Global Financial Crisis, COVID-19, Lockdown, and Herd Behavior in the US ESG Leader Stocks

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Abstract

Using data of the constituents of the MSCI USA ESG leader index, this study investigates the herding behavior in the US ESG stocks over the period from January 03, 2007 to September 30, 2020. Our results reveal a significant herding behavior in the US ESG leader stocks. Our findings also show that herd effect is present in the US ESG stocks during both bear and bull market conditions. Our study documents the evidence of market-wide herding during the global financial crisis, COVID-19, lockdown, and post lockdown episodes. However, in all of these cases, herding is mainly characterized by intentional motives rather than fundamental factors. Finally, the outcome of our study has important implications for the investors, portfolio managers, and policy makers as herding can result in asset mispricing, adversely affecting portfolio diversification and adding to the market inefficiency.

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1. Introduction

Over the last two decades, herding behavior has attracted significant attention in the domain of behavioral finance literature and attendant implications for investment strategies and portfolio choice decisions. Herding is a behavioral phenomenon in which investors emulate other investors' behavior in the same market without considering their private information and fundamental analysis. Herding can be (i) fundamental or spurious, where investors reach to the same conclusion based on company fundamentals (Bikhchandani and Sharma 2000; Choi and Skiba 2015; Galariotis, Rong, and Spyrou 2015); or (ii) intentional herding where investors imitate their market peers while suppressing their own beliefs (Teraji 2003; Trueman 1994). Herding based on the fundamentals does not affect asset prices or market efficiency (Arjoon, Bhatnagar, and Ramlakhan 2020). In contrast, intentional herding drives the stock prices away from their fundamental or intrinsic value (Indārs, Savin, and Lublóy 2019), makes the market inefficient (Della Rossa, Giannini, and DeLellis 2020), and present serious challenges for regulators and policy makers.

There is a volume of the existing literature investigating herd effect in daily trading of individual investors using aggregate market data. For instance, the studies have examined the herding behaviour in financial markets (Batmunkh et al. 2020; Chang, Cheng, and Khorana 2000; Ukpong, Tan, and Yarovaya 2021; Zhu, Li, and Zheng 2020), cryptocurrency market (Ballis and Drakos 2020; Bouri, Gupta, and Roubaud 2019; Yarovaya, Matkovskyy, and Jalan 2021), energy stocks (Chang, McAleer, and Wang 2020), and commodity market (Júnior et al. 2020; Kumar et al. 2020; Youssef 2020).

Many of the existing studies find evidence of herd behavior in trading of the individual investors (Persaud 2000; Caporale, Economou, and Philippas 2008; Hwang and Salmon 2004; Economou, Kostakis, and Philippas 2011; Indārs, Savin, and Lublóy 2019; Júnior et al. 2020; Philippas et al. 2013; Tan et al. 2008; Vo and Phan 2017; Wang 2008), while others find no evidence of imitated trading in the investments of the individual investors (Christie and Huang 1995; Chang, Cheng, and Khorana 2000; Chiang and Zheng 2010; Gleason, Mathur, and Peterson 2004; Mobarek, Mollah, and Keasey 2014). One of the reasons that many of these studies do not find herding in investor's trading is that herding can be more visible and confined to a sector rather than the whole financial market (Fama and French 2008; Aziz and Ansari 2017). For instance, Júnior et al. (2020) finds the evidence of herding in investors' transactions in food commodities. In a similar vein, the herding can be more pronounced in the stocks with certain characteristics. For instance, Gong and Dai (2018) reports significant herd effect in Chinese lottery-type stocks and Aziz and Ansari (2017) document the evidence of herding in Indian lottery-type stocks. These evidences highlight the potential presence of herding at sector and even on stock characteristics level.

The environmental, social, and governance (ESG) stocks, also called socially responsible investing, constitute a subset of financial market, which have been attracting high attention due to their so-called performance and sustainable features in down market times. In this context, some recent studies document the safe-haven properties of ESG stocks during market down-turns (Rubbaniy et al. 2021). Unlike stock markets however, for which research is plentiful, the literature

about the tendency of investors' behavior in ESG stock markets is scant.[1] Our study adds to this debate by investigating herd investing in the US ESG leader stocks.

The studies on fundamental (or spurios) and non-fundamental (or intentional) herding are also limited and inconlusive. For instance, Galariotis, Rong, and Spyrou (2015) study herding in the US and UK firms and find that herding in the UK market is based on fundamental factors, while herding in the US market is driven by both fundamental and non-fundamental information. Arjoon, Bhatnagar, and Ramlakhan (2020) find evidence of both fundamental and intentional herding in the Singapore stock exchange. Indārs, Savin, and Lublóy (2019) document that investors in the Russian stock market herd towards market consensus mainly motivated by non-fundamental factors. They further argue that herding during down market conditions is based on non-fundamental factors without having any connection to the fundamentals. In summary, these studies conclude that herding in the financial markets can either be based on the fundamental analysis of the investors or driven by non-fundamental information.

