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## Article

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## FINANCIAL ECONOMICS | RESEARCH ARTICLE

# Do investors herd with industries or markets? Evidence from Pakistan stock exchange

Ume Salma Akbar<sup>1\*</sup>, Suresh Kumar Oad Rajput<sup>1</sup> and Niaz Ahmed Bhutto<sup>1</sup>

**Abstract:** This study investigates investors' herd behavior at market and industry level in Pakistan stock exchange (PSX). The novel contribution of this study is the incorporation of stock trading volume to explore the herding behavior laterally with daily stock returns. Using daily observations of the stock trading volume and stock closing prices of 254 firms listed on PSX for the period January 2000 - December 2014. Our empirical results found stock trading volume is the more robust predictor of herding than stock returns by employing ordinary least square method for cross-sectional absolute deviation (CSAD). Findings under stock returns indicate herding in eight industries at the industry level and in only one industry at market level. However, stock trading volume significantly predicts herding for 5 out of 11 industries both at industry and market level. This study recommends investor to focus more on daily trading volume than daily stock returns to devise their trading strategies.

**Subjects:** Economic Psychology; Finance; Business, Management and Accounting

**Keywords:** herding behavior; cross-sectional stock dispersion; Pakistan stock exchange  
**JEL classification:** G11; G12; G41



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### ABOUT THE AUTHORS

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### PUBLIC INTEREST STATEMENT

The purpose of this paper is to investigate the role of investors' herding in investment decision-making in Pakistan stock exchange (PSX). The findings show that stock trading volume illustrates clearer picture of herding than conventional measure of herd behavior "stock returns". This study has certain suggestions for investors as herding information facilitates investors in identification of potential risks at market place to device appropriate investment strategies. The presence of herding factor makes the assets mispriced and market inefficient, which boost the level of uncertainty among local or foreign investors. Therefore, they should take investment decisions wisely because unlike normal market conditions a large number of securities are required to get the equal level of diversification. This study recommends individual investors and professional investors like brokers to focus more on daily trading volume than daily stock returns to devise their trading strategies.

## 1. Introduction

In stock markets, the human tendency and conduct to imitate other's actions are called herding (Hirshleifer, 2003). As per behavioral finance, herding behavior of investors is the correlation among trades practices (Bikhchandani & Sharma, 2000). To access private information of other investors is generally impossible, so investors who have less trading knowledge and have no access to confidential information follow the observed patterns of other investors in persuasion of optimal investment decision-making (Chiang & Zheng, 2010; Banerjee, 1992; Bikhchandani, Hirshleifer, & Welch, 1992). When, that behavioral phenomenon occurs at the aggregate level, a crowd over the period of time trades in the same direction by using same information sources (Hirshleifer, 1994; Nofsinger & Sias, 1999).

Scharfstein (1990) attributes the cause of herding with managers' reputation arising out of acting differently than others. Probably, herding is the coincidence among investors when they are attracted to the securities sharing similar traits (Del Guercio, 1996; Falkenstein, 1996; Gompers & Metrick, 2001). A remarkable ground of herding is the fashion where assets of same style co-move too much and assets of different styles co-move too little (Barberis & Thaler, 2003). Basically, herding at the marketplace reflects the biases of investors (Javed, Zafar, & Hafeez, 2013). Tracing and getting clues from decision-making process of market sage to avoid decision biases always remained a challenge to academics and practitioners (Demirer & Kutun, 2006). Over the last two decades, the cognitive bias had remained an area of interest for behavioral economists (Raafat, 2009).

Significantly human errors and responses due to irrational behavioral biases cause imperfection at the market place (Lo, Repin, & Steenbarger, 2005). Scenario changes when managers who govern corporation, mimic the actions of others in the persuasion of taking rational decisions and to maintain the reputational capital at market place (Petersen, 1994; Scharfstein, 1990).

Whether herding behavior is rational or irrational, investor psychology research explains this mood swing as irrational behavior, where they follow the market consensus blindly by disregarding their previous beliefs and holding back their own information (Yao, Ma, & He, 2014). The intentional behavior of herding is the clustering of investors decisions, based on similar information (Chong, Liu, & Zhu, 2017).

Moreover, *ceteris paribus* invertors' rational and irrational behaviors, what is the effect on asset prices when market participants herd around, the findings of Chiang and Zheng (2010) suggest that herding can cause deviation of asset prices from their fundamental value. Therefore, herding got great attention in recent years, for creating trading strategies implication. It has become well documented empirical evidence around the world, and literature body is increasing day by day. Globally developed markets generally and emerging and developing markets, specifically, depict the prominent picture of herding behavior because herding is more ubiquitous there (Chang, Cheng, & Khorana, 2000; Chiang & Zheng, 2010). Herding behavior is enormously researched worldwide in most advanced and active stock markets to trace market efficiency through inventors' behaviors (Prosad, Kapoor, & Sengupta, 2012).

