

Impact of Herding Behaviour in the PSX in Relation to Foreign Investor Portfolio Investment

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ABSTRACT

The study analyses the herding behaviour in the Pakistan Stock Exchange and evaluates the influence of foreign portfolio investment (FPI) on this behaviour under different market conditions. Employing daily data of the KSE-100 index benchmark and individual stock returns of KSE-100 index companies from January 2020 to May 2025. The daily data were collected from the Pakistan Stock Exchange Data Portal and the National Clearing Company of Pakistan Limited (NCCPL). The study used the Cross-Sectional Absolute Deviation (CSAD) approach, along with a modified CSAD model for foreign investor flows. The results indicate significant evidence of market-wide herding in the PSX, indicated by a significant negative relationship between squared market return and return dispersion. The results further reveal asymmetric herding behaviour during bullish market conditions. Moreover, domestic investors express herding behaviour in response to net foreign selling, while no significant herding is observed during foreign buying. This implies that foreign investors act as informational leaders during capital outflows. These findings contribute to the behavioural finance literature by extending the CSAD model to an emerging market context with foreign capital flows. The study also offers practical implications for policymakers and investors in understanding market dynamics and improving market stability.

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INTRODUCTION

The stock market is one of the core indicators of the status of an economy; its growth and stability lead to brighter prospects for an economy, and vice versa (Mand et al., 2021). Investors' decisions are based on both quantitative and qualitative data. Javed et al. (2015) state that investors' assumptions depend on their surroundings, and they do not usually differentiate between the actual and psychological perception of an event. This difference may be caused by cognitive biases, limited capital, human defects, lack of appropriate information, and their implications for trading decisions Arif et al. (2021).

Market outcomes are significantly shaped by investor behaviour, since choices are influenced by behavioural elements like herding, market anomalies, and speculative attitudes, in addition to fundamental analysis, knowledge, and research. Among these factors, herding behaviour is one of the crucial factors, whereby investors mimic the behaviour of others rather than relying on their independent judgment. Herding behaviour gained considerable attention due to its potential to deviate asset pricing, increase volatility, and impact overall market efficiency.

Investors' herding is considered one of the behavioural strategies for selecting stocks, especially in stock markets. In general, herding is defined as the tendency of investors to follow the actions of the majority instead of acting on their own private information, analysis, and beliefs Bensaïda (2017). However, this behaviour may appear rational when investors assume that the collective market consensus embodies superior information. Consequently, the strength and frequency of herding behaviour can cause unexpected market shifts, asset bubbles, and sudden crashes (Islam, 2022).

Within financial studies, herding describes the investors' strategy when a large number of investors implement the same strategy in consensus and move in the same direction. Correlation in investors' trades is also considered herding in stock exchanges (Chiang & Zheng, 2010). It is a phenomenon where mass investors believe that a particular stock is on a rising trajectory and may significantly increase in the near future; therefore, they attempt to purchase such shares, increasing demand and, consequently, the share price, and vice versa. Thus, this behavioural synchronicity creates correlations in trading patterns, which is a defining feature of herding in capital markets (Chiang & Zheng, 2010).

Moreover, mass investors are inclined to prefer herding in extreme market conditions due to the high cost of information (Villatoro, 2009), and the absence of decision-making authority, such as a lack of technical analysis and chaos from brokerage house reports. In this context, Yousaf et al. (2018) state

that diversion from rational decision-making by collective consensus is called herding. This behaviour implies that investors consciously set aside their own fundamental or technical analysis and instead uncritically follow the prevailing market trend (Christie & Huang, 1995; Cote & Goodstein, 1999). Similarly, it is a common perception in secondary markets that similar, and often inaccurate, investment decisions are made by a large number of investors (Rahayu et al., 2021).

In an efficient market, stock prices depict all available information; therefore, the market remains in an equilibrium state. However, during herding phenomena, investors follow the market trend, either upward or downward, without properly evaluating the intrinsic value of securities. Their investment decisions are driven more by emotions and by the beliefs that the collective market consensus is correct, rather than their own intuitions and independent analysis (Satish & Padmasree, 2018). In addition, Jabeen et al. (2022) state that investors are heavily influenced by the behaviour of others in their decision-making.

Moreover, it also varies across different market states. Herding in a bullish trend is primarily caused by investors' greed, whereas in a bearish trend it is driven by fear of a market crash. In both situations, investors set aside their independent analysis and cognitive decision-making process and act in accordance with perceived market sentiments and overall market movements (Jabeen et al., 2023).

From the perspective of Pakistan, many studies have been undertaken on herding behaviour in the stock exchange. For instance, Yousaf et al. (2018) and Javed et al. (2015) studied herd behaviour using benchmark index data. Similarly, Jabeen and Rizavi (2019); Javaira and Hassan (2015); Kiran et al. (2020); Shah et al. (2017); Ullah and Hanif (2014) used firm-level data to construct a market portfolio and benchmark index to analyse herd phenomena. In addition, Mubeen et al. (2021) employed an industry-wise state-space model to examine herd behaviour. While Fatima et al. (2025) analysed herding behaviour by making five quintiles of 482 listed firms based on firm size in the PSX. Most recently, Mubeen et al. (2026) studied herding in the context of a high-risk and terrorism affected period. The study highlights a significant research gap, as herding behaviour has received limited attention in Pakistan, especially in the context of foreign portfolio investment. This paper identifies herd behaviour in companies of the KSE-100 index during both bull and bear market conditions. Furthermore, we explore herding behaviour in relation to foreign investors' portfolio investment trading, whether they are informational leaders or not. This study expands the behavioural finance literature by applying herding analysis to a foreign portfolio investment framework in the Pakistan Stock Exchange; to the best of our knowledge, this is among the first

studies examining herding behaviour in Pakistan in relation to foreign portfolio investment flows. For this purpose, returns of KSE-100 index companies are used with recent data ranging from January 2020 to May 2025. The research findings provide meaningful insights for market regulators, policymakers and investors to understand behavioural aspect and influence of foreign capital flows in Pakistan.

