Journal of Ecohumanism
2024
Volume: 3, No: 3, pp. 47 – 60
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i3.3326

Herding in ASEAN Stock Markets and COVID-19

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Abstract

Using the constituent stock data that comprise the chosen stock market indices, we investigate stock market herding in ASEAN stock markets and investigate if the ongoing COVID-19 epidemic affects the herding behavior. We examine whether investors in the following stock markets—Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam—display any herding behavior using the absolute dispersion or CSAD measure. Overall, our research suggests that herding behavior appears to be more common in ASEAN stock markets only when return volatility is low. The Vietnamese stock market appears to exhibit more "consistent" herding behavior among the ASEAN stock markets, particularly during the COVID-19 period. Consequently, our results imply that herding is not a common occurrence in the ASEAN stock markets and that investors in these markets exhibit greater irrationality during periods of low return volatility than they do under other market conditions.

Keywords: *Stock Herding; ASEAN; Stock Markets; COVID-19*

Introduction

In essence, stock market herding is a type of correlated trading in which investors in a specific market trade in tandem for a predetermined amount of time. By doing this, these investors give up on their own judgment of a stock or the market and mimic the consensus opinion of other investors, disregarding facts and fundamentals (Kizys et al., 2021). As a result, it's possible that the prices of securities will not reflect their true values (Adam and Sariouglu, 2020). Chauhan et al. (2020) claim that herding is an oddity that challenges the efficient market hypothesis because, behaviorally, it occurs because people believe that other people's behaviors will be preferable to their own, particularly during times of extreme volatility (Adam and Sariouglu, 2020).

The behavior of herding in the global stock markets (including developed, emerging and frontier stock markets) has been investigated by many authors, e.g. Christie and Huang (1995) in the U.S. stock markets; Chang et al. (2000) in the East Asian markets including Japan, Hong Kong, Korea, and Taiwan; Henker et al. (2006) in the Australian stock market; Almeida et al. (2012) in Latin American markets including Argentina, Brazil, Chile and Mexico; Chen and Demirer (2018) in the Taiwanese stock market; Medhioub and Chaffai (2018) in the GCC stock markets involving shariah-compliant stocks; Shantha (2019) in the Sri Lankan stock market; Ahmed et al. (2015) in the Spanish stock market; and more recently Adem and Sariouglu (2020) in the Turkish stock market; Arisanti (2020) in major ASEAN markets; Chauhan et al. (2020) in the Indian stock market; Choi and Yoon (2020) in the Korean stock markets; Economou (2019), Kizys et al. (2021) in the Balkan stock markets; Luu and Luong (2020) in the Taiwanese and Vietnamese stock markets; Ooi and Ahmad (2000) in 15 developing, advanced- and secondary-emerging markets; and Shrotryia and Kalra (2020) in the BRICS markets. Overall, it seems that there are differing opinions about whether herding occurs in these markets.

We investigate investor behavior in ASEAN stock markets by employing the methodology of De Almeida et al. (2012), which is based on the metrics and approaches of Christie and Huang (1995) and Chang et al. (2000), to test for the existence of herding behavior. Our research aims to address the following queries: (i) Do the ASEAN stock markets exhibit herd mentality? (ii) Are relationships in herding nonlinear? (iii) Does herding behavior change in a rising or falling market? (iv) Is herding behavior asymmetric under various market conditions, such as when market returns are positive or negative, when market activity is high or low, and when market volatility is low or high? v) Does COVID-19 affect herding behavior differently? To test for differences between the normal period and the COVID-19 period, we include

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dummy variables that reflect the COVID-19 and non-COVID-19 periods. The ASEAN stock markets, which comprise Singapore, Malaysia, Indonesia, the Philippines, Thailand, and Vietnam, as well as the U.S. stock market as a control market, are measured using the cross-section of absolute deviation (CSAD) for herding.

The Association of Southeast Asian Nations, or ASEAN, is an abbreviation for the nations that make up Southeast Asia. The ASEAN Declaration (Bangkok Declaration), which was signed by the five original ASEAN members—Indonesia, Malaysia, the Philippines, Singapore, and Thailand—formed the organization in 1967. Subsequently, a few more nations joined the association, bringing the total number of members to ten: ASEAN comprises the original members as well as Brunei, Cambodia, Laos, Myanmar, and Vietnam. The ASEAN Declaration outlines the organization's goals and objectives, which include promoting regional peace and stability through member nations' respect for justice and the rule of law as well as economic, trade, social, cultural, technical, scientific, educational, and administrative cooperation (visit https://asean.org/). With larger economies and more established financial markets than the other ASEAN members, countries like Malaysia, Thailand, and Indonesia may be regarded as more advanced emerging markets. Singapore, on the other hand, may have the most developed economy and financial markets among ASEAN members.

Overall, our research suggests that herding behavior appears to be more common in ASEAN stock markets only when return volatility is low. The Vietnamese stock market appears to exhibit more "consistent" herding behavior among the ASEAN stock markets, particularly during the COVID-19 period. Thus, compared to other market situations, our findings imply that investors appear to be more irrational when markets have minimal return volatility.

The remaining portions of this research are arranged as follows: While the data and technique employed in this study are presented in Section 3, the literature overview of the herding studies that served as the inspiration for our paper is provided in Section 2. The findings are discussed in Section 4, and the study is concluded in Section 5.

