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The effects of extreme market conditions on investors' herding behavior in the Malaysian stock market

Norazura Anuar[1], Zukarnain Zakaria[2*], Rossilah Jamil[3], Mohd Roslan Ismail[4]
[1,3]Azman Hashim International Business School, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia; norazuraanuar@yahoo.com.my (N.A.) rosillah@utm.my (R.J.).
[2,4]School of Business and Technology, IMU University, Kuala Lumpur, Malaysia; zukarnainzakaria@imu.edu.my (Z.Z.) mohdroslan@imu.edu.my (M.R.I.).

Abstract: The presence of herding behaviour could cause abnormality and extremely volatile markets, especially in emerging markets. This behaviour has been studied extensively but with inconclusive results. This paper investigates the effects of extreme market conditions on investors' herding behaviour in the Malaysian stock market. Two common measures for herding behaviour were employed: cross-sectional standard deviation (CSSD) and cross-sectional absolute deviation (CSAD). Data were extracted from the daily closing prices of 346 companies listed on Bursa Malaysia. The study spans from year 2000 to 2019, consisting of pre-crisis, during-crisis and post-crisis, during up- and down-market conditions. The results from CSSD revealed the presence of herding behaviour during the pre-crisis in both extreme up and down-market conditions. In the post-crisis, herding behaviour was observed in extreme up-market conditions. Using CSAD, herding behaviour was prevalent in extreme up-market conditions and post-crisis in extreme down-market conditions. These findings offer additional evidence supporting the existence of herding behaviour during extreme market conditions. Mitigating herding behaviour through enhanced information disclosure and increased investor awareness can improve market quality and reduce volatility.
Keywords: *Crisis, Emerging markets, Herding behaviour, Market conditions, Stock market.*

1. Introduction

Various studies found that the financial crisis has made stock market prices deviate from their fundamental values [5,12,17,38]. They argued that investors' behaviour is one of the contributing factors to this phenomenon. According to the literature, during crises and extremely volatile markets, investors' herding behaviour may lead to market anomalies and a divergence from the EMH.

Herding behaviour refers to the behaviour where investors ignore their own opinions and knowledge, but follow a collective trading behaviour [29]. Investors imitate other investors because they lack the necessary information or believe that other investors have more updated information than they do. In other words, herding behaviour occurs because investors disregard fundamental analyses in their investment decisions. This behaviour becomes apparent among inexperienced investors who are unfamiliar with the market [30].

The presence of herding behaviour in financial markets has significant implications for policymakers. Herding can lead to market inefficiencies, increased volatility, and the potential for systemic risks. Persistent herding can undermine investor confidence in the market's ability to reflect true asset values. This can reduce participation and liquidity in the market. In addition, herding can affect the transmission mechanisms of monetary and fiscal policies. For instance, if herding leads to asset bubbles, traditional policy tools might be less effective in stabilising the economy.

Herding has been proven to commonly happen during crises and is more likely to occur during major market fluctuations [10,12]. Herding behaviour is also anticipated to be more prevalent during extreme

* Correspondence: zukarnainzakaria@imu.edu.my

market conditions when individual investors are more likely to follow the crowd rather than their own beliefs or knowledge [8,23]. In brief, previous studies found that herding behaviour commonly appears in a highly volatile market and high uncertainty.

Most of the studies on herding behaviour were conducted in developed markets, and only a few focused on emerging economies [4,12,24]. Generally, empirically, there is still inconclusive evidence regarding the presence of herding behaviour [9,43]. Thus, it is interesting to examine herding behaviour in emerging economies for several reasons. Herding behaviour has been associated with abnormal market volatility and market inefficiencies, poor corporate governance, insider trading, weak market regulation, frequent government and central bank intervention, uneducated investors and inadequate rules for listed businesses' information disclosure [32].

As an emerging market, the Malaysian stock market can be seen as inefficient because the non-institutional investors are more dominant and there is also a problem of information asymmetry among the investors [4,23]. Emerging markets have been portrayed as having imperfect regulatory frameworks, particularly in terms of market transparency. The unavailability of reliable information is another reason for the herding behaviour occurrence and this reason appears to be an essential issue for emerging markets like Malaysia [22]. This behaviour could cause difficulty for investors in the Malaysian stock market to manage their portfolios effectively.