Despite its importance, a small number of studies have focused herding in South Asian countries. Only few studies are conducted on Pakistan stock market. "An emerging market characterized by high volatility, high market concentration, high returns and relative inability to mobilize new investment" (Javaira & Hassan, 2015; Khalid, 2007). In country there is the dominance of large investors over the small (Mirza & Shahid, 2008). That dominance became a probable cause of demutualization (merger of main exchanges into one). Before demutualization, there were three stock exchanges: Karachi stock exchange (KSE), Islamabad stock exchange (ISE), and Lahore stock exchange (LSE) that merged into Pakistan stock exchange (PSX) on 11 January 2016 (Shah, Shah, & Khan, 2017). Although the

sample of this study does not cover the demutualization period, it is a major breakthrough in the history of financial markets of Pakistan. Capital market of Pakistan is unique to be explored, as the PSX remained the best-performing stock market of the world in the year 2002 (Yasser, Entebang, and Mansor, 2011). Moreover, it remained one of the best performing, leading and oldest stock exchanges in the emerging markets. As per (MSCI)-2009, PSX is the third-best performer in the world. Therefore it is merely important to investigate herding in such a contributive stock market of the world.

This study contributes to the body of the existing literature by testing herd behavior in PSX on the ground of stock trading volume besides the stock returns at industry and market level. No other study uses these two major indicators, so this paper is the first attempt to uncover the herding behavior of firms listed on PSX.

The remainder of the study is classified in the following way. Section II reviews the literature and covers previous research work; Section III goes over the data description and research methodology. Section IV reports the descriptive statistics and empirical results. Section V draws the conclusion of study, discusses the policy implications, highlights the limitations, and proposes the directions for future researchers.

## 2. Literature review

### 2.1. Herding phenomenon

Huge number of studies has examined herding behavior among investors' decisions. According to Bikhchandani et al. (1992) and Nofsinger (1999), herding is the behavior where investors keep aside their own private information and follow the actions that are being taken by financial gurus at the marketplace. Mostly, the amateur investors are exposed to this phenomenon due to the lack of adequate market knowledge (Venezia, 2011).

Trading strategies of amateur investors pave a way for intrinsic value drift, as fundamental stock prices are not in focus under those strategies (Lakonishok, 1992). In the result, decisions became biased and market volatility emerges (Chang et al., 2000; Christie & Huang, 1995). The literature holds two poles of theories to investigate herding behavior where one explores herding headed for a particular stock and other states about market wide herding. Under single stock herd, single individual investor or group of them pursue one particular security while neglecting all other available in the market with similar characteristics (Banerjee, 1992; Bikhchandani et al., 1992). In the second scenario, investors follow the trends and tend at the aggregate market level (Chang et al., 2000; Christie & Huang, 1995).

Existence of herding remained a debate among researchers; several studies came up with several findings that assure the presence of herding in international markets generally and in emerging markets specifically (Shyu & Sun, 2010). In contrast, other studies confirm no herding at all in their respective stock markets. Christie and Huang (1995) was the first to employ an empirical approach to investigate herding in equity returns just to confirm herding behavior in equity markets. Later on, Chang et al. (2000) added an additional regression parameter in Christie and Huang (1995) as a more sensitive tool to identify herding behavior in stock returns. Using these models mixed shreds about the evidence of herding are reported in various stock markets around the world.

### 2.2. Herding in emerging markets

Following the market deregulations and liberalization, herding behavior is more likely to exist in emerging markets (Bikhchandani & Sharma, 2000). Moreover, global integration of emerging Asian markets attributed as a contributing factor for herding (Poshakwale & Thapa, 2009). Short horizon investments trends by speculators dominate in the capital markets of South Korea and Taiwan that lead markets toward herding practices (Froot, Scharfstein, & Stein, 1992). Chang et al. (2000)

further supported herding in the context of the short-term horizon investments and argued that government interventions cause dissimilarity in herding behavior in emerging markets.

With regard to the existence of herd behavior in Chinese stock markets literature contains a debate. On one hand, Demirer and Kutan (2006) found no herding in Chinese stock market by incorporating the theory of market efficiency and asset pricing model. On the other hand, Lee, Chen, and Hsieh (2013) verify herding. Tan, Chiang, Mason, and Nelling (2008) brought a totally different view with herding in the A-share and B-share stock market. Yao et al. (2014) validate strong herding in largest, smallest, and growth stocks. However, weaker herding evidence was found in midcap stock and value stock. In Arab stock market, Balcilar, Demirer, and Hammoudeh, (2014) confirmed the existence of herding behavior. The studies of Vo and Phan (2016) and Bui, Nguyen, Nguyen, and Titman (2018) validate herding in the Vietnam stock market.

### **2.3. Herding in developed markets**

Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010) did not any evidence of herd behaviour in United States markets hence confirm no herding in the US markets and most of the developed markets. Studies attribute this tendency of no herding to sophisticated investors behaviors in developed markets that are based on better information and usage of high-quality analytical tools.

### **2.4. Herding in Pakistan**

In Pakistan, herding behavior is still a puzzle to solve, literature holds two opposite viewpoints. Jhandir and Elahi (2015) explored the existence of herd behavior in KSE; whereas, the findings of Javaira and Hassan (2015) and Javed et al. (2013) report no evidence of herd conduct in KSE. Furthermore, Zafar and Hassan (2016) found partial herding in up and down market in KSE. Shah et al. (2017) indorse two behaviors, one states “large firms show herding behavior in extreme market movements,while, the second suggests industry portfolios show the weak evidence of herding towards the market”.

Consequently, this is a matter of great debate in the premises of Pakistan stock market to confirm the existence of herd behavior. This study endeavors to find the answer to the above-raised question at overall market and industry level in Pakistan through the stock returns a herding measure used by previous studies along with a new and more robust approach the stock trading volume.