Literature Review

Stock market herding is correlated trading in which participants in a given market trade in the same way over an extended period of time. Investors who herd tend to give up on their own assessments of a stock. As a result, the price of assets may not reflect their underlying values since they mimic the activities of other investors or the consensus view (Adam and Sariouglu, 2020). The alternative, referred to as the "crowd effect" or stock market herding, is when a group of investors imitates the actions of a few (educated) investors without necessarily checking the veracity of the information (Kizys et al., 2021). Thus, herding is an oddity that behaviorally opposes the efficient market hypothesis (Chauhan et al., 2019). The efficient market hypothesis is predicated on the idea that other people's behaviors are preferable to one's own, particularly in times of extreme volatility (Adam and Sariouglu, 2020).

Previous studies that have investigated the behavior of herding in various stock markets include Christie and Huang (1995) in the U.S. stock market; Chang et al. (2000) in East Asian stock markets; Henker and Henker et al. (2006) in the Australian stock market; Almeida et al. (2012) in Latin American markets; Chen and Demirer (2018) in the Taiwanese stock market; Medhioub and Chaffai (2018) in the GCC stock markets; Shantha (2019) in the Sri Lankan stock market; Ahmed et al. (2015) in the Spanish stock market; and most recently Adem and Sariouglu (2020) in the Turkish stock market; Chauhan et al. (2020) in the Indian stock market; Choi and Yoon (2020) in the Korean stock markets; Economou (2019) across international markets including the EU; Kizys et al. (2021) in the Balkan stock markets; Luu and Luong (2020) in the Taiwanese and Vietnamese stock markets; and Shrotryia and Kalra (2020) in the BRICS markets. Based on an examination of these papers, it appears that results are, at best, inconsistent across these several marketplaces, with the majority of these studies employing the techniques suggested by Christie and Huang (1995) and Chang et al. (2000).

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One of the most frequently mentioned studies in the market herding literature is Christie and Huang's (1995) investigation. They investigate the actions of investors in the US stock markets. During this process, they create the metrics that are currently commonly used to analyze herding behavior in stock markets: the cross-sectional absolute deviation of returns (CSAD) and the cross-sectional standard deviation of returns (CSSD). Christie and Huang (1995) claim that when there is intentional herding activity, people will repress their own opinions in order to support the general market behavior. As a result, the returns on individual shares will resemble the market return more closely. However, their examination of U.S. equities shows very little evidence of herding using either strategy.

According to Chang et al. (2000), herd behavior will cause the absolute deviation of returns to grow non-proportionally during extreme market situations or even cause the dispersion to decrease as returns rise. In order to account for any nonlinearity between CSAD and market returns, they provide an alternative regression model that makes use of nonlinear regression parameters. They contend that as market returns rise, returns will fall (or rise at a diminishing rate) as a result of market herding. They investigate the herding phenomenon in the U.S. stock markets and East Asian markets, such as Hong Kong, Japan, South Korea, and Taiwan, using this model. They speculate that variations in the relative significance of institutional vs individual investors, the caliber and extent of disclosure, and the evolution of derivatives markets among nations influence the actions of investors. Comparing the less developed markets—South Korea and Taiwan—to the more developed ones—Japan, Hong Kong, and the United States—they generally discover more evidence of herding in the former. Additionally, they discover a noteworthy non-linear relationship between the underlying market returns in the Taiwan and South Korean stock markets and the equity return dispersions. Furthermore, they discover that the CSAD often rises in prosperous market environments but does not do so in falling ones.

Almeida, Costa, and Da Costa Jr. (2012) have studied herd behavior in key Latin American stock markets, such as those in Argentina, Brazil, Chile, and Mexico. They do not discover much evidence of herding behavior in the sample stock markets using Christie and Huang's (1995) model. But regardless of significant market shocks like the 9/11 and 2008 crisis or other market upheavals, Chang et al. (2000) found constant evidence of herding in the Chilean stock market. While there is no indication of herding in Brazil during the time of their investigation, it is only evident in Argentina and Mexico during times of low market volatility.

Using market-level data, Kizys et al. (2021) uncover evidence of herding behavior across over 70 foreign stock markets during the COVID-19 crisis covering the period between January – March 2020. Additionally, they discover that herding (or anti-herding) is significantly impacted by the level of rigor of the government's response, as measured by the Oxford Government Response Stringency index. Furthermore, they discover that limitations on short sales appear to be successful in reducing herding behavior in the relevant EU stock markets.

Economou (2019) examines if entry into the EU (Bulgaria, Croatia, Romania, and Slovenia) and the Eurozone (Slovenia) has had any impact on herding behavior in four frontier markets in Balkan countries using foreign sentiment indicators, such as the German VDAX and the U.S. CBOE VIX indices. Additionally, they look into the possibility of regional cross-market herding, or whether trade activity in three other markets influences herding in each of the four countries. The study's findings point to a predominance of cross-market herding dynamics in the area as opposed to those seen in each nation, pointing to a herding tendency that has been "imported".

Adem and Sarioglu (2020) provide evidence that investors' herding behavior appears to be affected by market conditions. They discover that herding increases during market downturns (and increases when daily data is used), suggesting that investors do not appear to act logically during these downturns. Additionally, they discover that asymmetric investor herding behavior is implied by the herding level being noticeably high during periods of high market volatility. The findings of Choi and Yoon's (2020) study, which show indications of herding behavior in Korean stock markets during downturns, corroborate this. Adverse herding behavior is shown during low-volatility and low-trading volume periods. Generally

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speaking, Choi and Yoon discover that investor sentiment, as measured by the implied volatility index derived from the KOSPI200 option, has an impact on herding behavior.

