Int. Journal of Economics and Management 11 (S2) : 393 – 407 (2017)

PERTANIKA JOURNALS

IJEM
International Journal of Economics and Management
Journal homepage: http://www.econ.upm.edu.my/ijem

Lead-Lag Relationship: Did the Financial Crisis Affect the Interdependence of ASEAN-5 and the Global Stock Market?

ARIEF RIJANTO

Faculty of Prasetiya Mulya Business School, Universitas Prasetiya Mulya

ABSTRACT

In the stock market, the lead-lag effect is based on theories suggesting that information can sometimes be transmitted slowly (quickly) to the investor. The lag-lag effect is the result of time-varying expected returns (Lo & MacKinlay, 1990). The global financial crisis in 2008 that shocked the US capital market changed the Association of Southeast Asian Nations (ASEAN)-5 stock market lead-lag long-term relationship with other global stock markets. Because of differing time zones and trading hours, investorsexperience differences in information transmission. This study focuses on the stock market lead-lag relationship and changes in long-term interdependencies before, during, and after the financial crisis to explore information transmission globally. We used the vector error correction model (VECM) to analyze the interdependence between ASEAN-5 and other global stock markets. The lead-lag relationship and interdependence among thestock markets of ASEAN-5, Korea, Japan, Hong Kong, United States (US), and United Kingdom (UK) have changed. Stock market interdependence increased during the financial crisis and the US stock market led the decrease in other countries'stock markets. However, after the financial crisis, ASEAN-5 stock market interdependence was stronger with the US and UK stock markets than other Asian countries' markets, even those of other ASEAN-5 members. This shows that no lead-lag relationships or interdependence exists within the ASEAN-5 stock markets; thus, the implementation of ASEAN financial market integration will face great challenges in the ASEAN capital market.

Keywords: ASEAN integration, financial crisis, lead-lag relationship, interdependence, VECM

JEL Classification: G01, G12, G15

*Corresponding author: Email : arief.rijanto@pmbs.ac.id

INTRODUCTION

The economic growth of member nations of the Association of Southeast Asian Nations (ASEAN) resulted in a tremendous increase in the size of these nations' stock market capitalization from 1996 to 2011. Market capitalization increased in the Indonesian stock market by 4.3 times, 1.3 times for Malaysia, 2.0 times for the Philippines and Singapore, and 4.0 times to 2.68 times for Thailand (May-Se et al., 2014). Capital and global investment portfolios continue to flow to ASEAN, with Hong Kong and Singapore playing the role of investment intermediary (Pongsaparn et al., 2011).

The 2008global financial crisis was caused by the United States (US) stock market crash and shocked stock markets all over the world, resulting in a decline in global stock market returns (Azmanet al., 2002; Mishkin, 2011; Reavis, 2012). In times of financial crisis, institutions and financial instruments suddenly experience a massive loss inthe value of assets (Mersud and Naida, 2013). The US and European financial crises also affected the global stock market interdependence, including inASEAN countries. Large numbers of foreign investors withdrew their investments in other countries, causing the financial crisis to spread through the global financial markets (Royfaizal et al., 2009). Equity markets in developing countries posted higher growth than in developed countries during the 2008financial crisis, but the integration of stock markets in developing countries was not as comprehensive as in developed countries (Wang et al., 2013).

After the crisis of 1998, the US became the country that had the greatest influence on the world's stock markets. US economic trends affected the decisions of US investors and in turn their activities affected the stock markets in the countries in which they invested their capital. Furthermore, international investors tend to be more reactive to US capital market news and pay less attention to news from other countries (Masih and Masih, 1999).

ASEAN countries' stock markets have had strong long-term interdependence with the US stock market (Ibrahim, 2000). During 1990-2003, the stock market integration relationship with ASEAN countries increased (Daly, 2003). Once past the 1998 crisis, ASEAN countries tended to integrate with the US and Japan; only Indonesia's stockmarket had no integration with the stock markets in the US and Japan. Malaysia and Thailand were affected by the Japanese stock marketin the long term (Majid et al., 2008). The Philippines was influenced by the US and Singapore stockmarkets. Meric et al. (2012) examined the aftermath of the 2008 crisis and found that the correlation between global stock markets increased from year to year.

The financial crisis represented a critical issue for investors in preparing their portfolio because a country's stability is the basis for preparing international portfolio diversification. Cheng et al. (2003) proved that ASEAN markets had interdependence in the period before and after the Asian crisis in 1998, but not during the crisis. Chung and Ariff (2015) conducted an analysis of co-integration between the stock markets of Malaysia, Singapore, and Thailand and three non-ASEAN countries (Hong Kong, Japan, and the US) in the period before and after the Asian financial crisis in 1998. The co-integration test revealed at least two co-integrating equations (pre-crisis and post-crisis) in ASEAN stock markets.

Sheng and Tu (2000) found that after an international event announced in Hong Kong during trading hours, Hong Kong's stock index closing price affected the New York index

on the same day. Conversely, when important economic news in the US was issued during a particular trading hour, it influenced the closing price of Hong Kong's stock index closing price on the next day. The study demonstrated that the time difference in stock market trading may affect relations between countries' stock markets.

The financial crisis in 2008 caused by US subprime mortgages and the European sovereign debt crisis in 2009 affected most stock markets across the world because of the time differences that cascaded the flow of information between countries. The financial crisis and global stock markets lead-lag relationship tends to change from time to time. Information regarding a crisis is transmitted slower (faster) to global investors. The lead-lag effect from time-varying expected returns in different time zones and trading hours may change (Lo and MacKinlay, 1990). This study aims to analyze the lead-lag relationship before, during, and after the 2008 global financial crisis forthe stock markets of ASEAN-5, Japan, Korea, Hong Kong, the US, and the UKusing daily trading data. ASEAN-5 represents the five biggest economies in ASEAN countries. Japan, Korea, and Hong Kong are the major economies within the Asia region that play an important role in the ASEAN region. The US is a major economy where the 2008 financial crisis started and the UK is included to represent Europe due its major role in the European Union (EU).

