COVID-19 INDUCED HERDING: A CASE OF SECTORAL INDICES OF THE INDIAN STOCK MARKET

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Abstract

Herding tendencies are likely to be more prominent during the crisis period. The Covid-19 outbreak has been nothing less than a crisis for the world. Assuming the possibility of Covid-19 induced herding among investors, this study attempts to examine the behaviour in the Indian stock market (S&P BSE) by analyzing the daily returns data of 10 indices and the S&P BSE Sensex using the CSAD model from January 01, 2015 to December 31, 2020, by dividing the period into three sets: whole period, pre Covid-19 outbreak period and during Covid-19 outbreak period. The complete analysis is done for three different states of the markets (general – overall market condition, bullish and bearish). The study finds the Indian stock market to experience sector specific herding behavior during Covid-19 period under the study, in general, as well as during bullish and bearish trends.

1. Introduction

The behavioural finance domain justifies the anomalies and inefficiencies of the markets as outcomes of investors behaving irrationally. Herding is one such irrational behaviour. Herding tendencies are likely to be more prominent during crisis periods than in normal conditions. During normal circumstances, when the market and economic conditions are likely to be stable, investors think rationally and make informed investment decisions (Mertzanis & Allam, 2018), but during the crisis period, they tend to suppress their private information and follow the crowd decisions (Chauhan et al., 2019; Chiang & Zheng, 2010). During down market periods also (akin to crisis led situations in the short-run), investors lose confidence in the information they possess, their rational thinking takes a back seat, and herding tendencies become prominent (Tessaromatis & Thomas, 2009).

Covid-19 disease, which originated in December 2019, has spread worldwide, and affected economies severely. The World Health Organization has also given Covid-19 a pandemic status – a public health crisis. The pandemic has grossly impacted people's health, livelihood, and the entire food system ("Impact of Covid", 2020). According to the World

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Economic Outlook Report, Covid-19 has also affected world GDP growth (International Monetary Fund [IMF], 2021, as cited in Yeyati & Filippini, 2021). Stock markets are no different, and have also not been spared the horror of Covid-19. Stocks across various sectors and economies have seen a massive freefall in their prices in the first month after the Covid-19 outbreak, and the subsequent recovery has also been slow and uneven (Bradley & Stumpner, 2021). Considering these widespread effects of Covid-19, it would be appropriate to understand it as nothing less than a crisis period, and so, the investors are likely to show herding tendencies during this period as well. A couple of studies have accentuated this behaviour (Bouri et al., 2020; Espinosa-Méndez & Arias, 2020 & 2021;).

Herding means going along in a particular group. Banerjee (1992) has talked about herd behaviour in various social and economic situations, where people decide on doing something just because everyone else is doing so, even at the cost of ignoring the information they possess. In social psychology, experiments on individuals' group behaviour suggest that they abide by the group decision, even when they perceive them to be wrong (Asch, 1952, as cited in Christie & Huang, 1995, p. 31).

In investment decision-making, herding behaviour signifies a tendency of an investor to copy the decision (behaviour) of the other investor(s) without giving a rational thought to it. Such a behaviour is quite the opposite of traditional theories' claims about investors being rational and information oriented in financial decision-making. Nofsinger and Sias (1999) explains herding as a group of investors trading in the same direction over a period. Herding behaviour in financial markets has an overall detrimental effect. One of the possible explanations for the deviation in asset prices, high volatility in asset returns, abnormal losses, and instability in financial markets is the influence of herding behaviour among the investors on the stock prices (Bui et al., 2018; Chiang & Zheng, 2010; Choe et al., 1999; Javaira & Hassan, 2015; Kaminsky & Schmukler, 1999). This effect further aggravates when there is a crisis induced herding.

Covid-19 has not affected any one country or region. Rather it has put the whole world through a prolonged social and economic crisis. It has also affected many industries, hardly leaving any scope for a face saver. Herding tendency among investors during such a global phenomenon is a plausible assumption and a vital area of research regarding financial markets. Though there have been a few Covid-19 specific studies on herding behaviour (internationally and in India), the results are mixed. European and Australian markets have experienced increased herding, whereas Chinese markets have experienced lower herding during the Covid-19 period than usual (Espinosa-Méndez & Arias, 2020, 2021; Guosong et

al., 2020). Indian markets have experienced industry-specific herding during Covid-19 (Dhall & Singh, 2020). These limited number of studies and their mixed results leave much scope for exploring herding tendencies, especially industry specific, during the Covid-19 period. This paper attempts to examine the herd formation tendency of investors in Indian stock market during the Covid-19 period. The cross-sectional absolute deviation (CSAD) measure, as proposed by Chang et al. (2000), has been used to examine the herd formation and behaviour in the ten sectoral indices of Indian stock market.

The structure of the paper is as follows: Section 2 summarizes the relevant literature on herding behaviour and hypothesis. Section 3 describes the methodology adopted and the data used for analysis. Section 4 discusses the results and the outcomes of the study in detail. Furthermore section 5 concludes the study while highlights the significant findings.

2. Literature Review

Numerous studies have focused on the herding tendency and its impact on asset prices, asset returns, and stock market stability. As per a few theoretical models on herding behaviour, portfolio managers exhibit reputation-based herding behaviour, out of the concern for reputation associated with their skills and ability as investment managers (Scharfstein & Stein, 1990; Trueman, 1994); or compensation-based herding behaviour where they end up having an inefficient investment portfolio as a result of their compensation linked with how they perform in comparison with similar other professionals (Brennan, 1993; Roll, 1992 as cited in Bhikhchandani & Sharma, 2001, p. 292). Institutional investors also do excessive positive feedback trading with a more significant impact on the asset returns than retail investors (Nofsinger & Sias, 2002). Shiller and Pound (1989) found that institutional investors give significant importance to advice from other professionals on buying and selling volatile stocks. Lakonishok et al. (1992), in their study on fund managers, found little herding evidence for small stocks, whereas, for large stocks, such behaviour was absent. In a similar study, Grinblatt et al. (1995) also found weak evidence of herding behaviour among fund managers.