Additionally, it appears that herding behavior varies with market conditions during different market periods. Shantha (2019) finds evidence of herding in a frontier market of the Colombo Stock Exchange in Sri Lanka during the civil war period and in both up- and down-market days between 2000 and 2009. Ahmed et al. (2015), on the other hand, discover that Spanish investors are more logical and do not give up their personal information, as seen by the lack of herding behavior both before and after the 2008 financial crisis. According to this research, a rise in volatility during bear markets raises forecasters' uncertainty, which makes them rely more on Christie and Huang's (1995) rational asset pricing models, which result in returns that deviate from an overall mean return.

Using the approach suggested by Chiang and Zheng (2010), Medhioub and Chaffai (2018) investigate GCC Islamic stocks in order to assess herding behavior from 2006 to 2016. This study uses Shariah-compliant stocks from the GCC stock exchanges to try and link herding behavior to ethics and morals. They only discover substantial evidence of herd behavior in Qatar and Saudi Arabia. Additionally, evidence of herding behavior is detected during down-market periods in Saudi Arabia and Qatar when looking for any asymmetries in the herd behavior between the up- and down-market periods. Additionally, the authors discover that in Kuwait and the United Arab Emirates, the Islamic and conventional stock markets have a tendency to follow each other. This suggests a relationship between the two stock markets.

A few studies that focus on ASEAN stock markets are Arisanti (2020) in Indonesia, Malaysia, Thailand, and Vietnam; Ooi and Ahmad (2000) in 15 developing, advanced, and secondary-emerging markets, including several ASEAN stock markets like Indonesia, Malaysia, Philippines, and Singapore; Luu and Luong (2020) in an emerging market (Taiwan) and a frontier market (Vietnam) during the COVID-19 and H1N1 pandemics; and Gebkaa and Wohar (2013) in which herding is examined in global stock markets like Malaysia, Philippines, Singapore, and Thailand.

Gebkaa & Wohar (2013) look at whether herding is a universal occurrence and whether it varies over time, between nations, and between economic sectors. Their sample includes Singapore, Malaysia, Thailand, and the Philippines in addition to a number of developed and emerging economies, including the United States, France, Australia, Japan, and Argentina. They do not discover any indication of cross-national herding using the corresponding market-wide indicators. Nonetheless, they consistently observe evidence of herding in some sectoral indexes, primarily in the sectors of consumer services, basic materials, and oil and gas equities. Additionally, this study discovers that herding appears to have waned over time and is more common in rising markets than in down ones.

More recently, Luu and Luong (2020) investigate whether, during the H1N1 and COVID-19 pandemics, herding behavior differs in frontier markets (Vietnam) and emerging markets (Taiwan). Every stock listed on both markets between 2000 and 2020 is included in their sample. They discover relatively little evidence of herding, i.e., solely in the real estate and insurance sectors in Taiwan and Vietnam's materials and insurance industries, using Christie and Huang's linear model. However, they only discover five sectors in Taiwan and more evidence of herding in Vietnam (i.e., 12 sectors) when they use the state space model. In the Australian stock market between 2001 and 2002, herding within particular industry sectors is also examined by Henker et al. (2006). This study concludes that there is insufficient evidence of market-wide herding in the Australian equity market or within industry sectors, with the exception of the Property Trust industry sector.

Ooi and Ahmad (2020) use 15 stock markets in developing, advanced emerging, and secondary emerging markets between 2007 and 2016 to examine the impact of social determinants on herding behavior, including prosperity, education, ageing society, industry orientation, and gender. Four ASEAN stock markets—Indonesia, Malaysia, the Philippines, and Singapore—are included in his analysis. Herding is found in Singapore, Mexico, Poland, South Africa, China, and the Philippines, but is not found in Canada, Hong Kong, Japan, the United Kingdom, Brazil, Malaysia, Chile, Indonesia, or Russia.

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An investor's actions may alter in response to new information and announcements. Studying herding behavior surrounding Fed Funds Target Rate announcements by the U.S. Federal Reserve, Arisanti (2020) examines five ASEAN stock markets: Malaysia, Indonesia, Thailand, Vietnam, and the Philippines. The daily data of all 130 financial corporations that are listed on the five stock marketplaces is used in this study. Within seven days following the Fed Funds releases, the author observes evidence of herding behavior in the ASEAN markets. On the other hand, Shrotryia and Kalra (2020) examine herding behavior in normal and asymmetric circumstances from January 2011 to May 2019 as well as the impact of the major shift in banking policies in the BRICS stock markets. The only places where herding for asymmetric and normal circumstances is identified are China and South Africa. With the exception of Russia, there is some evidence of herding during turbulent times. Furthermore, there was a great deal of herding in the Indian and South African markets while a common depository institution was being established.

Even in down markets or crises, it appears that there is, at most, inconsistent evidence of stock market herding in global stock markets, including those in ASEAN, or that the evidence is not as strong as one might anticipate. There is conflicting information regarding whether herding occurs in a non-linear fashion. Although one would expect investors to herd more during a crisis or in a down market since the pressure to perform as well as their fellow investors is more severe during these crunch situations, herding appears to be more prominent in some cases during the up market in some stock markets.

Data and Methodology

Methodology

In their analysis of herding behavior in the American stock markets, Christie and Huang (1995) suggest two metrics for return dispersions: the average absolute deviation of a stock's return from the market return (CSAD) and the average deviation of a stock's return from the market return (CSSD). In essence, CSSD and CSAD are 20-day rolling dispersions of a stock's return from the return of the index on a given day, which are used to quantify herding behavior in individual stocks. The returns on individual stocks will diverge less from the return of the market index if there is herding. Stated differently, higher values in CSSD and CSAD suggest a lack of herding, whereas lower measures show signs of herding.