Existing literature suggest that varying levels of herding can be associated with changes in market conditions. For instance, herding can be more prominent during down market conditions due to increased risk or lower level of confidence (Fu and Lin 2010; Duygun, Tunaru, and Vioto 2021; Lao and Singh 2011) or up market conditions (Zheng, Li, and Chiang 2017; Arjoon, Bhatnagar, and Ramlakhan 2020). Furthermore, the level of herding is intensified during financial crises and extreme market conditions, which is largely driven by panic rather than rational trading on fundamentals (Stavroyiannis and Babalos 2017; Yousaf, Ali, and Shah 2018; Yarovaya, Matkovskyy, and Jalan 2021; Galariotis, Rong, and Spyrou 2015; Guney, Kallinterakis, and Komba 2017). While studying the Hong Kong stock market, Lam and Qiao (2015) find that investor herding is more prevalent during up market conditions. In the analysis of energy stocks of the US, Europe, and Asia, Ukpong, Tan, and Yarovaya (2021) report that investors display herding behavior during low market conditions and the recent episode of COVID-19. Yarovaya, Matkovskyy, and Jalan (2021) find no evidence of herding in cryptocurrencies during COVID-19, but report that herding is contingent upon the up and down market conditions. On the contrary, Susana, Kavisanmathi, and Sreejith (2020) empirically prove that herding is prevelant in the top ten cryptocurrencies during COVID-19 but find no evidence of herding during upswing and lowswing days. Using comprehensive data of the stock markets of 72 countries Kizys, Tzouvanas, and Donadelli (2021) conclude that investor display herding behaviour during COVID-19 pandemic. All these studies present inconclusive presence of herding in different sectors of financial markets and across different market conditions for instance bear, bull, GFC and COVID-19.

Our study of herding behavior in ESG stocks is motivated by at least two reasons. The reason is increasing focus of global investors on incorporating the environmental, social and governance factors into the security selection process, also called socially responsible investing (SRI), has linked ESG elements with fundamental factors which not only capture better long-term and sustainable returns for investors, but also benefit the society by influencing the behavior of

[1] https://www.investors.com/news/esg-investing-wildly-popular-little-known-ibd-tipp-poll-shows/

companies.[2] Consequently, the demand for ESG stocks has surged recently. For instance, the increase in the assets under management in ESG ETFs by three-fold from just $59bn at the end of 2019 to $174bn at the close of 2020.[3] In the last four years, more than 50% of the funds in the UK and US have rebranded themselves as ESG funds.[4] Even conventional fund managers pay attention to ESG information (Van Duuren, Plantinga, and Scholtens 2016), and half of the FTSE 1000 firms linked their CEO pays to the better ESG ratings.[5] This increased demand for ESG stocks might lead naïve traders to mimic the market behavior or behavior of their investment gurus.

The second driver of this study is the potential contribution to the academic debate on herd investing by extending it to ESG stock markets, which has recently received increasing focus from academia. For instance, Nagy, Kassam, and Lee (2016) argue that MSCI's ESG stocks portfolio outperformed the MSCI world index over the sample period of 2007 to 2015, while also increasing their ESG profile. Additionally, a negative or low correlation of ESG securities with other assets (stocks, currency and commodities) during normal and crisis periods allows investors to hedge their portfolios using ESG stocks (Ferriani and Natoli 2020; Rubbaniy et al. 2021; Andersson et al. 2020). Using the wavelet coherence method on three global and one emerging market ESG indices, Rubbaniy et al. (2021) document that ESG stocks can be used as safe-haven assets in the portfolio choice of the investors during COVID-19. Broadstock et al. (2021) investigate a sample of Chinese firms to conclude that investment in ESG stocks lowers the financial risk during COVID-19 and high ESG stock portfolios outperform low ESG stock portfolios. Raimo et al. (2021) conclude that firms with higher level of ESG disclosures have lower cost of debt and better access to third party financial resources.

The notion of high past and better expected future returns is often the driving force behind herding behaviour, currently a dominant characteristic of ESG stocks, that makes ESG stocks a strong candidate for the investigation of herd behavior. However, despite the recent shift in the investment choice of the US and global investors towards ESG stocks, and growing focus of academics on ESG stocks, the existing literature have rarely highlighted the issue of herd investing in ESG stocks. Our study fills this void in the existing literature and particularly examines whether (1) investors in ESG stocks exhibit herding; (2) If herding exists in the ESG stocks, is it driven by intentional or fundamental factors? (3) Does herd investing vary during up and down-market conditions? (4) How do investors behave towards ESG stocks during extreme market movements for instance global financial crisis (GFC), COVID-19, lockdown and post-lockdown episodes of ESG stock market?

Our results reveal that herding behavior is present in the ESG stocks. Our findings also show that investors exhibit herding behaviour during both bear and bull market conditions. However, in both market conditions the herd investing is mainly characterized by intentional factors. Our results also document the evidence of market-wide herding during the GFC, COVID-19, lockdown, and

[2] For example, the 2020 Sustainable financing and investing survey reports that 89% of the investors consider ESG issues as very important, and 49% of the investors thinks ESG can either increase portfolio return or decrease the risk. Edmans (2011) concludes that SRI screening can improve the portfolios return.

[3] https://www.ft.com/content/486afe00-5347-4f23-ab30-fb2ab901b2cb

[4] https://www.ft.com/content/74888921-368d-42e1-91cd-c3c8ce64a05e

[5] https://www.ft.com/content/609eae5e-1576-4081-9340-5d5001b5b02e

post lockdown episodes. It is interesting to note that in all these cases, herding is mainly driven by intentional motives rather than fundamental analysis.