Studies on specific regions, countries or stock markets have mixed evidences of herding behaviour. While analyzing the dispersion in stock returns, Christie and Huang (1995) found no evidence of herding in US markets. No herding evidence was found by Henker et al. (2006) in Austrian stock market. Chang et al. (2000), in their study on US and Asian stock markets, found mixed results, with no evidence of herding in Hong Kong and US markets,

partial evidence in Japanese markets, and significant herding evidence in Taiwanese and Korean markets. Chiang and Zheng (2010), in their study on 18 countries, found US and Latin American markets to be free from herding in contrast with Asian markets. Balcilar et al. (2014) found herding evidences for Saudi Arabia, Qatar, Kuwait and Dubai markets but little of it for the Abu Dhabi stock market. In the context of Chinese markets, some studies have contrasting results (Demirer & Kutan, 2006; Tan et al., 2008).

Studies on investment behaviour during extreme volatility, short-term market shocks and crisis also support the prominence of herding instincts among the investors during such times. In their study on the Athens stock market for the 1985-2004 period, Tessaromatis and Thomas (2009) found little evidence of herding; however, they found strong herding behaviour present for the 1998-2004 sub-period when the market corrected after significant advancement. Chang et al. (2000) and Demirer et al. (2010) found herding to be prominent during down-market situations. Rompotis (2018) discovered excessive volatility-led imitative trading behaviour among exchange traded funds (ETFs). Vo and Phan (2017) found stock investors divesting from stocks with negative returns and moving towards safer stocks almost simultaneously. In the Indian context, Dutta et al. (2016) found periodic herding in 50 Indian stocks that were a part of the study for the period 2006-2016. Lao and Singh (2011) found evidence of herding in Indian stock market during up-market conditions. However, Kumar et al. (2016) did not find any significant herding evidence in either up-market or down-market conditions. Some studies on bigger crises like the Asian crisis (Demirer et al., 2014; Zheng et al., 2017), the dot-com bubble (Litimi et al., 2016), or for that matter, the global financial meltdown (Litimi, 2017), have found statistically substantial herding behaviour among investors during such testing times. However, a couple of other studies have not been able to detect any such behaviour, for example, Stavroyiannis and Babalos (2017) during turbulent times for the US markets and Shrotryia and Kalra (2019) for the Indian markets during the 2008 crisis.

Covid-19 specific studies on herding behaviour also have mixed outcomes. In two similar but separate studies for Australian stock markets (Espinosa-Méndez & Arias, 2020), and European stock markets (Espinosa-Méndez & Arias, 2021), the authors found strong evidence of increasing herding behaviour during the Covid-19 period for both the markets. In a similar study for Chinese stock markets by Guosong et al. (2020), the market experienced lower herding during the Covid-19 period than usual. Bouri et al. (2020) found Covid-19 induced market herding to be strong for emerging markets and European PIIGS stock markets. In some studies, specific to India, Selvan and Ramraj (2020) found Indian

capital markets to be experiencing increasing herding behaviour during Covid-19 where as Dhall and Singh (2020) found industry-specific herding behaviour in their study on 12 NSE industry indices.

Given the above discussion on the scarce herding studies specific to Covid-19 and their mixed results, the present study proposes the following hypothesis:

H_1. Herding behaviour is significantly observable in the sectoral indices of the Indian stock market.

H_{1a}. Covid-19 induced herding behaviour is significantly observable in the sectoral indices of the Indian stock market.

H_2. Herding behaviour is significantly observable in the sectoral indices of the Indian stock market during bull and bear phases.

H_{2a}. Covid-19 induced herding behaviour is significantly observable in the sectoral indices of the Indian stock market during bull and bear phases.

3. Methods

The existing empirical models for assessing the herding behaviour take the approach of analyzing the trading patterns (Grinblatt et al., 1995; Lakonishok et al., 1992) or analyzing the dispersion in returns (Christie & Huang, 1995; Chang et al. 2000). The method of measuring herding based on trading patterns, as proposed by Lakonishok et al. (1992), has two significant shortcomings: (1) it does not give importance to the amount of stock traded and focuses on the number of investors, and (2) it fails to identify the intertemporal trading patterns (Bhikhchandani & Sharma, 2001, p. 297). Considering these shortcomings, the present paper adopts the dispersion in returns method for assessing herding behaviour. Chirstie and Huang (1995) proposed CSSD (cross sectional standard deviation) as a dispersion measure in returns for establishing herding tendency, where lower dispersion signifies herding tendency by investors. Improvising on the CSSD model, Chang et al. (2000) proposed CSAD (cross sectional absolute deviation) as a less stringent measure of dispersion in returns for establishing herding tendencies not only during distressed periods but during more normal conditions as well. For the analysis, the present paper proposes to consider three different states of the markets (general – overall market condition, bullish and bearish) and not just restrict the examination to extreme conditions. As a result, the study proposes using the CSAD model to analyze the dispersion in returns, rather than the CSSD model.

