should increase with an increase in returns. In the presence of herding behavior all individual returns should move in the same direction and CSSD and CSAD must display value nearer to zero. The cross-sectional standard deviation of returns has a mean value of 1.7147% with a standard deviation of 1.091%. The range of this dispersion lies between 0.0023 to 15.47%. Comparative to CSSD, CSAD show less dispersion as the range of returns is low and lie between 0.0011% to 4.6496% with a mean value of 1.27% and a standard deviation of 0.64%. Both CSAD and CSSD display higher dispersion from individual returns.

Table 2

**Descriptive Statistics of CSSD and CSAD**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM</td>
<td>5406</td>
<td>0.0401</td>
<td>1.3128</td>
<td>10.6161</td>
<td>-11.6447</td>
<td>-0.3282</td>
<td>9.1728</td>
</tr>
<tr>
<td>CSSD</td>
<td>5406</td>
<td>1.7147</td>
<td>1.0909</td>
<td>15.4709</td>
<td>0.0023</td>
<td>2.1838</td>
<td>15.2286</td>
</tr>
<tr>
<td>CSAD</td>
<td>5406</td>
<td>1.2726</td>
<td>0.6383</td>
<td>4.6496</td>
<td>0.0011</td>
<td>1.4388</td>
<td>6.8093</td>
</tr>
</tbody>
</table>
Regression results based on CSSD

Table 3 reports the results of estimates of herding measure in extreme market conditions. The estimation was performed using Newey-West consistent standard errors.

Table 3
Estimates of herding measure in extreme market conditions: CSSD

<table>
<thead>
<tr>
<th>Panel A: Market returns in extreme 1% of the distribution.</th>
<th>Variables</th>
<th>α</th>
<th>βU</th>
<th>βL</th>
<th>Adj R²</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSSD</td>
<td></td>
<td>0.0168***</td>
<td>0.0298***</td>
<td>0.0249***</td>
<td>0.09</td>
<td>255.92***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(60.16)</td>
<td>(4.55)</td>
<td>(3.32)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Panel B: Market returns in extreme 5% of the distribution.

<table>
<thead>
<tr>
<th>Variables</th>
<th>α</th>
<th>βU</th>
<th>βL</th>
<th>Adj R²</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSSD</td>
<td>0.0158***</td>
<td>0.0153***</td>
<td>0.0140***</td>
<td>0.15</td>
<td>493.51***</td>
</tr>
<tr>
<td></td>
<td>(109.88)</td>
<td>(23.30)</td>
<td>(22.21)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

***, ** and * represent significance at a level of 1%, 5% and 10%.

Panel A and B report the result of two sets of dummy variables, where the dummies consist of the extreme returns that lie in 1% and 5% of the lower and upper tails of the distributions. All the estimated coefficient is significantly positive, these findings are coherent with the Christie and Huang (1995) and maintain the validity of rational asset pricing model. These results are against the hypothesis and negate the presence of herd behavior due to increased dispersion among individual and market returns. Under these circumstances, individual does not follow the market consensus and markets functioning is according to the basis of rational asset pricing model. Chen (2013) also reports the absence of herding in a large set of the global stock market during extreme market conditions. Javaira and Hassan (2015) observe similar results in Pakistani stock market and report positive significant coefficient in these two markets indicating the absence of herding in extreme market conditions.

Estimates of herding behavior using CSAD

This study utilizes Newey-West consistent estimator (1987) to estimate Eq (3) and (4) using the methodology recommended by Chiang and Zheng (2010). The study also employs an empirical model developed Chang et al. (2000) twice by imposing a restriction of $\gamma_2 = 0$ and then by relaxing the restriction of $\gamma_2 = 0$. Table 4 and Table 5 contains the results estimated using the model suggested by Chang et al. (2000) model with restriction and without restriction.
It is evident from table 4 that the nonlinear term $\gamma_3$ is significant and negative for Pakistani stock market, according to Chang et al. (2000) the negative and significant coefficient of $R^2_m$ indicates the presence of herding. This outcome is consistent with Malik and Elahi (2014) and contradicts Javaira and Hassan (2015), they find no sign of herding in the Pakistani equity market during normal market states. These results support the hypothesis of nonlinearity in the relationship between cross-sectional dispersion of returns as negative nonlinear term indicate the existence of herding behavior and deviation from efficiency in Pakistan stock market in general.

Table 5 reports the results based on equation 5, the relative asymmetry in market returns and cross-sectional dispersion is captured by the term $\gamma_2 \neq 0$. The combined value of $\gamma_1 + \gamma_2$ portrays the positive and significant relationship between market returns and return dispersion, and market returns have a greater impact on return dispersion as $R_m > 0$. The positive returns in the market ($\gamma_1 + \gamma_2$) have an absolute 10% larger effect than negative returns ($\gamma_1 - \gamma_2$). This effect can be calculated by the ratio ($\gamma_2 + \gamma_1$) / ($\gamma_1 - \gamma_2$). These returns are also supportive of the evidence that herding behavior present in the Pakistani stock market and contradict previous findings of Javed, Nousheen and Bilal (2011) and Javaira and Hassan (2015).

