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## Assessing the contagion effect on herding behaviour under segmented and integrated stock markets circumstances in the USA, China, and ASEAN-5

**Abstract.** This paper investigates the contagion effect of herding behaviour in the US, China, and ASEAN-5 stock markets by considering the level of market integration. We employed individual stocks and market returns on daily basis data during the global financial crisis (GFC) and the recent tranquil periods. The sample observed consists of stocks having higher liquidity and larger market capitalisation in each of the stock markets. We applied the cross-sectional returns dispersion approach and ordinary least squares to achieve the purpose by involving static correlation. During the GFC period, the empirical result provides evidence on the presence of herding transmission from the dominant stock market to other integrated markets bilaterally. Specifically, herding behaviour in a domestic market was affected by herding activity in integrated foreign markets. By contrast, herding behaviour in a domestic market was not affected by herding in segmented foreign markets. Comparing to the recent tranquil period of 2017-2018, the contagion effect appears on the market only during the crisis period. Therefore, market participants should be more conservative in anticipating the emergence of this phenomenon for integrated markets under market crisis circumstances.

**Keywords:** Contagion Effect; Herding Behaviour; Integrated Market; USA; China; ASEAN-5

**JEL Classification:** F36; G12; G15

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**Оцінка впливу ефекту ланцюгової реакції на «стадну поведінку»****на сегментованих та інтегрованих фондових ринках США, Китаю та АСЕАН-5**

**Анотація.** У статті дано оцінку впливу ефекту ланцюгової реакції на «стадну поведінку» на фондових ринках США, Китаю та АСЕАН-5 з урахуванням ринкової інтеграції. Для проведення дослідження авторами статті було зібрано інформацію, що стосується ринкової віддачі за окремими позиціями на щоденній основі як в період глобальної фінансової кризи, так і в період спокою. Предметом дослідження стали акції, що мають більш високу ліквідність, і фондові ринки з більшою капіталізацією. Авторами було використано трансекторальний підхід до визначення ринкової прибутковості й застосовано метод найменших квадратів для досягнення кінцевого результату дослідження. Результат, отриманий емпіричним шляхом, показує, що в період глобальної фінансової кризи вступає в дію механізм трансмісії як на ключових фондових ринках, так і на інтегрованих ринках. Зокрема, на «стадну поведінку» учасників внутрішнього ринку безпосередній вплив має поведінка учасників на інтегрованих зовнішніх ринках. Разом із тим, поведінка учасників на сегментованих ринках не впливає на «стадну поведінку» учасників на внутрішньому ринку. Аналіз даних стосовно спокійного для ринків періоду 2017–2018 років дозволяє зробити висновок про те, що ефект ланцюгової реакції на ринку проявляється тільки під час кризи. Отже, учасникам ринку слід бути стриманішими щодо прогнозів, які стосуються досліджуваного явища на інтегрованих ринках в умовах кризи.

**Ключові слова:** ефект ланцюгової реакції; «стадна поведінка»; інтегрований ринок; США; Китай; АСЕАН-5.

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**Оценка влияния эффекта цепной реакции на «стадное поведение»****на сегментированных и интегрированных фондовых рынках США, Китая и АСЕАН-5**

**Аннотация.** В статье дана оценка влияния эффекта цепной реакции на «стадное поведение» на фондовых рынках США, Китая и АСЕАН-5 с учетом рыночной интеграции. Для проведения исследования авторами статьи была собрана информация, касающаяся рыночной отдачи по отдельным позициям на ежедневной основе как в период глобального финансового кризиса, так и в период спокойствия. Предметом исследования стали акции, имеющие более высокую ликвидность, и фондовые рынки с большей капитализацией. Авторами был использован транссекторальный подход к определению дисперсии рыночной доходности и применен метод наименьших квадратов для достижения конечного результата исследования. Результат, полученный эмпирическим путем, показывает, что в период глобального финансового кризиса вступает в действие трансмиссионный механизм как на ключевых фондовых рынках, так и на интегрированных рынках. В частности, на «стадное поведение» участников внутреннего рынка непосредственное влияние имеет поведение участников на интегрированных внешних рынках. Вместе с тем, поведение участников на сегментированных рынках влияет на «стадное поведение» участников на внутреннем рынке. Анализ данных относительно спокойного для рынков периода 2017–2018 гг. позволяет сделать вывод о том, что эффект цепной реакции на рынке проявляется только в период кризиса. Следовательно, участники рынка должны быть более сдержанными в отношении прогнозов, касающихся рассматриваемого явления на интегрированных рынках в условиях кризиса.