The study selects 10 sectoral indices of S&P BSE (Table 1), based on the authors' judgement about the sectors that are likely to be impacted the most (positively or negatively) due to Covid-19 crisis. Daily returns data of 10 indices and the S&P BSE Sensex from January 01, 2015, to December 31, 2020, are used as input for analysis. The same (1485 data points for each of the 10 indices) have been obtained from the ProwessIQ. WHO declared The Covid-19 outbreak as a Public Health Emergency of International Concern (PHEIC) on January 30, 2020 ("COVID-19 public health", 2020, para. 2). The study's objective is to analyze the herd behavior in different periods and accurately assess the impact of Covid-19 crisis on herding. So, the entire sample data is divided into subsamples as follows:

1. Whole Period: January 01, 2015 to December 31, 2020.
2. Pre Covid-19 (outbreak) Period: January 01, 2015 to January 30, 2020.
3. During Covid-19 (outbreak) Period: January 31, 2020 to December 31, 2020.

As three different states of the markets (general – overall market condition, bullish and bearish) are considered for examination, and not just extreme conditions, the study uses return dispersion by absolute mean - CSAD model (Chang et al. 2000). The CSAD model for the detection of herding behavior is statistically defined as follows:

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

where, CSAD represents absolute deviation of indices returns from market returns; $R_{i,t}$ represents the index i's return at t time-period; $R_{m,t}$ stands for average market return at t time-period.

Table 1: Selected Sectoral Indices of S&P BSE and the Number of Constituent Stocks (N)

Indices	Sector	N	Indices	Sector	N
S&P BSE AUTO	Automobile	16	S&P BSE IT	Information technology	51
S&P BSE FMCG	Fast-moving consumer goods	63	S&P BSE Finance	Finance	110
S&P BSE REALTY	Real estate	10	S&P BSE BANKEX	Banking	10
S&P BSE HEALTHCARE	Healthcare	70	S&P BSE Telecom	Telecommunication	13

S&P BSE INFRA	Infrastructure	31	S&P BSE Energy	Energy	21

Source: Authors' compilation from the BSE website

Herding behavior would increase the correlation between indices returns and S&P BSE Sensex return, so indices return and S&P BSE return relation would convert into a non-linear relationship as per the CAPM model. The multiple regression model as per Chang et al. (2000) for measuring CSAD of indices return is as follows:

$$CSAD_t = \beta_0 + \gamma_1 R_{m,t} + \gamma_2 |R_{m,t}| + \gamma_3 R_{m,t}^2 + \varepsilon_t \qquad \ldots\ldots\ldots (2)$$

here, $|R_{m,t}|$ is the absolute market return at the t time-period, and its magnitude does not show the market direction. $R_{m,t}^2$ value shows the non-linear relationship arising because of herding behavior, and the negative significant coefficient of γ_3 shows the presence of herding behavior (Chang et al. 2000). There can be asymmetrical relationship between CSAD and market return in the increasing and decreasing trends. So, the model, as mentioned above can be separated into two different models as per the Bull (UP) and Bear (Down) market to measure the herding behavior:

$$CSAD_t^{UP} = \alpha + \gamma_1^{UP} |R_{m,t}^{UP}| + \gamma_2^{UP} (R_{m,t}^{UP})^2 + \varepsilon_t \, if R_{m,t} > 0 \qquad \ldots\ldots\ldots (3)$$

$$CSAD_t^{Down} = \alpha + \gamma_1^{Down} |R_{m,t}^{Down}| + \gamma_2^{Down} (R_{m,t}^{Down})^2 + \varepsilon_t \, if R_{m,t} < 0 \qquad \ldots\ldots\ldots (4)$$

where, negative coefficients of $(R_{m,t}^{UP})^2$ shows the presence of herding behavior in bullish market condition while a negative coefficient of $(R_{m,t}^{Down})^2$ indicates herding behavior in bearish market condition.

4. Results

4.1. Descriptive Statistics

Table 2 provides the descriptive statistics of CSAD from 2015 to 2020 for selected S&P BSE indices. As the whole data is divided into three panels to study the herding behavior, Panel A examines whole period, Panel B examines the pre Covid-19 period and panel C examines

during Covid-19 period. From Panel A, maximum value of CSAD is in Realty and Telecom sectors, 1.04 and 1.08, respectively. Panel B has lower CSAD as compared to Panel A. As compared to panel A and Panel B, Panel C has a higher CSAD value for all sectors, indicating higher volatility in all the sectors during Covid-19 period.

Further, Tables 3 and 4 provide the descriptive analysis of selected S&P BSE indices in two different market condition, UP (Bullish) and Down (Bearish), for all three panels, respectively. In these two different scenarios, Realty and Telecom sectors are have the maximum value of CSAD returns which show a higher side of volatility in these two sectoral indices as compared to other selected indices. Because skewness values are not zero in all the scenarios, it is concluded that all CSAD values are not normally distributed. All the CSADs are not-normal and asymmetrical but having stationarity as kurtosis values are larger than 3 for all phases, except for Finance sector during Covid-19 period. To be sure about the same, the Jarque Bera test for testing the normality of the distribution of CSAD values is also examined. The test results support the above claim.

4.2. Sector Herding Behavior in the Indian Market

As per equation (2), the negative and significant coefficient of γ_3 denotes herding behavior in that market (Christie & Huang, 1995; Chang et al., 2000). Table 5 shows the regression model coefficient values as per equation (2) for all selected 10 S&P BSE indices CSAD values, to confirm the herding behavior for three different panels. As per Table 5, Panel A shows that except Auto (γ_3 = -1.411, p < 0.05), FMCG (γ_3 = -0.826, p < 0.1) and Energy (γ_3 = -1.514, p < 0.05), all the other sectors are experiencing anti-herding behavior. The F-test statistic gives significant results, indicating that the model has a good fit overall. Therefore, H1 is supported for the Auto, FMCG and Energy sectors for the whole period. Panel B shows the result of multiple regression for the pre Covid-19 period as per equation (2). Positive coefficients of γ_3 for all the sectoral indices show that for the pre Covid-19 period, herding behavior is absent across all the sectoral indices. This is very much in line with the findings of Ganesh et al. (2016) and Dhall and Singh (2020).