LITERATURE REVIEW

A large body of literature exists on herding behaviour theories as well as empirical studies; however, their findings often lack consensus and sometimes even contradict one another. Behavioural biases and market anomalies significantly affect investors' investment strategies in financial markets. Among these behavioural aspects, herding behaviour is considered one of the most common factors influencing investment strategies.

Theoretical Framework

The present study is based on the theory of informational cascades and rational herding. Banerjee (1992) and Bikhchandani et al. (1992) state that when investors observe the actions of predecessors, it can become rational to disregard private information and imitate the mass market, generating informational cascades in which prices no longer aggregate dispersed information efficiently. Scharfstein and Stein (1990) endorsed this view with reputational herding, whereby professional investors mimic peers to protect their reputations under uncertainty.

In the context of foreign portfolio investment, the informational leadership hypothesis applies the logic of informational cascade theory by arguing that foreign institutional investors possess superior information-processing capacity and global resources. Consequently, their trades serve as informative public signals that domestic investors may rationally follow (Alemanni & Ornelas, 2006; Nguyen et al., 2016; Senarathne & Jianguo, 2018). These theoretical perspectives jointly motivate the study's empirical expectations in two ways. First, return dispersion is expected to contract non-linearly during extreme market movements if informational cascades give rise to market-wide herding. Second, return dispersion is expected to contract during periods of extreme foreign flows if domestic investors regard foreign investors as informational leaders, thereby giving rise to foreign-induced herding.

Market-Wide Herding

The pioneering studies were conducted in the 1990s. Bikhchandani and Sharma (2000) observe that herding is a situation where investors imitate the behaviour of other investors. Similarly, Nofsinger and Sias (1999) argued that herding occurs when a unidirectional flow of capital among investors occurs over a period of time. Chang et al. (2000) endorsed the existence of herding behaviour in emerging markets of South Korea and Taiwan, while developed exchanges like Hong Kong and the US provided no significant evidence.

Cajueiro and Tabak (2009) investigated the Japanese stock exchange and found that herding behaviour tends to emerge in extreme market phases. Zhou and Lai (2009) state that in Hong Kong, herding behaviour is dominant, particularly in small-cap stocks during a downward market trend. This pattern likely reflects a shift in market sentiment, driven by a shared fear of market collapse. Furthermore, Blasco et al. (2012), using the Granger causality test, analysed herding patterns in the Spanish market. Their study concluded that herding behaviour is influenced by investors' sentiments and previous return patterns.

The literature also explores the essence of herding in the context of religious occasions. Gavriilidis et al. (2013) identified significant herding behaviour during the Islamic month of Ramzan across seven Muslim-majority countries, whereas Yousaf et al. (2018) reported the absence of herding behaviour during Ramzan, highlighting the variability in investor behaviour under religious or cultural contexts.

Kumar et al. (2016) examined the National Stock Exchange (NSE) of India from 2008 to 2015 by employing the CSAD approach proposed by Chang et al. (2000). They also detected no significant evidence of herding, even during extreme bear and bull periods. Likewise, Satish and Padmasree (2018) studied the NSE using the same approach and introduced three structural breaks, i.e. before, during, and after the financial crisis. They also found similar results of non-herding behaviour. This consistency across multiple time and methodology indicates the potential importance of regulatory frameworks and market maturity in reducing investor herd mentality. Choi and Yoon (2020) employed the CSAD and quantile regression to analyse herding in the Korean stock market. They state that herding tends to occur in intense market situations.

In the context of Pakistan, Jabeen and Rizavi (2019) investigated the prevalence of herding behaviour in the context of the Pakistan Stock Exchange across twenty years from 1998 to 2018. They used the CSAD and CSSD (Cross-Sectional Standard Deviation) approach on daily share prices of 528 companies, compiling these companies into 35 sectors. The research finds no significant market-wide herding. However, sector-specific analyses revealed the prevalence of herding

in certain sectors. These findings indicate that herding tendencies may be localised and influenced by sector-specific dynamics rather than overall market movements. Similarly, Arif et al. (2021) used a State Space Model in the Pakistan Stock Exchange from 2000 to 2016. Their industry-wise results indicate that the banking and sugar industries were highly affected by herding, while the textile and manufacturing sectors were slightly affected. This implies that herding behaviour may be more common in industries characterised by higher levels of investor sentiment or volume impact.

In contrast, Shah et al. (2017) and Kiran et al. (2020) found no significant herding behaviour in the market, even during bear markets. Their results support the idea that unfavourable market conditions may not always compel Pakistani investors to herd, emphasising that investor behaviour may be resilient or rational amid downturns.