LITERATURE REVIEW

Financial crisis impact

A financial crisis is defined as a condition used to determine differences in the situation of financial institutions or financial instruments that occur quickly and suddenly in large numbers and involve a loss in value of assets (Mersud and Naida, 2013). The global crisis in 2008 originated from plummeting home values in the US subprime mortgagemarket (Reavis, 2012; Mishkin, 2011). House prices from the 1990s to 2006 had increased by 8% per year. High home demand led to more people buying homes through various types of credit. The decline in home prices also affected the increasing number of Americans who could not pay their mortgage. This caused bank liquidity problems. At the same time, banks were obliged to provide returns to their investors. This situation led to bank failures and triggered the financial crisis in 2008.

The public debt of countries in Europe as a whole did not appear to be a problem in the mid-2000s (Lane, 2012). Comparing the debt-to-gross domestic product (GDP) ratio, countries in Europe had values that resembledthose of the US. However, key countries, such as Greece, Ireland, Italy, Portugal, and Spain, were affected most by the subprime mortgage crisis in 2008. Indeed, some countries had a debt ratio greater than 60%. Other countries in the euro zone that had a debt-to-GDP ratio above 100% included Greece, Ireland, Italy, Portugal, and Spain.The debt ratio of each country against its GDP was 165% (Greece), 109% (Ireland), 121% (Italy), 106% (Portugal), and 67% (Spain).

Lead-Lag Relationship between Stock Markets

Theory suggests a lag-lag effect on equity markets resulting from asymmetric information. In the stock market, the lead-lag effect is based on theories suggesting that information can be

transmitted slowly (quickly) to investors. Lo and MacKinlay (1990) stated that the lead-lag effect contained a persistent and highly significant industry component. Hou (2007) foundthat big firms lead small firms within the same industry and the intra-industry lead-lag effect drives the overall lead-lag effect.

In financial theory, the lag-lag effect can be seen as the result of non-synchronous trading or time-varying expected returns (Lo and MacKinlay, 1990; Mech, 1993; McQueen et al., 1996). However, Chordia and Swaminathan (2000) suggested that these two lead-lag relationship theories explain only a small portion of the lead-lag patterns observed in the stock market.

Lau and McInish (1993) found an increase in capital market relationships associated with lead (lag) in 10 countries during the period before the US crisis in 1987 as compared to the period after the crisis in 1987. In the years before the US crisis, 20 lead (lag) associations were found in45 relationships. After the crisis, lead (lag) associations decreased to 43. The financial crisis increased the interdependence among nations' capital markets. In addition, arbitration was caused by the inefficiency of one country's capital market versus that of other countries. Investors can use this condition to gain an advantage.

Arshanapalli et al. (1995) analyzed the influence of the after-effects of the US crisis in 1987 on the Asian capital market. The analysis used stock market daily data from the US, Japan, Hong Kong, and ASEAN countriescovering 1986through1992; the US influence on the Asian market was greater after the crisis of 1987. Palac and McMiken (1997) observed an integration relationship of the five ASEAN countries and found that all ASEAN countries had strong co-integration relationships during 1987-1995 except for Indonesia.

Ibrahim (2005) observed an interdependence relationship among the US, Japanese, and ASEAN stockmarkets in 1988-1997.The result showed that no interdependence relationship was found between Indonesia and other ASEAN countries or the United States and Japan in the period before and after the financial crisis in 1989. However, there was interaction among ASEAN countries. Royfaizal et al. (2009) examined the interdependence relationship between ASEAN-5+3, which consists of Malaysia, Singapore, the Philippines, Thailand, Indonesia, China, Japan, and Korea, with the US capital market using weekly data on prices in the capital market during 1990-2007 and found that the ASEAN-5+3 and US stock markets had an interdependence relationship in the period during and after the crisis of 1997. Chen et al. (2003) investigated the interaction between the five founding nations of ASEAN-5 in the period before, during, and after the Asian crisis of 1997 and found a co-integration relationship before and after the Asian crisis of 1997, but not during the crisis.

Majid et al. (2008) empirically observed the interdependence among five ASEAN countries, the US, and Japan. The data used were the daily closing price of the composite index for 1988-2006. The study found that in the long-term relationship, Indonesia tended to be more independent from the US and Japan, Malaysia was more influenced by Japan than the United States, Thailand was more influenced by the US market but in an extension also dependent on Japan, the Philippines wasmore influenced by the US than by Japan, and Singapore interplayed with the US and Japan.

RESEARCH METHODOLOGY

This research used the stock market index of ASEAN-5, Korea, Japan, Hong Kong, the US, and the UK from 2003 through 2013. The countries were selected based on the regional economic cooperationamong ASEAN-5, the dominant Asian countries (Korea, Japan, and Hong Kong), European countries (the UK), and the US as the source of the financial crisis in 2008. The research variables used the daily closing price of the US stock market indexes (DJIA), UK (FTSE), Singapore (STI), Malaysia (KLSE), Thailand (SET), Philippines (PSEi), Indonesia (JKSE), Japan (N225), Korea (KOSPI), and Hong Kong (HSI). The daily data, obtained from Bloomberg stock market data for 2003 to 2013, were divided into three periods:before the crisis (January 2003 to July 2007), during the crisis (August 2007 to December 2009), and after the crisis (January 2010 to December 2013).