The paper attempts to analyze the impact of the Covid-19 crisis on the herding tendencies in the sectoral indices in the Indian stock market. As per Panel C in Table 5 (during Covid-19 period), herding behavior is present for only Auto (γ_3 = -2.512, p < 0.05), FMCG (γ_3 = -3.181, p < 0.01), Healthcare (γ_3 = -2.738, p < 0.1) and Energy (γ_3 = -2.421, p < 0.1) sectors

and not for the other sectors. Therefore, H1a is refuted for Realty, Infra, IT, Bank, Telecom and Finance sectors. It is also worth noting that, these (Auto, FMCG, Healthcare and Energy) are also the sectors experiencing higher volatility during Covid-19 period compared to the pre Covid-19 period (refer Table 2). Herding, in these four sectors, either sell-side or buy-side, can be attributed to their being highly affected due to the Covid-19 outbreak and the subsequent lockdown. Herding evidence for Auto, FMCG and Energy sectors for the whole period (Panel A) can be entirely attributed to the Covid-19 outbreak and its effects because the same sectors experience herding during Covid-19 period (Panel C) but experience no herding for the pre Covid-19 period (Panel B). This finding is quite contradictory to the findings of a few studies (Bouri et al., 2020; Espinosa-Méndez & Arias, 2020 & 2021; Selvan & Ramraj, 2020), which have found market-wide herding behaviour during the Covid-19 period.

4.3. Herding Behaviour under Bullish Market Condition

As per the previous research, investors are more prone to trade in bullish trends, which results in herding behaviour (Riaz et al., 2020). Out of the total 1485 sample data points in the study, 800 data points (refer Table 3 for descriptive) are categorized and analyzed as bullish market condition. Table 6 provides the result of multiple regression as per equation (3) for three different time-periods during bullish trend of stock market.

As per the Panel A results, all the sectors experience anti-herding behavior for the whole period. F value is significant for all the sectors, which shows the model's appropriateness. Therefore, H2 is refuted for all the sectoral indices. This result is consistent with the findings of Kumar et al. (2016), who deny the evidence of herding behaviour during bullish market conditions in the Indian stock market. However, the result does not match that of Lao and Singh (2011), who found herding behavior more prevalent during up-market conditions. Panel B shows the result of herding behavior of selected sectors for pre Covid-19 period. All the sectors except Telecom have positive γ_2^{UP} coefficients. So, there is a possibility of herding in the Telecom sector. However, even though the estimated γ_2^{UP} coefficient of the Telecom sector is negative but because it is insignificant (γ_2^{UP} = -2.785, p > 0.1), it also proves anti-herding there. This effectively proves that there is no herding tendency across all the sectors in the pre Covid-19 period. Our result is in line with Dhall and Singh (2020), whose study found no industry specific herding in the pre Covid-19 period.

Table 2: Daily CSAD Descriptive in General (overall market conditions)

Indices	Panel A: Whole Period					Panel B: Pre Covid-19 period					Panel C: During Covid-19 period				
	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness
Auto	1485	0.61	0.006	9.699	2.253	1255	0.55	0.005	5.808	1.901	230	0.92	0.008	8.477	2.136
FMCG	1485	0.59	0.006	13.138	2.814	1255	0.53	0.005	11.718	2.346	230	0.98	0.01	4.467	1.914
Realty	1485	1.04	0.01	8.813	2.224	1255	0.99	0.01	10.543	2.381	230	1.27	0.011	3.442	1.619
Healthcare	1485	0.74	0.007	10.157	2.56	1255	0.66	0.006	5.287	1.842	230	1.17	0.012	3.869	1.912
Infra	1485	0.59	0.005	9.589	2.107	1255	0.53	0.005	3.148	1.483	230	0.93	0.008	8.814	2.14
IT	1485	0.81	0.008	9.934	2.443	1255	0.75	0.007	12.458	2.578	230	1.13	0.01	3.878	1.786
Bank	1485	0.53	0.005	8.778	2.372	1255	0.47	0.004	6.682	2.01	230	0.9	0.008	3.017	1.565
Energy	1485	0.73	0.007	18.058	3.165	1255	0.65	0.006	24.654	3.258	230	1.11	0.011	5.725	2.05
Telecom	1485	1.08	0.011	10.127	2.475	1255	1	0.01	8.716	2.333	230	1.53	0.014	7.889	2.237
Finance	1485	0.41	0.004	8.019	2.345	1255	0.36	0.003	5.41	1.891	230	0.74	0.007	1.813	1.355

Note(s): Obs. – Observations; Std. Dev. – Standard Deviation. This table shows the observations, mean, standard deviation, kurtosis, and skewness of cross-sectional absolute deviation for selected indices during sample period.