### **2.5. Motivation for using “stock trading volume”**

This study employs a new approach “stock trading volume” to measure the investors herd behavior, an indicator recommended by (Chen, Rui, & Xu, 2003). Trading volume covers different dimensions of stock market, as a large trading volume for a single stock or at aggregate level indicates the existence of a crowd that confirm the herding behavior among investors at particular point of time (Chen et al., 2003). That generates the swarming effect; an increase in the trading volume due to incremental trading activities of particular stock or group of securities (Ichiki & Nishinari, 2015). Hence, due to its previously mentioned precise and robust attributes, stock trading volume can better serve as the herding proxy in a market like PSX where the existence of herding behavior is still to be confirmed.

### **2.6. Proposed hypotheses**

H1: Investors herd with market returns in PSX.

H2: Investors herd with industry returns in PSX.

H3: Investors herd with market trading volume in PSX.

H4: Investors herd with industry trading volume in PSX.

### 3. Data and research methodology

#### 3.1. Data

This study examines the herding behavior in PSX, previously known as KSE, applying the methodology used by Zheng, Li, and Chiang (2017) and Chen et al. (2003). The data is obtained from the Bloomberg database, consists of daily closing stock prices, trading volume, index trading volume, index returns, and market capitalization of firms listed on the PSX. Covering the sample period from 3 January 2000 to 31 December 2014, sample comprises 254 firms consistently listed on PSX since 2000. Therefore the selection criteria are based on firm's listing on PSX for the sample period. We organize 254 firms into 11 industry groups including "Business Equipment", "Chemicals", "Durable Consumer Goods", "Energy", "Healthcare", "Manufacturing", "Money and Finance", "Nondurable Consumer Goods", "Telecommunication", "Utilities", and "Other" according to industry classification of (Fama & French, 1997).

#### 3.2. Methodology

We calculated stock returns for the shares of individual firm by the given equation:

$$R_t = 100 \times [\log (P_t) - \log (P_{t-1})]$$

where,  $P_t$  denotes the price at time  $t$  and  $P_{t-1}$  indicates the last price. Stock return is the log difference of both current and last price. Further, returns of market portfolio are based on equally weighted portfolio of all firms in each classified industry.

As herding cannot be measured directly from financial markets, we require different proxies to detect the herd behavior at the marketplace. The literature grabs mainly two strands of research where one proxy addresses herding behavior at the individual level by incorporating asymmetric buying and selling orders, for example, more selling behavior means herding on selling side and vice versa. Conversely, the second strand measures herd behavior at the aggregate market level through asset pricing model by employing the relationship between cross-sectional dispersion of stock returns and extreme movement of stock market returns. The cross-sectional standard deviation (CSSD) method was first introduced by Christie and Huang (1995) is calculated as follows:

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

where,  $N$  denotes the number of firms in a portfolio,  $R_{it}$  is the return of stock  $i$  at time  $t$ , and  $R_{mt}$  is the equally weighted return of portfolio at time  $t$ .

Christie and Huang (1995) methodology of CSSD reports significantly lower dispersion of stock return, in the situation of extreme price movements, a condition where high herding behavior is expected. Later on, Chiang and Zheng (2010) resolved the issue by using CAPM: generalization approach to detect the herding behavior in overall market conditions. Further, he modified the herding measure from CSSD to the cross-sectional absolute deviation (CSAD) of returns.

Chiang and Zheng (2010) proposed a linear correlation between stock return dispersion and the absolute value of stock returns. Under herding situation investors trade in the direction of market; hence, individual stock returns follow the pattern of overall market return. Therefore, when herding arrives the linear relation gets away between cross-sectional absolute deviation and absolute value stock market return. As a result, a negative and nonlinear relation emerges between stock market return and CASD that indicates the existence of herding behavior.

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{m,t}| \quad (2)$$



As described earlier, the linear relation between the CSAD and the squared value of stock market returns does not hold any more when herding behavior occurs. At overall market level, herding is detected through the following model.

$$CSAD_t = \alpha + \gamma_1 |R_{m,t}| + \gamma_2 R_{m,t}^2 + \epsilon_t \quad (3)$$

where negative and statistically significant value of ( $\gamma_2$ ) validates the presence of herding.

As we are working at industry level besides overall market level, our study contains a series of estimation models to explore herding behavior in PSX.

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{ind,t}| \quad (4)$$

Industry level stock return dispersion (CSAD) is calculated in the above equation, where the stock market return is replaced by industry average returns  $R_{ind}$ .

$$CSAD_t = \alpha + \gamma_1 |R_{ind\_market,t}| + \gamma_2 R_{ind\_market,t}^2 + \epsilon_t \quad (5)$$

In Equation (5) here are two terms (i)  $R_{ind\_market}$  calculated through:

$$R_{ind\_market,t} = R_{ind,t} - E(R_{ind,t})$$

(ii) term is  $(R_{ind,t})$  the expected industry return and is calculated as follows:

$$CAPM: E(R_{ind,t}) = \alpha + \beta R_{m,t}$$

So, once again, the negative and statistically significant value of ( $\gamma_2$ ) confirms the investors herding at the industry level, which is consistent with Yao et al. (2014).