Ullah and Hanif (2014) analysed herding behaviour employing Chang et al. (2000) framework with the expansion of several macroeconomic variables, i.e. industrial output, inflation, monetary policy announcements and fuel prices. They concluded that the stock market exhibits a tendency of herding during bull and bear market situations, particularly around the announcement of inflation rates and monetary policy. Their results highlight the role of macroeconomic signals in influencing collective investor behaviour for herding irrespective of general market conditions.

Mahmood et al. (2020) used a similar SEM model on 250 respondents and examined how investors in Pakistan frequently adopt behavioural shortcuts, with herding as a significant factor. Particularly, in unpredictable market situations, many investors tend to imitate the behaviour of others. Furthermore, the study suggests that financial literacy may help investors make more autonomous and informed decisions. Likewise, Hussain et al. (2022) also investigated herding with a similar model of demographic differences among shareholders using Structural Equation Modelling (SEM) on qualitative data from 210 respondents. Their findings draw attention to the ways in which occupation, age, and wealth affect this propensity. Herding was found to be more prevalent among younger, wealthier people and non-business professionals. However, their cross-sectional design incorporates herding at a single point in time and limits the understanding of how herding may evolve over time under different market conditions.

Moreover, Nizam et al. (2024) use psychological factors to estimate herding behaviour in Pakistan via SEM model. Their results reveal that herding behaviour is positively and significantly influenced by investors' experience in trade, culture, information accessibility, and market sentiments. Overconfidence biases are insignificant in determining herding behaviour. As a whole, their study suggests

that investor psychology and herding behaviour exhibit a combined effect on the structure of the Pakistani stock market.

Islam (2022) investigated herding using historical prices of the banking sector in the Dhaka Stock Exchange. They bifurcated the analysis into two distinct periods, i.e. local and global crises. The study found that herding exists in the whole study period and is specifically prominent during the time of the local crisis. However, herding disappeared during the global crisis, highlighting a local bias in investor herding. This implies that investors are influenced by collective behaviour, especially in times of domestic uncertainty or optimism. Khalid et al. (2025) studied herd behaviour in ten Islamic countries across Shariah-compliant stocks under the CSAD model. They estimated that herding behaviour exists in Shariah-compliant stocks of all ten countries. Moreover, the study emphasises the way behavioural biases also affect Islamic equity markets, especially during periods of market uncertainty.

Fatima et al. (2025) studied herding in 482 firms of the PSX. They used the CSAD methodology to capture daily data from 2011 to 2020. They made five quintiles of portfolios based on firm size. Their results revealed that herding behaviour varies across firm-size quintiles, with investors in large-cap companies exhibiting stronger herding towards overall market movements than those in small-cap firms. They conclude that firm size influences herding behaviour in the Pakistan Stock Exchange. Mubeen et al. (2026) examine herding behaviour in the PSX in the context of high-risk and terrorism-affected periods by employing a state-space model. They found substantial herding that gets stronger when the market is under stress but is weaker when uncertainty becomes extreme. However, during intense terrorism-related shocks, sentiment-driven herding weakens as investors shift toward fundamentals. The results highlight that extreme uncertainty alters, rather than enhances, herding behaviour in emerging markets.

Foreign Portfolio Investment and Herding

Scholars have also examined the behaviour of foreign investors and how they often mimic each other as well as local investors. Interestingly, local investors also tend to follow the lead of foreign investors as an informational leader, creating a two-way influence in trading patterns. Foreign investment strategies may dominate the mindset of local investors (Nguyen et al., 2016), as foreign investors are assumed to have a premium advantage in developing countries due to greater resources, deeper knowledge, better education and a stronger capacity to handle risk. Therefore, the actions of foreign investors may differ significantly from those of local investors. For that reason, many studies

endorsed herding behaviour when local investors emulate the trading activities of foreign investors (Alemanni & Ornelas, 2006; Jeon & Moffett, 2010; Nguyen et al., 2016).

Setyawan and Ramli (2006) analysed the Indonesian stock market and found that rational herding occurs among local investors who follow the footsteps of foreign investors. Chen (2001) also studied a similar scenario and found that local investors mimicked foreign investors before the Asian Financial Crisis of 1997; however, herding behaviour subsided following the crisis. Nguyen et al. (2016) investigate the Vietnam stock market and report that herding behaviour exists in bear market conditions. They further explore that foreign investors' net buying is consistently followed by local investors across all market states. In contrast, net selling by foreign investors is only mimicked during bull market conditions.

Chattopadhyay et al. (2017) identified herding behaviour among foreign institutional investors through the application of a run test on value-based ratios in the Indian market. Their findings suggest that Foreign Institutional Investors (FIIs) reveal persistent herding behaviour. Akçaalan et al. (2019) studied the impact of foreign investors on the herding behaviour of local investors in the Istanbul Stock Exchange during the period of 2001 to 2016. They found that herding behaviour appeared to be more prominent when foreign investors' trading activity increased. Furthermore, herding also emerged during periods of political crisis in the country.

Alemanni and Ornelas (2006) also studied the behaviour of foreign investors in nine emerging countries from different continents using the LSV (Lakonishok, Shleifer, and Vishny) measure of herding. Their findings suggest that foreign investors tend to herd more than local investors in respective countries due to a lack of local information and heavy reliance on global news agencies. However, they found that such herding had no impact on market volatility. Kim and Wei (2002) studied the Korean stock market and also emphasised the role of foreign investors in influencing market dynamics.