Table 3: Daily CSAD Descriptive for Bull Market Condition

Indices	Panel A: Whole Period					Panel B: Pre Covid-19 period					Panel C: During Covid-19 period				
	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness
Auto	800	0.61	0.006	12.967	2.497	663	0.55	0.005	7.552	2.017	137	0.92	0.008	12.486	2.583
FMCG	800	0.59	0.006	9.832	2.458	663	0.53	0.005	8.457	2.089	137	0.98	0.009	4.234	1.856
Realty	800	1.04	0.009	5.418	1.959	663	0.99	0.009	5.812	1.991	137	1.25	0.011	3.467	1.655
Healthcare	800	0.74	0.007	8.121	2.248	663	0.66	0.006	3.435	1.621	137	1.17	0.01	5.39	2.105
Infra	800	0.59	0.005	15.925	2.583	663	0.53	0.004	2.437	1.397	137	0.93	0.008	15.074	2.919
IT	800	0.81	0.008	9.653	2.358	663	0.75	0.007	13.142	2.534	137	1.12	0.01	3.34	1.632
Bank	800	0.53	0.005	10.082	2.564	663	0.47	0.004	8.628	2.298	137	0.9	0.008	4.198	1.804
Energy	800	0.73	0.007	16.97	3.101	663	0.65	0.005	6.539	1.835	137	1.11	0.012	6.572	2.21
Telecom	800	1.08	0.011	10.915	2.504	663	1	0.01	8.923	2.398	137	1.52	0.012	15.475	2.803
Finance	800	0.41	0.004	7.827	2.283	663	0.36	0.003	6.133	1.962	137	0.74	0.006	2.221	1.342

Note(s): Obs. – Observations; Std. Dev. – Standard Deviation. This table shows the observations, mean, standard deviation, kurtosis, and skewness of cross-sectional absolute deviation for selected indices during the bullish market condition for sample period.

Table 4: Daily CSAD Descriptive for Bearish Market Condition

Indices	Panel A: Whole Period					Panel B: Pre Covid-19 period					Panel C: During Covid-19 period				
	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness	Obs.	Mean	Std. Dev.	Kurtosis	Skewness
Auto	685	0.61	0.006	5.868	1.967	592	0.55	0.005	3.895	1.775	93	0.93	0.008	3.995	1.575
FMCG	685	0.59	0.006	17.178	3.237	592	0.52	0.005	16.604	2.691	93	0.99	0.011	4.348	1.925
Realty	685	1.03	0.01	11.584	2.456	592	0.99	0.01	12.99	2.618	93	1.26	0.01	3.079	1.494
Healthcare	685	0.74	0.008	10.78	2.726	592	0.66	0.006	7.015	2.058	93	1.19	0.014	2.102	1.564
Infra	685	0.59	0.005	3.626	1.623	592	0.53	0.005	3.577	1.539	93	0.94	0.007	0.914	1.059
IT	685	0.81	0.008	10.345	2.546	592	0.75	0.007	11.814	2.612	93	1.13	0.01	5.288	2.085
Bank	685	0.53	0.005	6.256	2.048	592	0.47	0.004	3.005	1.538	93	0.91	0.008	1.416	1.217
Energy	685	0.73	0.007	19.262	3.237	592	0.65	0.007	29.816	3.884	93	1.12	0.01	2.256	1.555
Telecom	685	1.08	0.01	8.951	2.432	592	1	0.009	6.289	2.03	93	1.55	0.016	3.31	1.714
Finance	685	0.41	0.004	8.302	2.422	592	0.36	0.003	4.696	1.819	93	0.75	0.007	1.408	1.362

Note(s): Obs. – Observations; Std. Dev. – Standard Deviation. This table shows the observations, mean, standard deviation, kurtosis, and skewness of cross-sectional absolute deviation for selected indices during the bearish market condition for sample period

Table 5: Regression Results of CSAD and Market Return (Rm) of Daily Returns

Indices	α	γ_1	γ_2	γ_3	F-stat	Adj. R^2
Panel A: Whole Period						
Auto	0.004	0.033	0.242	-1.411	34.874***	0.064
	(19.560) ***	(2.501) *	(8.185) ***	(-3.356) **		
FMCG	0.004	0.028	0.329	-0.826	94.606***	0.159
	(16.034) ***	(2.150) *	(11.271) ***	(-1.991) *		
Realty	0.009	-0.006	0.222	-0.755	12.854***	0.023
	(22.382) ***	(-0.263)	(4.343) ***	(-1.042)		
Healthcare	0.005	-0.011	0.299	-0.036	66.129***	0.116
	(18.173) ***	(-0.631)	(8.033) ***	(-0.067)		
Infra	0.005	0.011	0.141	1.072	61.748***	0.109
	(23.132) ***	(0.912)	(5.295) ***	(2.840) **		
IT	0.006	0.057	0.249	-0.213	38.261***	0.070
	(20.749) ***	(3.240) **	(6.385) ***	(-0.385)		
Bank	0.004	0.038	0.212	0.171	74.235***	0.129
	(18.677) ***	(3.264) **	(8.195) ***	(0.466)		
Energy	0.005	0.013	0.268	-1.514	26.604***	0.049
	(19.109) ***	(0.757)	(7.226) ***	(-2.878) **		
Telecom	0.010	0.020	0.150	-0.056	6.962***	0.012
	(22.637) ***	(0.791)	(2.690) **	(-0.071)		
Finance	0.003	0.022	0.205	-0.181	94.267***	0.159
	(17.034) ***	(2.408) *	(10.206) ***	(-0.633)		
Panel B: Pre Covid-19 Period						
Auto	0.005	0.025	0.014	5.227	16.405***	0.036
	(19.886) ***	(1.500)	(0.299)	(3.419) **		
FMCG	0.004	0.018	0.143	1.099	18.640***	0.041
	(18.027) ***	(1.164)	(3.274) **	(0.765)		
Realty	0.009	-0.072	0.125	5.505	14.094***	0.030
	(18.471) ***	(-2.309) *	(1.421)	(1.909)		
Healthcare	0.006	0.039	0.070	3.994	14.163***	0.031