The initial step of this study determined the optimal lag length, unit root forstationarity test, and the cointegration between the variables. To determine the optimal lag based on Akaike (1981), we chose the smallest Akaike information criterion (AIC) value. Then the unit root test method was used to check the data stationarity. Dickey and Fuller (1979) defined time series data as stationary when the mean and variance values are constant during a period of time. The co-variance value between the two time periods is only dependent on the lag. The unit root test was run using the augmented Dickey-Fuller (ADF) method. Data are called stationary when the data do not have a unit root.

The Granger causality test is used to determine the causal relationship between two variables; the test results can determine the existence of a two-way correlation, one-way correlation, or the absence of correlation between the two variables. Based on Granger (1969), if there are two variables, X and Y, containing time series data in each variable, a simple causality equation modelof regression and estimation can be used, as follows:

$$Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_{1t}$$

$$X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + u_{2t}$$

Based onthe two regression equations above, it was assumed that u1t and u2t do not have a relationship. So, the equation produced four possible relationships that can occur based on the coefficient value, as follows:

1. Causality unidirectional from X to Y, if $\sum \alpha \neq 0$ and $\sum \delta = 0$.
2. Causality unidirectional from Y to X, if $\sum \alpha = 0$ and $\sum \delta \neq 0$.
3. Causality bilateral, if $\sum \alpha \neq 0$ and $\sum \delta \neq 0$.
4. No causality or independent if $\sum \alpha = 0$ and $\sum \delta = 0$.

Before using the vector error correction model (VECM) model, the Johansen co-integration test was used to determine the long-term relationship and short-term dynamics between the time series data and the variables (Kennedy, 2003). The Johansen (1988) method produced atrace value and maximum eigenvalue. Also, eigenvalues were used to obtain an estimation matrix as the number of observations. The trace value showed anull hypothesis suggesting at least an integrated vector *r*, contrary to the alternative hypotheses which say that the number of co-integrated vectors is greater than than r (Palamalai, Kalaivani, and Devakumar, 2013).

After checking co-integration, VECM was used to analyze the long-term lead-lag relationship among the stock markets of ASEAN-5, Korea, Japan, Hong Kong, the US, and the UK. VECM has been found to be better than VAR in predicting stock prices in Taiwan's capital market (Kuo and Chen-Yin, 2016). The VAR model only showed the lead-lag relationship and not the long-term relationship between variables (Tswei, 2013). The VECM model wascreatedtoovercomethe short-term balanceproblemsbycorrectingtheerrorthatmayhave occurred in eachvariable. The VECM model, formulated by Granger (1988), is as follows:

$$\Delta Y = \alpha + \beta \Delta X + \gamma v_{t-1} + e_t$$

where υ_{t-1} is the co-integration error, which can be written as:

$$v_{t-1} = Y_{t-1} - \delta_0 - \delta_1 X_{t-1}$$

The equation shows the change of X to Y in the long term, which would be balanced by a previous error. The ΔX value describes the X variable as a short-term "error." If γ is significant, then the coefficients become an adjustment to fluctuations in relationships between long-term variables. If $\upsilon_{t-1} > 0$, then the model is not in a balanced situation because the variable Y_{t-1} has a value above its equilibrium value. Toreturn to equilibrium, the y value is expected to be negative. So, if the value of $\gamma\ \upsilon_{t-1} < 0$, the value of $\Delta Y<0$ will return to its equilibrium. When the value of Yt is above its equilibrium, then in the next period it will decline to correct the "errors" that occured. Conversely, if $\upsilon_{t-1} < 0$, then Y is below the equilibrium and the γ value can expected to be negative, so that the value of $\gamma\ \upsilon_{t-1} > 0$ and $\Delta Y > 0$.

RESULTS

Table 1 shows10-yearyearly stock market returns for 10 markets. In 2003, all the indexes experienced a gain, with SET having the biggest and FTSE the smallest. In 2004, the inverse occurred; SET was the only weakened index. In 2004 and 2006, JKSE experienced the largest increase while in 2005 and in July 2007 KOSPI was the highest. Some indexes experienced a sideways trend, such as DJIA and KLSE in 2005 and N225 in 2007. In the period before the crisis, JKSE experienced the biggest gain with a yield of 452.70%, followed by PSEi (243.79%) and the KOSPI (208.07%). Meanwhile, the yield of DJIA and FTSE did not reach above 100%.

Table 1. Stock Market Returns: ASEAN-5, Korea, Japan, Hong Kong, US, and UK.

Time Period	Year	DJIA	FTSE	HSI	N225	KOSPI	JKSE	PSEi	KLSE	SET	STI
Before Crisis	2003	25.3%	13.6%	34.9%	24.5%	29.2%	62.8%	41.6%	22.8%	116%	32.8%
	2004	3.2%	7.5%	13.2%	7.6%	10.5%	44.6%	26.4%	14.3%	-13.5%	15.6%
	2005	-0.1%	16.7%	4.5%	40.2%	54.3%	16.2%	13.5%	-0.5%	6.8%	13.9%
	2006	16.3%	10.7%	32.6%	6.9%	3.3%	55.3%	42.6%	21.8%	-4.8%	28.0%
During Crisis	2007	6.0%	2.2%	17.5%	0.1%	34.8%	30.1%	17.4%	25.3%	26.5%	19.3%
	2008	-32.7%	-30.9%	-47.8%	-42.1%	-39.3%	-50.4%	-48.2%	-38.9%	-46.6%	-48.9%
	2009	18.8%	22.1%	52.0%	19.0%	49.7%	87.0%	63.0%	45.2%	63.3%	64.5%
After Crisis	2010	11.0%	9.0%	5.3%	-3.0%	21.9%	46.1%	37.6%	19.3%	40.6%	10.1%
	2011	4.7%	-5.6%	-21.3%	-17.3%	-11.8%	2.5%	3.7%	-0.2%	-0.7%	-18.2%
	2012	7.3%	5.8%	22.9%	22.9%	9.4%	13.3%	32.2%	10.3%	35.8%	19.7%
	2013	26.5%	14.4%	2.9%	56.7%	0.7%	-1.0%	1.3%	10.5%	-6.7%	0.0%