Additionally, several studies show that foreign investors influence domestic market participants' expectations. In underdeveloped and emerging countries, it is widely believed that foreign investors possess better knowledge than local investors; therefore, foreign investors' actions often get closer attention and act as informational leaders in these markets. Poshakwale and Mandal (2014) examined herding behaviour in the National Stock Exchange of India using a Kalman filter, covering the time frame of 1997 to 2012. They report that local investors mimic the trading strategies of foreigners, and especially FIIs, during bear market conditions and periods of high volatility, as they rely on foreigners' informational advantage in decision-making. Senarathne and Jianguo (2018) studied herding at the firm-specific and aggregate portfolio levels under

different market conditions, with respect to domestic investors of the Colombo Stock Exchange following the trade patterns of international investors. They employed the modified CSAD model of Chang et al. (2000), substituting market returns with returns on foreign capital flows. Their overall results suggest no evidence of herding toward foreign investors, except under specific bullish conditions where local investors follow the foreigners' footprints.

Synthesis of the Literature and Research Gap

Overall, the reviewed literature reveals three important patterns. First, herding behaviour is more prevalent in emerging markets like Bangladesh, Pakistan, South Korea, Taiwan, and Vietnam than in developed markets such as the United States and Hong Kong (Chang et al., 2000; Chiang & Zheng, 2010). This difference is generally attributed to weaker information environments, lower market efficiency, and less mature regulatory and institutional frameworks in these economies. Second, herding is asymmetric across different market states: several studies detect stronger herding in bullish and high-volatility phases and weaker or absent herding in bearish phases (Islam, 2022; Nguyen et al., 2016), although the direction of the asymmetry varies across markets. Recent Pakistani evidence confirms that herding is more pronounced among large-capitalisation stocks (Fatima et al., 2025), and persists in Shariah-compliant segments across Islamic markets (Khalid et al., 2025). Third, consistent with the informational leadership view, domestic investors in emerging markets often follow the trading decisions of foreign investors, particularly during periods of foreign capital outflows and heightened market uncertainty (Nguyen et al., 2016; Senarathne & Jianguo, 2018).

Despite this growing body of evidence, no Pakistani study has yet integrated these strands by testing market-wide herding and foreign-flow-induced herding within a unified CSAD framework using post-2020 data. This study aims to fill this gap by analysing whether foreign portfolio investors act as informational leaders in the PSX under bull/bear and net-buying/net-selling states over January 2020 to May 2025.

METHODOLOGY

The study employs secondary data comprising daily stock prices of KSE-100 index companies, the benchmark index, and foreign portfolio investment for the period from January 2020 to May 2025 to investigate herding behaviour in the Pakistan Stock Exchange under the influence of foreign portfolio investment. For this purpose, daily data of KSE-100 index companies, which represent 80% to 85% of the market capitalisation of the whole market. Out of the hundred

companies constituting the index, ninety-nine companies are selected for the final sample, as one company is excluded due to its thin trading pattern, which could distort the robustness of the herding estimates. These data are obtained from the Data Portal of the Pakistan Stock Exchange, while foreign investment data are sourced from the official website of National Clearing Company of Pakistan Limited. The analysis of high-frequency, i.e. daily, data enhances the research by more effectively capturing behavioural patterns and short-term market dynamics.

Market-Wide Herding

Traditional finance suggests that under normal market conditions, investors are rational (Subramaniam & Velnampy, 2017). Therefore, dispersion exists between cross-sectional returns of individual firms and overall market returns because investor decisions rely on these factors, i.e., dispersed information, independent analysis, and interpretations. However, in extreme market phenomena, individuals overlook their private information and collectively pursue market movements. As a result, the dispersion between individual securities returns and aggregate market returns gradually decreases. Consequently, the correlation between individual securities returns and market returns also moves in the same direction, indicating herding behaviour.

The pioneering empirical model to capture herding was proposed by Christie and Huang (1995) by employing the CSSD model. However, Chang et al. (2000) criticised this model because of the absence of non-linear dynamics associated with herding. Consequently, this study implements the CSAD model proposed by Chang et al. (2000), which efficiently captures non-linear market behaviour.

The CSAD is determined as follows:

$$CSAD_{m,t} = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{m,t}|$$

Where $R_{m,t}$ represents the market return derived from the KSE-100 index, which serves as a proxy for overall market performance (Javed et al., 2015). $R_{i,t}$ depicts the return of stock i on day t . While modulus represents absolute values. Conventionally, CAPM express a linear relationship between market return and CSAD. However, in the case of herding activity, this relationship becomes non-linear, specifically during periods of extreme market volatility (Chang et al., 2000).

The non-linear relation between CSAD and market returns is computed by following the model of Chang et al. (2000):

$$CSAD_{m,t} = \beta_0 + \beta_1 |R_{m,t}| + \beta_2 R_{m,t}^2 + \beta_3 CSAD_{t-1} + \varepsilon_t$$

Here, $CSAD_{m,t}$ represents dispersion in cross-sectional returns. $R_{m,t}^2$ exhibits the herding behaviour of investors if its coefficient is negative and statistically significant. It implies that investors uniformly follow market trends and overlook their own analysis. Such phenomena also increase the correlation between market returns and individual stock returns. Financial time-series data may be inclined to serial correlation in the error term, which can provide spurious estimates. Following Lao and Singh (2011), a one-period lag of the dependent variable is used in all regression equations to mitigate the phenomenon of autocorrelation, and hence the endogeneity issue is resolved.