	(19.669) ***	(1.962)	(1.269)	(2.195) *		
Infra	0.005	-0.034	0.007	4.298	14.502***	0.031
	(21.796) ***	(-2.257) *	(0.166)	(3.112) **		
IT	0.0060	0.046	0.103	6.574	25.517***	0.055
	(18.395) ***	(2.009) *	(1.603)	(3.127) **		
Bank	0.004	0.031	0.121	2.022	26.564***	0.058
	(18.064) ***	(2.245) *	(3.178) **	(1.613)		
Energy	0.006	-0.046	0.070	2.607	10.121***	0.021
	(19.926) ***	(-2.365) *	(1.278)	(1.445)		
Telecom	0.010	0.081	0.041	-0.253	2.349	0.003
	(20.056) ***	(2.550) *	(0.461)	(-0.086)		
Finance	0.003	0.016	0.103	1.832	34.039***	0.073
	(17.831) ***	(1.531)	(3.586) ***	(1.946)		

Panel C: During Covid-19 Period

Auto	0.006	0.028	0.314	-2.512	8.216***	0.087
	(7.608) ***	(1.058)	(4.499) ***	(-3.178) **		
FMCG	0.004	0.021	0.554	-3.181	30.327***	0.278
	(4.463) ***	(0.740)	(7.344) ***	(-3.72) ***		
Realty	0.012	0.061	0.018	1.101	2.353	0.017
	(10.513) ***	(1.659)	(0.185)	(0.993)		
Healthcare	0.006	-0.082	0.513	-2.738	20.460***	0.204
	(5.494) ***	(-2.230) *	(5.211) ***	(-2.456) *		
Infra	0.007	0.046	0.146	0.853	19.411***	0.195
	(9.864) ***	(1.980) *	(2.380) *	(1.224)		
IT	0.009	0.062	0.129	0.493	5.988**	0.062
	(9.207) ***	(1.873)	(1.469)	(0.496)		
Bank	0.006	0.034	0.192	-0.005	12.155***	0.128
	(8.090) ***	(1.311)	(2.785) **	(-0.007)		
Energy	0.008	0.058	0.348	-2.421	6.253***	0.065
	(6.586) ***	(1.576)	(3.519) **	(-2.163) *		
Telecom	0.013	-0.066	0.244	-1.762	2.426	0.018

	(8.734) ***	(-1.365)	(1.909)	(-1.216)		
Finance	0.005	0.016	0.222	-0.664	15.244***	0.158
	(7.438) ***	(0.790)	(3.997) ***	(-1.054)		

Note(s): This table shows the relevant herding coefficient of Equation (2): $CSAD_t = \beta_0 + \gamma_1 R_{m,t} + \gamma_2 |R_{m,t}| + \gamma_3 R_{m,t}^2 + \varepsilon_t$. t-statistics values are reported in parentheses. ***, ** and * in superscript denote significance at 1%, 5% and 10% levels respectively.

Panel C shows the result of herding behavior in bullish market conditions during Covid-19 period. Auto (γ_2^{UP} = -4.208, p < 0.1), FMCG (γ_2^{UP} = -6.072, p < 0.01), Healthcare (γ_2^{UP} = -6.670, p < 0.05) and Finance (γ_2^{UP} = -3.024, p < 0.1) sectors have negative and significant coefficients of γ_2^{UP}. It establishes herding behavior in those sectors during Covid-19 period.

Therefore, H2a is partially supported for Auto, FMCG, Healthcare and Finance sectors. Our findings partially match that of Dhall and Singh (2020) for the post Covid-19 period under their study, where they found Auto and Pharma (Healthcare) sectors to be experiencing herding. Covid-19 has resulted in many short-term and long-term challenges for institutions in the Finance sector too, especially the banking and insurance industry. These industries are highly affected by operational barriers, dip in revenues, increase in claims and deteriorating asset quality and liquidity. Assuming sell-side herding in this sector during Covid-19 period will not be entirely out of place.

Table 6: Regression Results of CSAD and Market Return (Rm) in Bull Market Condition

Indices	α	γ_1^{UP}	γ_2^{UP}	F-stat	Adj. R^2
Panel A: Whole Period					
Auto	0.004	0.271	-0.466	47.143***	0.104
	(12.387) ***	(5.709) ***	(-0.526)		
FMCG	0.004	0.350	-0.649	77.047***	0.160
	(11.002) ***	(7.347) ***	(-0.732)		
Realty	0.009	0.118	1.964	12.067***	0.027
	(16.169) ***	(1.468) ***	(1.315)		
Healthcare	0.005	0.385	-1.766	51.380***	0.112
	(11.652) ***	(6.846)	(-1.685)		