Robustness Analysis

In this section, for a robustness check, the model is extended to report several episodes of volatility that may influence our implications. A panic situation or economic forces are the driven forces behind the crisis. Herding intensity is high in turbulent markets.

In the first subsection, the effect of the domestic crisis in the Pakistani equity market is
analyzed and three crisis period of 2005, 2006 and 2008 are chosen for this analysis. The first two crises was due to the combined effect of speculations and bad governance. Whereas, the third crisis is linked with a number of national and international news that include political as well as economic issues. Finally, this study examines the effect of the consequence of the Asian crisis that occurs in 1997 and the global financial crisis happened in 2008.

Table 6
Estimates of herding behavior during crisis Period: CSAD

<table>
<thead>
<tr>
<th>Panel A: Financial crisis of Pakistani Market</th>
<th>Variables</th>
<th>( \gamma_1 )</th>
<th>( \gamma_2 )</th>
<th>( \gamma_3 )</th>
<th>( \gamma_4 )</th>
<th>Adj R(^2)</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisis period: March 2005</td>
<td>CSAD</td>
<td>0.009***</td>
<td>0.496***</td>
<td>-3.074***</td>
<td>-3.171***</td>
<td>0.31</td>
<td>823.204***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(51.177)</td>
<td>(16.191)</td>
<td>(-3.937)</td>
<td>(-2.963)</td>
<td></td>
<td>(51.177)</td>
</tr>
<tr>
<td>Crisis period: April 2006-June 2006</td>
<td>CSAD</td>
<td>0.009***</td>
<td>0.498***</td>
<td>-3.078***</td>
<td>-4.563***</td>
<td>0.32</td>
<td>829.826***</td>
</tr>
<tr>
<td>Crisis period: May 2008-January2009</td>
<td>CSAD</td>
<td>0.009***</td>
<td>0.496***</td>
<td>-3.016***</td>
<td>-1.557***</td>
<td>0.31</td>
<td>823.436***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(77.595)</td>
<td>(35.208)</td>
<td>(-10.894)</td>
<td>(-2.855)</td>
<td></td>
<td>(77.595)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel A: Financial crisis around the world</th>
<th>Variables</th>
<th>( \gamma_1 )</th>
<th>( \gamma_2 )</th>
<th>( \gamma_3 )</th>
<th>( \gamma_4 )</th>
<th>Adj R(^2)</th>
<th>F-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crisis period: July 1997 to January 1998</td>
<td>CSAD</td>
<td>0.009***</td>
<td>0.492***</td>
<td>-3.092***</td>
<td>0.792</td>
<td>0.31</td>
<td>819.967***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(51.095)</td>
<td>(16.086)</td>
<td>(-3.972)</td>
<td>(0.401)</td>
<td></td>
<td>(51.095)</td>
</tr>
<tr>
<td>Crisis period: August 2009 – April 2009</td>
<td>CSAD</td>
<td>0.009***</td>
<td>0.505***</td>
<td>-2.995***</td>
<td>-2.987***</td>
<td>0.32</td>
<td>839.190***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(51.275)</td>
<td>(16.418)</td>
<td>(-3.729)</td>
<td>(-2.567)</td>
<td></td>
<td>(51.275)</td>
</tr>
</tbody>
</table>

***, ** and * represent significance at a level of 1%, 5% and 10%.

Table 6 provides an insight into the impact of the crisis on herding behavior. From the above results, it is concluded that all three local crisis have a significant impact on Pakistani investor herding behavior. The findings are similar to the Javaira and Hassan, (2015) they report significant herding only during the crisis situation.

It is also observed that the only global financial crisis of 2008 has a significant influence on the investment decision-making process of an investor. These findings are coherent with the observations of Chiang and Zheng (2010). Garg and Gulati (2013) also observe similar behavior.
during the global financial crisis in India.

The empirical evidence supports the hypothesis that domestic and global crisis have an impact on investors herding behavior. Therefore, it can be concluded that during a period of market frictions investor is less likely to base their decisions on market fundamentals and prices are forced away from their fundamental values. Markets are inefficient and the rational asset pricing model no longer is applied to the fair price determination. The investor usually set aside their knowledge and track the market consensus in order to avoid uncertainty. This effect is common for both national and global crisis situations.

The possible reason for the significant influence of the global financial crisis on herding in an Asian market of Pakistan can be due to information asymmetry and inability to interpret the available information set appropriately in the market. In a developing market like Pakistan, investors usually follow the news from the global market and design their strategies grounded on the investment strategies of major institutional investors or follow the trend of developed and sophisticated markets when shock is common like global crisis. The strategies designed by mimicking the action of these institutional investors are further followed by the individual investors in markets like Pakistan. Thus, generating an activity that results in herd formation.