Our study contributes to the herding literature on several fronts. First, our study is the first to provide evidence of herd behavior in ESG stocks, which has never been discussed in the existing literature. Second, no literature detecting and differentiating the spurious and intentional herding using higher fundamental factors (4 and higher) of Fama (2014) exist to date. Therefore, our study distantly contributes on this front. Third, our study documents that herding in the US ESG stocks is not only prevalent during bear and bull market conditions, but also exists during the GFC, COVID-19, lockdown, and post-lockdown periods. This investigation is unique in the current literature. Finally, intentional herding can likely result in asset mispricing, adversely affects portfolio diversification, and adds to the market inefficiency. Therefore, the information about herding behavior in the ESG stocks improves the informed investment decision making of investors and portfolio managers involving ESG investment strategies; and thus, has important implications for the investors and portfolio managers.

The rest of the study is organized as follows: Section 2 discusses the research design and methodology. Section 4 submits the main findings of the study, and Section 5 concludes the research.

2. Research Design and Methodology

2.1.Methodology

Existing mainstream literature on herding uses two approaches to measure cross-sectional dispersion in the market portfolio returns, i.e., Christie and Huang (1995) cross-sectional standard deviation (CSSD) and Chang, Cheng, and Khorana (2000) cross-sectional absolute dispersion (CSAD). A major drawback in Christie and Huang (1995) CSSD measure is that it is sensitive to outliers and a squared term used in its construction can make the inference biased (Economou, Kostakis, and Philippas 2011). We use the CSAD measure of cross-sectional dispersion initially developed by Chang, Cheng, and Khorana (2000) and further extended by Galariotis, Rong, and Spyrou (2015) and Dang and Lin (2016). The basic rationale behind the development of Chang, Cheng, and Khorana (2000) model is that in the episodes of large movements in the asset prices, investors typically prefer to suppress their privately held diverse views to adhere to common sentiment in the market. This preference results in the congregation of stock returns around the average market return and scales down the cross-sectional return dispersion. We follow Chang, Cheng, and Khorana (2000) to measure cross-sectional absolute deviation in returns using the equation below:

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

Where $CSAD_t$ is the portfolio return dispersion measure in time *t*, N is the number of stocks in the portfolio in time *t*, $R_{i,t}$ is the observed return of stock *i* in time *t*, $R_{m,t}$ represents the equally weighted average cross-sectional return of stocks *m* in the portfolio in time *t*.

After computation of the $CSAD_t$, we use the non-linear framework of Chang, Cheng, and Khorana (2000) to examine the causal relationship between average market return and cross-sectional absolute deviation which is as follows:

$$CSAD_t = \lambda_0 + \lambda_1 \left|R_{m,t}\right| + \lambda_2 R_{m,t}^2 + \mathrm{u_t} \quad (2)$$

Where λ_0 is the intercept, $\lambda_1, \lambda_2$are loadings of $\left|R_{m,t}\right|$ and $R_{m,t}^2$ respectively; $\left|R_{m,t}\right|$ ($R_{m,t}^2$) is the absolute (squared) cross-sectional average returns, and $u_{i,t}$ is the error term. Chang, Cheng, and Khorana (2000) demonstrate that the asset pricing model suggests a positive linear relationship between CSAD and absolute market return. However, in the wake of extreme price movements herd behavior or the market consensus appears which declines the value of $CSAD_t$ and makes the relationship non-linear. A significantly negative value of λ_2 in Equation 2 due to market consensus captures the non-linearity in the relationship between $R_{m,t}^2$ and $CSAD_t$ and indicates presence of herding behavior during the episodes of market swings.

A sound theoretical ground of Chang, Cheng, and Khorana (2000) model allows many studies (Guney, Kallinterakis, and Komba 2017; Kabir and Shakur 2018) to analyze the herding in the market using daily time series data. However, Arjoon, Bhatnagar, and Ramlakhan (2020) document that the use of daily time series or high-frequency data may aggravate the serial correlation issue, and thus make the parameters biased and mislead the inference drawn from them. To deal with the issue, Arjoon, Bhatnagar, and Ramlakhan (2020) modify Equation 1 and developed Equation 2 as follows:

$$CSAD_t = \lambda_0 + \lambda_1 \left|R_{i,t}\right| + \lambda_2 R_{m,t}^2 + \lambda_3 CSAD_{t-1} + \mathrm{u_t} \quad (3)$$

Where inclusion of $CSAD_{t-1}$ in the model eliminates the spurious element in the explanation of autocorrelation in $CSAD$. Following Christie and Huang (1995) and Chang, Cheng, and Khorana (2000), we use Newey and West (1987) heteroscedasticity and autocorrelation consistent estimators to address the autocorrelation issue in the estimates of regression coefficients.