Infra	0.006	-0.063	6.373	86.157***	0.176
	(19.470) ***	(-1.54) ***	(8.381)		
IT	0.006	0.346	-0.351	47.104***	0.103
	(13.106) ***	(5.524)	(-0.301)		
Bank	0.003	0.292	-0.268	69.608***	0.147
	(10.869) ***	(6.685) ***	(-0.330)		
Energy	0.006	0.181	1.063	25.446***	0.058
	(13.950) ***	(3.035) ***	(0.959)		
Telecom	0.010	0.267	-3.037	4.810**	0.009
	(14.839) ***	(2.860) **	(-1.750)		
Finance	0.002	0.271	-0.840	88.604***	0.180
	(10.203) ***	(8.362) ***	(-1.394)		
Panel B: Pre Covid-19 Period					
Auto	0.005	-0.100	12.708	34.685***	0.092
	(14.817) ***	(-1.50)	(5.531) ***		
FMCG	0.004	0.111	2.867	14.980***	0.041
	(12.907) ***	(1.683)	(1.261)		
Realty	0.009	0.106	2.953	4.369*	0.010
	(13.668) ***	0.879	0.712		
Healthcare	0.006	-0.026	12.059	33.951***	0.091
	(14.545) ***	(-0.34)	(4.561) ***		
Infra	0.005	0	2.558	2.931	0.006
	(15.944) ***	(0.006)	(1.251)		
IT	0.007	-0.167	22.054	64.667***	0.161
	(15.432) ***	(-1.95)	(7.478) ***		
Bank	0.004	0.071	6.501	35.956***	0.096
	(12.534) ***	(1.237)	(3.292) **		
Energy	0.006	0.003	2.912	2.787	0.005
	(16.341) ***	(0.037)	(1.192)		
Telecom	0.010	0.161	-2.785	0.927	0
	(13.040) ***	(1.126)	(-0.567)		
Finance	0.003	0.064	5.079	47.501***	0.123
	(12.960) ***	(1.572)	(3.644) ***		

Panel C: During Covid-19 Period

Auto	0.004	0.497	-4.208	14.348 ***	0.164
	(3.707) ***	(4.235) ***	(-2.502) *		
FMCG	0.003	0.761	-6.072	36.27 ***	0.342
	(2.252) *	(6.465) ***	(-3.598) ***		
Realty	0.013	-0.069	3.778	3.606*	0.037
	(7.155) ***	(-0.379)	(1.443)		
Healthcare	0.004	0.706	-6.670	15.416***	0.175
	(2.688) **	(4.740) ***	(-3.123) **		
Infra	0.009	-0.187	7.703	45.943***	0.398
	(9.503) ***	(-1.975)	(5.672) ***		
IT	0.008	0.357	-2.239	5.888**	0.067
	(5.464) ***	(2.255) *	(-0.987)		
Bank	0.005	0.398	-2.323	13.150***	0.152
	(4.076) ***	(3.249) **	(-1.321)		
Energy	0.008	0.394	-2.147	5.883**	0.067
	(4.189) ***	(2.106) *	(-0.800)		
Telecom	0.011	0.418	-5.257	2.249	0.018
	(5.755) ***	(2.114) *	(-1.854)		
Finance	0.004	0.393	-3.024	16.408***	0.185
	(4.061) ***	(4.242) ***	(-2.274) *		

Source: Authors' compilation.

Note(s): This table shows the relevant herding coefficient of Equation (3): $CSAD_t^{UP} = \alpha + \gamma_1^{UP}\left|R_{m,t}^{UP}\right| + \gamma_2^{UP}\left(R_{m,t}^{UP}\right)^2 + \varepsilon_t \text{ if } R_{m,t} > 0$. t-statistics values are reported in parentheses. ***, ** and * in superscript denote significance at 1%, 5%, and 10% levels respectively.

4.4. Herding Behavior under Bearish Market Condition

Table 7 shows the result of herding behavior in bearish market conditions for all the three time-periods, as per equation (4). For Panel A regression result, all the sectors except Auto and Energy experience anti-herding behavior. For the remaining sectors, γ_2^{Down} coefficients are positive/negative but insignificant, which shows the absence of herding behavior. F-test results are significant for all the sectors, showing the model's appropriateness. Therefore, H2

is partially supported for Auto (γ_2^{Down} = -1.418, p < 0.05) and Energy (γ_2^{Down} = -2.142, p < 0.05) sectoral indices. Panel B results show anti-herding behavior for all the sectors during the downward trend for the pre Covid-19 period. According to the Panel C results during Covid-19 period, except FMCG (γ_2^{Down} = -2.420, p < 0.1) and Energy (γ_2^{Down} = -2.450, p < 0.1) sectors, all the sectors are not experiencing herding during bearish market condition. This signifies partial support for H2a. Dhall and Singh (2020) found no herding for the whole period and the pre Covid-19 period in their study, however, for post Covid-19 period they found sector specific herding for the Media sector.

Table 7: Regression Results of CSAD and Market Return (Rm) in Bearish Market Condition

Indices	α	γ_1^{Down}	γ_2^{Down}	F-stat	Adj. R2
Panel A: Whole Period					
Auto	0.005	0.182	-1.418	11.231***	0.029
	(15.327) ***	(4.486) ***	(-2.890) **		
FMCG	0.004	0.304	-0.875	63.957***	0.156
	(11.247) ***	(7.698) ***	(-1.826)		
Realty	0.009	0.252	-1.365	9.185***	0.023
	(15.447) ***	(3.518) ***	(-1.575)		
Healthcare	0.006	0.253	0.592	48.439***	0.122
	(13.048) ***	(4.673) ***	(0.902)		
Infra	0.005	0.206	-0.286	41.866***	0.107
	(15.428) ***	(5.585) ***	(-0.640)		
IT	0.007	0.149	0.059	13.328***	0.035
	(15.751) ***	(2.781) **	(0.091)		
Bank	0.004	0.139	0.449	42.739***	0.109
	(15.336) ***	(4.156) ***	(1.110)		
Energy	0.005	0.286	-2.142	18.357***	0.048
	(13.315) ***	(5.645) ***	(-3.483) **		
Telecom	0.009	0.116	0.543	7.512**	0.019
	(16.005) ***	(1.602)	(0.620)		
Finance	0.003	0.154	0.103	55.860***	0.138
	(13.194) ***	(5.592) ***	(0.307)		
Panel B: Pre Covid-19 Period					