As seen in Table 1 from the movement of the 10 stock markets during the crisis period, the index decreased from year to year.The lowoccurred from October 2008 to March 2009. From August to December 2007, all indexes looked fairly stable, staying at a certain position. Only the JKSE and HSI indexes gained more than 10%, and N225 weakenednearly 10%. In 2008, the lead-lag relationship between all indexes weakened nearly 50%. In 2009, the index seemed to gain quite extreme increases of more than 40%. However, the DJIA, FTSE, and N225 experienced limited gains of around 20%. In the crisis period, N225 experienced the highest decline; it weakened by 37.49%, followed by DJIA, at 21.96%. On the whole, the average index plunged more than 10%during this period. Concurrently, the yield of JKSE gained 12.32%. This was in line with the strengthening of 86.98%in 2009.

In 2010, several indexes experienced significant post-crisis gains. N225 was the only weakened index. In the following year, the indexes seemed to experience limited gains and downfalls. HSI experienced the largest decline at above 20% while DJIA experienced the greatest gain. In 2012, the stock market experienced gains led by SET, PSEi, HSI, and N225 with increases of more than 20%. In 2013, the N225 index experienced a gain which was quite extreme compared to the other indexes. In the after-crisis period, PSEi had the biggest gain with a yield of 92.94%, followed by SET (76.81%) and JKSE (68.65%). All in all, the average index gained more than 20%. Meanwhile, the yield of HSI and STI gained 6.56% and 9.31%, respectively.

The AIC valuewas used to select the optimal lag before, during, and after the crisis period. The optimal lag obtained before the crisis period was lag-2.During the crisis period, the optimal lagwas lag-2. After the crisis period, the optimal lag was lag-2. This optimal lag was employed in data processing using the subsequent econometric model. Because the time series data were daily, lag-2 (t=-2) means twodays before the current day (t =0).

The ADF stationarity was tested before, during, and after the financialcrisis periods. The result showed that all probability valuesare above the significance level of 0.01, which means that the data are not stationary. These results indicatethat the unit root test needs to be performedon the first-difference data. After processing the first difference to all stock markets, the results showed that all stock market data before, during, and after the crisis period are stationary.

Table 2.Granger Causality TestBefore Crisis.

	GrangerCause – Before FinancialCrisis									
Caused by	Indeks	JKSE	DJIA	FTSE	HSI	N225	KOSPI	PSEi	STI	KLSE	SET
	JKSE		3.21808	1.21718	5.42428	2.24129	3.16908	21.3675	2.08097	3.17349	2.19638
			[0.0404]	[0.2964]	[0.0045]	[0.1068]	[0.0424]	[0.0000]	[0.1253]	[0.0422]	[0.1117]
	DJIA	65.7551		54.4767	109.97	97.5205	74.6121	112.264	102.446	73.3046	24.8265
		[0.0000]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	FTSE	23.4278	1.69174		47.2486	69.5985	50.4621	74.4228	38.9809	32.2162	12.68
		[0.0000]	[0.1846]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	HSI	0.6042	1.99258	0.63877		4.54681	0.84843	21.4779	0.31783	4.6324	2.47837
		[0.5467]	[0.1368]	[0.5281]		[0.0108]	[0.4283]	[0.0000]	[0.7278]	[0.0099]	[0.0843]
	N225	0.28123	0.67096	0.1304	0.92022		2.51088	8.70142	2.02925	0.13836	0.8192
		[0.7549]	[0.5114]	[0.8778]	[0.3987]		[0.0816]	[0.0002]	[0.1319]	[0.8708]	[0.441]
	KOSPI	0.5173	1.28988	1.20964	0.64284	1.04378		11.8672	0.35373	0.93647	6.02301
		[0.5963]	[0.2757]	[0.2987]	[0.526]	[0.3524]		[0.0000]	[0.7021]	[0.3923]	[0.0025]
	PSEi	2.13698	1.85036	1.01386	3.21121	1.08926	2.60485		1.83055	1.99122	2.78025
		[0.1185]	[0.1576]	[0.3631]	[0.0407]	[0.3368]	[0.0743]		[0.1608]	[0.1370]	[0.0624]
	STI	1.40681	2.29855	0.1367	9.69701	11.706	6.33895	27.3644		7.47541	2.18398
		[0.2453]	[0.1009]	[0.8722]	[0.0000]	[0.0000]	[0.0018]	[0.0000]		[0.0006]	[0.1130]
	KLSE	0.32844	0.77015	0.05311	0.80509	0.65977	2.72694	17.3766	0.62442		4.6394
		[0.7201]	[0.4632]	[0.9483]	[0.4473]	[0.5172]	[0.0658]	[0.0000]	[0.5357]		[0.0098]
	SET	0.79904	0.54757	0.63236	0.32995	0.52116	2.12266	9.47355	0.82558	1.34293	
		[0.4500]	[0.5785]	[0.5315]	[0.719]	[0.5940]	[0.1202]	[0.0000]	[0.4382]	[0.2615]	

[] The probability value(p-value) is at the 0.01, 0.05, and 0.1 level, rejection of the null hypothesis is at the 0.01, 0.05, and 0.1 level, respectively.