Malaysia's stock market is also very sensitive to the shock in the global economy. For example, when Malaysia's gross domestic product (GDP) growth decreased during the global financial crisis from 7.6% in the first quarter of 2008 to -6.2% in the first quarter of 2009 [36], its stock market was severely affected. The Kuala-Lumpur Composite Index (KLCI) plummeted from 1393 points in January 2008 to 876 points in December 2009 [1]. However, how Malaysian investors behave during this extreme market condition is still not very clear. Therefore, this paper aims to empirically investigate the effects of market conditions on the investors' herding behaviour in the Malaysian stock market.

2. Literature Review

The occurrence of herding behaviour defies the existence of the Efficient Market Hypothesis (EMH), which claims that all investors are rational, have access to the same information and are eventually able to determine the expected stock price in the same way [15]. EMH implies that the stock price should reflect the information on the market and the security's value. On the contrary, herding behaviour suggests that investors are not always rational, thus they do not always determine the share price through market analysis. Therefore, herding behaviour could cause the market to become volatile by driving the securities off their intrinsic value, hence, the share prices will not only represent investors' rational expectations but also their irrational market decisions [22].

Herding behaviour has become a more common phenomenon, especially in the aftermath of severe global crises as herding behaviour aggravates and creates market volatility [17,20, 31,39]. Several studies have examined the existence of herding behaviour in various market conditions such as during the global financial crisis [41,42]. Studies also reported that herding behaviour was one of the investment strategies employed by investors during the crisis period [2,34]. The behaviour enables them to mimic the activities of others by utilising the same information sources and applying the same interpretation to market signals, hence making the same investment decisions [21].

To ascertain herding behaviour during the period of market stress, [10] regresses the cross-sectional standard deviation of stock return from market return with constant and dummy variables that capture excessive market movement. They argued that during extreme market conditions, a negative coefficient of the dummy variable indicates the presence of herding behaviour, while a positive coefficient implies non-herding behaviour. According to them, the market environment can influence investors' decision-making. This is based on the rational asset price theory, which assumes that investment decisions depend on the private information available from the market. They also support the idea that during extreme market conditions, investors suppress their own information and base their decisions on the overall market trends. Therefore, when the market is under stress, herding behaviour is more prevalent as individual returns are clustered toward aggregate market returns.

The alternative model to determine the existence of herding behaviour was proposed by Chang et al. [5]. They assume that rational asset pricing models predict an increase in return dispersion during market stress. They also claim that the linear relationships between individual dispersion and market performance can be predicted by rational asset pricing models. The linear and increasing relationship between dispersion and market return, however, will not hold if individual market participants tend to mimic overall market behaviour while disregarding their prior behaviours during the high volatility period. Chang et al. [5] have tested the model in five countries: the US, Japan Hong Kong, South Korea, and Taiwan, but found no evidence of herding behaviour in the US, Japan, and Hong Kong. Financial crises and volatile market movements have been proven to exacerbate herding behaviour [17,20]. A study by Economou, Katsikas, and Vickers [13] showed herding behaviour is prevalent on days when the Athens Stock Exchange deals with down markets and has high volumes and high levels of market volatility. A study by Caporale, Economou and Philippas [6] on the Athens Stock market also found that herding is more pronounced during market rallies than during market crashes. Gabbori, Awartani, Maghyereh and Virk [16] discover that herding is more prominent during the up-market than the down-market in the Saudi stock market.

Similar findings were also recorded in the Chinese stock markets [37,40] and the Hong Kong stock market [26]. However, on the contrary, a study by Lao and Singh [27] found herding behaviour is prevalent in the Chinese stock market only when the market is falling, and trading volume is high. Lao and Singh [27] also demonstrate that herding behaviour occurs during up-market conditions in the Indian stock market. Economou et al. [12] found evidence of herding occurring in the UK market during the global financial crisis period (2007-2009) and the sub-period of 2004-2007. Meanwhile, a study by Arjoon, Bhatnagar and Ramlakhan [3] for Singapore concluded that herding behaviour is more prevalent during rising market conditions, due to high liquidity and volatility.