The above equation only reflects the presence of herding behaviour in the stock market. While it does not address the market state either herding is more dominant in bull or bear market states. For this purpose, a dummy variable is included in the equation.

For the bull state, the equation is specified as:

$$CSAD_{m,t} = \beta_0 + \beta_1 D_{Bull} |R_{m,t}| + \beta_2 D_{Bull} R_{m,t}^2 + \beta_3 CSAD_{t-1} + \varepsilon_t$$

Where D_{Bull} is used as a dummy variable for the bull market state. It will be considered as 1 when the market provides bullish state and zero otherwise. A negative and significant value of β_2 indicates the existence of herding behaviour in the bull market state.

Similarly, the bear state equation is specified as:

$$CSAD_{m,t} = \beta_0 + \beta_1 D_{Bear} |R_{m,t}| + \beta_2 D_{Bear} R_{m,t}^2 + \beta_3 CSAD_{t-1} + \varepsilon_t$$

Where D_{Bear} is used as a dummy variable for the bear market state. It will be considered as 1 when the market provides bearish state and zero otherwise. If β_2 value is negative and significant, it means herding behaviour exists in the down market state.

Foreign Portfolio Investment and Herding:

When local investors generally mimic the trading pattern of foreign investors, the disparity between individual stock returns and foreign portfolio returns

tends to narrow. This disparity is analysed under several market situations to assess whether local investors' behaviour varies with different levels of market stress. Researchers generally identify CSAD as an effective indicator to determine behavioural signals because it indicates whether stock returns are broadly scattered or narrowly clustered. Therefore, serve as a good measure of whether herding behaviour exists among investors or whether they make their own decisions independently.

To study this phenomenon, a modified CSAD model is used by incorporating returns on foreign portfolio investment into the traditional CSAD model. For this purpose, the return on foreign portfolio investment is calculated using the approach of Senarathne and Jianguo (2018), who use monthly returns. In our study, $R_{f,t}$ is constructed from the daily net foreign portfolio investment flows, defined as the change in cumulative foreign portfolio investment.

To compute foreign herding, we used the modified Cross-Sectional Absolute Deviation (CSAD) model proposed by Senarathne and Jianguo (2018):

$$CSAD_{i,t} = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{f,t}|$$

Where $R_{i,t}$ refers to the returns of individual companies in the dataset. $R_{f,t}$ represents the return on the net flow of foreign investment portfolio at time t . Foreign herding is captured via a modified specification, where the key expectation is that the estimated coefficients will be negative and significant. Such results state that when returns on foreign portfolio investment expand or contract rapidly, domestic investors also adjust their trading positions in the same manner, and decrease cross-sectional discrepancies (Bensaïda, 2017; Chang et al., 2000).

This construction substitutes the foreign-flow return for the market return in the dispersion measure, allowing $CSAD_{f,t}$ to register whether individual stock returns converge toward the pattern implied by foreign investors' aggregate trading.

To further analyse foreign herding, the modified CSAD regression model adopted by Senarathne and Jianguo (2018) is estimated. The following equation is employed to test the null hypothesis of no herding.

$$CSAD_{i,t} = \beta_0 + \beta_1 |R_{f,t}| + \beta_2 R_{f,t}^2 + \beta_3 CSAD_{f,t-1} + \varepsilon_t$$

Where $R_{f,t}^2$ refers to square return on foreign portfolio investment. In the presence of herding, β_2 is anticipated to be negative and significant (Jabeen et

al., 2023; Ouarda et al., 2013).

Herding under extreme market conditions can be measured by the following equations.

$$CSAD_{t,t} = \beta_0 + \beta_1 D_{f,Buy} |R_{f,t}| + \beta_2 D_{f,Buy} R_{f,t}^2 + \beta_3 CSAD_{f,t-1} + \varepsilon_t$$

Where $D_{f,buy}$ is a dummy variable that equals 1 when foreign investors are net buyers and 0 in case when net foreign investors are net sellers.'

Similarly, herding during net selling days of foreign investors is measured by:

$$CSAD_{t,t} = \beta_0 + \beta_1 D_{f,Sell} |R_{f,t}| + \beta_2 D_{f,Sell} R_{f,t}^2 + \beta_3 CSAD_{f,t-1} + \varepsilon_t$$

Where $D_{f,sell}$ takes the value of 1 when foreign investors are net sellers and 0 otherwise.

Endogeneity and Structural Considerations

Two econometric caveats warrant acknowledgement. First, foreign portfolio flows and domestic market returns may be jointly determined: foreign trading can move prices, while price movements simultaneously attract or repel foreign flows, creating potential simultaneity bias. The inclusion of the lagged dependent variable mitigates dynamic misspecification and serial correlation, and the buy/sell state partition conditions on the direction of flows; nevertheless, the estimated coefficients are interpreted as evidence of behavioural association rather than strict causality. Future research may address simultaneity directly through Vector Autoregressive or Generalised Method of Moments frameworks.