Table 2 shows the before-crisis period from January 1, 2003, through August 31, 2007. The JKSE had a one-way relationship with six other countries. DJIA and FTSE led and affected all ASEAN-5 countries, Korea, Hong Kong, and Japan as lagging,ata significance level of 0.01. JKSE had a lead-lag relationship with DJIA, HSI, KOSPI, PSEI, and KLSE. JKSE influenced KOSPI and KLSE ata significance level of 0.05. Meanwhile, JKSE was influenced by HSI and PSEI at a significance level of 0.01. FTSE also had a strong influence and led JKSE. Also, JKSE had a strong influence on HSI and PSEI. JKSE led and affected KOSPI and KLSE ata significance level of 0.05. A one-way relationship was found in the period before the crisis wheremost of the stock markets were influenced and led by the US and UK stock markets.

Table 3.Granger Causality TestDuring Crisis.

	GrangerCause– During Financial Crisis Period									
Caused by	Indeks	JKSE	DJIA	FTSE	HSI	N225	KOSPI	PSEi	STI	KLSE	SET
	JKSE		1.11532	1.38268	2.25628	9.56864	4.71483	17.8534	0.01538	12.96	4.64039
			[0.3422]	[0.247]	[0.0807]	[0.0000]	[0.0029]	[0.0000]	[0.9974]	[0.0000]	[0.0032]
	DJIA	21.1074		45.4449	51.2977	128.742	42.7664	108.474	44.7749	35.2288	24.866
		[0.0000]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	FTSE	10.312	0.70333		32.7484	70.7406	25.5113	45.3026	13.4712	19.7343	9.972
		[0.0000]	[0.5503]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	HSI	0.57951	0.82599	2.28375		8.78031	2.7035	7.61185	2.6282	7.288	2.05949
		[0.6286]	[0.4798]	[0.0779]		[0.0000]	[0.0447]	[0.0000]	[0.0494]	[0.0000]	[0.1044]
	N225	0.72315	0.59854	0.9292	0.27452		0.79829	4.5356	3.91634	0.97861	1.12255
		[0.5384]	[0.6161]	[0.4262]	[0.8438]		[0.4951]	[0.0037]	[0.0087]	[0.4023]	[0.3392]
	KOSPI	1.70355	1.59365	1.28241	2.47709	5.59171		6.96824	2.08429	2.22594	2.75737
		[0.1651]	[0.1897]	[0.2794]	[0.0604]	[0.0009]		[0.0001]	[0.1011]	[0.0840]	[0.0416]
	PSEi	0.73226	0.59038	3.07915	1.13797	3.80094	1.33122		0.27836	5.63805	3.31077
		[0.5330]	[0.6215]	[0.0270]	[0.3330]	[0.0102]	[0.2632]		[0.841]	[0.0008]	[0.0198]
	STI	2.07068	2.25198	3.62877	19.6271	25.5625	11.2653	21.9058		7.8606	1.78392
		[0.1029]	[0.0812]	[0.0129]	[0.0000]	[0.0000]	[0.0000]	[0.0000]		[0.0000]	[0.149]
	KLSE	1.92466	2.95351	3.0042	2.73301	3.20935	2.29268	8.17694	1.80129		2.05302
		[0.1243]	[0.0320]	[0.0299]	[0.0430]	[0.0227]	[0.0770]	[0.0000]	[0.1457]		[0.1053]
	SET	1.56805	1.03602	2.67935	2.53322	9.87105	3.83446	12.5986	0.28492	4.53565	
		[0.1959]	[0.3760]	[0.0462]	[0.0560]	[0.0000]	[0.0097]	[0.0000]	[0.8363]	[0.0037]	

[] The probability value(p-value) is at the 0.01, 0.05, and 0.1 level, rejection of the null hypothesis at the 0.01, 0.05, and 0.1 level.

Duringthe 2008 financial crisis, Indonesia was still influenced by the US and UK. Table 3 shows a one-way causal relationship in the period of crisis.JKSE was affected by and lagged DJIA and FTSE at a significance level of 0.01. JKSE led and influenced N225, KOSPI, PSEI, KLSE, and SET at a significance level of 0.01. However, JKSE influenced and lagged HSI at a significance level of 0.10.

Table 4. Granger Causality Test After Financial Crisis.

	GrangerCause–After Crisis									
Caused by	Indeks	JKSE	DJIA	FTSE	HSI	N225	KOSPI	PSEi	STI	KLSE	SET
	JKSE		0.52066	0.58242	0.01571	1.68002	3.72973	14.5126	0.39131	4.54277	6.49282
			[0.5943]	[0.5587]	[0.9844]	[0.1869]	[0.0243]	[0.0000]	[0.6763]	[0.0109]	[0.0016]
	DJIA	82.5119		29.1134	142.477	122.233	132.829	89.4844	105.953	96.682	40.114
		[0.0000]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	FTSE	33.7757	2.16997		98.4859	87.8528	97.5271	69.0263	72.9214	57.8259	18.1022
		[0.0000]	[0.1147]		[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
	HSI	0.43039	3.01578	1.144		3.83962	5.47415	11.3339	0.77556	1.41435	0.45869
		[0.6504]	[0.0494]	[0.3190]		[0.0218]	[0.0043]	[0.0000]	[0.4607]	[0.2436]	[0.6322]
	N225	5.97247	0.46347	1.35848	1.43029		0.21542	1.71654	1.03298	2.00004	3.88346
		[0.0026]	[0.6292]	[0.2575]	[0.2397]		[0.8062]	[0.1802]	[0.3563]	[0.1359]	[0.0209]

Table 4 (Cont.)