In a study conducted by Lai and Lau [25] on the Malaysian stock market, they discovered signs of herding behaviour among Malaysian investors, particularly during periods of extremely low market activity and the financial crisis. Their findings align with the conclusions drawn by Nha et al. [33] who investigated herding behaviour across four Southeast Asian stock markets, including Malaysia. Specifically, Nha et al. [33] found evidence of herding behaviour in Indonesia and Vietnam during the up-market, whereas in Malaysia, the behaviour was detected during market down-market. The research indicated the presence of herding behaviour in both Malaysia and Indonesia in the pre-crisis and during the crisis. In contrast, a recent study by Yao and Tangjitprom [43] found no evidence of herding behaviour in the rising and declining market conditions of Malaysia's stock market.

3. Methodology

This empirical study uses the daily closing stock prices of 346 companies listed on the Bursa Malaysia. The study periods are from the year 2000 to 2019, comprising a total of 4,923 observations for each company, after removing unavailable data. Given that this study encompasses the global financial crisis, similar to Litimi [29], it categorises the crisis period into three sub-periods: the pre-crisis period from February 2007 to February 2008, the crisis period from March 2008 to March 2009, and the post-crisis period from April 2009 to April 2010. The analysis in this study is conducted for the entire period and across the three market conditions: pre-crisis, during the crisis, and post-crisis periods. Additionally, the study performs further analysis to explore herding behaviour in both up and down-market situations during each market condition.

The first step in the data analysis is to ascertain the stationarity properties of the series used in this study. This is crucial as the presence of unit roots in time series data can introduce challenges in statistical inferences. To assess the stationarity of the data, the Augmented Dickey-Fuller test [11] and the Phillips-Peron test [35] are employed. The null hypothesis for both tests posits that the series has a unit root. In conducting these tests, the Akaike Information Criteria (AIC) is utilised to determine the optimal lag length of the model. During the estimation process, all data was transformed into logarithms, and the analyses were performed using EViews.

3.1. Model Specification

This study utilised a regression model to statistically analyse the herding behaviour of investors under extreme market conditions. There are two measures of herding behaviour used in this study. The first measure was proposed by [10]; using cross-sectional standard deviation (CSSD) of stock return from the market return. The formula for CSSD is as follows:

$$CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(R_{i,t}-R_{m,t})^2}{N-1}} \quad (3)$$

where N is the number of listed stocks, $R_{i,t}$ is the return of stock i at time t, and $R_{m,t}$ is the average market return at time t. This study used the regression model proposed by [10] to identify the herding behaviour. The model is presented in Equation 4 below.

$$CSSD_t = \theta_0 + \theta_1 |R_{m,t}| + \theta_2(R_{m,t})^2 + \varepsilon_t \quad (4)$$

The regression model in Equation 4 aims to statistically capture the clustering in the market return when there is an excessive move in the market. Therefore, a negative and significant value of θ_2 suggests the presence of herding behaviour in the market [10].

To capture the existence of herding behaviour during extreme market conditions, this study also adopted the model employed by [10]. Several empirical studies (for example, [2,18,19,44]) have also used the same model. The regression model for the extreme market condition is presented in Equation 5.

$$CSSD_t = \beta_0 + \beta_1 D_t^U + \beta_2 D_t^L + \varepsilon_t \quad (5)$$

where, D^U and D^L are dummy variables for extreme up-market condition and extreme down-market condition, respectively. $D_t^U = 1$ if the market return lies in the extreme upper x per cent of the observation and 0 otherwise. $D_t^L = 1$ if the market return lies in the extremely lower of x per cent of the observation and 0 otherwise. Litimi, BenSaïda, and Bouraoui [28] in their study have defined extreme market return arbitrarily.

In this study, the extreme up-market is defined if the market return values are higher than Percentile 90 (P_{90}), while extreme down-market is when the market return values are below Percentile 10 (P_{10}) value. The presence of herding behaviour is suggested if coefficients β_1 and β_2 are negative and statistically significant. While positive values indicated non-herding.