One of the main flaws in the herding measure of (Fama 2014) is that it does not differentiate between herding based on fundamental valuation and non-fundamental information. Following Galariotis, Rong, and Spyrou (2015) and Dang and Lin (2016), we decompose the variation in CSAD based on the fundamental and non-fundamental information and identify whether herding in ESG stocks is based on fundamental analysis (spurious herding) or following the peers. To differentiate between fundamental and non-fundamental herding, we use the five-factors capital asset pricing model proposed by Fama and French (2015). Whereas the unexplained part of the CSAD of return represents herding based on non-fundamental information. For the decomposition of CSAD, we follow Dang and Lin (2016), and use the following models:

$$CSAD_t = \lambda_0 + \lambda_1 \left|R_{m,t} - R_{f,t}\right| + \lambda_2 |HML|_t + \lambda_3 |SMB|_t + \lambda_4 |RMW|_t + \lambda_5 |CWA|_t + \mathrm{u_t} \quad (4)$$

$$CSAD_{t,NON-FUNDAMENTAL} = u_t \quad (5)$$

$$CSAD_t = CSAD_{t,FUNDAMENTAL} + CSAD_{t,NON-FUNDAMENTAL} \quad (6)$$

Where, $R_{m,t}$ is the market return at time t, $R_{f,t}$ represents the risk-free rate, HML is the difference between the returns of high and low M/B stock portfolios, SMB is the difference between small stocks returns and returns of big stock portfolios, RMW is the robust minus weak stock portfolios, CWA is the difference between high and low investment firms stock portfolio, and u_t is the error term. Finally, to test whether the herding is driven by fundamental or non-fundamental factor, we develop the following model:

$$CSAD_{t,FUNDAMENTAL} = \lambda_0 + \lambda_1 |R_{m,t}| + \lambda_2 R_{m,t}^2 + \lambda_3 CSAD_{t-1} + u_t \quad (7)$$

$$CSAD_{t,NON-FUNDAMENTAL} = \lambda_0 + \lambda_1 |R_{m,t}| + \lambda_2 R_{m,t}^2 + \lambda_3 CSAD_{t-1} + u_t \quad (8)$$

We also examine the herding behavior in various market conditions for instance bear and bull market conditions. We use Chiang and Zheng (2010) model to test our hypothesis. This method is considered more robust than the Tan et al. (2008) approach, which splits the sample into two and estimates different models for the subsamples (Economou, Kostakis, and Philippas 2011). We use the below-mentioned model to test the asymmetric herding behavior based on market returns.

$$CSAD_t = \lambda_0 + \lambda_1 D_U |R_{m,t}| + \lambda_2 D_D R_{m,t}^2 + \lambda_3 D_D CSAD_{t-1} + u_t \quad (9)$$

$$CSAD_t = \lambda_0 + \lambda_1 D_U |R_{m,t}| + \lambda_2 D_U R_{m,t}^2 + \lambda_3 D_U CSAD_{t-1} + u_t \quad (10)$$

Where D_U (D_D) is the dummy variable that takes value equal to 1 if $R_{m,t} > 0$ ($R_{m,t} < 0$), and 0 otherwise. We estimate Equation 9 for both the fundamental and non-fundamental components of the CSAD to test the underlying mechanism of herding, if any. The statistically significant and negative coefficient of λ_2 and imply herding during bear and bull market days, respectively.

Additionally, we also test whether ESG investors herd during the GFC. We follow Chiang and Zheng (2010) model to test this hypothesis, which is stated as:

$$CSAD_t = \lambda_0 + \lambda_1 D_{crisis} |R_{m,t}| + \lambda_2 D_{crisis} R_{m,t}^2 + \lambda_3 D_{crisis} CSAD_{t-1} + u_t \quad (10)$$

Where D_{crisis} is a dummy variable that takes the value of 1 if *t* falls during the period of GFC and 0 otherwise. We estimate Equation (10) separately for both the fundamental and non-fundamental components of the CSAD to test whether the herding in the market, if any, is based on fundamental or non-fundamental information. The statistically significant and negative coefficient of λ_2 imply herding during the GFC.

Finally, we apply Equation (10) to examine whether investors herd in the US ESG stocks during COVID-19, lockdown and post-lockdown episodes one-by-one.

2.2.The data and basic statistics

The envisaged data for this study comprises of daily closing prices of the constituents of MSCI USA ESG leader index and spans over January 03, 2007 to September 30, 2020. The daily stock prices ($P_{i,t}$) are extracted from Datastream and the stock returns are computed as $R_{i,t}$=100 x [log($P_{i,t}$) – Log($P_{i,t-1}$)]. To minimize the effect of outliers, we winsorized the stock returns at 1st and 99th percentiles. Our final sample includes 3,493 (471) and 172 daily observations for full sample (GFC) and COVID-19 pandemic respectively. $R_{m,t}$ is the equally-weighted average portfolio returns of all the *m* constituent stocks of the index on day *t*, while $CSAD_t$ is computed following Equation (1). Panel A of Table 1 reports the descriptive statistics of $R_{m,t}$ and $CSAD_t$ over the whole sample period and during the episodes of GFC and COVID-19 pandemic. The panel shows that average returns (and SD) of ESG stocks are highest during Covid-19 pandemic, followed by GFC and full sample periods. This finding sounds consistent with the theory of the safe-have property of the ESG stocks (Rubbaniy et al. 2021) during down market times. Panel B of Table 1 provides further insights about the dynamics of our variables of investigation by reporting the Ljung-Box serial correlation and Augmented Dickey-fuller test statistics. The highly significant and fairy large values of the Ljung-Box serial correlation test statistics for higher order serial correlations suggest the informational inefficiencies in the pricing process (Arjoon, Bhatnagar, and Ramlakhan 2020). Our reported values of Augmented Dickey-fuller test strongly reject the presence of unit root in both time series of $R_{m,t}$ and $CSAD_t$ over the whole sample period and during the episodes of GFC and COVID-19 pandemic.

Insert Table 1 about here

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3. Results and Discussions

This section discusses the results of our study to answer our research questions.