Second, the sample period spans several distinct regimes, including the COVID-19 market crash of March 2020, episodes of domestic political instability and IMF program negotiations during 2022–2023, and the pronounced PSX rally of 2024–2025. The bull/bear and net-buying/net-selling partitions employed in this study captures regime-dependent behaviour in a coarse manner; however, formal structural break testing (e.g., Bai–Perron multiple breakpoint analysis) is beyond the present scope and is identified as an avenue for future research.

RESULTS AND DISCUSSION

Table 1.
Descriptive Statistics

	CSAD _{m,t}	R _{m,t}	CSAD _{f,t}	R _{f,t}
Mean	0.0144	0.0008	0.0157	-0.0002
Median	0.0143	0.0004	0.0147	-0.0001
Maximum	0.0413	0.0945	0.0905	0.0068
Minimum	0.0000	-0.0686	0.0000	-0.0168
Std. Dev.	0.0054	0.0116	0.0079	0.0010
Skewness	-0.0433	-0.1651	2.2347	-5.3878
Kurtosis	5.8330	10.9652	15.7524	77.9218
Jarque-Bera	471.63	3731.10	10720.06	336363.30
Probability	0.0000	0.0000	0.0000	0.0000
Observations	1409	1409	1409	1409

Table 01 illustrates the descriptive statistics of the variables CSAD_{m,t}, market return (R_{m,t}), foreign adjusted CSAD_{f,t} and foreign investment returns (R_{f,t}) employing daily data from Jan 01, 2020 to May 27, 2025. The mean value of CSAD depicts a moderate level of return dispersion among individual stocks with respect to the market return. Notably, the mean value of CSAD_{f,t} is slightly greater than CSAD_{m,t}, indicating that return dispersion in foreign portfolio returns is slightly greater than the general market return’s dispersion. This could suggest that in the Pakistani equity market, the diverse reactions of individual stocks to foreign investment inflows exist to some extent.

The average market return is positive but economically very minimal at 0.0008, although in the studied period the Pakistan Stock Exchange outperformed. The highest standard deviation of market returns further reflects this phenomenon. In contrast, returns on net flow of foreign investments are slightly negative.

The skewness coefficients reflect that variables are not symmetrical and are skewed in different directions. The CSAD_{m,t} and R_{m,t} values are close to zero, representing symmetry around their respective means. While CSAD_{f,t} shows noticeable positive skewness, indicating that the right tail is longer, with infrequent substantial variations in cross-sectional dispersion with respect to net flows of foreign portfolio investment. Conversely, foreign investment returns R_{f,t} exhibit a pronounced negative skewness value of -5.3878, suggesting that the left tail is longer, with acute negative shocks. The kurtosis values of all variables considerably exceed the standard of three, indicating a high peak with heavy tails, implying the presence of severe volatility in the data. Jarque-Bera values are also substantially high for all variables, endorsing non-normality in the

distribution, which is similar to the results of Arslan and Javid (2014) and Lindhe (2012).

Table 2.

Augmented Dickey-Fuller Unit Root Test

Variables	Original Series		
	Model I Drift	Model II Tr & Drift	Model III None
$CSAD_{m,t}$	-9.9715*	-9.9822*	-1.308
$R_{m,t}$	-33.5665*	-33.6834*	-33.4442*
$R^2_{m,t}$	-10.0465*	-10.0437*	-7.8082*
$CSAD_{f,t}$	-10.1114*	-10.1074*	-1.7676**
$R_{f,t}$	-15.9498*	-16.3659*	-15.0582*
$R^2_{f,t}$	-37.3441*	-37.3624*	-36.8714*
Critical Value 0.05	-2.896	-3.413	-1.941
Null Hyp: data has a unit root/ data is not stationary			
Alt Hyp: data is stationary			
** Significant at 0.01, * Significant at 0.05			

Table 02 explains that the null hypothesis of the presence of a unit root is rejected for all variables at the 1% significance level. Therefore, all variables are stationary in levels, making them suitable for regression analysis with no issue of spurious relationships.

For clarity, each regression table reports the dependent variable and estimated equation in its header, coefficient estimates with standard errors, t-statistics and p-values, and model diagnostics (adjusted R^2 , Durbin–Watson statistic, and F-statistic). All models are estimated on 1,409 daily observations spanning January 1, 2020, to May 27, 2025.

Figure 01 reports the regression results of market-wide $CSAD_{m,t}$ and $CSAD_{f,t}$ estimated with market returns and returns on foreign investment flows. The constant term is positive and statistically significant in both equations, suggesting the existence of underlying dispersion in stock returns even without market swings and foreign investment flows, respectively.

The coefficients of the absolute terms of market return, i.e. $IR_{m,t}$ and $IR_{f,t}$ are positive and significant in both equations, implying that dispersion in stock returns increases as movement in market return increases, which is rational and consistent with the traditional Capital Asset Pricing Model. It complies with rational asset pricing behaviour. However, in the regression equation of $CSAD_{m,t}$, the coefficient of the squared market return $R^2_{m,t}$ is negative and statistically significant, exhibiting the presence of herding behaviour. It shows