Christie and Huang (1995) explore whether herding behavior varies between the higher and lower tail of the market return distribution using these two measures. In this study, we define the upper and lower extremes for all markets in our sample using the CSAD measure and the 5 percent threshold. As a result, we anticipate that the (absolute) return dispersion will drop in the presence of severe or mild herding (upper or lower tail). Christie and Huang (1995) employ a model in their study to examine if herding occurs at the high and lower extremities of the market return distribution. Their model predicts that the coefficients of the lower and upper extremes of market returns will both be negative and statistically significant if investors herd during periods of extreme.

According to Chang et al. (2000), the conditional asset-pricing model would have predicted that, in the absence of herding behavior, the relationship between the return dispersions and market return would be linear and directly proportional. On the other hand, they speculate that if herding existed during market extremes, the CSAD measure would tend to grow non-proportionally or even decline as |r_(m,t) | rises. As a result, they provide a model that incorporates the absolute market return and the squared market return as independent variables in order to account for the non-linear relationship between the degree of equity return dispersions and the total market return.

In essence, a statistically significant negative squared market return coefficient would indicate the existence of herding in the stock market and would indicate non-linearity. In such a scenario, when mean returns rise, CSAD will grow at a falling pace (in moderate herding cases) or even decline (in extreme herding cases). Nonetheless, the CAPM's predictions are upheld if the squared market return coefficient is positive (or if it is negative but not statistically significant), which also suggests that there isn't any herding activity throughout the studied periods.

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Because Chang et al.'s model adds a coefficient to the quadratic component, it is more sensitive to nonlinearity between the mean return and the measure of dispersion. Studying asymmetrical herd behavior in stock markets as a function of observed volatility (high or low), traded volumes (high or low), or return (positive or negative) is made feasible by this model.

In this work, we test for herding in ASEAN stock markets around the current COVID-19 epidemic using the same methodology as De Almeida et al. (2012), who in turn followed Christie and Huang (1995) and Chang, Cheng, and Khorana (2000). The financial volatility and uncertainty of the Great Depression and the 2008 Financial Crisis are being replicated throughout the COVID-19 period, posing significant problems (Ibrahim et al., 2020). Nevertheless, we include dummy variables for both the COVID-19 and normal periods instead of testing for the herding behavior during the two periods independently. The following formula was put forth by Christie and Huang (1995) to examine herding behavior for extreme market return values at the 5% and 95% percentiles:

$$CSAD_t = \alpha + \beta_1 D^L + \beta_2 D^U + \beta_3 (D^{C19} \times D^L) + \beta_4 (D^{C19} \times D^U) + \varepsilon_t \quad [1]$$

where, DC19 is equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.

Chang, E. C., Cheng, J. W., & Khorana, A. (2000) and De Almeida et al. (2012) proposed a model based on CAPM and incorporating test for non-linearity by including r_(m,t)^2 in the equation:

$$CSAD_t = \alpha + \beta_1 |r_{m,t}| + \beta_2 r_{m,t}^2 + \beta_3 (D^{C19} \times |r_{m,t}|) + \beta_4 (D^{C19} \times r_{m,t}^2) + \varepsilon_t \quad [2]$$

We use the start date of the Chinese lockdown, November 19, 2019, as the starting point for the COVID-19 period, and extend it until the end of the sample period. When β_2 and (β_2+β_4) have negative and significant coefficients, it means that herding was more common before COVID-19 than it was after.

We also run the following models to see if the herding behavior is asymmetric during the up- and down-market periods (Equations [7] and [8]), the high and low volume of trading periods (Equations [9] and [10]), and the high and low volatility periods (Equations [11] and [12]). This is in addition to running Equations [5] and [6] above, following Chang et al. (2000) and De Almeida et al. (2012) and adding the dummy variable representing the COVID-19 period.

$$CSAD_t^{UP} = \alpha + \beta_1 |r_{m,t}^{UP}| + \beta_2 (r_{m,t}^{UP})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{UP}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{UP})^2\right) + \varepsilon_t \quad [3]$$

$$CSAD_t^{DN} = \alpha + \beta_1 |r_{m,t}^{DN}| + \beta_2 (r_{m,t}^{DN})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{DN}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{DN})^2\right) + \varepsilon_t \quad [4]$$

$$CSAD_t^{HL} = \alpha + \beta_1 |r_{m,t}^{HL}| + \beta_2 (r_{m,t}^{HL})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{HL}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{HL})^2\right) + \varepsilon_t \quad [5]$$

$$CSAD_t^{LL} = \alpha + \beta_1 |r_{m,t}^{LL}| + \beta_2 (r_{m,t}^{LL})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{LL}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{LL})^2\right) + \varepsilon_t \quad [6]$$

$$CSAD_t^{HV} = \alpha + \beta_1 |r_{m,t}^{HV}| + \beta_2 (r_{m,t}^{HV})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{HV}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{HV})^2\right) + \varepsilon_t \quad [7]$$

$$CSAD_t^{LV} = \alpha + \beta_1 |r_{m,t}^{LV}| + \beta_2 (r_{m,t}^{LV})^2 + \beta_3 (D^{C19} \times |r_{m,t}^{LV}|) + \beta_4 \left(D^{C19} \times (r_{m,t}^{LV})^2\right) + \varepsilon_t \quad [8]$$

where,

CSADUP and CSADDN refer to the up (high return) and down (low return) periods respectively,

CSADHL and CSADLL refer to the high and low volume of trading respectively, and,

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CSADHV and CSADLV refer to the high volatility and low volatility periods respectively.