3.1.Does herding exist in the US ESG leader stocks?

Table 2 presents the estimation results of the baseline CSAD model specified in Equation (3). As explained earlier, a negative herding coefficient λ_2 on $R_{m,t}^2$ is taken as evidence of herd behaviour in the ESG stocks. All estimations use the Newey-West heteroscedastic and autocorrelation correction for standard errors (Newey and West 1987). Our results in Column 4 of Table 2 suggest the presence of herding in the ESG market, as λ_2 is negative and statistically significant at the 1% level of significance. It implies that even though the US is a developed market with many sophisticated and professional investors and superior sources of information collection, many investors might be prone to suppress their personal information or signals and mimic their peers'

trading behaviour. The finding is consistent with previous studies (Ukpong, Tan, and Yarovaya 2021) who find evidence of herding at the industry level in the US. The findings of the study contradict the result of Chang, Cheng, and Khorana (2000) and Chiang and Zheng (2010), who find no evidence of herding in the US equity markets.

Insert Table 2 about here

Table 2 also reports the results of Equations (7) and (8), which estimate the herding based on fundamentals (also called spurious herding) and non-fundamental (intentional herding) information, respectively. Herding based on fundamentals refers to the notion that many sophisticated investors react similarly to new fundamentals-based information during both bear and bull market conditions; while, non-fundamental or intentional herding comes from the idea that naïve and noise traders may also contribute to herding by tracking and following their informed counterparts. We find evidence of market-wide herding during the sample period with least (or almost no) reference to fundamentals factors; however, our results report strong evidence of herding based on non-fundamental factors. This finding further supports the idea that jumping on the bandwagon of ESG stocks trading is due to following the peers and not driven by the fundamental analysis of the investors.

3.2. Is the herding behavior of the investors in the US ESG leader stocks asymmetric during bull and bear market conditions?

Table 3 reports the results of herding behaviour in the US ESG stocks on days with bull and bear market conditions and computed using the model specified in Equation (9). A statistically significant and negative coefficient of $R_{m,t}^2$ in Column 4 of Table 3 confirms the presence of herding in ESG stocks in the US market during both bull and bear market conditions. These findings are in line with several studies, which report that investors exhibit herding during up (Tan et al. 2008; Galariotis, Krokida, and Spyrou 2016; Zheng, Li, and Chiang 2017; Arjoon, Bhatnagar, and Ramlakhan 2020) and down (Tan et al. 2008; Fu and Lin 2010; Lao and Singh 2011; Duygun, Tunaru, and Vioto 2021) market conditions.

Insert Table 3 about here

Table 3 also reports whether the herd investing in the US ESG stocks is driven by fundamental or non-fundamental factors during bull and bear market conditions. Our results in Column 4 of Table 3 indicate that investors herd in ESG stocks during both bull and bear market situations and in both market conditions; however, overall herding is significantly driven by noise or non-fundamental traders. We also observe that the role of non-fundamental based herding in explaining overall herding is much higher during the bull market conditions compared to bear market situations. Our findings are in contradiction with the results of Indārs, Savin, and Lublóy (2019), who find no evidence of fundamental herding during up and down-market conditions. Our findings show that investors suppress their own beliefs and fundamental evaluations during both bull and bear market conditions and follow the informed or sophisticated investors, which may lead to market inefficiency, drive asset prices away from fundamental values, and cause asset mispricing (Hwang and Salmon 2004; Hung, Lu, and Lee 2010). Our results also show that the role of non-fundamental factors in explaining herding in the US ESG stocks is not symmetric across fundamental and non-fundamental informational factors.

3.3.Do investors herd in the US ESG leader stocks during times of global financial crisis?

Numerous studies report that herding behaviour is more prevalent during turbulent times (Chang, Cheng, and Khorana 2000; Arjoon, Bhatnagar, and Ramlakhan 2020) compared to times of normal market. We also investigate whether ESG stock investors herd during times of GFC. Table 4 reports the results of investors' herd behavior during the GFC, and whether herding in GFC is driven by fundamental or non-fundamental factors. Our results confirm the existence of significant market-wide herding during the GFC. More importantly, the herding during the GFC is mainly driven by noise traders or non-fundamental factors. If we compared our results in Table 4 with that of Table 2, there are two very clear observations: (1) herding during GFC is significantly higher than overall herding; and (2) the role of intentional herding to explain overall herding is dominant in both cases and remains higher during GFC. These findings suggest that ESG investors suppress their own beliefs and fundamental evaluations and mimic each other's behaviour, which is prevalent during the GFC.

Insert Table 4 about here

Our findings are consistent with some of the mainstream literature which documents that investors exhibit herding behaviour in the financial crisis (Indārs, Savin, and Lublóy 2019; Arjoon, Bhatnagar, and Ramlakhan 2020; Galariotis, Rong, and Spyrou 2015; Chang, Cheng, and Khorana 2000). Furthermore, our findings are also consistent with Clements et al. (2017) who find evidence of herding in the US equity market during the GFC, European debt crisis and Chinese stock market crash of 2015. The results complement the study of BenSaïda (2017) who conclude that herding is present in almost every sector of the US stock market during turmoil periods.

