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Herd Behaviour and COVID-19 Intervention

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Abstract

The paper attempted to confirm the rational assets pricing model by examining the herd behaviour in extreme market returns and examining the COVID-19 intervention by comparing before COVID-19, during COVID-19 and after COVID-19 period. Cross Sectional Standard Deviation (CSSD) calculated as the index and further regressed by using dummy variables (Extreme upper tail market returns =1, otherwise = 0). For the better inferences stationarity of time series data were checked by both graphically and Augmented Dickey – Fuller test in all three states of COVID-19. Finally, the Cumulative-Sum (CUSUM) test was conducted to check the parameter stability of the regression model. The finding of the study supports the rational asset pricing models, meaning that there is no presence of herding in NEPSE in extreme upper tail returns. But it rejects the rational asset pricing models in case of extreme lower market returns and in COVID-19 period. For better affirmation of rational assets pricing models, future research can extend the work by addressing the market characteristics, such as: trading volume, volatility, and liquidity.

INTRODOUCTION AND STUDY OBJECTIVES

Herding behaviour, as a tendency of individuals to follow the actions or decisions of a larger group or crowd, consequently, affects in the financial markets and social situations (Cont, 2001). Herding behaviour can lead to market efficiency, as investors collectively adjust their expectations based on new information, but it can also lead to market instability and systemic risks (Bikhchandani & Sharma, 2000).

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In social situations, herding behaviour can foster social cohesion and facilitate group decision-making (Frey & Van de Rijt, 2021). Therefore, it is crucial to understand the causes and effects of herding behaviour to mitigate its negative consequences and promote its positive effects (Chang & Yu, 2020).

Lack of concrete information regarding the financial assets may encourage the investors towards the crowd effect, i.e., they rely on decisions of others rather than their own (Banerjee, 1992). The problem addressed in this research is the potential impact of herding behaviour on investment decisions. Despite the potential negative consequences of herding behaviour, there is a lack of research examining its prevalence and effects during times of uncertainty, such as a global pandemic. This study aims to investigate whether investors in Nepalese stock markets exhibit herding behaviour during the COVID-19 pandemic, and to compare the levels of herding behaviour during pre-pandemic, pandemic, and post-pandemic periods. The research problem is significant because understanding the prevalence and effects of herding behaviour during times of uncertainty can inform investment strategies and help to promote more stable and efficient financial markets. The primary objective of the study is to examine the herding behaviour and COVID-19 intervention.

LITERATURE REVIEW

Individual investors or groups of investors follow herd momentum by confirming the opinions or behaviours of the majority, even if such opinions or behaviours are irrational or not in their best interest. Christie and Huang (1995), used the asset pricing model theory to test the presence of herd behaviour during the market stress. The cross-sectional standard deviation (CSSD) was computed by using daily stock prices and further CSSD were predicted by using a regression model where the market stress or extreme returns case were used as the dummy variables. The study found that there is existence of herding behaviour.

Firm data and sector wise CSSD were calculated and further used for estimation. CSSD were estimated by using regression on the basis of market dummies variable (Demirer & Kutan, 2006). Daily price of the Chinese stock exchange was used for the analysis (both Shanghai and Shenzhen). The study found inexistence of crowd effect formation in the stock market. The finding supports rational asset pricing and market efficiency.

Similarly, Gleason et al. (2003) study found that there is no presence of herding behaviour in the European future market. For the analysis researcher computed CSSD index of 2,691 observations. Further CSSD were estimated by using regression on market dummy variables (i.e. extreme market returns).

Amirat and Alwafi (2020) studied and found the presence of herding behaviour in case of crypto-currency market. For the analysis 20 large companies were used and collected from Bloomberg and coinmarketcap.com. 1492 daily closing prices were collected for the period of 1st Jan 2015 to 31st Jan 2019. Daily closing prices were used for returns calculation and the author calculated the deviation index which was further used for the regression analysis.