The second measure of herding behaviour used in this paper was established by [5]; using cross-sectional absolute deviation (CSAD) of stock return from market return. The formula to calculate CSAD is as follows:

$$CSAD_t = \frac{1}{N}\sum_{i=1}^{N}\left[R_{i,t} - R_{m,t}\right] \quad (6)$$

where, $R_{i,t}$ is the return of stock i on day t, $R_{m,t}$ is the market return on day t and N is the number of listed stocks on day t. According to Chang et al. [5], the association between CSAD and market return has always been positive. However, when herding behaviour occurs, this relationship should be negative since when the absolute market return value increases, the CSAD value decreases, or vice versa. Equation 7 presents the model recommended by Chang et al. [5] to estimate the relationship between CSAD and market return.

$$CSAD_t = \gamma_0 + \gamma_1 |R_{m,t}| + \gamma_2(R_{m,t})^2 + \varepsilon_t \quad (7)$$

Meanwhile, to determine the herding behaviour during the up-market condition (Equation 8) and down-market condition (Equation 9), the following regression models are employed.

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$$CSAD_t^U = \alpha_{u0} + \pi_{u1} |R_{m,t}^U| + \pi_{u2}(R_{m,t}^U)^2 + \varepsilon_t \quad \text{if } R_{m,t} > 0 \quad (8)$$

$$CSAD_t^D = \alpha_{d0} + \pi_{d1} |R_{m,t}^D| + \pi_{d2}(R_{m,t}^D)^2 + \varepsilon_t \quad \text{if } R_{m,t} < 0 \quad (9)$$

Under the rational asset pricing model, the above regressions should be linear, which implies π_2=0, if there is no herding behaviour. On the other hand, the presence of herding behaviour is suggested by a statistically significant negative value of π_{u2}/ π_{d2}.

4. Data Analysis and Findings

4.1. Descriptive Analysis of Market Return

Table 1 illustrates the descriptive statistics of market return, $R_{m,t}$ for the entire study period (year 2000 until 2019) and during the three market conditions, respectively. From Table 1, the statistics demonstrate that the market returns have positive mean values for the entire period, pre-crisis, and post-crisis periods. Only during the crisis period, the mean value of market return was negative. The highest mean value occurs in the post-crisis periods (0.066) whilst the lowest mean value occurs during the crisis period (-0.067). Meanwhile, the highest and lowest market returns during the entire period of study were 6.885 and -4.471, respectively. revealing the high volatility during the entire period of study. Table 1 also presents the values of P_{10} (threshold level for the down-market) and P_{90} (the threshold level for the up-market) for the respective periods.

Table 1.
Descriptive statistics of market return ($R_{m,t}$).

Period	Minimum	Maximum	Mean	10th Percentile (P_{10})	90th Percentile (P_{90})
Entire period (Year 2000 - 2019) (n = 4923)	- 4.471	6.885	0.011	-0.055	0.724
Pre-crisis (Feb 2007 - Feb 2008) (n = 265)	- 1.539	1.163	0.022	-0.891	0.799
During crisis (March 2008 - March 2009) (n = 265)	- 1.885	1.553	- 0.067	-0.938	1.072
Post-crisis (April 2009 - April 2010) (n = 271)	- 0.972	1.078	0.066	-0.665	0.741

Note: P_{10} represents the threshold levels for extreme down-market; P_{90} represents the threshold levels for extreme up-market. n=no. of observation.

4.2. Unit Root Tests

The results in Table 2 show that both the ADF and PP tests for CSSD and CSAD at level are significant at 5% level, suggesting that the series are stationary at level, hence I (0). The same tests are also performed at first difference. The results found the series is also significant at 5% level except for CSAD where the result from the PP test demonstrates that the series is not significant at 5%. However, the ADF tests found CSAD in the first difference is significant. Based on the unit root test results, in further analysis, data at level will be used in the estimation.

Table 2.
Results of unit root tests.

Measure for herding behaviour	Series and critical value	ADF test		PP test	
		Intercept	**Intercept and trend**	**Intercept**	**Intercept and trend**
CSSD	Level	-6.226*[18]	-6.343*[18]	-85.645*[48]	-85.832*[48]
	Critical value (5%)	(-2.861)	(-3.410)	(-2.861)	(-3.410)
	First difference	-19.407*[29]	-19.409*[29]	-847.508*[318]	-48.332*[318]
	critical value (5%)	(-2.861)	(-3.410)	(-2.861)	(-3.410)
CSAD	Level	-5.102*[29]	-5.196*[29]	-88.240*[48]	-88.386*[48]
	Critical value (5%)	(-2.861)	(-3.410)	(-2.861)	(-3.410)
	First difference	-19.906*[28]	-19.908*[28]	-1022.290[490]	-1025.223[490]
	Critical value (5%)	(-2.861)	(-3.410)	(-2.861)	(-3.410)

Note: The figures in parenthesis are MacKinnon's (1996) critical value at 5% level. Figures in [] are optimum lag length based on AIC. *Indicates significance at 5% level. ADF: Augmented dickey-fuller, PP: Phillip-Perron.