Based on Equation (5), we further expanded our analysis with Equation (6).

$$CSAD_t = \alpha + \gamma_1 |R_{ind\_market,t}| + \gamma_2 R_{ind\_market,t}^2 + \gamma_3 |R_{PSX}| + \gamma_4 R_{PSX}^2 + \epsilon_t \quad (6)$$

The above equation estimates two herding coefficients one at industry level: ( $\gamma_2$ ) where its negative and significant value validates investors herd behavior at the industry level. The negative and statistically significant value of ( $\gamma_4$ ) declares the herding at the market level.

Similarly, a positive relationship between mean absolute deviation of stock trading volume and market trading volume authenticates the absence of the herding phenomenon. Chiang and Zheng (2010) proposed the linear correlation between stock return dispersion and the absolute value of stock return. Hence, when herding arrives linear relationship between the CSAD and absolute value, stock trading market volume gets away. As a result, we found a negative and nonlinear relationship between the squared value of stock market volume and CASD. We take stock trading volume, Therefore, each equation contains stock trading volume rather than return to trace the herd behavior in the stock market. Under the situation of herding investors' trade in the direction of market, the individual stock volume follows the pattern of overall market volume.

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |Vol_{i,t} - Vol_{m,t}| \quad (7)$$

As defined earlier, the linear relation between the CSAD and the squared value of stock trading volume does not hold when herding behavior occurs. At overall market level, herding is detected through the following model.

$$CSAD_t = \alpha + \gamma_1 |Vol_{m,t}| + \gamma_2 Vol_{m,t}^2 + \epsilon_t \quad (8)$$



where negative and statistically significant value of ( $\gamma_2$ ) validates the presence of herding.

$$CSAD_t = \frac{1}{N} \sum_{i=1}^N |vol_{i,t} - vol_{ind,t}| \quad (9)$$

Industry level stock trading volume dispersion (CSAD) is calculated in the above equation, where the stock market trading volume is replaced by industry average trading volume Volindt.

$$CSAD_t = \alpha + \gamma_1 |vol_{ind\_market,t}| + \gamma_2 vol_{ind\_market,t}^2 + \epsilon_t \quad (10)$$

In Equation (10) here are two terms (i)  $Vol_{ind\_market}$  calculated through:

$$Vol_{ind\_market,t} = Vol_{ind,t} - E(Vol_{ind,t})$$

Further (ii) term is  $(Vol_{ind,t})$  the expected industry trading volume and is calculated as follows:

$$CAPM: E(Vol_{ind,t}) = \alpha + \beta Vol_{m,t}$$

Hence, once again the negative and statistically significant value of ( $\gamma_2$ ) confirms the investor herding at the industry level.

Based on Equation (10), we further expanded our analysis with Equation (11).

$$CSAD_t = \alpha + \gamma_1 |Vol_{ind\_market,t}| + \gamma_2 Vol_{ind\_market,t}^2 + \gamma_3 |Vol_{PSX}| + \gamma_4 Vol_{PSX}^2 + \epsilon_t \quad (11)$$

The above equation estimates two herding coefficients one at industry level: ( $\gamma_2$ ) where its negative and significant value validates investors' herd behavior at the industry level. The negative and statistically significant value of ( $\gamma_4$ ) declares the herding at the market level.

## 4. Results and discussion

### 4.1. Descriptive analysis

Table 1 presents the descriptive statistics of CSAD stock returns for 11 weighted average industry portfolios. The number of observations crosses 3,500 for each industry. Log of stock returns is taken for each industry portfolio before calculating  $CSAD_t$ . The values of stock return CSAD are different for different industries. "Other" industry has highest average CSAD value followed by "Money and Finance" and "Manufacturing", while "Energy" industry experience lowest average CASD of all industries in Pakistan. This indicates higher turnover in "Other", "Money and Finance", and "Manufacturing" industries of PSX but less turnover in "Energy", "Health", and "Telecom" industries of Pakistan. Further, none of the 11 industries is negatively skewed. When checking for kurtosis all of the 11 industries have heavier tail data distribution.

Table 2 provides the descriptive statistics of CSAD stock trading volume for 11 weighted average industry portfolios. The number of observations crosses 3,500 for each industry. Log of stock trading volume is taken for each industry portfolio before calculating  $CSAD_t$ . The values of stock trading volume CSAD are different for different industries. "Chemical" industry has the highest average CSAD value followed by "Money" and "Manufacturing", while "Telecom" industry experience the lowest average CASD of all industries in Pakistan. This indicates higher turnover in "Chemical", "Money and Finance", and "Manufacturing" industries of PSX but less turnover in "Telecom", "Business Equipment", and "Durable Consumer Goods" industries of Pakistan. Further, "Chemicals" and "Manufacturing" industries are negatively skewed and rests are the positively skewed. While checking for kurtosis 4 out of 11 industries: "Durable Consumer Goods", "Energy", "Telecom", and "Other" industries have negative values of kurtosis with light tails. Whereas seven out of 11 industries: "Business Equipment", "Chemicals", "Healthcare", "Manufacturing", "Money and Finance", and "Utility" industries have heavier tail data distribution.