Tan et al. (2008) also studied and found that there is existence of herding behaviour in both Shenzhen A – share and B – share stocks. The secondary data were used for the analysis where data were collected from the Chinese stock market and Accounting Research (CSMAR) database. Individual daily returns and individual daily trading volume were collected and further processed to obtain the volatility in stock.

Several studied were performed on crowd behaviour on financial markets and found presence of herding or irrational decision making on financial markets (Chiang & Zheng, 2010; Khan et al., 2011; Mandal, 2011). There are lots of other studies which support the inexistence of irrational decision making in the financial market (Vidal-Tomas, 2019; Chang et al., 2000;). Very few studies were conducted on COVID-19 intervention like (Ali, 2020; Wu et al., 2020; Gil-Alana & Monge, 2020;). But in the context of Nepal no study regarding the herding behaviour using the daily closing index of NEPSE was found during this study. Therefore, it is important to examine the extent and drivers of herding behaviour in the Nepalese financial sector, as well as its implications for market performance and stability. Therefore, this paper attempted to confirm the rational assets pricing model by examining the herd behaviour in extreme market returns and examining the COVID-19 intervention by comparing before COVID-19, during COVID-19 and after COVID-19 period.

RESEARCH METHODS

The herding behaviour represents the tendency of following the crowd and for measuring the herding in the Nepalese financial sector, NEPSE was used as the primary and as an only one option. The first news arrived regarding the genetic sequence of COVID-19 spread on 12th Jan 2020. Therefore, before that period the state was unknown about the COVID-19 and its impacts, so the data were segregated by considering COVID-19 intervention from 12th Jan 2020. For ease of readability and understandability the following operationalisation were used in this paper:

Table 1
Operational definition of variables of study

S.N.	Notation	Meaning
1	R_m	Market portfolio returns [i.e. Nepal Stock Exchange (NEPSE) Returns]
2	$CSSD_t$	Cross-Sectional Standard Deviation at time 't'
3	$PRE_{COVID-19}$	Time period of "2018/July/17 to 2020/Jan/09"
4	$DURING_{COVID-19}$	Market returns at period of "Dec/01/2019 to Dec/29/2021"
5	$POST_{COVID-19}$	Market returns at period of "Jan/01/2022 to Feb/28/2023"

Table 2
State and Observation Period

Sample Period (YYYY/MM/DD)	State	No. of Observation
2018/07/17 – 2020/01/09	$PRE_{COVID-19}$	363
2020/01/12 – 2023/05/04	$DURING_{COVID-19}$	737
2023/05/07 – 2024/04/10	$POST_{COVID-19}$	216
Total		1316

Note: Pneumonia cases were increasing in Wuhan, China, after that WHO reported the cluster of cases of Pneumonia on social media on 4-Jan, 2020. China publicly shared the genetic sequence of COVID-19 on 12-Jan, 2020 (WHO, 2020). WHO officials declare the end of COVID-19 on 5-May, 2023 (WHO, 2023). To ensure maximum data involvement in the analysis, the observations were taken from 17-July 2018 at that day Non-Life Insurance Sector were added in the NEPSE. All non-trading days were removed from the data set Investment sector were not included in the data set because it was listed on the NEPSE from 28-Feb, 2021.

For accurate results it is important to consider all the observable data as much as possible. In the case of individual closing price indexes there is a problem in data. Some companies were merged, others did not exist, some recently emerged and largely the issue exists in the non-operation days. Such issues questioned the authenticity in the stock market representation. So, for the accuracy of the results and sample validity sector wise indicess were used which represents the stock market effectively. Again, the investment sector is listed from 28 Feb 2021, so, except the investment sector all other sectors were included as the sample.

Data Analysis Methods

Closing indexes were used for the calculation of returns for specific sector's returns. All the closing indexes of different sectors were downloaded from the official website of NEPSE. After calculating returns, the returns were used to further calculate the deviation on returns as index and finally that index was used in regression to measure the herding by examining the role of extreme market returns of 1 percent and 5 percent (i.e. dummy variables).