The results in Table 2 show that both the ADF and PP tests for CSSD and CSAD at level are significant at 5% level, suggesting that the series are stationary at level, hence *I*(0). The tests are also performed at first difference. The results found the series is also significant at 5% level except for CSAD where the result from the PP test demonstrates that the series is not significant at 5%. However, the ADF tests found CSAD in the first difference is significant. Based on the unit root test results, in further analysis, data at level were used in the estimation.

4.3. Results from Herding Behaviour Regressions

Table 3 presents the estimation results of herding behaviour using CSSD (Equation 4) for the entire period of study (2000 to 2019) and the three crisis periods: the pre-crisis (February 2007 to February 2008), during the crisis (March 2008 to March 2009) and the post-crisis periods (April 2009 to April 2010). A statistically negative and significant coefficient θ_2 indicates the presence of herding behaviour. The regression results for the entire sample period, pre-crisis and during crisis periods found no evidence of herding behaviour based on the positive value for coefficient θ_2. On the other hand, herding behaviour is detected in post-crisis period based on the negative and significant value of θ_2.

Table 3.
Estimation results for herding behaviour using CSSD model.

Period	θ_0	θ_1	θ_2	**Adj. R^2**
Entire period (Year 2000-2019) (N=4923)	0.694	0.164	0.114	0.172
	(100.827)	(8.973)	(16.646)	
Pre-crisis (Feb 2007 until Feb 2008) (N=265)	0.844	-0.071	0.362	0.087
	(21.176)	(-0.446)	(2.662)	
During crisis	1.142	0.207	0.047	0.138

(March 2008 until March 2009) (N=265)	(20.823)	(1.075)	(0.329)	
Post-crisis (April 2009 until April 2010) (N=271)	0.764	0.772	-0.765*	0.030
	(17.128)	(3.179)	(-2.926)	

Note: Figures in () are t-statistic. *Indicates 5% significant level. N is no. of observation. In the estimation, the data were in the logarithm.

In further analysis, the estimation was carried out to investigate the existence of herding behaviour in extreme up- and down-market conditions during the three crisis periods. In identifying the extreme market condition, the market return data that was lower than the 10th Percentile (P_{10}) were categorised as down-market. While the market return data above the 90th Percentile (P_{90}) were categorised as up-market. Similarly, the estimations were performed for the overall study period and the three sub-crisis periods.

Table 4 presents the estimation results by sub-periods. Using the entire period of study, the estimation result showed that coefficient β_1 is positive, implying non-herding in the extreme up-market condition. Coefficient β_2 is also positive and not significant, indicating that herding behaviour is also not present in the extreme down-market in Malaysia.

During the pre-crisis period, herding behaviour is detected in both extreme up-market and extreme down-market conditions. Meanwhile, during the crisis period, both coefficients β_1 and β_2 are negative but not significant at 5%, indicating there is non-herding behaviour in the extreme up- and down-markets during the crisis period. Lastly, for the post-crisis period, the results showed both coefficients are negative, but only β_1 is significant at 5% levels, suggesting that during the post-crisis period in Malaysia, herding behaviour is only present in the extreme up-market.

The regression results in Table 3 revealed that herding behaviour is not present when the CSSD model is estimated using the entire sample period, pre-crisis period, and during the crisis period. The herding behaviour is only detected during the post-crisis period. However, when the data were divided into extreme up- and down-market (Table 4), herding behaviour was detected in both extreme market conditions during the pre-crisis period. Meanwhile, during the post-crisis period, herding behaviour was detected in the extreme up-market condition only. The finding suggests that, in general, Malaysian investors only imitate other investors when the market is extremely up. During the extreme down-market, investors are likely to make their own investment decisions.