Auto	0.005	0.087	-0.071	2.878	0.006
	(13.920) ***	(1.331)	(-0.035)		
FMCG	0.004	0.167	-0.240	13.001***	0.039
	(12.653) ***	(2.878) **	(-0.132)		
Realty	0.009	0.157	7.364	14.406***	0.044
	(12.345) ***	(1.219)	(1.814)		
Healthcare	0.006	0.121	-1.750	1.744	0.003
	(13.877) ***	(1.529)	(-0.701)		
Infra	0.005	0.024	5.529	18.076***	0.055
	(14.679) ***	(0.394)	(2.926) **		
IT	0.006	0.289	-4.669	6.633***	0.019
	(11.857) ***	(3.119) **	(-1.599)		
Bank	0.004	0.147	-1.190	9.121***	0.027
	(13.521) ***	(2.913) **	(-0.751)		
Energy	0.006	0.137	2.327	9.807***	0.029
	(12.220) ***	(1.623)	(0.874)		
Telecom	0.010	-0.063	1.532	0.168	-0.003
	(15.725) ***	(-0.574)	(0.441)		
Finance	0.003	0.123	-0.482	12.703***	0.038
	(12.644) ***	(3.045) **	(-0.378)		
Panel C: During Covid-19 Period					
Auto	0.008	0.175	-1.694	1.693	0.015
	(6.502) ***	(1.809)	(-1.779)		
FMCG	0.005	0.461	-2.420	14.176***	0.225
	(3.017) **	(4.028) ***	(-2.150) *		
Realty	0.012	-0.012	0.591	0.467	-0.012
	(7.829) ***	(-0.105)	(0.506)		
Healthcare	0.008	0.464	-1.521	12.828***	0.206
	(3.988) ***	(3.040) **	(-1.014)		
Infra	0.008	0.178	-0.452	7.451**	0.124
	(7.126) ***	(2.133) *	(-0.550)		
IT	0.010	0.013	1.138	3.517*	0.052
	(6.481) ***	(0.118)	(1.028)		

Bank	0.008	0.067	0.790	6.901**	0.115
	(6.631) ***	(0.738)	(0.891)		
Energy	0.008	0.288	-2.450	3.025	0.043
	(4.958) ***	(2.449) *	(-2.118) *		
Telecom	0.014	0.201	-0.725	1.350	0.008
	(5.512) ***	(1.023)	(-0.375)		
Finance	0.005	0.143	-0.021	8.775***	0.146
	(5.229) ***	(1.817)	(-0.027)		

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Note(s): This table shows the relevant herding coefficient of Equation (4):

$$CSAD_t^{Down} = \alpha + \gamma_1^{Down}\left|R_{m,t}^{Down}\right| + \gamma_2^{Down}\left(R_{m,t}^{Down}\right)^2 + \varepsilon_t \; if \; R_{m,t} < 0$$

*. t-statistics values are reported in parentheses. ***, ** and * in superscript denote significance at 1,5 and 10% levels respectively.*

5. Conclusion

The study investigates the Covid-19 induced herding behavior in 10 sectoral indices of the Indian stock market using the CSAD model for the period January 01, 2015 to December 31, 2020, by further dividing the period into three subsets: whole period; pre Covid-19 period; and during Covid-19 period. In addition to analyzing herding behaviour in general (overall market conditions), analysis for herding is also done separately for bullish and bearish market conditions to investigate better the impact of the Covid-19 crisis on investors' behaviour.

All the sectors under the study support the rationale of asset pricing model (Fama, 1970) for pre Covid-19 period and experience no herding behavior in general as well as for bullish and bearish market conditions. This justifies that market is informationally efficient prior to the Covid-19 crisis. This finding is in line with the study of Dhall and Singh (2020), which found no herding in the pre Covid-19 period. Kumar et al. (2016) also found no significant herding evidence in bullish or bearish market conditions. The absence of herding across all sectors for the pre Covid-19 period is a significant finding for the present study. As a result of this, herding observed during Covid-19 period is significantly attributable to the Covid-19 crisis.

The Indian stock market experiences sector specific herding behavior during Covid-19 period under the study. This finding matches with that of Dhall and Singh (2020), who also found industry-specific herding to be present during Covid-19 period under their study, whereas it is contradictory to the findings of a couple of India and other countries' specific studies

(Bouri et al., 2020; Espinosa-Méndez & Arias, 2020 & 2021; Selvan & Ramraj, 2020), which have found market-wide herding behaviour during Covid-19 period. The dynamics of stock markets are complex and could differ from country to country. Sectors that experience herding in general during Covid-19 period are Auto, FMCG, Energy and Healthcare. Covid-19 induced many events like lockdown; higher inflation and fuel prices; reduction in demand for vehicles, fuel, and energy; reduced manufacturing, transportation, and other economic activities; panic buying of consumer products by families to hoard during the lockdown period; and higher demand for healthcare products (medicines and equipment) to name a few. All these events have put pressure on the four sectors, thereby leading to investors crowding in or out of them simultaneously. While analyzing separately for bullish market conditions also, sector-specific herding is significantly observed, Auto, FMCG, Healthcare and Finance sectors experiencing herding. Similarly, during bearish market conditions, FMCG and Energy experience herding behavior.

This study adds to the scant but growing body of literature on investors' behaviour and decision-making tendencies during Covid-19 and a generic crisis. It is of interest to individual investors and financial community to arrive at appropriate investment decisions and regulatory authorities at large for maintaining financial stability in the markets during such a period of distress. Future studies can attempt to analyze herding during the Covid-19 period using larger number of sectors and / or stock markets of various countries / regions.

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