Caused by	KOSPI	0.00272	1.22305	1.61347	0.23743	0.30775		8.57167	0.16155	2.97082	0.52091
		[0.9973]	[0.2948]	[0.1997]	[0.7887]	[0.7352]		[0.0002]	[0.8508]	[0.0517]	[0.5941]
	PSEi	3.97919	1.60214	3.3424	0.33602	2.11551	1.79164		0.98648	2.0609	1.75347
		[0.019]	[0.2020]	[0.0357]	[0.7147]	[0.1211]	[0.1672]		[0.3732]	[0.1279]	[0.1737]
	STI	0.66746	0.7252	0.5994	6.26424	9.19014	10.4095	24.0357		5.85846	1.56399
		[0.5132]	[0.4845]	[0.5493]	[0.0020]	[0.0001]	[0.0000]	[0.0000]		[0.003]	[0.2098]
	KLSE	2.15499	1.50581	3.03214	1.31136	3.4841	0.68844	3.90061	2.48118		0.08504
		[0.1164]	[0.2223]	[0.0486]	[0.2699]	[0.031]	[0.5026]	[0.0205]	[0.0841]		[0.9185]
	SET	5.57659	1.37381	4.40972	1.24226	6.82874	8.80443	29.1162	1.92511	6.09673	
		[0.0039]	[0.2536]	[0.0124]	[0.2892]	[0.0011]	[0.0002]	[0.0000]	[0.1464]	[0.0023]	

[] The probability value(p-value) is at the 0.01, 0.05, and 0.1 level, rejection of the null hypothesis at the 0.01, 0.05, and 0.1 level.

Table 4 shows that after the crisis period, JKSE had a two-way relationship with PSEi and SET. JKSE experienced one-way influence from DJIA, FTSE, and N225. JKSE also had a one-way influence on KOSPI and KLSE. Meer and Omar (2008) found that Indonesia's long-term relationship tended to be independent from the US and Japanese stock markets. The Granger causality test results showed a causality relationship between the stock markets of the ASEAN-5, Korea, Japan, and Hong Kong with the US and UK. After the crisis period, Indonesia was influenced only by the US and UK, and not by other Asian countries (Thailand, Philippines, and Japan). This result differs from what occurred during the 1998 Asian crisis,as Roy et al. (2009) explained; they said that in the period before the financial crisis in 1998, Indonesia was only affected by Thailand and in the crisis period it was only affected by the Philippines. Meanwhile, after the financial crisis in 1998, Indonesia stood as an independent state without influences from other countries.

The Johansen co-integration test aims to check the number of co-integration equations that occured in the samples tested using the trace value and maximum eigenvalue compared to the critical value. In the period before and after the crisis, there was at least one co-integration equation. This means that in the period before and after the crisis, interdependence relationship existedamongthe stock markets of ASEAN-5+3, the US, and the UK. The 2008 financial crisis in the US stock market ledto changes in the long-term relationships among countries globally.

Table 5.Stock Market Lead-Lag Relationship Before the Crisis Period.

		Independent (lag-1)									
	Index	DJIA_t-1	FTSE_t-1	HSI_t-1	N225_t-1	KOSPI_t-1	JKSE_t-1	PSEi_t-1	STI_t-1	KLSE_t-1	SET_t-1
Dependent(lag-0)	DJIA	−0.0628	0.0742	−0.0153	−0.0241	0.6967	−0.3761	0.1648	−0.1564	0.0106	−0.1561
		[0.0581]	[0.2715]	[0.506]	[0.2299]	[0.0036]	[0.0665]	[0.082]	[0.3457]	[0.9801]	[0.5878]
	FTSE	0.1745	−0.2205	−0.0198	−0.0071	0.2504	−0.1870	0.0986	0.0851	0.0991	−0.1115
		[<0.0001]	[<0.0001]	[0.0865]	[0.4787]	[0.0374]	[0.0693]	[0.0383]	[0.3072]	[0.6414]	[0.4409]
	HSI	0.6082	0.3782	−0.0738	−0.1094	−0.2535	0.5704	0.2328	0.6431	−0.0231	−0.1863
		[<0.0001]	[0.001]	[0.0585]	[0.0013]	[0.5321]	[0.1007]	[0.1472]	[0.0224]	[0.9744]	[0.7029]
	N225	0.5219	0.5592	0.0330	−0.0945	−1.312	0.2763	0.0796	0.7775	−1.0044	−0.1452
		[<0.0001]	[<0.0001]	[0.4073]	[0.0066]	[0.0016]	[0.4362]	[0.6276]	[0.0069]	[0.1712]	[0.771]
	KOSPI	0.0413	0.0517	−0.00512	−0.01102	−0.00244	0.0508	0.0122	0.0350	−0.05902	0.0650
		[<0.0001]	[<0.0001]	[0.1601]	[0.0005]	[0.9487]	[0.1182]	[0.4156]	[0.1833]	[0.3795]	[0.155]

Table 5 (cont.)

Dependent(lag-0)	JKSE	0.0473	0.0200	-0.0007	−0.00489	−0.03524	0.0850	0.0057	0.0071	−0.0472	0.0488
		[<0.0001]	[0.0828]	[0.8629]	[0.1535]	[0.3888]	[0.0152]	[0.7232]	[0.8017]	[0.5141]	[0.3221]
	PSEi	0.1062	0.0898	0.0080	−0.00445	−0.0385	0.1771	−0.0463	0.0046	0.3580	0.1312
		[<0.0001]	[<0.0001]	[0.2626]	[0.4729]	[0.6031]	[0.0052]	[0.114]	[0.9285]	[0.0063]	[0.1407]
	STI	0.0229	0.0154	0.0006	−0.00288	0.0001	0.0173	−0.00443	0.0158	0.1530	−0.04904
		[<0.0001]	[0.0037]	[0.7314]	[0.0682]	[0.995]	[0.2825]	[0.552]	[0.2267]	[<0.0001]	[0.0306]
	KLSE	0.0152	0.0115	−0.0003	−0.00456	0.0562	0.0180	0.0074	−0.026149	0.0808	−0.0716
		[<0.0001]	[0.1128]	[0.8911]	[0.0341]	[0.0289]	[0.4139]	[0.4657]	[0.1421]	[0.0758]	[0.0207]
	SET	0.0875	0.0524	−0.0035	−0.0126	−0.0663	0.0798	0.0257	0.1366	−0.0389	−0.05271
		[<0.0001]	[0.0017]	[0.544]	[0.0109]	[0.2627]	[0.115]	[0.2717]	[0.192]	[0.5849]	[0.1986]

Coefficient, [] the probability value (p-value) is 0.01, 0.05, and 0.1, rejection of the null hypothesis at 0.01, 0.05, and 0.1.