Table 4.
Estimation results for herding behaviour using CSSD model.

Period	β_0	β_1	β_2	Adj. R^2
Entire period	0.754	0.017	0.438	0.093
Year 2000 - 2019 (N = 4923)	(171.039)	(0.871)	(22.448)	
Pre-crisis	1.411	-0.223*	-0.404*	0.288
(Feb 2007 until Feb 2008) (N = 265)	(19.932)	(-7.571)	(-5.463)	
During crisis	1.878	-0.528	-0.44	0.546
(March 2008 until March 2009) (N = 265)	(27.146)	(-15.311)	(-6.057)	
Post-crisis	1.163	-0.262*	-0.144	0.208
(April 2009 until April 2010) (N = 271)	(14.301)	(-7.815)	(-1.693)	

Note: Figures in () are t-statistic. β_1 and β_2 respectively represent the coefficient for up and down markets. *Indicate significant at 5% levels. N = no. of observation.

Table 5 presents the regression results of the herding behaviour from the CSAD model. Like in the case of CSSD, the estimations for using CSAD were also conducted for the entire period of study and the three sub-crises periods. As mentioned above, statistically negative, and significant γ_2 indicate the existence of herding behaviour. From Table 5, the estimation results confirm that herding does not exist in the entire period of study, pre-crisis, and during crisis periods as coefficient γ_2 is positive. However, consistent with the CSSD, the result demonstrated the existence of herding behaviour during the post-crisis period, where coefficient γ_2 is negative and significant at 5% levels.

Table 5.
Estimation results for herding behaviour using CSAD model.

Period	γ_0	γ_1	γ_2	Adj. R^2
Entire period Year 2000-2019 (n = 4923)	0.552 (92.29)	0.106 (6.674)	0.117 (19.795)	0.187
Pre-crisis (Feb 2007 until Feb 2008) (n = 265)	0.654 (18.665)	0.01 (0.07)	0.202 (1.692)	0.087
During crisis (March 2008 until March 2009) (n = 265)	0.918 (19.137)	0.224 (1.329)	-0.017 (-0.135)	0.035
Post-crisis (April 2009 until April 2010) (n = 271)	0.601 (15.875)	0.635 (3.083)	-0.630* (-2.838)	0.027

Note: Figures in () are t-statistic. *Indicate significant at 5% levels. N = no. of observation. In the estimation, the data were in the logarithm.

Table 6 displays the results when further analysis was carried out by separating the data into extreme up- and down-market conditions (Equations 8 and 9). The regressions were also estimated for the entire period and three sub-crisis periods. When the data are analysed for the extreme up-market condition (Equation 8), only coefficient πu_2 for the entire period of study is negative and significant at a 5% level, suggesting the presence of herding behaviour. Meanwhile, for the down-market (Equation 9), herding behaviour exists only in the post-crisis period.

Table 6.
Estimation results for herding behaviour using CSAD model with market conditions.

.	Up-market (Equation 8)				Down-market (Equation 9)			
Period	π_{u0}	πu_1	πu_2	Adj. R^2	α	πd_1	πd_2	Adj. R^2
Entire period Year 2000-2019 (N = 4923)	0.602 (58.202)	0.273 (10.166)	-0.048* (-5.865)	0.039	0.814 (71.365)	-0.447 (-12.922)	0.179 (9.244)	0.066
Pre-crisis (Feb 2007 until Feb 2008) (N = 265)	0.800 (14.050	-0.480 (-1.820)	0.484 (1.863)	0.010	0.611 (11.283)	0.262 (1.278)	-0.100 (0.625)	0.022
During crisis	1.010 (14.352)	-0.510 (-1.952)	0.335 (1.711)	0.018	1.139 (19.379)	-0.948 (-4.764)	0.736 (5.054)	0.135

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(March 2008 until March 2009) (N = 265)								
Post-crisis (April 2009 until April 2010) (N = 271)	1.054	-1.107	0.699	0.227	0.539	1.529	-1.241*	0.221
	(22.115)	(-4.349)	(2.614)		(9.309)	(4.668)	(-3.339)	

Note: Figures in () are t-statistic. *Iindicates significant at 5% levels. N is no. of observation. In the estimation, the data were in the logarithm.