**Time-varying herding behavior**

Table 7 enlighten the time-varying nature of herding coefficient. Herding coefficient, \( \gamma_{2,t} \), is the state series of nonlinear term in Eq. (7). Mean and median for the herding coefficient is negative and the maximum observation is 0.028, nearer to zero. The negative sign of coefficients also supports the evidence of herding activity and suggest that time-varying herding is widely present in this market.

<table>
<thead>
<tr>
<th>( \gamma_{2,t} )</th>
<th>Obs</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>Max</th>
<th>Min</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5406</td>
<td>-0.046</td>
<td>-0.049</td>
<td>0.049</td>
<td>0.086</td>
<td>-0.166</td>
<td>0.156</td>
<td>2.844</td>
</tr>
</tbody>
</table>

From figure 1, it is observed that most of the herding coefficient are negative and time-varying in nature. This indicates significant herding activities in Pakistan economy in most of the time period with the exception of few positive spikes during 2000, 2001 and 2004. The herding coefficient is -0.101 and especially during and post-crisis periods it remains negative.
Figure 1: The series of herding coefficient overtime for the Pakistani stock market.

Two major international financial crisis are taken into consideration, the Asian financial crisis of 1997 and the global financial crisis of 2008. For the domestic market, crisis period was defined as the 2005 stock market crash. Market display persistent herding behavior during all domestic crisis period. During the crisis and post crisis period herding coefficient remains significant and negative. These findings agree the outcomes of Chiang et al. (2013), as they find similar results in ten Pacific Basin markets except the US market. Most of the emerging markets exhibit similar behavior. Yang and Chen (2015) find the dynamic response of herding during crisis and post-crisis period in Greater China and US market and concluded that investor behavior in Asian markets like China is more sensitive to the Global market factors. Therefore, it can be concluded that Pakistani investor normally exhibits herding behavior which is time-varying in nature. It can be attributed to the presence of greater influence of speculators, information asymmetry, bad governance, and market inefficiency.

Conclusion

Herding is a psychological state where investors rationally or irrationally mimic the action of market players leading to the market inefficiency and extreme stress. This study empirically examines this phenomenon in Pakistani stock market by using daily return data for industrial stock returns from January 1995 to December 2015. This study was unique in many aspects. Previous studies on herding behavior in Pakistan uses firm-level data; this study followed the approach of Chiang and Zheng (2010) by using daily returns on Industrial indices. Secondly, this research not only analyzed herding behavior with the constant coefficient model but also examine time-varying herding behavior.
through Kalman filter estimation. Lastly, the effect of the national and international financial crisis is also investigated on herding behavior.

In this study linear model suggested by Christie and Huang (1995) indicates an increase in dispersion and provide no evidence of herding during periods of lofty market swings indicating a divergence in the market trading pattern. These results are in agreement with the previous literature and maintain the validity of rational capital asset pricing model (CAPM).

Results based on Chang et al. (2000) and Chiang and Zheng (2010) models indicate significant herding behavior in Pakistani stock market and results and it can be implied that nonlinear model can better capture the interdependence of asset and market returns (Chen, 2013). This nonlinearity is well established in previous research. The main aim of this research was to analyze the time varying response of herding behavior in a country like Pakistan, where the main indicators of the economy are monitored on the basis of the functioning of the Stock market. The evidence proves the existence of the time-varying response of herding behavior in the Pakistani stock market. This behavior is more pronounced during and post-crisis period.

It is also concluded that investor sentiment is highly affected by abnormal activity in the market. In a crisis situation, investors rather than obtaining fundamental information rely on the investment activities of other investors in the market and this effect appear to be severe during extreme conditions of market and specifically in a crisis like adverse situations. Evidence suggests that Pakistani investors are highly influenced by Global leaders rather than their Asian counterparts. This tendency is supported as study finds the insignificant effect of the Asian crisis and significant impact of the Global Financial crisis of 2008.

Investor generally followed the market consensus due to overreaction to adverse news prevailing in the market. The investor’s decision is highly influenced by the sentiments, as the continued existence of herding behavior suggests. In the presence of widespread fear, the overreaction of news and speculation, little effort to make more conscious decision making by obtaining fundamental information could result in improved efficiency in the stock market. In addition, a certain measure like liberalization of financial markets, the formation of risk management practices, enhancing financial disclosure standards can be initiated by the regulators in order to improve market efficiency. Increased informational efficiency as a result of the stated repercussion can induce rational decision making and reduces the impact of behavioral tendency like herding behavior.

One of the limitations of this research is the use of secondary data to investigate herding behavior. It is observed that if a market face sentiment swings results based on survey data provide unreliable results. Another limitation of this research is the use of market activity data that capture the herding behavior of investors in general. Future research can focus on the herd formation caused by institutional investors as the market is dominated by concentrated corporate ownership.
References