Returns: Sectoral index differences were used for returns calculation. The returns of 11 sectors of NEPSE were calculated by using the daily sectoral closing index. Closing index of each sector were downloaded from (NEPSE) and further downloaded data were used to calculate the returns by following formula:

$$R_{i,t}/R_{m,it} = \frac{I_{it} - I_{it-1}}{I_{it-1}}$$

Where, closing index of previous day () were subtracted from today () index of a particular sector and further divided by base index.

Deviation on Returns: Christie & Huang (1995) proposed the model for deviation in returns.

$$CSSD_{it} = \sqrt{\frac{\sum_{i=0}^{N}(R_{i,t} - R_{m,t})^2}{N-1}}$$

Where,
$CSSD_{it}$ = Cross-Sectional Standard Deviation of "i" sector on "t" time.

$R_{i,t}$= Returns on sector calculated by daily closing index differences.
$R_{m,t}$ = Market returns on "t' time.
i = sector
t = time

Regression using Dummy Variable: Christie & Huang (1995) proposed the dummy regression model to measure the extreme market returns impact on deviation of returns. Where extreme returns were measured by the dummy variable (i.e. if extreme 1, otherwise 0).

$$CSSD_t = + \alpha + \beta_1 D_t^U + \beta_2 D_t^L + e$$

Where,
D_t^U= Extreme upper tail market returns (i.e. 1 or 0).
D_t^L= Extreme lower tail market returns (i.e. 1 or 0).