All the models above are estimated using the OLS regression, using Newey and West (1987b) robust error estimation. Note that data for CSAD, |r_(m,t) | and r_(m,t)^2 are all stationary when tested using the ADF–Fisher and PP–Fisher.

We bring in the dummy variable DC19 to enable the coefficients for both pre-COVID-19 and COVID-19 periods be estimated simultaneously and extract the standard deviations of the coefficients for COVID-19 period (i.e. when DC19 equals to 1) to test the significance of coefficients. For example, in equation [5], the variance for the estimator for |r_(m,t) | when DC19 =1, is given by,

$$\hat{\sigma}_{\frac{\partial CSAD}{\partial |r_{m,t}|}}\Big|_{C19=1} = \sqrt{\text{var}(\hat{\beta}_1) + \text{var}(\hat{\beta}_3) + 2Cov(\hat{\beta}_1\hat{\beta}_3)} \quad [9]$$

Data

For each of the sample stock markets, we collect daily stock price and trading volume information for the constituent stocks between September 4, 2018, and November 18, 2020. For the same period, we additionally acquire the same data for each of the sample countries' representative stock market indices, which are as follows: The LQ45 Index for Indonesia, the SET50 Index for Thailand, the VN Index for Vietnam, the Bursa Malaysia KLCI for Malaysia, the Straits Times Index for Singapore, and the PSE Composite Index for the Philippines. Furthermore, we also get comparable data for all the stocks that make up the index, as well as for the Dow Jones 30 index. We delineate the normal period as falling between October 10, 2018 and October 15, 2019, and the COVID-19 period as starting on November 18, 2019, and ending at the conclusion of the sample period, which corresponds to the start of Wuhan, China's lockdown due to the coronavirus.

Descriptive Statistics

The descriptive data of CSAD for the pre-COVID-19 and COVID-19 periods are shown in Tables 3.1 and 3.2, respectively. For every country in the dataset, the COVID-19 period has greater CSAD measure's mean, standard deviation, median, and maximum values than the pre-COVID-19 period did. Nonetheless, compared to the pre-COVID-19 period, the minimum values of the CSAD measure for the Dow Jones, Indonesia, and the Philippines (Malaysia, Singapore, Thailand, and Vietnam) are lower in the COVID-19 period. The skewness score is more favorable throughout the COVID-19 period, with the exception of the Vietnamese market. Additionally, during the pre-COVID-19 and COVID-19 periods of this study, Indonesia and Dow Jones, respectively, had the highest and lowest means of the CSAD measure.

Table 3.1: Descriptive Statistics for the CSAD Measure before COVID-19

Statistics	Pre-COVID-19 period						
	Dow Jones	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Mean	0.0078	0.0193	0.0084	0.0116	0.0113	0.0108	0.0101
Median	0.0075	0.0185	0.0077	0.0119	0.0100	0.0104	0.0095
Maximum	0.0175	0.0411	0.0236	0.0243	0.0377	0.0214	0.0249
Minimum	0.0000	0.0097	0.0034	0.0000	0.0040	0.0061	0.0046
Std. Dev.	0.0030	0.0059	0.0032	0.0045	0.0046	0.0027	0.0031
Skewness	0.2176	1.2967	1.5138	-0.7187	2.0419	1.1614	1.4705
Kurtosis	4.1612	5.0400	5.9784	4.3680	9.3389	4.6361	6.4545
Jarque-Bera	16.9787	113.8569	187.1364	43.9693	604.1311	82.7433	215.2684

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DOI: https://doi.org/10.62754/joe.v3i3.3326

Probability	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 3.2: Descriptive Statistics for the CSAD Measure during COVID-19

Statistics	COVID-19 period						
	Dow Jones	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Mean	0.0118	0.0255	0.0124	0.0159	0.0163	0.0172	0.0122
Median	0.0104	0.0189	0.0109	0.0147	0.0110	0.0149	0.0112
Maximum	0.0576	0.1647	0.0479	0.0653	0.1071	0.0610	0.0352
Minimum	0.0000	0.0095	0.0048	0.0000	0.0043	0.0067	0.0047
Std. Dev.	0.0079	0.0195	0.0062	0.0090	0.0144	0.0086	0.0051
Skewness	2.6137	3.3009	2.3786	1.9075	3.2893	2.6263	1.2798
Kurtosis	12.7615	17.6179	10.9455	10.8147	16.2615	11.2662	5.0487
Jarque-Bera	1353.8590	2626.2660	889.7796	828.7035	2328.4280	983.1793	110.1766
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Findings

In this study, we aim to address the following queries: (i) Do the ASEAN stock markets exhibit herd mentality? (ii) Is there a nonlinear herding relationship? (iii) Does herding behavior change in a rising or falling market? (iii) Does herding behavior exhibit asymmetry in response to varying market conditions, such as favorable and unfavorable returns, high and low market activity, and low and high volatility? v) Does COVID-19 affect herding behavior differently?

Results from equations [1] through [8] are shown in this section; asterisks indicate important coefficients. The dependent variable in each regression model is CSAD. Equation [9] is used to get the standard errors for the corresponding coefficients for the COVID-19 timeframe. We will focus on the coefficients for D^L, D^U and r_(m,t)^2 initially. Herding behavior and nonlinearity in the relationship will be shown by a significant negative coefficient.

The findings of equation [1], where the extreme values of the market returns serve as the independent variables, are shown in Table 4.1. Herding behavior is only shown for the lower extremity of market return (significant negative coefficients) during the pre-COVID-19 period, with the exception of Singapore. Herding has not been observed during the COVID-19 pandemic. Vietnam has the lowest level of herding among the study countries, while the Philippines has the most.