**Table 1. Descriptive statistics of stock returns**

	<b>Busi Equip</b>	<b>Chems</b>	<b>Durbl</b>	<b>Engy</b>	<b>Hlth</b>	<b>Manuf</b>	<b>Mony</b>	<b>Nodur</b>	<b>Tele</b>	<b>Util</b>	<b>Other</b>
Mean	1.795	2.981	1.839	1.881	2.053	2.402	2.520	2.058	1.757	2.276	2.014
Maximum	4.545	4.807	4.544	4.011	4.457	4.238	4.036	3.906	5.107	4.291	5.941
Minimum	0.000	0.000	0.000	0.565	0.000	0.728	0.000	0.000	0.000	0.000	0.000
St.Dev	0.680	0.540	0.646	0.617	0.548	0.503	0.403	0.494	0.915	0.461	1.039
Skewness	0.257	-0.350	0.130	0.406	0.144	-0.339	0.113	0.779	0.721	0.263	0.217
Kurtosis	0.890	0.705	-0.280	-0.692	0.851	0.289	1.703	0.298	-0.182	0.635	-0.023
Obs	3682	3685	3685	3684	3685	3684	3686	3686	3685	3685	3684

**Table 2. Descriptive statistics of trading volume**

	<b>Busi Equip</b>	<b>Chems</b>	<b>Durbl</b>	<b>Enrgy</b>	<b>Hlth</b>	<b>Manuf</b>	<b>Mony</b>	<b>Nodur</b>	<b>Tele</b>	<b>Util</b>	<b>Other</b>
Mean	2.250	2.192	2.236	1.442	1.669	2.637	2.832	2.400	1.718	2.124	2.994
Maximum	50.820	142.519	49.223	22.396	75.048	26.730	28.686	16.326	21.501	89.696	70.018
Minimum	0.000	0.000	0.000	0.000	0.000	0.182	0.000	0.000	0.000	0.000	0.000
St.Dev	2.484	3.352	1.786	0.996	1.946	1.696	1.556	1.331	1.492	2.531	3.454
Skewness	7.368	34.948	9.501	8.048	21.522	4.878	4.198	3.102	4.218	23.930	6.490
Kurtosis	91.691	1398.097	191.769	133.736	700.425	41.562	40.008	17.921	35.995	784.693	84.561
Obs	3683	3686	3686	3685	3686	3685	3687	3687	3686	3686	3685

## 4.2. Empirical evidence

Empirical results presented in this section are covering the full sample period for all firms. We first explore herding behavior for stock returns at overall industry and market level, followed by investigation of herd behavior based on stock trading volume at overall industry and market level. Then, industry level herding analysis is made by using stock returns and stock trading volume, respectively. Lastly, we detect herding with industry and market-PSX likewise by employing stock returns and stock trading volume one to one.

### 4.2.1. Herding with overall industries and markets—stock returns

This section presents the empirical results on the existence of herd behavior at overall industries and market level. Table 3 contains no evidence of herding at the market level when considering stock returns variable in PSX by using Equations (3) and (5). While results show a significant and negative ( $\gamma_2$ ) (herding coefficient) at overall industries level in Pakistan which supports our hypothesis; investors herd with industry in terms of stock returns in PSX. While, the results reported in forth column show a significant and negative ( $\gamma_2$ ) (herding coefficient) at overall industries level in Pakistan, which supports our hypothesis that; investors herd with industry in terms of stock returns in PSX.

### 4.2.2. Herding with overall industries and markets—stock trading volume

Proceeding further, this section presents empirical results on the existence of herd behavior at overall industries and market level. Table 4 shows the clear signs of herding at the market level when considering stock trading volume variable in PSX by using Equations (8) and (10). Moreover, as expected, results show a significant and negative ( $\gamma_2$ ) (herding coefficient) at overall industries level in Pakistan, which supports our hypothesis: investors herd with industry in terms of stock trading volume in PSX. Besides, herding coefficient at overall market level is negative and statistically significant that supports our hypothesis: investors herd with markets in terms of stock trading volume in PSX.

### 4.2.3. Herding with industry

In case of herding stock returns or stock trading volume cluster at a point that eliminates the linear relationship between stock return dispersion CSAD and absolute value of stock market returns. Likewise scenario is followed by stock volume dispersion CSAD and absolute value of

**Table 3. Estimates of herding with overall industries and market**

	Intercept	$ R_{ind-market,t} $	$R^2_{ind-market,t}$	$ R_{psx} $	$R^2_{psx}$
Coefficient	0.129***			0.963***	0.000***
t-Statistics	(53.39)			(1057.28)	(25.51)
Coefficient	0.126***	0.013***	-0.006***	0.964***	0.000***
t-Statistics	(41.10)	(3.76)	(-7.89)	(1043.46)	(24.52)

The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

**Table 4. Estimates of herding with overall industries and market**

	Intercept	$ Vol_{ind-market,t} $	$Vol^2_{ind-market,t}$	$ Vol_{psx} $	$Vol^2_{psx}$
Coefficient	1.941***			0.381***	-0.086***
t-Statistics	(254.51)			(50.57)	(-67.50)
Coefficient	0.605***	0.490***	-0.043***	0.391***	-0.089***
t-Statistics	(12.81)	(24.15)	(-19.44)	(52.31)	(-69.91)

The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

**Table 5. Estimates of herding with industries. This table reports the regression results of the CSAD based on the following equation:**

$$CSAD_t = \alpha + \gamma_1 |R_{ind\_market}| + \gamma_2 R_{ind\_market}^2 + \epsilon_t \quad (5)$$