The VECM method is used to analyze the lead-lag relationshipsamong ASEAN countries, Korea, Japan, Hong Kong, the US, and the UK. Lag-0 represents the dependent variable and lag-1 the independent variable. As this study used daily data, each lag-0 (Lagging) and lag-1 (Leading) illustrates the one-day difference in the capital market trading day.

The VECM resultsare displayed in Table 5,which shows the lead-lag relationships during the before-crisis period. Before the crisis period, the US stock market was the leading stock market. TheUK stock market led all markets with the exception of the US and Malaysia (KLSE). The Japanese stock market led most of Asia's stock markets with the exception of Indonesia and the Philippines,whereas Singapore led Japan and Hong Kong. Malaysia's stock market significantly ledSingapore's.

Table 6.Stock Market Lead-Lag Relationship During Crisis Period.

		Independent (lag-1)									
	Indeks	DJIA_t-1	FTSE_t-1	HSI_t-1	N225_t-1	KOSPI_t-1	JKSE_t-1	PSEi_t-1	STI_t-1	KLSE_t-1	SET_t-1
Dependent(lag-0)	DJIA	−0.1432	−0.0473	−0.0213	−0.05925	0.468	0.442	−0.1364	0.371	−1.67295	−0.6459
		[0.0051]	[0.6638]	[0.3903]	[0.1816]	[0.2574]	[0.0932]	[0.4789]	[0.2014]	[0.0313]	[0.4678]
	FTSE	0.214	−0.3499	0.010	−0.0154	−0.5362	0.143	0.197	0.175	−0.4116	0.196
		[<0.0001]	[<0.0001]	[0.3678]	[0.4455]	[0.0046]	[0.2338]	[0.0252]	[0.1879]	[0.2453]	[0.6292]
	HSI	0.897	0.841	−0.3414	−0.1965	0.133	0.382	0.122	3.450	0.264	−4.3616
		[<0.0001]	[0.0017]	[<0.0001]	[0.0707]	[0.8956]	[0.553]	[0.7951]	[<0.0001]	[0.8895]	[0.0457]
	N225	0.572	0.594	−0.0733	−0.2903	−0.1268	0.516	0.811	1.425	−1.7336	−0.8818
		[<0.0001]	[<0.0001]	[0.0045]	[<0.0001]	[0.7681]	[0.0595]	[<0.0001]	[<0.0001]	[0.032]	[0.3407]
	KOSPI	0.053	0.033	−0.0084	−0.0166	−0.1189	0.075	0.061	0.151	−0.0973	−0.1020
		[<0.0001]	[0.0313]	[0.0154]	[0.0076]	[0.0403]	[0.0408]	[0.0239]	[0.0002]	[0.371]	[0.3777]
	JKSE	0.051	0.044	−0.01077	−0.0120	−0.1662	0.075	0.094	0.143	−0.0233	0.088
		[<0.0001]	[0.0504]	[0.0343]	[0.1892]	[0.0504]	[0.1671]	[0.0181]	[0.0164]	[0.8836]	[0.6305]
	PSEi	0.134	0.0310	−0.0149	0.005	−0.0819	0.210	0.047	0.164	0.102	−0.01805
		[<0.0001]	[0.1507]	[0.0027]	[0.5992]	[0.3215]	[<0.0001]	[0.2216]	[0.0049]	[0.511]	[0.9191]
	STI	0.021	0.0180	0.000	−0.0068	−0.0217	0.066	0.035	0.014	−0.0877	−0.0407
		[<0.0001]	[0.0132]	[0.9518]	[0.0192]	[0.4187]	[0.0001]	[0.0053]	[0.4476]	[0.0821]	[0.4818]
	KLSE	0.014	0.014	−0.00301	−0.0003	−0.0044	0.023	0.043	−0.0142	−0.0385	−0.0446
		[<0.0001]	[0.020]	[0.0332]	[0.8868]	[0.8517]	[0.1287]	[0.0001]	[0.3913]	[0.3834]	[0.3796]
	SET	0.087	0.0540	−0.0135	−0.0194	−0.1568	0.054	0.160	0.113	−0.2736	−0.2872
		[<0.0001]	[0.0318]	[0.0195]	[0.0597]	[0.1029]	[0.3726]	[0.0004]	[0.0946]	[0.1294]	[0.165]

Coefficient, [] the probability value (p-value) is 0.01, 0.05, and 0.1, rejection of the null hypothesis at 0.01, 0.05, and 0.1.

Table 6 shows that during the financial crisis period, the lead-lag relationship changes. Nevertheless, the US stock market was still leading. The UK stock market led all markets, too, except for the US and the Philippines (PSEi). The Japanese stock market still led most of Asia's stock markets with the exception of Malaysia, Indonesia, and the Philippines.

Table 7. Stock Market Lead-Lag Relationship After Crisis Period.