Findings from the CSAD models (Table 5) show that herding behaviour exists in the Malaysian stock market during the post-crisis period. Further analysis also confirmed that herding behaviour exists in post-crisis period during the extreme down-market condition (Table 6).

5. Discussion and Conclusion

This paper examines the effects of market conditions on herding behaviour within a framework of the emerging market, Malaysia. The presence of herding behaviour was investigated using daily data of 346 companies listed in Malaysian stock markets from the year 2000 to 2019. As the period of study consists of a significant global market crisis, the analyses were conducted for three different crisis periods: pre-crisis, during-crisis and post-crisis periods. Furthermore, the presence of herding behaviour in the respective crisis period was investigated in two different market conditions: up-market and down-market.

Estimation results using CSSD showed that herding behaviour was present in the post-crisis period, but not during the pre-crisis and crisis period. This study also found evidence of herding behaviour in the extreme-up and-down market during the pre-crisis period, while in the post-crisis period, the herding behaviour was detected only in the extreme-up condition. However, estimation results using CSAD found that herding behaviour is only present in the post-crisis period. Further analysis also revealed that during the post-crisis period, herding was only prevalent in extreme down-market conditions. The results showed that both measures produce mixed results depending on market conditions. This is consistent with the finding from [33] that herding varies depending on the market up and down. However, the findings contradict the study by [43], that herding behaviour is absent for rising and declining market conditions.

The existence of herding behaviour during extreme up-market is in line with the hypothesis that herding behaviour exhibits an asymmetrical reaction when the market is up in comparison to when the market is down [8,40]. According to Chiang, Li, Tan, & Nelling, [7], investors typically herd when the market is moving upward, and there may be an asymmetry in herding between rising and declining markets due to the flow of positive and negative information. Investor enthusiasm during the upmarket could significantly influence rational herd behaviour at this time. Conversely, during a down-market, information may be limited for the public, causing less herding in the down market. Investors are also less likely to hedge in the down market due to the possibility that the government may intervene when markets decrease significantly.

Mixed results produced by this empirical study could be because herding is a dynamic phenomenon that is likely to change over time in line with the market conditions. And this behaviour could contribute to abnormality and a divergence from the EMH especially during crisis and extremely volatile markets. As herding behaviour may cause prices to deviate from fundamentals, this action affects the process of price discovery. In other words, this may weaken the correlation between stock returns and firm-specific information included in financial statements [6], hence causing unreliable information dissemination.

Meanwhile, in the context of herding behaviour in financial markets, CSSD and SCAD are two statistical measures used to analyse the presence of herding among investors. They, however, sometimes produce conflicting results due to their different methodological approaches and sensitivities to market conditions.

The findings from this study contribute to investment strategy in several ways. Firstly, as herding behaviour influences investors to invest in the same portfolios; it can be challenging to locate, diversify and invest in an intercorrelated portfolio. As a result, investors might need to invest in different portfolios to gain the same benefits as in a market free of herding. Secondly, since herding is linked to mispricing, investors may be able to reap a non-market premium in addition to the expected portfolio return provided by traditional asset pricing models. To acquire this benefit, an investment strategy should encourage investors to look for undervalued stocks. This will also help to reduce some mispricing and increase pricing effectiveness in the process.

As for policy response to herding behaviour, Malaysian regulators should enhance market surveillance to identify and monitor herding behaviour by implementing stricter disclosure requirements and transparency. This can help reduce information asymmetries, especially among retail investors that contribute to herding, especially during extreme market conditions. Meanwhile, promoting financial education can help retail investors make more informed decisions, hence reducing the likelihood of herding based on misinformation or panic. Encouraging diversification and long-term investment strategies among institutional investors can also help to reduce the tendency to herd.

In conclusion, this paper empirically examines the existence of herding behaviour in the Malaysian stock market in extreme up-and-down-market conditions. The existence of herding behaviour was identified using CSSD and CSAD, and tested in three crisis periods: pre-, during and post-crisis. The results from CSSD reveal the presence of herding behaviour before the crisis in both extreme up and down-market conditions. Meanwhile, during the post-crisis period, herding behaviour was observed in extreme up-market conditions only. Using CSAD, herding behaviour was found prevalent in extreme up-market conditions and post-crisis in extreme down-market conditions.

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