Table 4.1: Herding Behavior during Low and High Market Returns

Equation [5]	Pre-Covid period		Covid period	
	D^L	D^U	D^L	D^U
Dow Jones	-0.0014**	0.0016**	0.0020**	0.0137**
Indonesia	-0.0031**	0.0069**	0.0024	0.0232**
Malaysia	-0.0015**	0.0075**	0.0018**	0.0094**
Philippines	-0.0035**	0.0027**	0.0003	0.0129**
Singapore	0.0002	0.0065**	0.0045**	0.0279**
Thailand	-0.0025**	0.003**	0.0030**	0.0139**
Vietnam	-0.0012**	0.0057**	0.0010	0.0053**

Note:
Equation [5] $CSAD_t = \alpha + \beta_1 D^L + \beta_2 D^U + \beta_3 (D^{C19} \times D^L) + \beta_4 (D^{C19} \times D^U) + \varepsilon_t$
D^{C19} is equaled to 1 for COVID-19 period, 0 for pre-COVID-19 period.
**significant at 5%, *significant at 10%.

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Volume: 3, No: 3, pp. 47 – 60
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https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i3.3326

The herding behavior seen in Table 4.1 appears to vanish when using the model proposed by Chang et al. (2000) and adopted by De Almeida et al. (2012), i.e. by integrating nonlinearity through the r_(m,t)^2 term. On the other hand, herding is only shown for the Dow Jones, the Philippines, and Vietnam, as seen in Table 4.2 (with substantial negative coefficients for r_(m,t)^2). Furthermore, with more than seven times the Dow Jones and more than three times the Philippines stock market, Vietnam has the highest degree of herding behavior.

Table 4.2: Herding Behavior Accounting for Nonlinearity

Equation [6]	Pre-COVID-19 period		COVID-19 period	
	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$
Dow Jones	0.1618**	-0.758	0.3846**	-0.880*
Indonesia	0.281	4.8309	0.4739**	2.7736**
Malaysia	-0.0235	33.9768**	0.5561**	-0.8789
Philippines	0.436**	-6.9191	0.5453**	-1.9619**
Singapore	0.1272	27.8628**	0.6467**	6.1325
Thailand	-0.2608**	22.7132**	0.4416**	-0.3744
Vietnam	0.2119**	1.7096	0.5142**	-6.4929**

Note:
Equation [6]: $CSAD_t = \alpha + \beta_1|r_{m,t}| + \beta_2 r_{m,t}^2 + \beta_3(D^{C19} \times |r_{m,t}|) + \beta_4(D^{C19} \times r_{m,t}^2) + \varepsilon_t$
D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.
**significant at 5%, *significant at 10%.

In line with De Almeida et al. (2012), we run more tests to look for any disparities in the herding behavior under various market situations. Applying equation [2] to the following market conditions—positive and negative market returns, high and low volume, and high and low market volatility—allows us to do additional analysis.

The results for positive and negative market returns are displayed in Tables 4.3 and 4.4, respectively. It's interesting to note that neither the COVID-19 nor non-COVID-19 phases show any signs of herding during good market returns. This result contrasts with that of De Almeida et al. (2012), who found evidence of herding behavior during good market returns but not during negative ones in their research of stock markets in Argentina, Brazil, China, Mexico, and the United States.

Table 4.3: Herding Behavior during Positive Market Returns

Equation [7]	Pre-COVID-19 period		COVID-19 period	
	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$
Dow Jones	0.0447	1.6751	0.3945**	-0.7559
Indonesia	0.381	8.9037	0.6502**	2.1845**
Malaysia	-0.0332	52.8226**	0.6960**	-1.8024
Philippines	-0.016	8.89*	0.4147**	-0.6331
Singapore	-0.012	33.2111**	0.3812*	18.1748**
Thailand	-0.288*	27.6691**	0.5284**	-0.7679
Vietnam	-0.0414	15.6611**	0.2948**	-0.3267

Note:
Equation [7] $CSAD_t^{UP} = \alpha + \beta_1|r_{m,t}^{UP}| + \beta_2(r_{m,t}^{UP})^2 + \beta_3(D^{C19} \times |r_{m,t}^{UP}|) + \beta_4\left(D^{C19} \times (r_{m,t}^{UP})^2\right) + \varepsilon_t$
D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.
**significant at 5%, *significant at 10%.

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DOI: https://doi.org/10.62754/joe.v3i3.3326

Of the countries, only Vietnam exhibits herding behavior to a relatively large degree (-8.8125) when market returns are negative (Table 4.4). Therefore, there is no sign of herding behavior when the market is split into positive and negative returns (except for Vietnam, where returns are negative). This could suggest that herding behavior is not typically induced by market return.

Table 4.4: Herding Behavior during Negative Market Returns

Equation [8]	Pre-COVID-19 period		COVID-19 period	
	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$
Dow Jones	0.0811	1.4486	0.2811**	-0.1410
Indonesia	0.3942	-3.5795	0.6530**	-2.7615
Malaysia	-0.1436	35.6503**	0.4306**	-0.0140
Philippines	-0.0359	8.5469	0.3217**	-0.0956
Singapore	0.1631	27.0326**	0.6829**	1.6959
Thailand	-0.2913**	21.2929**	0.3176**	0.6063
Vietnam	0.2449**	-0.3139	0.6242**	-8.8125**

Note:

Equation [8] $CSAD_t^{DN} = \alpha + \beta_1 \lvert r_{m,t}^{DN}\rvert + \beta_2 (r_{m,t}^{DN})^2 + \beta_3 (D^{C19} \times \lvert r_{m,t}^{DN}\rvert) + \beta_4 \left(D^{C19} \times (r_{m,t}^{DN})^2\right) + \varepsilon_t$

D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.