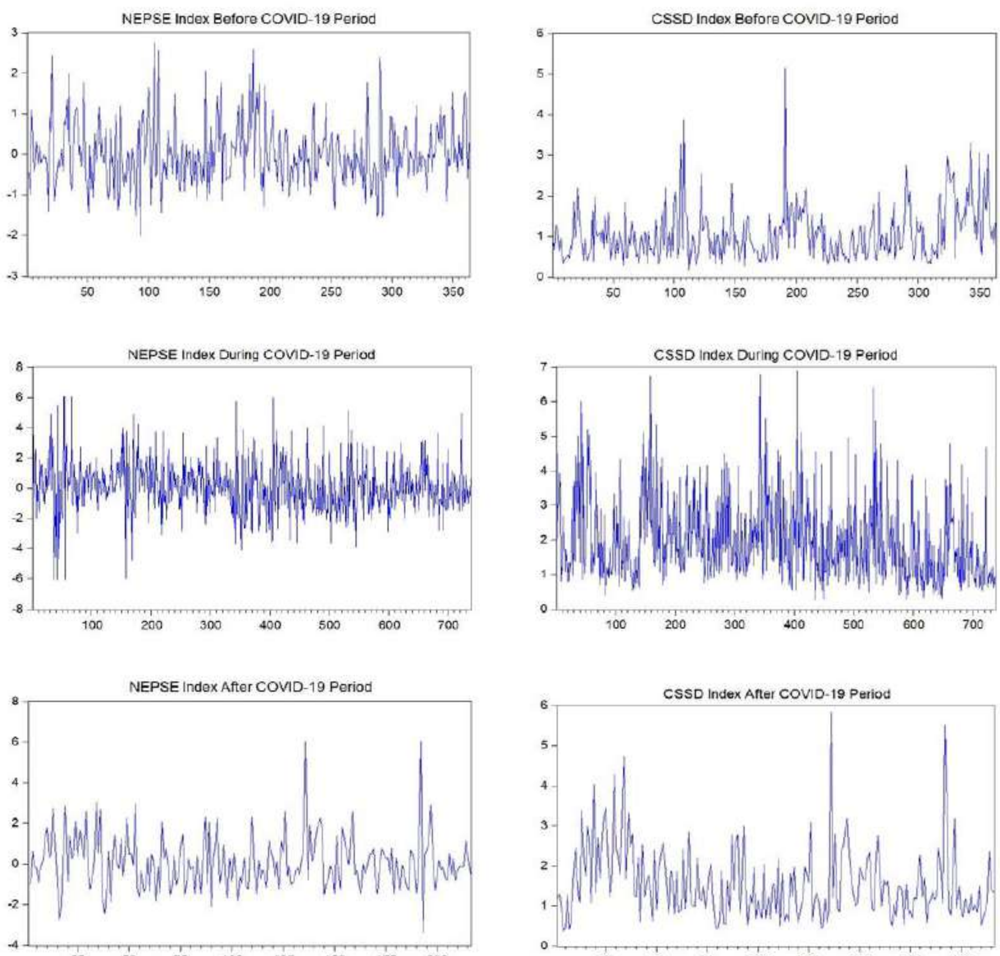

Figure 1. *Market returns and CSSD Returns Pre, During and Post COVID-19 Periods.*

CUSUM Test: Ploberger et al. (1989) propose the Cumulative-Sum (CUSUM) test to check the parameter's stability of the regression model. Before making statistical inferences there may be some need for validating the parameter of the regression model in case of time series analysis. So, the CUSUM test was conducted for testing the stability of the parameter of the regression model.

DATA ANALYSIS AND DISCUSSION

There is a relationship between how much the stock market goes up or down (market returns) and how much investors act like a herd (herding behaviour). When the market is going down, investors tend to follow each other more, which leads to less variation in the way they invest (cross-sectional standard deviation index decreases). But when the market is going up, investors tend to make their own decisions more, which leads to more variation in the way they invest (cross-sectional standard deviation index increases).

In case of time series data, unit root is widely checked before making any inferences (Hall, 1994). Unit root is often considered as the non-stationarity of time series data which means there is some trend in data with respect to time. So, the data must be stationary for the purpose of making statistical inferences, Fig 1 depicts less trend in the time series data. CSSD and NEPSE index are stationary which is further supported by the Augmented Dickey – Fuller (ADF) test, three state: before, during and after the COVID-19 are stationary or there is no any problem of unit root (i.e. p-value < 0.01) presented in table 3.

Table 3 shows different statistics to define the data nature and test for making inferences from that time series data. Average of market returns is 0.005 percent in pre-COVID-19 period which is increased in COVID-19 period (i.e. 0.073) and lower returns in post-COVID-19 (i.e. 0.045). The mean in the COVID time is higher than other states which indicates there may be a series of fluctuations in that time period also supported by the standard deviation of returns in COVID period (i.e. 1.984). The correlation coefficient between the market returns and CSSD is lower in COVID period (i.e. 0.206) and the relationship is found significant (i.e. p-value<0.01). The correlation is low in comparison to before and after COVID period (i.e. 0.216 and 0.439 respectively). But this is not enough to make inferences about the herding, rather the correlation coefficient signifies a good relationship between market returns and deviation which indicates deviation and returns on market are similar to three different states.

Regression results using dummy variables for upper tail and lower tail were used in the model and used 1's and 0's for their existence. The extreme returns (i.e. 1 percent or 5 percent) were used to predict the model. All ANOVA values were found significant, for 1 percent extreme market returns (i.e. p-value<0.01). Pre-intervention of COVID period in extreme returns of 5

Table 3
Descriptive and Inferential Statistics

Variables/State	PRECOVID-19	$DURING_{COVID-19}$	$POST_{COVID-19}$
No. of Observation (N)	363	737	216
Mean of:			
Market Return (R_m)	0.005	0.073	0.045
$CSSD_t$	1.060	1.984	1.560
Standard Deviation of:			
Market Return (R_m)	0.783	1.663	1.300
$CSSD_t$	0.639	1.188	0.899
Augmented Dickey – Fuller (ADF)	-6.731*	-8.803*	-11.645*
Correlations between (R_m) and $CSSD_t$	0.216*	0.206*	0.439*
Regression on Extreme 1 % Index Returns [$CSSD_t = + \alpha + \beta_1 D_t^U + \beta_2 D_t^L + e$]			
α	1.041*	1.958*	1.532*
β_1	3.062*	4.306*	4.132*
β_2	-0.804**	-1.620*	-1.138**
R-Square	0.203	0.142	0.210
ANOVA (F-stat)	45.747*	60.847*	28.305*
Regression on Extreme 5 % Index Returns [=]			
α	1.001*	1.896*	1.486*
β_1	1.886*	3.181*	2.627*
β_2	-0.680*	-1.389*	-1.038*
R-Square	0.694	0.412	0.451
ANOVA (F-stat)	166.997**	257.018*	87.663*