3.4. Do investors herd in the US ESG leader stocks during COVID-19 and lockdown?

The recent outbreak of COVID-19 is believed to have an unprecedented effect on global financial markets and existing studies already document the evidence of herding during COVID-19 in various financial markets, including capital markets (Espinosa-Méndez and Arias 2021; Kizys, Tzouvanas, and Donadelli 2021; Ukpong, Tan, and Yarovaya 2021), cryptocurrency markets (Susana, Kavisanmathi, and Sreejith 2020; Yarovaya, Matkovskyy, and Jalan 2021; Wu, Yang, and Zhao 2020; Shrotryia and Kalra 2021), and energy stocks (Chang, Cheng, and Khorana 2000).To add to this debate, we also investigate whether herding behavior in ESG stocks exists during the COVID-19. Panel A of Table 5 reports the evidence of market-wide herding during various market conditions (COVID-19, lockdown and post-lockdown), and concerning both fundamental and intentional factors. Our findings show that herd investing is prevalent in the US ESG leader stocks during the sample period of COVID-19. In addition, herding during COVID-19 is completely explained by the intentional motives of the investors and not by the sophistication of their fundamental analysis. Our findings are in contradiction to Chang, Cheng, and Khorana (2000) who find no evidence of herding in their sample of energy (renewable and fossil fuel) market of the US, Europe, and Asia. However, our finding is consistent with Wu, Yang, and Zhao (2020), who report the significant prevalence of herding in Chinese stocks during COVID-19. Our findings are also aligned with some studies (Espinosa-Méndez and Arias 2020; Espinosa-Méndez and Arias 2021), who provide evidence of significant herding in Australian and European stock markets during COVID-19. A comparison of our results in Table 5 and Table 4 further shows that herding in the US ESG leader stocks is not only present during both GFC and COVID-19 but has also been much higher during COVID-19 compared to the GFC. These findings generalize the conclusion of Table 4 in stating that ESG investors ignore their own beliefs and follow the footprints of each other during the down-market times.

An exponential global spread of COVID-19 resulted in unprecedented lockdown and frozen transportation and industries around the world in addition to an unmatched plummet in oil demand. A few existing studies investigate the financial market response to various factors during lockdown. For instance, Rubbaniy et al. (2021) document a significantly positive impact of the oil price shock on European stock indices during both lockdowns and post-lockdowns, while COVID-19 has an adverse impact on these indices in the same periods. We also investigate herding in the US ESG leader stocks during lockdown and post-lockdown in the US and the results are reported in Panels B and C of Table 5 respectively. Our results show that herding in the ESG leader stocks of the US is not only present during lockdown but also remained significant during post lockdown periods. However, in both the lockdown and post-lockdown period the overall herding was driven by intentional herding without any contribution by fundamental factors. In addition, herding during lockdown is higher compared to the post-lockdown sample period. Our results are inconsistent (consistent) with (Rubbaniy and Polyzos 2020), who find no evidence (significant presence) of herding in crypto currency market during lockdown (post-lockdown).

Insert Table 5 about here

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4. Conclusions

The main aim of this study is to investigate the herding behaviour in the US ESG leader stocks and determine whether the herding is driven by fundamental or non-fundamental factors during bear, bull and extreme market conditions. The study employs the CSAD model developed by Chang, Cheng, and Khorana (2000) on the daily data of the US ESG leader stocks and uses Fama and French (2015) five-factor model to differentiate the intentional herding from the spurious one. Overall, our results confirm market-wide herding in the US ESG leader stocks, which is mainly driven by non-fundamental factors. Our findings are consistent with (Ukpong, Tan, and Yarovaya 2021), who report industry-level herding in the US stock market. The results of the study refute the assertion made by Chiang and Zheng (2010) that US equity investors do not follow the herds.

Our findings indicate that ESG investors in the US display herding behaviour during both bear and bull market conditions, but herding is substantially characterized by intentional factors rather than fundamental evaluations in both of the market situations. Our results show that ESG investors in the US involve in herd investing during the global financial crisis, which is in line with existing literature (Arjoon, Bhatnagar, and Ramlakhan 2020; BenSaïda 2017; Galariotis, Rong, and Spyrou 2015; Indārs, Savin, and Lublóy 2019). Lastly, we find that the ESG investors in the US suppress their own beliefs and mimic others trading strategies during COVID-19, lockdown, and post-lockdown days. Herding during COVID-19, lock-down, and post-lockdown days is primarily based on non-fundamental factors and completely ignores fundamental evaluation by the investors in their investment decisions.

The findings of the study have several implications for the investor, portfolio managers, policymakers and regulators. First, while making investment decisions, investors and portfolio managers must consider that prices may differ from intrinsic values when herding is driven by non-fundamental factors. Second, herding creates sub-optimal diversification as its difficult for the investors to identify negatively correlated stocks. As a result, investors may need to invest in a wider range of stocks in times of market herds to achieve the same level of diversification as they would do in a market without herding. Third, intentional herding may result in asset mispricing, creates market inefficiency and lowers the portfolio diversification benefits; thus, knowing about herding may help investors and portfolio managers make more informed decisions. Finally, regulators must ensure that all pertinent information is freely accessible to all investors; otherwise, investors can imitate their peers due to difficulty in accessing the information, and creating inefficiency in the market.