	Busi Equip	Chem	Durables	Energy	Health	Manu	Mony	Nodur	Telecom	Util	Other
$\alpha$	0.204*** (18.44)	0.103*** (18.67)	0.285*** (24.07)	0.435*** (35.08)	0.153*** (27.70)	0.395*** (23.47)	0.366*** (21.55)	0.105*** (14.12)	0.005 (0.98)	0.068*** (18.42)	0.054*** (19.95)
$\gamma_1$	0.932*** (198.13)	0.971*** (411.63)	0.893*** (173.82)	0.694*** (78.73)	0.970*** (321.72)	0.841*** (111.08)	0.864*** (120.23)	0.974*** (236.85)	0.981*** (294.22)	0.989*** (628.01)	1.002*** (1238.61)
$\gamma_2$	0.002*** (9.53)	0.000*** (11.33)	0.002*** (12.53)	0.013*** (18.61)	0.000*** (8.29)	0.007*** (13.60)	0.005*** (10.15)	0.001** (2.26)	0.000 (1.01)	0.000*** (5.53)	-0.000** (-2.05)
$R^2$	0.9725	0.9975	0.9544	0.8565	0.9894	0.9439	0.9409	0.9877	0.9866	0.9977	0.9990

The equation is estimated for each of the 11 industries: "Business Equipment", "Chemicals", "Durable Consumer Goods", "Energy", "Healthcare", "Manufacturing", "Money and Finance", "Nondurable Consumer Goods", "Telecommunication", "Utilities", and "Other" in Pakistan stock exchange (PSX) including 254 listed firms. The data range from 1/3/2000 to 12/31/2014. The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

**Table 6. Estimates of herding with industries. This table reports the regression results of the CSAD based on the following equation:**

$$CSAD_t = \alpha + \gamma_1 |Vol_{ind\_market}| + \gamma_2 Vol_{ind\_market}^2 + \epsilon_t \quad (10)$$

	Busi Equip	Chem	Durables	Energy	Health	Manu	Mony	Nodur	Telecom	Util	Other
$\alpha$	1.279*** (71.16)	3.580*** (131.44)	2.448*** (119.35)	1.547*** (14.10)	1.207*** (102.96)	2.822*** (154.60)	3.058*** (157.00)	1.217*** (61.53)	4.191*** (50.10)	2.989*** (92.73)	1.511*** (47.79)
$\gamma_1$	0.564*** (14.70)	-0.403*** (-8.38)	-0.740*** (-21.41)	0.579*** (9.89)	0.935*** (41.11)	-0.368*** (-11.10)	-0.577*** (-17.27)	0.939*** (29.56)	-0.499*** (-13.08)	-0.353*** (-9.57)	0.058 (1.11)
$\gamma_2$	0.077*** (4.85)	-0.078*** (-3.93)	0.062*** (4.74)	-0.118*** (-15.22)	0.001 (0.14)	-0.068*** (-4.85)	0.086*** (6.28)	-0.133*** (-12.39)	-0.000 (-0.18)	-0.016* (-1.64)	0.285*** (16.01)
$R^2$	0.4596	0.3375	0.3196	0.2139	0.8008	0.3151	0.2771	0.5579	0.5768	0.3656	0.4140

The equation is estimated for each of the 11 industries: "Business Equipment", "Chemicals", "Durable Consumer Goods", "Energy", "Healthcare", "Manufacturing", "Money and Finance", "Nondurable Consumer Goods", "Telecommunication", "Utilities", and "other" in Pakistan stock exchange (PSX) including 254 listed firms. The data range from 1/3/2000 to 12/31/2014.

The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

stock market trading volume. Subsequently, a negative and significant ( $\gamma_2$ ) (herding coefficient) proves evidence of herding activities. Tables 5 and 6 report the results estimated through Equations (5) and (10).

#### 4.2.4. Herding with industry- stock returns

Table 5 sheds light on the empirical results of herding at the industry level, based on Equation (5). As per findings only one industry “Other” in PSX supports our hypothesis: investors herd with industry returns in PSX. The herding coefficient ( $\gamma_2$ ) is positive for 10 out of 11 industries: “Business Equipment”, “Chemicals”, “Durable Consumer Goods”, “Energy”, “Healthcare”, “Manufacturing”, “Money and Finance”, “Nondurable Consumer Goods”, “Telecommunication”, and “Utilities”. This finding represents more volatility in “Other” and less volatility in rest of the industries of PSX. That suggests herding behavior is more likely to occur in volatile industries.

#### 4.2.5. Herding with industry—stock trading volume

When incorporating stock trading volume, herding at the industry level is estimated by Equation (10). According to Table 6, there are certain evidences that support our hypothesis that states “investors herd with industry volume in Pakistan stock exchange (PSX)”. Results show that the herding coefficient ( $\gamma_2$ ) is negative for 6 out of 11 industries but negative and significant for 5 industries, specifically, “Chemicals”, “Energy”, “Manufacturing”, “Nondurable Consumer Goods”, and “Utility” industries; whereas, in “Telecommunication”, herding coefficient is negative but insignificant and no herding found in rest of the industries. So, herding phenomenon grounded on trading volume detects more volatility in the “Chemicals”, “Energy”, “Manufacturing”, “Nondurable Consumer Goods”, and “Utility” industries of PSX.