** P-value < 0.01; ** P-value < 0.05;*

Note: Dummy regressions were computed by using extreme market returns of 1% and 5%. is assumed 1 if the CSSD index returns is above 1 percent otherwise it is assumed 0. Similarly, is assumed 1 if the CSSD index returns is lower than 1 percent otherwise it is assumed 0. Same rule is applied for extreme market returns of 5 percent.

percent have significance at 5 percent for ANOVA (i.e., p-value<0.05). All 6 models are good enough for making inferences with respect to ANOVA test. R-square values of 6 models were presented but there were dummies 1's and 0's and measuring their role in CSSD, so, the R-square is not effective for measuring explanation power of independent variables. So, all the model and statistics were validly and accurately measured for assuring the inferences.

All the coefficients were positive and significant (i.e. p-value<0.01; p-value<0.05) except the left tail of 1 percent and 5 percent extreme market returns. All left tail coefficients at 1 percent and 5 percent market returns in all states of COVID were found negative

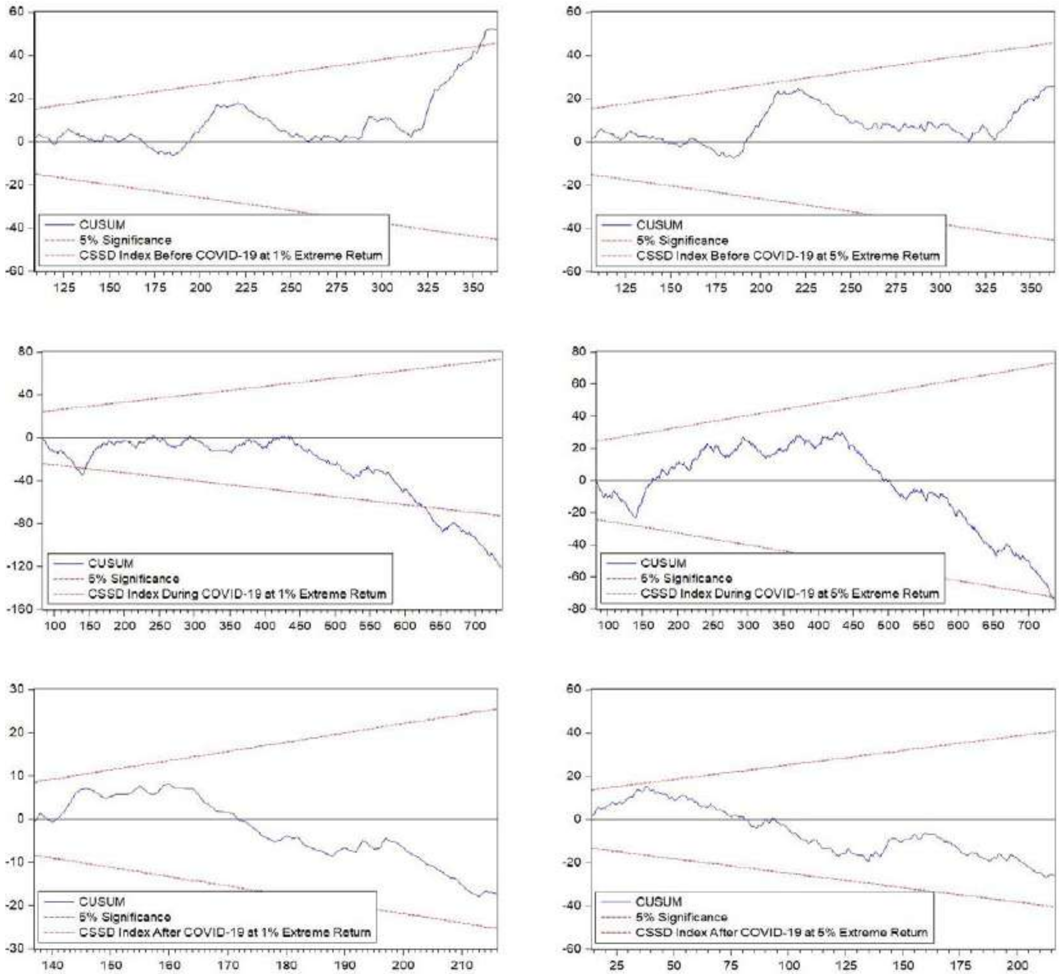

Figure 2. *CUSUM Test for Parameter Stability*

and significant (i.e. p-value<0.01; p-value<0.05). According to the regression model suggested by Christie & Huang (1995), in case of positive and significant regression coefficient of extreme market returns dummies lack the herd momentum. Similar case was found in this study that coefficients of the right tail of the extreme market returns of 1 percent and 5 percent were positive but in left tail the coefficients were found negative meaning that the herd effect was found only in lower market returns. All calculated coefficients were statistically significant at either 1 percent or 5 percent level of significance.

The CUSOM test depicted in Fig 2 is an econometric test used to assess the stability of parameters in a regression model. The upper and lower 5% significance line is represented by a dotted line and the curve line represents the prediction which lies in between the 5 % significant line. All the models are stable except during COVID Pandemic (at Extreme 5% Index Returns) because the estimated value falls within the confidence interval. In the case of the COVID pandemic period (at Extreme 5% Index Returns) the model was not stable. In all other cases, the model parameter was stable. Something abnormality was found in COVID period but major regression results using market returns dummies doe not support such abnormality.

CONCLUSION AND IMPLICATIONS