**Ключевые слова:** эффект цепной реакции; «стадное поведение»; интегрированный рынок; США; Китай; АСЕАН-5.

**1. Introduction**

The herding behaviour and stock market integration have been studied separately in financial literature. It indicates that both topics attract wide attention from academicians. Nevertheless, the studies that link the concept of market integration, in the form of the contagion effect, to the concept of herding behaviour are still scarce. In fact, herding behaviour may be widespread when the connection between global stock markets tends to be higher due to financial integration. The existing theories and empirical studies state that foreign stock markets have a role in the occurrence of herding behaviour in a local market, and the market integration tends to increase. Therefore, it can be assumed that the role of foreign markets may have a significant impact on a local market when the markets are integrated. On the contrary, such a framework is unlikely to occur in the segmented stock markets.

Foreign countries have an important part in altering the global economic system. On a smaller scale, when a stock market is integrated into the system, then the adaptation to such a dynamic change becomes an absolute capability, including when the situation is bad. Investors are more inclined to do herding either under unfavourable circumstances or in times of economic depressions. Furthermore, herding behaviour that can exacerbate volatility, and market stability may occur in any stock market (Lee, 2017; Wang & Wang, 2018). Such behaviour would be transmitted to other markets when the intermarket is connected by the system. Indeed, integration has a number of benefits, including synergy (UNESCAP, 2017). However, in the case of a stock market, in which there is herding activity, other integrated stock markets would be vulnerable to the phenomenon.

Involvement of foreign stock markets is reflected by incorporating foreign herding behaviour as dependent variables in the model, and proxied by the dispersion of returns dispersion. This framework was studied, among others, by Chiang and Zheng (2010); Economou, Kostakis, and Philippas (2011); Mobarek, Mollah, and Keasey (2014); Galariotis, Rong, and Spyrou (2015). According to Chiang and Zheng (2010), it is assumed that integrated stock markets have been facilitated with high-tech equipment and have efficient trading activities and information processing. Therefore, it is reasonable to include the foreign herding behaviour to identify the role of

global factors, based on the theory of the contagion effect. In addition, Guney, Kallinterakis and Komba (2017) provided evidence of herding behaviour in eight African frontier stock markets. Then, the researchers investigated the role of regional integration by examining the impacts of market returns in the region on herding behaviour and concluded that investor behaviour in markets with low integration in the international financial system is not significantly impacted by non-domestic factors.

Market participants and regulators should pay more attention to the contagion effect because it has important implications in accelerating the spread of crises, as documented. For example, Chiang, Jeon, and Li (2007) argued that the impact of contagion disseminates intermarket financial crises, and herding activity exacerbates stock market crises. Furthermore, Boyer, Kumagai, and Yuan (2006) and Chiang and Zheng (2010) asserted that the crisis that spread among international asset holders was primarily due to contagion factors than fundamental changes. In addition, Calvo and Mendoza (2000) and Kawai and Wignaraja (2011) stated that financial integration and transmission effect are a series of free trade practices among countries. Financial integration could make investment activities of developed market participants transmitted and imitated by emerging market participants who are often vulnerable to the herding behaviour.