CSAD _{m,t} CSAD _{m,t} = β ₀ + β ₁ R _{m,t} + β ₂ R ² _{m,t} + β ₃ CSAD _{t-1} + ε _t					CSAD _{f,t} CSAD _{f,t} = β ₀ + β ₁ R _{f,t} + β ₂ R ² _{f,t} + β ₃ CSAD _{f,t-1} + ε _t				
Variables	Coeff.	S.E	t-Stat	Prob.	Variables	Coeff.	S.E	t-Stat	Prob.
C	0.006	0.000	19.688	0.000**	C	0.009	0.000	20.581	0.000**
R _{m,t}	0.593	0.022	26.377	0.000**	R _{f,t}	1.240	0.381	3.257	0.001**
R ² _{m,t}	-6.065	0.457	13.265	0.000**	R ² _{f,t}	90.672	36.513	-2.483	0.013*
CSAD _{t-1}	0.330	0.019	17.686	0.000**	CSAD _{f,t-1}	0.360	0.025	14.498	0.000**
Adj. R ²	0.523	D.W Stats		1.998	Adj. R ²	0.138	D.W Stats		2.183
F-Stat.	515.970	Prob. (F-Stat.)		0.0000	F-Stat.	76.339	Prob. (F-Stat.)		0.000

** Significant at 0.01, * Significant at 0.05

Figure 1: Regression Results

that the returns of individual stocks incline to cluster around market returns during extreme market movements; hence, the return dispersion from the market significantly decreases.

Similarly, in the CSAD_{f,t} regression, the coefficient of R²_{f,t} is also negative and statistically significant, revealing a non-linear relationship between CSAD_{f,t} and net foreign investment flows. These results demonstrate foreign-induced herding behaviour, as dispersion in stock returns decreases amid high foreign inflows and outflows. It implies that domestic investors adjust their trading strategies with trading strategies of foreign investors. These outcomes are in line with earlier evidence of Christie and Huang (1995), Chang et al. (2000), and Demirer and Kutan (2006).

Whereas model diagnostics are also reliable, the adjusted R-squared value for the CSAD_{m,t} equation is 0.5234, indicating that 52% of the variation in CSAD is captured by these independent variables, reflecting strong explanatory power. In contrast, the adjusted R-squared for the CSAD_{f,t} is comparatively low at 13.80%. The Durbin-Watson indicator also suggests no issue of autocorrelation in either model. Furthermore, the significance of the F-statistics justifies that both models are well specified.

Figure 02 deals with the regression estimates of the non-linear CSAD_{m,t} model under bull and bear market states. The significant and positive coefficients of D_{Bull} (R_{m,t}| and D_{Bear} (R_{m,t}| indicate that the market generally behaves according to a rational asset pricing model, where return dispersion increases with market movements. In both equations, the lagged dependent variable CSAD_{t-1} is positive and statistically significant, indicating persistence in return dispersion throughout the period. It implies that current dispersion is partially

Bull State					Bear State				
$CSAD_{m,t} = \beta_0 + \beta_1 D_{Bull} R_{m,t} + \beta_2 D_{Bull}R_{m,t}^2 + \beta_3 CSAD_{t-1} + \varepsilon_t$					$CSAD_{m,t} = \beta_0 + \beta_1 D_{Bear} R_{m,t} + \beta_2 D_{Bear}R_{m,t}^2 + \beta_3 CSAD_{t-1} + \varepsilon_t$				
Variables	Coeff.	S.E	t-Stat	Prob.	Variables	Coeff.	S.E	t-Stat	Prob.
C	0.008	0.000	22.656	0.000**	C	0.008	0.000	21.395	0.000**
$D_{Bull} R_{m,t} $	0.415	0.027	15.447	0.000**	$D_{Bear} R_{m,t} $	0.156	0.034	4.595	0.000**
$D_{Bull}R_{m,t}^2$	-3.740	0.606	-6.171	0.000**	$D_{Bear}R_{m,t}^2$	1.125	0.835	1.348	0.178
$CSAD_{t-1}$	0.364	0.022	16.542	0.000**	$CSAD_{t-1}$	0.416	0.023	17.974	0.000**
Adj. R ²	0.337	D.W Stats		2.090	Adj. R ²	0.248	D.W Stats		2.129
F-Stat.	239.558	Prob. (F-Stat.)		0.0000	F-Stat.	156.063	Prob. (F-Stat.)		0.000

** Significant at 0.01, * Significant at 0.05

Figure 2: Regression Results in Bull & Bear Market State

affected by dispersion from the prior period to some extent, reflecting market awareness and gradual adjustment dynamics.

The coefficient of $D_{Bull}R_{m,t}^2$ is negative and statistically significant, indicating evidence of strong herding behaviour in the Pakistan stock market during bull market states. This behaviour may occur when individual investors disregard their own information and align with the prevailing market view due to optimism or greed among major investors. Conversely, the coefficient of $D_{Bear}R_{m,t}^2$ is positive and insignificant, providing no evidence of herding behaviour during down market conditions. These results align with previous studies of Shah et al. (2017) and Kiran et al. (2020), who also found no evidence of herding during bear markets in Pakistan.

It implies that, in contrast to bullish situations, investors do not collectively converge to the market return during severe market falls. Instead, they may hold their positions, probably for cautions behaviour and higher risk aversion. This may be attributed to the prevailing influence of long-term investors in the market who do not panic over short-term declines (Lao & Singh, 2011). These results of asymmetric herding are also reported by Huang et al. (2015) and Islam (2022); they also detected significant herding in the up market and insignificance in the down market. Overall results reveal an asymmetric herding pattern in the Pakistan Stock Exchange.