Table 1: Descriptive Statistics

Panel A: Summary Statistics of CSAD and log portfolio returns						
	Mean	Median	SD	Skewness	Kurtosis	N
			Full sample			
CSAD	0.984	0.899	0.445	1.137	6.822	3493
Portfolio Return (%)	1.066	0.592	1.396	2.578	9.722	3493
			Global Financial Crisis			
CSAD	1.534	1.468	0.589	-0.200	3.854	471
Portfolio Return (%)	1.713	1.190	1.596	1.374	4.375	471
			COVID-19 Pandemic			
CSAD	1.428	1.367	0.589	0.751	6.091	172
Portfolio Return (%)	1.739	1.307	1.653	1.342	4.180	172

Panel B: Ljung-Box Serial Correlation and Augmented Dicky-Fuller tests				
	Lag 1	Lag 5	Lag 10	ADF
			Full sample	
CSAD	965.6***	2507.28***	5533***	-28.44***
Portfolio Return (%)	59.78***	141.97***	370.41***	-62.77***
			Global Financial Crisis	
CSAD	88.40***	219.37***	455.27***	-11.20***
Portfolio Return (%)	9.03***	24.37***	97.41***	-18.68***
			COVID-19 Pandemic	
CSAD	20.62***	52.65***	93.70***	-8.84***
Portfolio Return (%)	10.85***	39.93***	92.87***	-11.75***

Notes: Table 1 reports the basic statistics of CSAD and portfolio returns (R_m) of the US ESG leader stocks over the sample time span of January 03, 2007 to September 30, 2020. Panel A provides the descriptive statistics of two variables of interest. Panel B presents Ljung-Box test statistics for Lag 1, 5 and 10 as well as Augmented Dickey Fuller test for both time series. ***,**, * shows the significance at 1%,5% and 10% respectively.

Table 2: Herd investing in ESG stocks

Variables	Intercept	|Rmt|	Rmt^2	$CSAD_{t-1}$	Adj.R^2
Overall	0.274***	0.336***	-0.065***	0.562***	0.620
	(16.790)	(21.339)	(-25.939)	(27.361)	
Intentional	-0.052***	0.332***	-0.064***	-0.105***	0.307
	(-2.895)	(19.931)	(-24.173)	(-4.750)	
Fundamental	0.326***	0.005***	-0.001***	0.667***	0.985
	(152.700)	(3.238)	(-3.970)	(288.658)	

Notes: Table 2 reports the estimated coefficients for the following models: $CSAD_t = \lambda_0 + \lambda_1|R_{i,t}| + \lambda_2 R_{m,t}^2 + \lambda_3 CSAD_{t-1} + u_t$ (total herding); $CSAD_{t,FUNDAMENTAL} = \lambda_0 + \lambda_1|R_{m,t}| + \lambda_2 R_{m,t}^2 + u_t$ (fundamental herding); $CSAD_{t,NON-FUNDAMENTAL} = \lambda_0 + \lambda_1|R_{m,t}| + \lambda_2 R_{m,t}^2 + u_t$ (non-fundamental herding). Where $CSAD_t$ is the cross-sectional absolute deviation of stock returns with respect to cross-sectional average return $R_{m,t}$. T-statistics are reported in the parentheses. ***,**, * shows the significance at 1%,5% and 10% respectively. All estimations use the Newey & West (1987) heteroscedastic and autocorrelation corrected standard errors.

Table 3: Herd investing in ESG during bear and bull market

Variables	Intercept	|Rmt|	Rmt^2	$CSAD_{t-1}$	Adj.R^2
Bull Market					
Overall	0.222***	0.406***	-0.074***	0.702***	0.844
	(28.754)	(14.721)	(-17.688)	(35.625)	
Intentional	0.264***	0.334***	-0.066***	-0.162***	0.375
	(33.315)	(13.090)	(-17.209)	(-9.031)	
Fundamental	-0.042***	0.071***	-0.009***	0.865***	0.972
	(-11.233)	(10.620)	(-8.250)	(114.282)	
Bear Market					
Overall	0.026***	0.374***	-0.074***	0.762***	0.905
	(9.195)	(15.159)	(-11.816)	(51.538)	
Intentional	-0.007***	0.276***	-0.048***	-0.109***	0.184
	(-2.538)	(11.126)	(-7.274)	(-7.057)	
Fundamental	0.032***	0.097***	-0.026***	0.871***	0.976
	(16.189)	(9.335)	(-7.651)	(106.151)	

Notes: Table 3 reports the estimated coefficients for the following models: $CSAD_t = \lambda_0 + \lambda_1 D_U \left|R_{m,t}\right| + \lambda_2 D_U R_{m,t}^2 + \lambda_3 D_D \left|R_{m,t}\right| + \lambda_4 D_D R_{m,t}^2 + u_t$ (total herding); $CSAD_{t,FUNDAMENTAL} = \lambda_0 + \lambda_1 D_U \left|R_{m,t}\right| + \lambda_2 D_U R_{m,t}^2 + \lambda_3 D_D \left|R_{m,t}\right| + \lambda_4 D_D R_{m,t}^2 + u_t$ ((fundamental herding); $CSAD_{t,NON-FUNDAMENTAL} = \lambda_0 + \lambda_1 D_U \left|R_{m,t}\right| + \lambda_2 D_U R_{m,t}^2 + \lambda_3 D_D \left|R_{m,t}\right| + \lambda_4 D_D R_{m,t}^2 + u_t$ ((non-fundamental herding). Where $CSAD_t$ is the cross-sectional absolute deviation of stock returns with respect to cross-sectional average return $R_{m,t}$. D_U is a dummy variable that takes the value 1 on days when the market returns is positive and 0 otherwise; D_D is a dummy variable that takes the value 1 on days when the market return is negative and 0 otherwise. T-statistics are reported in the parentheses. ***,**, * shows the significance at 1%,5% and 10% respectively. All estimations use the Newey & West (1987) heteroscedastic and autocorrelation corrected standard errors.