Relevant studies on the transmission of herding behaviour to different stock markets show varied findings. Khan and Park (2009) presented empirical evidence and found strong evidence of contagion herding. They analysed the time-varying correlation coefficients across stock markets of Thailand, Malaysia, Indonesia, Korea, and Philippines. Furthermore, Peltomäki and Vähämaa (2015) documented that herding behaviour in the EMU market had an effect on non-EMU markets from September 2008 to January 2014. In contrast, Economou et al. (2011) concluded that the CSAD of Greece had no effect on the CSADs of Portugal and Spain in value weighted market returns. In addition, Chiang and Zheng (2010) showed that the CSAD of the US had no effect on the CSADs of Thailand, Korea, and Malaysia during the Asian crisis period. In this regard, there is no explanation as to why the findings provide controversial results. This research gap needs to be solved by investigating the level of integration of all stock markets, the contagion effect of which will be tested.

Our research contributes to the assessment of the impact of herding behaviour from foreign stock markets on the herding activity in the domestic stock market by considering the degree of market integration. This contagion or spill-over effect is predicted to occur for integrated stock markets, precisely from the globally dominant market (the US stock market), from the market involved due to a trade agreement in Asia (China), and from a regionally dominant market within the ASEAN region (Singapore) to the other four ASEAN stock markets, namely Indonesia, Malaysia, Philippines and Thailand. In contrast, the contagion effect is expected not to occur for segmented stock market pairs. Therefore, the first step of testing the effects of inter-market herding contagion is to identify the degree of bilateral integration between the stock markets where the presence of herding was found.

**2. Brief Literature Review**

Wang and Wang (2018) argued that the convergence in the individuals' behaviour influenced by the gurus is called herding. In the financial market, herding is the convergent investment activities of market participants who have the leader in the process. In addition, herding is typically described as the work behaviour of investors to follow others and they trade securities in parallel flow (Aytaç, Coqueret, & Mandou, 2018). According to BenSaïda (2017), herding appeared in the US stock market during financial crises and bubbles. The market players panic and ignore their own private information and are more inclined to believe informed traders. At the same time, investors in other stock markets are likely to respond by trading similarly to the market players of the US market resulting in a contagion effect. In contrast, the herding may disappear in the stock market in which the information and activities of the investors are not connected to the US market. The contagion effect which contributes to the transmission of a crisis is amplified by the existing financial links (Burzala, 2016).

Contagion is simply defined as the transmission of shocks among financial markets or the impact of spill-over from one market to other markets. Contagion could be either a good or a bad situation. Nevertheless, contagion is more defined as an increase in the correlation among financial markets on the financial crisis period compared to a relatively stable period and is usually associated with non-fundamental factors. The factors relating to the contagion effect have been stated in a number of studies. It has been stated that stock market integration can be a major contagion risk, as evidenced in the case of the 1997 Asian crisis (Tai, 2007). Meanwhile, Hernandez and Valdes (2001) found evidence that trade relations and location proximity seemed to be a relevant contagion channel during the Thailand and the Brazilian crises. Their findings are expected to be a logical framework in terms of the impact of contagion herding associated with the level of stock market integration and geographical proximity within a stock market area. In addition, Khan and Park (2009) stated that herding contagion is rooted from independent factors.

Previously Bekaert and Harvey (1997) argued that in terms of the global international financial movement integrated financial markets are more sensitive to external shocks, and a volatility spill-over is a consequence of financial interdependence among stock markets. In addition, King and Wadhani (1990) proposed an alternative explanation on the relations between markets and argued that stock trading in one particular market affects stock prices in other markets, even though the source of the trade is purely noise. They called this relation the market contagion hypothesis.

**3. Data Description and Methodology**

Being initial samples in this research, the stocks represent an index having higher trading liquidity and larger market capitalisation in each stock market of China, Indonesia, Malaysia, Philippines, Singapore, Thailand and the United States of America. Furthermore, these stocks are relevant to the index listed and issued at the end of year 2016. The leading index names, taken from the seven markets, are

SSE-50 of China, LQ-45 of Indonesia, KLCI-50 of Malaysia, PSEi-30 of Philippines, STI-30 of Singapore, SET-50 of Thailand, and DJI-30 of the US stock market. The numbers following the index names indicate the number of stocks included in the index. These stocks were periodically reviewed so that the composition of members listed in the index could change.