**significant at 5%, *significant at 10%.

We find slightly more evidence of the presence of herding behavior when the sample data is split into high and low market volume periods, as seen in Tables 4.5 and 4.6, respectively, than when the markets are split into positive and negative returns. With the exception of the Philippines and Vietnam, no herding tendency appears to have been seen during the pre-COVID-19 period despite the huge volume of trades (Table 4.5). There is a lot of herding behavior in the Vietnamese market. On the other hand, evidence of herding behavior appears to be limited to the Philippines during the low volume of trading, with a relatively high herding degree.

Table 4.5: Herding Behavior during High Market Volume

Equation [9]	Pre-COVID-19 period		COVID-19 period	
	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$
Dow Jones	0.215*	-3.2418	0.3744**	-0.9283
Indonesia	-0.6085	41.9812**	0.2380*	4.1921**
Malaysia	-0.0453	32.4081**	0.5891**	-1.8242
Philippines	0.3009*	-4.0503	0.4690**	-1.3974*
Singapore	-0.0566	33.7401**	0.3005	14.7453**
Thailand	-0.2555	20.614**	0.4329**	-0.580
Vietnam	0.146**	2.0354	0.4964**	-6.8019**

Note:

Equation [9] 〖CSAD〗_t^HL=α+β_1 |r_(m,t)^HL |+ β_2 (r_(m,t)^HL)^2+β_3 (D^C19×|r_(m,t)^HL |)+ β_4 (D^C19×(r_(m,t)^HL)^2)+ε_t

DC19 equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.

**significant at 5%, *significant at 10%.

Table 4.6: Herding Behavior during Low Market Volume

Equation [10]	Pre-COVID-19 (D^{C19}=0)		COVID-19 (D^{C19}=1)	
	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$	$\lvert r_{m,t}\rvert$	$r_{m,t}^2$
Dow Jones	**0.1382****	**0.0289**	**0.3856****	**-0.6118**
Indonesia	**0.7045****	**-12.2647**	**0.5161***	**5.4885**

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DOI: https://doi.org/10.62754/joe.v3i3.3326

Malaysia	**-0.0084**	**23.2743***	**0.3497****	**3.1232**
Philippines	**0.5823****	**-16.2173***	**0.6440****	**-4.4612**
Singapore	**0.5167***	**6.6337**	**1.0073****	**-3.1349**
Thailand	**-0.287****	**23.872****	**0.4035****	**0.8281**
Vietnam	**0.0722**	**12.9635****	**0.3910****	**-1.5810**

Note:

Equation [10] $CSAD_t^{LL} = \alpha + \beta_1|r_{m,t}^{LL}| + \beta_2(r_{m,t}^{LL})^2 + \beta_3(D^{C19} \times |r_{m,t}^{LL}|) + \beta_4\left(D^{C19} \times (r_{m,t}^{LL})^2\right) + \varepsilon_t$

D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.

**significant at 5%, *significant at 10%.

The outcomes of equations [7] and [8] are shown in Tables 4.7 and 4.8, respectively. The markets in these models are separated into periods of high and low market return volatility. As Table 4.4 demonstrates, the results obtained during the period of negative market returns are quite similar to the result obtained during periods of high market volatility, i.e., evidence of herding behavior is only found in the Vietnamese market during the COVID-19 phase.

On the other hand, herding behavior appears to be more common during the pre-COVID-19 and COVID-19 periods when market volatility is low (see Table 4.8). For both times, herding behavior is observed in the Philippines, Indonesia, and the Dow Jones. Herding habits, on the other hand, appear to be limited to Malaysia and Thailand during the COVID-19 period. Remarkably, Vietnam's herding behavior (seen in earlier tables) appears to vanish during the COVID-19 period. Rather, herding appears to be present for Thailand, Malaysia, Indonesia, the Philippines, and the Dow Jones. Furthermore, the size of the herding coefficient (r_(m,t)^2) is observed to be comparatively larger than that which is reported in earlier tables.

Table 4.7: Herding Behavior during High Market Volatility

Equation [11]	**Pre-COVID-19 period**		**COVID-19 period**	
	$\|r_{m,t}\|$	$r_{m,t}^2$	$\|r_{m,t}\|$	$r_{m,t}^2$
Dow Jones	0.0611	0.2564	0.2464**	0.1643
Indonesia	-0.456	33.4307**	0.3992**	3.0172**
Malaysia	-0.0373	27.4729**	0.3740**	1.4843
Philippines	-0.0266	3.6837	0.2559**	0.2964
Singapore	0.1203	21.7797*	0.7051**	4.2406
Thailand	-0.142	11.3484*	0.3022**	0.7845
Vietnam	0.0708	3.2782	0.3450**	-4.4502**

Note:

Equation [11] $CSAD_t^{HV} = \alpha + \beta_1|r_{m,t}^{HV}| + \beta_2(r_{m,t}^{HV})^2 + \beta_3(D^{C19} \times |r_{m,t}^{HV}|) + \beta_4\left(D^{C19} \times (r_{m,t}^{HV})^2\right) + \varepsilon_t$

D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.