In terms of model diagnostics, the adjusted R-square of the model is 33.86% for the bull market and 24.8% for the bear market. The Durbin-Watson value is close to 2 reports no issue of serial correlation in the residuals of both equations. Moreover, the significance of the F-statistic also confirms the overall goodness of the estimated model.

Foreign Buy State					Foreign Sell State				
$CSAD_{it} = \beta_0 + \beta_1 D_{f,Buy} R_{f,t} + \beta_3 D_{f,Buy} R_{f,t}^2 + \beta_4 CSAD_{f,t-1} + \varepsilon_t$					$CSAD_{it} = \beta_0 + \beta_1 D_{f,Sell} R_{f,t} + \beta_3 D_{f,Sell} R_{f,t}^2 + \beta_4 CSAD_{f,t-1} + \varepsilon_t$				
Variables	Coeff.	S.E	t-Stat	Prob.	Variables	Coeff.	S.E	t-Stat	Prob.
C	0.010	0.000	22.112	0.000**	C	0.010	0.000	21.800	0.000**
$D_{f,Buy} R_{f,t} $	0.132	0.782	0.169	0.866	$D_{f,Sell} R_{f,t} $	1.133	0.379	2.990	0.003**
$D_{f,Buy} R_{f,t}^2$	47.473	216.872	0.219	0.827	$D_{f,Sell} R_{f,t}^2$	-83.440	36.349	-2.296	0.022*
$CSAD_{f,t-1}$	0.366	0.025	14.728	0.000**	$CSAD_{f,t-1}$	0.360	0.025	14.496	0.000**
D.W					D.W Stats				
Adj. R ²	0.132	Stats		2.181	Adj. R ²	0.137	Prob. (F-		2.182
F-Stat.	72.350	Prob. (F-Stat.)		0.0000	F-Stat.	75.687	Stat.)		0.000

** Significant at 0.01, * Significant at 0.05

Figure 3: Regression Results of Foreign Buy & Sell Market State

Figure 3 reports the results of the modified $CSAD_{f,t}$ model when foreign investors are net buyers and net sellers. The dependent variable, $CSAD_{f,t}$, determines the cross-sectional dispersion of individual stock returns over the foreign market returns. In the case of net foreign buying, the coefficient of $D_{f,Buy} R_{f,t}^2$ is statistically insignificant. This suggests that the cross-sectional difference between individual stock returns and foreign investors' returns increases, and individual stock returns continue to move independently rather than converging towards foreign investors' returns, even during periods of intense foreign buying. Consequently, local investors do not replicate the trading patterns of foreign investors during buying phases; instead, they appear to make independent investment decisions or prefer to follow general market behaviour. In contrast, in the case of net foreign selling, the coefficient of $D_{f,Sell} R_{f,t}^2$ is negative and statistically significant, showing evidence of herding driven by foreign investors' selling activity. It implies that local investors tend to follow the trading pattern of foreign investors when they sell in the market, which is consistent with the results of Nguyen et al. (2016). In contrast, Senarathne and Jianguo (2018) reported the absence of significant herding evidence in the Colombo Stock Exchange.

According to model diagnostics, the adjusted R-squared of the model is relatively low at approximately 13%, which is usual for behavioural finance for heterogeneous investors' responses. The Durbin-Watson statistic of around 2.18 in both models indicates no problem of serial correlation. Additionally, the F-statistics of the overall models are also significant.

CONCLUSION

The primary focus of the study is to detect market-wide herding and examine the influence of foreign portfolio investment on herding behaviour in the Pakistan Stock Exchange. By employing daily data from January 2020 to May 2025, the study employed the CSAD model proposed by Chang et al. (2000) along with a modified version of the CSAD framework. To capture the differences in investor behaviour, the study period is split into bull and bear market phases, as well as net foreign buying and net foreign selling days by foreign investors.

The outcomes demonstrate evidence of market-wide herding in the PSX. The statistical significance of the non-linear term in the CSAD model reveals that during periods of severe fluctuations, individual stock returns align near the market return, where investors tend to disregard their own intuitions and personal analysis and prefer market trends. Herding behaviour is found to be asymmetric in nature, whereas during bull phases, optimism and greed encourage investors to mimic the market trend under the assumption that the majority is correct. Conversely, no significant herding behaviour is found during bearish periods. It implies that during bear periods, investors rely more on their own decision-making during market downturns, possibly reflecting the existence of long-term investors who are less affected by short-term downturns.

The findings also highlight the influential role of foreign portfolio investors in shaping local trading behaviour. During extreme market conditions, results suggest that domestic investors tend to follow foreign investors in case of net foreign selling. However, during net foreign buying, this phenomenon does not exist. This trend implies that foreign investors act as an informational leader, particularly when they sell in the market, therefore influencing overall market returns and investors' responses.

Overall, results demonstrate that herding behaviour within the Pakistan Stock Exchange is conditional rather than pervasive and significantly influenced by foreign capital flows and market sentiments. Policymakers should promote financial literacy awareness campaigns, closely monitor foreign capital flows, and strengthen market transparency to mitigate herding bubbles and weaken redundant synchronisation in investment decisions.

This study may be enhanced in future studies by considering sector-wise herding with respect to foreign flows or employing political regime's structural breaks in data for capturing market dynamics. Future research may use VAR or GMM frameworks to examine possible endogeneity between foreign flows and returns. Further, formal structural break tests may be applied to better capture regime shifts across the sample period.

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