A number of stocks are excluded from the initial samples because the data of the stocks are incomplete. Of the total 265 stocks, the number of stocks not included in the analysis is 40. The number of excluded stocks are as follows: 20 SSE-50 stocks, 4 LQ-45 stocks, and 16 SET-50 stocks. We observe the sample both during the global financial crisis (GFC) and the tranquil periods. The decision of the GFC observation period, ranging from 3 March 2008 to 31 March 2009 is adopted from Litimi, BenSaïda, and Bouraoui (2016). Meanwhile, the tranquil period is observed from 03 April 2017 to 30 April 2018.

The first step of our analysis is to identify the level of integration for all the stock markets by using market index returns. In analysing the short-run relationship between stock market returns, we apply the static correlation approach. This method is adopted from previous studies, among others from Grubel (1968), Levy and Sarnat (1970), and Karim & Ning (2013) who applied the Pearson correlation. The subsequent step is to analyse the contagion effect of herding behaviour using ordinary least squared technique by developing varied models.

Contagion herding is operationally analysed by testing whether the dispersion of returns, as measured by cross-sectional absolute deviation of returns (CSAD), in a stock market was attributed to the dispersion of returns in dominant markets. The relationship is expressed by the following model:

$$CSAD_{it} = \gamma_0 + \sum_{j=1}^n \delta_j CSAD_{jt} + \varepsilon_t \tag{1}$$

The model includes explanatory variables of the dispersion of returns in foreign stock markets (CSAD<sub>f</sub>, j = 1, 2, 3). The argument proposed that CSAD in domestic stock market i (CSAD<sub>i</sub>) could be partially explained by CSAD of foreign dominant markets (CSAD<sub>j</sub>). The term of  $\delta_j$  is the coefficient of CSAD for foreign markets. The impact of transnational herding is marked by  $\delta_j > 0$ .

The equation formation consists of three models. Firstly, the dispersion of returns in each of the markets in Indonesia, Malaysia, Philippines and Thailand are impacted by the dispersion of returns in the markets of Singapore, China, and the US. Secondly, the dispersion of returns in each of the markets in Singapore and China are impacted by the dispersion of returns in the US market. Thirdly, the dispersion of returns in the market of Singapore is impacted by the dispersion of returns in the Chinese market.

Six estimation models of contagion herding among China (CSAD<sub>CN</sub>), Indonesia (CSAD<sub>ID</sub>), Malaysia (CSAD<sub>MY</sub>), Philippines (CSAD<sub>PL</sub>), Singapore (CSAD<sub>SG</sub>), Thailand (CSAD<sub>TH</sub>), and the US markets (CSAD<sub>US</sub>) are expressed as follows:

$$CSAD_{CN,t} = \gamma_0 + \delta_1 CSAD_{US,t-1} \tag{2}$$

$$CSAD_{ID,t} = \gamma_0 + \delta_1 CSAD_{SG,t} + \delta_2 CSAD_{CN,t} + \delta_3 CSAD_{US,t-1} \tag{3}$$

$$CSAD_{MY,t} = \gamma_0 + \delta_1 CSAD_{SG,t} + \delta_2 CSAD_{CN,t} + \delta_3 CSAD_{US,t-1} \tag{4}$$

$$CSAD_{PL,t} = \gamma_0 + \delta_1 CSAD_{SG,t} + \delta_2 CSAD_{CN,t} + \delta_3 CSAD_{US,t-1} \tag{5}$$

$$CSAD_{SG,t} = \gamma_0 + \delta_1 CSAD_{CN,t} + \delta_2 CSAD_{US,t-1} \tag{6}$$

$$CSAD_{TH,t} = \gamma_0 + \delta_1 CSAD_{SG,t} + \delta_2 CSAD_{CN,t} + \delta_3 CSAD_{US,t-1} \tag{7}$$