**significant at 5%, *significant at 10%.

Table 4.8: Market condition: Low Market volatility

Equation [12]	**Pre-COVID-19 period**		**COVID-19 period**	
	$\|r_{m,t}\|$	$r_{m,t}^2$	$\|r_{m,t}\|$	$r_{m,t}^2$
Dow Jones	0.3447**	-9.5998**	0.4434**	-15.1506**
Indonesia	0.6625**	-12.9251**	0.3879**	-5.3005**
Malaysia	0.1837**	0.8712	0.4517**	-20.5844**
Philippines	0.9655**	-34.1907**	1.2044**	-46.4098**
Singapore	0.0628	32.193**	0.1326	6.2398
Thailand	-0.0938	14.4815**	0.2860**	-8.1640*

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Volume: 3, No: 3, pp. 47 – 60
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i3.3326

Vietnam	0.2119**	-6.0402**	0.1702*	-4.7379

Note:

Equation [12] $CSAD_t^{LV} = \alpha + \beta_1|r_{m,t}^{LV}| + \beta_2(r_{m,t}^{LV})^2 + \beta_3(D^{C19} \times |r_{m,t}^{LV}|) + \beta_4\left(D^{C19} \times (r_{m,t}^{LV})^2\right) + \varepsilon_t$

D^{C19} equals to 1 for COVID-19 period, 0 for pre-COVID-19 period.
**significant at 5%, *significant at 10%.

Overall, our research suggests that herding behavior appears to be more common in ASEAN stock markets when return volatility is low. The Vietnamese stock market exhibits more "consistent" herding behavior among the ASEAN stock markets, particularly during the COVID-19 period. Thus, in line with the findings in Almeida et al. (2012), our data imply that investors appear more irrational during periods of low return volatility in the market than during other market situations.

Conclusions

We aim to address the following queries in this study: (i) Do the ASEAN stock markets exhibit herd mentality? (ii) Are relationships in herding nonlinear? (iii) Does herding behavior change in a rising or falling market? (iii) Does herding behavior exhibit asymmetry in response to varying market conditions, such as favorable and unfavorable returns, high and low market activity, and low and high volatility? v) Does COVID19 affect herding behavior differently?

In essence, stock market herding is correlated trading in which participants in a given market trade in the same way over an extended period of time. Investors who follow the herd often give up on their own opinions about a stock. As a result, the price of securities may not reflect their underlying values since they mimic the activities of other investors or the general consensus (Adam and Sariouglu, 2020). According to Kizys et al. (2021), stock market herding, also known as the crowd effect, refers to the collective conduct of a group of investors who replicate or rely on the choice of some (educated) investors without necessarily checking the accuracy of the information. Chauhan et al. (2020) claim that herding is an aberration that behaviorally defies the efficient market theory. It is predicated on the idea that the deeds of others are superior to their own. It is anticipated that during a crisis, when investors could be under a great deal of pressure to perform and are more prone to making mistakes, this behavior would be more common. Consequently, the need to herd will intensify during these erratic times (Adam and Sariouglu, 2020).

We adopt the methodology of Almeida et al. (2012), who investigate herding behavior in several markets around Latin America. To test for any differences during the COVID-19 period versus the normal period, we incorporate dummy variables representing the COVID-19 and the non-COVID-19 periods into our models, which we develop based on Almeida et al. (2012), who adopt Christie and Huang (1995) and Chang et al. (2000) methodologies. The US stock market serves as the control market, while the ASEAN stock markets—which include Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam—are measured using the cross-section of absolute deviation (CSAD).

In conclusion, we discover that for every country in our sample, the mean, standard deviation, median, and maximum values of the CSAD measure are greater in the COVID-19 period than they were in the pre-COVID-19 period. Herding behavior is evident in all markets for the lower extremity of market returns (with substantial and negative coefficients) during the pre-COVID-19 period, with the exception of the Singaporean stock market. There does not appear to be any indication of herding throughout the COVID-19 period's lower and upper extremes of market returns. Nevertheless, the herding behavior that was previously noted in the lower extreme of market returns during the pre-COVID-19 period appears to vanish once nonlinearity is included in our model, and herding is now limited to the stock markets of the Philippines and Vietnam (as well as the Dow Jones).

Next, we study herding under various market conditions: high and low volume, high and low market volatility, and positive and negative market returns. With the exception of the Vietnamese stock market, which exhibits herding behavior to a somewhat greater extent when market returns are negative, there is no evidence of herding activity when the market is split into positive and negative returns. De Almeida et al. (2012) found less evidence of herding behavior during negative market returns, but more during good market returns. This conclusion contrasts with their findings. This research implies that herding behavior

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Volume: 3, No: 3, pp. 47 – 60
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i3.3326

is not usually induced by market return. We find evidence of herding behavior in the Philippines as well as Vietnam when the sample data is split into high and low market volume categories. Evidence of herding is seen in both Vietnam and the Philippines for the high volume of trades that occurred prior to COVID-19; however, for the low volume of trading, evidence of herding appears to be limited to the Philippines. Furthermore, the results for times of high market volatility are fairly similar to those obtained during the time of negative market returns, meaning that the Vietnamese stock market only showed signs of herding behavior during the COVID-19 period. On the other hand, herding behavior appears to be more common during both the pre-COVID-19 and COVID-19 periods when market volatility is low. For instance, herding is seen in Malaysia and Thailand during the COVID-19 period, in Vietnam during the pre-COVID-19 period, and in Indonesia and the Philippines (as well as the Dow Jones) during both periods.

In summary, our results suggest that herding behavior appears to be more common in ASEAN stock markets generally only during periods of low market return volatility. Particularly during the COVID-19 period, the herding behavior of the Vietnamese stock market appears to be more "consistent" than that of the other ASEAN stock markets. According to our research, when return volatility is low in the market, investors appear to be more irrational than they are in other market circumstances.

Acknowledgement

The authors would like to thank the support of Prince Sultan University for paying the Article Processing Charges of this publication.

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ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
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