Table 4: Herd investing in ESG during global financial crisis

Variables	Intercept	|Rmt|	Rmt^2	$CSAD_{t-1}$	Adj.R^2
Overall	0.528***	0.414***	-0.083***	0.489***	0.525
	(7.469)	(9.260)	(-11.056)	(10.067)	
Intentional	0.200***	0.405***	-0.081***	-0.176***	0.300
	(2.846)	(8.971)	(-10.595)	(-3.577)	
Fundamental	0.328***	0.009***	-0.002***	0.665***	0.985
	(43.014)	(2.274)	(-2.365)	(136.433)	

Notes: Table 4 reports the estimated coefficients for the following models: $CSAD_t = \lambda_0 + \lambda_1 |R_{i,t}| + \lambda_2 R_{m,t}^2 + \lambda_3 CSAD_{t-1} + u_t$ (total herding); $CSAD_{t,FUNDAMENTAL} = \lambda_0 + \lambda_1 |R_{m,t}| + \lambda_2 R_{m,t}^2 + u_t$ (fundamental herding); $CSAD_{t,NON-FUNDAMENTAL} = \lambda_0 + \lambda_1 |R_{m,t}| + \lambda_2 R_{m,t}^2 + u_t$ (non-fundamental herding). Where $CSAD_t$ is the cross-sectional absolute deviation of stock returns with respect to cross-sectional average return $R_{m,t}$. We follow Chiang and Zheng (2010) to set the US GFC time span from March 01, 2008 to December 31, 2009. T-statistics are reported in the parentheses. ***,**, * shows the significance at 1%,5% and 10% respectively. All estimations use the Newey & West (1987) heteroscedastic and autocorrelation corrected standard errors.

Table 5: Herd investing in ESG during COVID-19, Lockdown and Post-lockdowns

Variables	Intercept	|Rmt|	Rmt^2	$CSAD_{t-1}$	Adj.R^2
Panel A: Herding During Covid-19					
Overall	0.498***	0.568***	-0.103***	0.373***	0.510
	(5.388)	(8.238)	(-9.376)	(4.465)	
Intentional	0.175*	0.553***	-0.100***	-0.283***	0.389
	(1.815)	(7.629)	(-8.762)	(-3.361)	
Fundamental	0.323***	0.015	-0.003	0.656***	0.946
	(15.885)	(1.266)	(-1.313)	(44.844)	
Panel B: Herd Investing in ESG during Lockdown					
Overall	1.281***	0.302	-0.096***	0.440***	0.490
	(3.575)	(1.394)	(-3.536)	(2.738)	
Intentional	0.957***	0.303	-0.095***	-0.240	0.593
	(2.535)	(1.363)	(-3.348)	(-1.419)	
Fundamental	0.325***	-0.001	-0.002	0.680***	0.956
	(3.745)	(-0.018)	(-0.268)	(18.323)	
Panel C: Herd Investing in ESG during Post-Lock down					
Overall	0.584***	0.459***	-0.085***	0.327***	0.486
	(5.587)	(8.118)	(-8.974)	(4.562)	
Intentional	0.289***	0.435***	-0.083***	-0.344***	0.366
	(2.607)	(7.101)	(-7.959)	(-4.725)	
Fundamental	0.295***	0.023	-0.002	0.671***	0.912
	(7.834)	(1.430)	(-0.575)	(24.473)	

Notes: Table 5 reports the estimated coefficients for the following models: $CSAD_t = \lambda_0 + \lambda_1 D_C|R_{m,t}| + \lambda_2 D_C R_{m,t}^2 + \lambda_3 D_L|R_{m,t}| + \lambda_4 D_L R_{m,t}^2 + \lambda_5 D_P|R_{m,t}| + \lambda_4 D_P R_{m,t}^2 + u_t$ (total herding); $CSAD_{t,FUNDAMENTAL} = \lambda_0 + \lambda_1 D_C|R_{m,t}| + \lambda_2 D_C R_{m,t}^2 + \lambda_3 D_L|R_{m,t}| + \lambda_4 D_L R_{m,t}^2 + \lambda_5 D_P|R_{m,t}| + \lambda_4 D_P R_{m,t}^2 + u_t$ (fundamental herding); $CSAD_{t,NON-FUNDAMENTAL} = \lambda_0 + \lambda_1 D_C|R_{m,t}| + \lambda_2 D_C R_{m,t}^2 + \lambda_3 D_L|R_{m,t}| + \lambda_4 D_L R_{m,t}^2 + \lambda_5 D_P|R_{m,t}| + \lambda_4 D_P R_{m,t}^2 + u_t$ (non-fundamental herding). Where $CSAD_t$ is the cross-sectional absolute deviation of stock returns with respect to cross-sectional average return $R_{m,t}$. We follow Rubbaniy et al., to set dates of COVID-19, lockdown and post-lockdown. T-statistics are reported in the parentheses. ***,**, * shows the significance at 1%,5% and 10% respectively.

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