Herding behaviour is proxied by the cross-sectional absolute deviation of returns (CSAD), and its values are generated by Eq. (8). The CSAD, which is the measurement of the



dispersion of returns is obtained according to the formula composed by Chang, Cheng, and Khorana (2000):

$$CSAD = \frac{1}{N} \sum_{i=1}^N |R_{i,t} - R_{p,t}|, \tag{8}$$

where:

$R_{i,t}$  is the cross-sectional average returns of  $N$  stocks on portfolio of stock  $i$  on day  $t$  sampled in a stock market;

$N$  is the number of stocks in the portfolio.

The daily returns of individual stock  $i$  ( $R_{i,t}$ ) is calculated by applying the following formula:

$$R_{i,t} = 100 \times (\ln(P_{i,t}) - \ln(P_{i,t-1})), \tag{9}$$

where:

$R_{i,t}$  in equation (9) is the observed stock returns of firm  $i$  on day  $t$ ;

$P_{i,t}$  is stock price of firm  $i$  on day  $t$ ;

$P_{i,t-1}$  is stock price of firm  $i$  on day  $t-1$ .

**4. Empirical Results and Discussion**

Table 1 provides information on the level of integration among the stock markets, as measured by the coefficient of the Pearson static correlation, along with its significance level. During the period of the global financial crisis, the correlation coefficient values show that the market returns (RM\_SG) in Singapore have a significant correlation with the returns of the other four stock markets in the ASEAN region. The correlation coefficient values of the market returns in Singapore are 63.0 percent in Indonesia, with 52.8 percent of market returns in Malaysia, 52.1 percent in the Philippines and 67.4 percent in Thailand. This information indicates that the stock markets in Indonesia, Malaysia, Philippines and Thailand are strongly integrated with the stock market in Singapore during the financial crisis period. One symptom of the integrated stock markets is the cross-market movement of stocks in the same direction (Karim & Ning, 2013; Kearney & Lucey, 2004; Mobarek & Mollah, 2016).

The correlation level between market returns in Singapore and markets returns in the four ASEAN countries is not different from the correlation level of market returns in the USA and the four ASEAN countries. It appears that the correlation coefficient values are higher and significant. However, the coefficient values of the US market pairs are lower than those of Singapore, with 36.4 percent of market returns in Indonesia, 25.5 percent in Malaysia, 38.6 percent in the Philippines and 42.9 percent in Thailand. In addition, the level of correlation between market returns in the USA and Singapore is 50.9 percent. The above information suggests that the five ASEAN stock markets are strongly integrated with the US market.

The situation above is different from the pair of China and all other stock markets. The correlation level of returns appears very low between China and the four ASEAN markets, ranging from 4.9 percent to 11.6 percent. The correlation values of China market returns are 11.4 percent of market returns in Indonesia, along with 10.1 percent in Malaysia, 4.9 percent in the Philippines and 11.6 percent in Thailand. The lowest and the highest values of correlation for China market returns were found at 4.5 percent of market returns in the US and 16.8 percent in Singapore market returns. These results suggest that the level of integration of the Chinese stock market with other stock markets, especially with the US stock market, is very weak. The pair of the developed stock markets has a higher degree of

integration than the pair of emerging stock markets (Najmudin, Shaferi, Wahyudi, & Muharam, 2017).

From the above analysis of the Pearson correlation, the summary results show that the degree of integration of stock markets in Singapore, the US and the four ASEAN countries (Indonesia, Malaysia, Philippines and Thailand) is generally higher, whereas the degree of integration between the Chinese stock market and the four ASEAN stock markets appears very low. This fact can be a clue in analysing the occurrence of herding contagion from the three major stock markets (the US, China, and Singapore). On this basis, it is possible to conclude that herding behaviour in the US stock market will be followed by investors in all the observed stock markets, except for the Chinese stock market. The herding behaviour in the stock market in Singapore will be responded by investors in the four other ASEAN stock markets; and, on the contrary, the herding behaviour that occurs in the Chinese stock market will not be a trigger for investors in the five ASEAN stock markets.