#### 4.2.6. Herding with industry and PSX—stock returns

We found significant herding behavior in a few industries of PSX in Tables 5 and 6. As per Chang et al. (2000), Kabir and Shakur (2018) and Zheng et al. (2017), herding is there in Asian stock markets. To test whether the significance of industry herding still exists in Pakistan, we expanded our analysis with Equation (6) as per the previous discussion, and the herding at the industry level was detected with a negative and significant ( $\gamma_2$ ) herding coefficient; whereas, the investors herding at the market level is being detected through significant and negative ( $\gamma_4$ ). This finding combined with our previous finding in Table 7 interestingly shows that the same “Other” industry holds significant and negative market level herding coefficient ( $\gamma_4$ ); whereas, rest of the industries do not show any evidence of herding activities at the market level. When comparing industry level herding with market level herding, we found eight industries: “Business Equip”, “Durable Consumer Goods”, “Energy”, “Health”, “Manufacturing”, “Money and Finance”, “Nondurable Consumer Goods”, “Telecom”, and “Other”, and 8 out of 11 industries have negative and significant herding coefficients ( $\gamma_2$ ) in comparison with market herding coefficient at the market level ( $\gamma_4$ ). It is observed here that the behavior of industry herding is more pronounced in expanded Equation (6), while Equation (5) found herding behavior in only one industry.

#### 4.2.7. Herding with industry and PSX—stock volume

To test whether the significance of herding behavior still exists in Pakistan when employing stock trading volume, we expanded our analysis with Equation (11) as per the previous discussion; the herding at the industry level was detected with a negative and significant herding coefficient ( $\gamma_2$ ) and the herding at the market level is being detected through significant and negative  $\gamma_4$ . Empirical findings reported in Table 8 show that the industry level herding coefficient ( $\gamma_2$ ) is found to be significant and negative for 3 industries out of 11 industries, interestingly this time two new industries: “Healthcare” and “Telecom” besides previous three: “Energy”, “Nondurable Consumer Goods”, and “Utility” demonstrate investor herding behavior in PSX.

Table 8 further reports the investors’ herding at the market level by  $\gamma_4$  and found 5 out of 11 industries have significant and negative herding coefficient. This time, three new industries, namely “Business Equipment”, “Health Care”, and “Other”, express herding behavior after adding the market variable in



**Table 7. Estimates of Herding with Industries. This table reports the regression results of the CSAD based on the following equation:**

$$CSAD_t = \alpha + \gamma_1 |R_{ind\_market,t}| + \gamma_2 R_{ind\_market,t}^2 + \gamma_3 |R_{PSX}| + \gamma_4 R_{PSX,t}^2 + \varepsilon_t \quad (6)$$

	Busi Equip	Chem	Durables	Energy	Health	Manu	Mony	Nodur	Telecom	Util	Other
$\alpha$	0.202*** (14.51)	0.100*** (15.72)	0.270*** (19.35)	0.382*** (27.56)	0.152*** (22.13)	0.378*** (20.79)	0.350*** (19.45)	0.104*** (13.18)	0.006 (0.94)	0.068*** (15.41)	0.059*** (16.61)
$\gamma_1$	0.020 (1.30)	0.007 (1.07)	0.030** (2.04)	0.122*** (8.65)	0.005 (0.68)	0.042*** (2.78)	0.043*** (3.01)	0.003 (0.52)	0.008 (1.33)	0.001 (0.23)	0.003 (0.68)
$\gamma_2$	-0.012*** (-3.60)	-0.002 (-1.46)	-0.006* (-1.88)	-0.018*** (-6.08)	-0.003* (-1.92)	-0.006* (-1.74)	-0.006** (-1.99)	-0.002 (-1.48)	-0.006*** (-4.11)	-0.001 (-1.41)	-0.004*** (-4.87)
$\gamma_3$	0.935*** (196.93)	0.972*** (396.94)	0.892*** (168.92)	0.671*** (72.46)	0.972*** (318.22)	0.835*** (107.25)	0.858*** (115.43)	0.975*** (235.07)	0.982*** (295.13)	0.990*** (617.62)	1.003*** (1252.88)
$\gamma_4$	0.002*** (9.12)	0.000*** (10.83)	0.002*** (12.51)	0.013*** (19.94)	0.000*** (7.92)	0.007*** (13.90)	0.005*** (10.53)	0.000** (2.19)	0.000 (1.16)	0.000*** (5.04)	-0.000** (-2.41)
R2	0.9727	0.9975	0.9544	0.8597	0.9894	0.9441	0.9411	0.9877	0.9867	0.9977	0.9991

The equation is estimated for each of the 11 industries: "Business Equipment", "Chemicals", "Durable Consumer Goods", "Energy", "Healthcare", "Manufacturing", "Money and Finance", "Nondurable Consumer Goods", "Telecommunication", "Utilities", and "other" in Pakistan stock exchange (PSX) including 254 listed firms. The data range from 1/3/2000 to 12/31/2014. The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

**Table 8. Estimates of Herding with Industries and Markets. This table reports the regression results of the CSAD based on the following equation:**

$$CSAD_t = \alpha + \gamma_1 |Vol_{ind\_market}| + \gamma_2 Vol_{ind\_market}^2 + \gamma_3 |Vol_{PSX}| + \gamma_4 Vol_{PSX}^2 + \epsilon_t \quad (11)$$