Daily closing sectoral indexes were used for the analysis, after collecting complete data, basic descriptive statistics and stationarity of time series data were checked. According to the regression model suggested by Christie & Huang (1995), in case of positive and significant regression coefficient of extreme market returns dummies lack the herd momentum. Similar case was found in this study that coefficients of the right tail of the extreme market returns of 1 percent and 5 percent were positive but in the left tail the coefficients were found negative meaning that the herd effect was found only in lower market returns. All calculated coefficients were statistically significant at either 1 percent or 5 percent level of significance.

Unstandardised beta coefficients of the dummy right tail return at 1 percent and 5 percent market returns are positive and statistically significant like study of (Chang et at., 2000; Gleason et al., 2003; Demirer & Kutan, 2006; Vidal-Tomas, 2019). This indicates that, in upper market returns the herd momentum is absent and in lower market returns the herd momentum exists. This result was contradicted with the finding of (Tan et al., 2008; Chiang & Zheng, 2010; Khan et al., 2011; Amirat & Alwafi, 2020). There is some contradiction in results even though the methodological contexts are similar except COVID-19 intervention in some cases.

The methodological context of this paper consistent with the studies of Ali (2020; Wu et al., 2020) but not with their results. The studies (Ali, 2020; Wu et al., 2020) tested the COVID interventions and contradicts with the finding of present study. The study collected sectoral level data and found herding in extreme lower returns consistent with the finding of (Demirer & Kutan, 2006). The study collects the sector level data from NEPSE and supports the rational asset pricing models, meaning that there is no presence of herding in NEPSE in extreme upper tail returns. But reject the rational asset pricing models in case of extreme lower market returns. In COVID-19 period, the herd effect was found in only lower market returns.

This study is primarily based on the sectoral data from NEPSE, further can be examined the influence of market characteristics, such as: trading volume, volatility, and liquidity. Additionally, the replication of this research by considering individual stock daily closing index would strengthen the understanding of rational asset pricing models.

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Conflict of interest
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