From the information in Table 2, three findings about contagion herding during the crisis period can be assumed, respectively from column 2 to column 7. Firstly, the herding behaviour in the Chinese stock market is not impacted by the herding activity in the US stock market. Secondly, the herding behaviour in the stock markets of Indonesia, Malaysia, Thailand, and Philippines is impacted by the herding activity in Singapore and the US stock markets, although it is not impacted by the herding behaviour in the Chinese stock market. Thirdly, the herding behaviour in the Singapore stock market is affected by the herding activity in the stock markets in the USA and China.

Tab. 1: Pairwise cross-market correlation

	RM_ID	RM_MY	RM_PL	RM_TH	RM_SG	RM_CN
RM_SG	***0.630	***0.528	***0.521	***0.674		
RM_CN	*0.114	0.101	0.049	*0.116	***0.168	
RM_US <sub>t-1</sub>	***0.364	***0.255	***0.386	***0.429	***0.509	0.045

Note: This table reports pairwise cross-market returns correlation. RM\_ID, RM\_MY, RM\_PL, RM\_TH, RM\_SG, RM\_CN, and RM\_US stand for market returns in Indonesia, Malaysia, Philippines, Thailand, Singapore, China, and the US, respectively. The asterisks (\*\*\*, \*\*, \*) indicate that the  $p$ -value is statistically significant at the 1%, 5%, 10% level, respectively. Subscript  $t-1$  on the US market returns (RM\_US<sub>t-1</sub>) shows a one-day trading lag between the US market and Asian markets.

Source: Calculated by the authors

Tab. 2: Estimates of the contagion effect on herding behaviour

	CSAD_CN	CSAD_ID	CSAD_MY	CSAD_PL	CSAD_SG	CSAD_TH
Constant	***1.814	***1.257	***0.840	***0.841	**0.367	***0.882
CSAD_SG				***0.354		
D(CSAD_SG)		***0.281	**0.077			
LOG(CSAD_SG)						***0.819
CSAD_CN		0.123	0.041		**0.142	-0.037
D(CSAD_CN)				-0.020		
CSAD_US <sub>t-1</sub>	0.057	***0.640	***0.233	***0.293	***0.706	***0.152
Adj.-R <sup>2</sup>	0.003	0.218	0.127	0.341	0.389	0.405

Note: The CSAD for Singapore stock market partially was performed in transformation form, i.e., in first difference form D(CSAD\_SG) and in logarithm form LOG(CSAD\_SG), due to multicollinearity problem with CSAD of the US stock market.

Source: Calculated by the authors

The four stock markets in the ASEAN region, namely Indonesia, Malaysia, Philippines, and Thailand, have the same characteristics in terms of herding contagion from the stock markets in Singapore, China and the USA. On the other hand, investors in the Singapore stock market are different from investors in the four other ASEAN stock markets in responding to information coming from the Chinese stock market. This evidence appears in the phenomenon of contagion herding that emerged in the Singapore stock market from the Chinese stock market. Furthermore, it is known that investors who do herding in the Chinese stock market have characteristics that are most different from the previous five stock markets.

The herding activity of Chinese investors does not represent a response to the herding behaviour in the US stock market, even in the GFC started from the US stock market.