	Busi Equip	Chem	Durables	Energy	Health	Manu	Mony	Nodur	Telecom	Util	Other
$\alpha$	-1.171*** (-11.15)	1.610*** (40.45)	2.820*** (21.04)	1.035*** (62.28)	-0.235*** (-6.16)	2.640*** (41.38)	2.111*** (56.03)	-1.679*** (-46.27)	1.849*** (92.65)	2.076*** (83.64)	-0.552*** (-3.00)
$\gamma_1$	0.835*** (23.51)	-1.159*** (-59.11)	-0.863*** (-23.82)	-0.936*** (-72.58)	1.064*** (68.95)	-1.209*** (-50.29)	-1.103*** (-68.37)	1.573*** (94.10)	-0.929*** (-133.78)	-0.878*** (-76.85)	0.093* (1.77)
$\gamma_2$	0.041*** (2.88)	0.077*** (9.72)	0.083*** (6.28)	-0.007*** (-4.63)	-0.014*** (-2.14)	0.163*** (17.06)	0.099*** (15.16)	-0.217*** (-41.14)	-0.006*** (-9.04)	-0.023*** (-7.71)	0.277*** (15.81)
$\gamma_3$	0.676*** (15.37)	0.509*** (29.64)	-0.255*** (-4.44)	0.982*** (82.97)	0.341*** (20.80)	-0.241*** (-8.75)	0.103*** (6.11)	0.486*** (31.23)	0.779*** (72.23)	0.116*** (10.44)	0.864*** (11.12)
$\gamma_4$	-0.042*** (-8.76)	0.003 (1.59)	0.038*** (6.03)	-0.004*** (-3.58)	-0.013*** (-7.55)	0.075*** (24.10)	0.041*** (21.16)	-0.003* (-1.95)	0.028*** (23.94)	0.052*** (41.52)	-0.088*** (-10.40)
R2	0.4596	0.8983	0.3378	0.9864	0.9105	0.7219	0.8463	0.9109	0.9910	0.9457	0.4339

The equation is estimated for each of the 11 industries: "Business Equipment", "Chemicals", "Durable Consumer Goods", "Energy", "Healthcare", "Manufacturing", "Money and Finance", "Nondurable Consumer Goods", "Telecommunication", "Utilities", and "other" in Pakistan stock exchange (PSX) including 254 listed firms. The data range from 1/3/2000 to 12/31/2014.

The numbers in parentheses are t-statistics. \* Statistical significance at the 10% level. \*\* Statistical significance at the 5% level. \*\*\* Statistical significance at the 1% level.

the equation. Notably, “Energy” and “Nondurable Consumer Goods” industries are the same as in Table 6. However, 5 out of 11 industries, specifically “Durable Consumer Goods”, “Manufacturing”, “Money and Finance”, “Telecom”, and “Utility” industries, have significant but non-negative herding coefficients. In contrast, “Chemical” industry holds non-negative and insignificant herding coefficient. Therefore collectively, “Chemicals”, “Durable Consumer Goods”, “Manufacturing”, “Money and Finance”, “Telecom”, and “Utility” industries of PSX do not illustrate any herding activities. When comparing industry level herding with market level herding, we found that industry level herding coefficient ( $\gamma_2$ ) has larger absolute values in comparison with market level herding coefficient ( $\gamma_4$ ).

## 5. Conclusion, limitations, and future directions

This study investigates investors’ herd behavior in PSX at industry and market level. We follow the methodology of Zheng et al. (2017) with a major difference of incorporating stock and market trading volume suggested by Chen et al. (2003) in addition to stock and market returns. On the sample of 254 listed firms that further divided into 11 industries as per industry classification of (Fama & French, 1997): “Business Equipment”, “Chemicals”, “Durable Consumer Goods”, “Energy”, “Healthcare”, “Manufacturing”, “Money and Finance”, “Nondurable Consumer Goods”, “Telecommunication”, “Utilities”, and “Other”. Using the daily stock data ranges from 3 January 2000 to 31 December 2014, collected from Bloomsburg’s data bank. The results we found are surprisingly different under both variables estimates. Empirical evidence under stock returns supports our hypotheses: herding exists at both industry and market in PSX, for eight industries at the industry level but only for one industry at the market level. These findings stand in contrast to the earlier literature of Javaira and Hassan (2015) and Javed et al. (2013) who found no herding in PSX, while are in accordance with the results of Jhandir and Elahi (2015). This paper pioneers research in the capital market of Pakistan by extending the investigation of herding behavior from stock returns to stock trading volume. In particular, stock trading volume tends to be more robust measure, where we find significant results for 5 out of 11 industries at the market as well as at industry level in PSX.

The findings of this study have certain implications for investors. Herding information well in advance facilitates investors in identification of potential risks at market place to devise appropriate investment strategies. The presence of herding factor makes the assets mispriced and market inefficient; hence, the level of uncertainty among local or foreign investor raises. They should take investment decisions wisely because unlike normal market conditions a large number of securities are required to get the equal level of diversification.

Like any study undertaken, this study has also encountered limitation. A limitation of this study is the empirical methodology to measure the herd behavior that confines economists to fully understand the process of herding.

This study is based on daily stock returns and daily stock trading volume data, Future researchers may change the frequency of data to weekly and monthly returns and trading volume. We tested herding in Pakistan at industry and market level. In future, it can be conducted on other emerging countries by considering institutional and individual investors separately.

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