All of the statements mentioned above are based on the estimation equations presented in Table 2 for each of the stock markets below:

$$CSAD_{CN,t} = ***1.814 + 0.057 CSAD_{US,t-1} \quad \text{China,} \quad (10)$$

$$CSAD_{ID,t} = ***1.257 + ***0.281 D(CSAD_{SG,t}) + 0.123 CSAD_{CN,t} + ***0.640 CSAD_{US,t-1} \quad \text{Indonesia,} \quad (11)$$

$$CSAD_{MY,t} = ***0.840 + ***0.077 D(CSAD_{SG,t}) + 0.041 CSAD_{CN,t} + ***0.233 CSAD_{US,t-1} \quad \text{Malaysia,} \quad (12)$$

$$CSAD_{PL,t} = ***0.841 + ***0.354 CSAD_{SG,t} - 0.020 D(CSAD_{CN,t}) + ***0.293 CSAD_{US,t-1} \quad \text{Philippines,} \quad (13)$$

$$CSAD_{SG,t} = **0.367 + **0.142 CSAD_{CN,t} + ***0.706 CSAD_{US,t-1} \quad \text{Singapore,} \quad (14)$$

$$CSAD_{TH,t} = ***0.882 + **0.819 LOG(CSAD_{SG,t}) + 0.037 CSAD_{CN,t} + ***0.152 CSAD_{US,t-1} \quad \text{Thailand.} \quad (15)$$

From the perspective of the origin of herding behaviour in the stock markets, the estimation of equations can be interpreted as follows. Firstly, the herding behaviour in the Singapore stock market has a positive effect on the herding in the other four ASEAN stock markets (Indonesia, Malaysia, Philippines and Thailand). It is marked by the regression coefficients of CSAD for the Singapore stock market in each model. The coefficients of CSAD<sub>SG</sub> are highly significant, which is 0.281 for Indonesia, 0.077 for Malaysia, 0.354 for Philippines and 0.819 for Thailand stock market. Secondly, the herding behaviour in the Chinese stock market has no effect on the herding in the four ASEAN markets, yet it has a positive effect on the herding in the Singapore stock market, with a CSAD<sub>CN</sub> regression coefficient of 0.142. Thirdly, the herding behaviour that arose in the US stock market has a positive effect on the herding in all ASEAN stock markets, yet it has no effect on the herding activity in the Chinese stock market.

The facts demonstrate that the dispersion of returns of the Chinese stock market does not influence the dispersion of returns of the four ASEAN stock markets, where the Chinese stock market is segmented bilaterally from each of the four stock markets. In addition, the dispersion of returns of the Chinese stock market, which is segmented with the US stock market, was not influenced by the dispersion of returns of the US stock market. Thus, it can be stated that the dispersion returns of the foreign stock market does not affect the dispersion of returns of the segmented domestic stock market. In contrast, the dispersion of returns dispersion of the foreign stock market that impacts the dispersion returns of the integrated domestic stock markets can be proved by the following three findings. Firstly, the dispersion of returns of the Singapore market positively impacts the dispersion returns of the four ASEAN markets, where the Singapore market is bilaterally integrated with those four markets, as shown in Table 1. Secondly, the dispersion of returns of the Chinese market has a positive impact on the dispersion of returns of the Singapore market.

Globally, the Chinese market is classified as segmented to international stock markets, as concluded by Najmudin, Syarif, Wahyudi, and Muharam (2017). However, the Chinese market is bilaterally integrated with the Singapore market, as shown in Table 1. Thirdly, the dispersion of returns of the US market positively affects the dispersion of the five ASEAN markets. Each of the five ASEAN markets is bilaterally integrated with the US market (Table 1). Therefore, the contagion effect of herding behaviour prevails in integrated stock markets.

Another reason is that the returns of emerging stock markets, as in the Chinese stock market, are less strongly correlated with the returns of large stock markets, such as the US stock market. In the case of the global financial crisis that exacerbated the US market, the Chinese market did not face significant problems sourced from the US market. This is corroborated by the analysis in the crisis period which indicates that the non-fundamental factor in the form of herding behaviour in the US market did not affect the herding activity in the

Chinese market. This shows that there is no herding contagion effect in segmented stock markets. In addition, the fundamental factors impacting the changes in the dispersion of returns, as documented in Galariotis et al. (2015), are changes in the US federal funds rate, changes in the Bank of England base rate, inflation rate, trade balance and consumer confidence.

Observations for the tranquil period indicates that herding activity was only detected in the stock markets in China and the Philippines. This result is shown by the coefficient of R<sup>2</sup><sub>m,t</sub> which is negative and significant at the level of 10%. The equations for both stock markets are expressed as follows:

$$CSAD_{CN,t} = ***0.878 + ***0.285 |R_{m,t}| - *0.053 R_{m,t}^2 \quad \text{China,} \quad (16)$$

$$CSAD_{PL,t} = ***0.980 + ***0.295 |R_{m,t}| - *0.090 R_{m,t}^2 \quad \text{Philippines.} \quad (17)$$

Furthermore, the market returns of the Chinese stock market has a very low correlation with the market returns of the stock market of the Philippines with its 9.6 percent. This indicates that both markets have a very weak integration level.

The herding contagion from the Chinese stock market to the Philippines stock market can be expressed as follows:

$$CSAD_{PL,t} = ***1.027 + 0.086 CSAD_{CN,t} \quad (18)$$

The above estimation shows that the dispersion of returns of the Chinese market (CSAD<sub>CN</sub>) has no effect on the dispersion of returns of the Philippines market (CSAD<sub>PL</sub>). Such a result suggests that the herding in the Philippines market was not the result of the herding in the Chinese market. These findings generally demonstrate that contagion effect of herding behaviour does not apply to segmented stock markets in crisis and tranquil periods.

### 5. Conclusions

The phenomenon of the contagion effect has been proven in this research by focusing on the contagion of herding behaviour. Observations suggest that there is herding behaviour in the stock markets in China, Indonesia, Malaysia, Philippines, Singapore, Thailand and the USA stock markets during the global financial crisis period. Therefore, the analysis of the contagion effect is applied to all stock markets where the herding is found. The herding contagion is characterised by cross-sectional dispersion of returns that was partially explained by cross-sectional dispersion of returns of other markets. The findings of this research show that the contagion effect of herding behaviour takes place from the dominant stock markets globally or regionally to other stock markets, with Singapore having the greatest impact on the other four ASEAN stock markets. The information derived from the dominant stock market to the integrated stock markets and the interaction among the investors may generate a mass and parallel trading activity<sup>1</sup>. Investors in developed stock markets play an important role in

<sup>1</sup>«A mass and parallel trading activity» is another name of herding behaviour. «A mass trading» means collective trading. The term of «parallel trading» was taken from Kraus and Stoll (1972). It means «a situation in which the trading of a group of investors in a given security at a given time is predominantly on one side of the market».

spreading their behaviour because their decisions and actions are accepted by investors in other stock markets.

The contagion effect of herding behaviour analysed in the previous section has indicated the following. Firstly, the herding behaviour in the Singapore stock market is transmitted to the other four ASEAN stock markets, namely Indonesia, Malaysia, Philippines and Thailand. Secondly, the herding behaviour in the Chinese stock market is not a trigger for the herding activities in the four ASEAN markets, yet it has triggered the herding behaviour in the Singapore stock market. Thirdly, the herding in the US stock market, with the USA being the country where the crisis originated, spreads to all the ASEAN stock markets, yet it is not the cause of the herding behaviour in the Chinese stock market. Finally, the contagion effect of herding behaviour among different stock markets is related to financial globalisation process. The higher connection among stock markets in the form of global or bilateral integration may increase and expand this

behaviour. As regards integrated stock markets, we find that the herding behaviour in the dominant foreign stock market causes the herding behaviour in the domestic stock market. On the contrary, there is no contagion effect for segmented stock markets.

The findings of this research support the contagion theory related to non-fundamental factors. Furthermore, the contagion effect of herding only occurs for integrated stock markets during financial crisis periods. The herding activity in the stock market of the country, where the crisis originated, became a trigger to other stock markets, which generated the herding contagion effect. During the credit market crisis, the existence of herding appears in the US stock market and is transmitted to other markets. Therefore, market participants should be more conservative in anticipating the emergence of herding behaviour in an integrated stock market during the crisis period, especially from the dominant market.

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