		Independent (lag-1)									
	Index	DJIA_t-1	FTSE_t-1	HSI_t-1	N225_t-1	KOSPI_t-1	JKSE_t-1	PSEi_t-1	STI_t-1	KLSE_t-1	SET_t-1
Dependent (lag-0)	DJIA	−0.10167	0.1810	0.0738	0.0009	−0.41807	0.1503	0.0700	−0.2409	−0.8729	−0.86117
		[0.0162]	[0.0464]	[0.0013]	[0.8356]	[0.0728]	[0.1574]	[0.3267]	[0.2927]	[0.0944]	[0.0107]
	FTSE	0.1584	−0.17247	0.0339	−0.00065	−0.16325	0.0164	0.0457	−0.1043	−0.1538	−0.39184
		[<0.0001]	[0.0001]	[0.0031]	[0.7665]	[0.1600]	[0.7564]	[0.1991]	[0.3607]	[0.5543]	[0.0199]
	HSI	0.7833	0.7992	−0.05438	0.0072	−0.9501	−0.21067	0.0835	−0.0565	−0.78107	0.2206
		[<0.0001]	[<0.0001]	[0.2173]	[0.3982]	[0.0338]	[0.3019]	[0.5421]	[0.8977]	[0.4354]	[0.7332]
	N225	0.1355	0.1210	−0.009479	−0.33401	0.4683	−0.411702	−0.471682	0.2638	2.7033	1.9571
		[0.6256]	[0.8394]	[0.9499]	[<0.0001]	[0.7597]	[0.5556]	[0.3149]	[0.8608]	[0.4305]	[0.3772]
	KOSPI	0.0623	0.0654	0.0021	0.0017	−0.14315	0.0036	0.0196	−0.0413343	−0.09248	0.0922
		[<0.0001]	[<0.0001]	[0.5689]	[0.0216]	[0.0002]	[0.8327]	[0.0922]	[0.2669]	[0.2755]	[0.0926]
	JKSE	0.1474	0.0277	−0.01338	0.0002	−0.02826	0.0671	−0.03423	−0.08573	−0.21435	0.1897
		[<0.00018]	[0.4266]	[0.1294]	[0.8867]	[0.7521]	[0.1006]	[0.2121]	[0.3298]	[0.2849]	[0.1432]
	PSEi	0.1478	0.1113	−0.00889	−0.001229	−0.03937	0.0657	−0.00789	0.0729	−0.00517	0.5794
		[<0.0001]	[0.0096]	[0.4126]	[0.5583]	[0.7206]	[0.1911]	[0.8151]	[0.5005]	[0.9833]	[0.0003]
	STI	0.0725	0.0695	0.0055	0.0008	−0.06071	0.0147	0.0175	−0.17689	−0.18565	0.0384
		[<0.0001]	[0.0001]	[0.2289]	[0.3461]	[0.1905]	[0.4882]	[0.2179]	[0.0001]	[0.074]	[0.5671]
	KLSE	0.0240	0.0176	−0.00283	−3.574e-05	0.0022	0.0101	0.0041	−0.01673	0.0749	0.0286
		[<0.0001]	[0.0055]	[0.0772]	[0.9082]	[0.8946]	[0.1754]	[0.4145]	[0.2952]	[0.0398]	[0.2237
	SET	0.0292	0.0045	−0.00244	0.0007	−0.007175	0.0443	−0.001263	−0.03169	−0.04304	−0.0425
		[<0.0001]	[0.6609]	[0.3438]	[0.1391]	[0.784]	[0.0002]	[0.8749]	[0.2182]	[0.4628]	[0.262]

Coefficient, [] the probability value (p-value) is 0.01, 0.05, and 0.1, rejection of the null hypothesis at 0.01, 0.05, and 0.1.

The VECM results in Table 7 show that after the financial crisis period the lead-lag relationship also changed. Nevertheless, the US stock market was still the leading stock market. The UK, Hong Kong, Korea, Malaysia, and Thailand stock marketswere influenced by the US stock market. From the lead-lag relationship pattern, after the 2008 financial crisis, stock markets around the world that had a lead-lag relationship did not significantly lead each other;nor was this seen during the financial crisis, especially in the ASEAN-5 stock markets. These lead-lag relationships indicate that the ASEAN-5 stock markets move independently of each other. That is, financial crisis information was transmitted more slowly among the stock markets in ASEAN countries.

DISSCUSION

The ASEAN-5 and global stock markets' lead-lag relationshipshave changed. The US stock market consistently affected the stock markets of ASEAN-5, Korea, Japan, Hong Kong, and the UK in all periods. Interestingly, the US did not have any interdependence with the UK before and during the crisis period, butdeveloped interdependence after the financial crisisof 2008. The US capital market led due to information transmission to other countries.

After the 2008financial crisis, the Indonesian stock market tended to move independently and was only influenced by the US stock market. The Indonesian lead-lag relationship was different before, during, and after financial crisis. Before the financial crisis, Indonesia was also influenced by the UK. During the financial crisis period, Indonesia was influenced by the US, UK, Korea, Japan, Hong Kong, Philippines, and Singapore. Similar to Indonesia, Thailand's stock market seemed to be interdependent. Most lead-lag relationships and interdependence among ASEAN-5, Korea, Japan, and Hong Kong changed because of the financial crisis information transmitted globally. Fewer ASEAN-5 stock markets were affected by each other. This indicated a decline in the degree of interdependence among the ASEAN-5 capital markets.

Before and after the financial crisis, the Singapore stock market significantly led Malaysia, the Philippines, Korea, Japan, and Hong Kong, but not Thailand and Indonesia. At the time of the financial crisis in 2008, all interdependence among ASEAN-5 stock markets increased. After the crisis, the interdependence between countries in ASEAN-5 declined. Malaysia led the other ASEAN stock markets with the exception of Indonesia. Indonesia was relatively more independent and was not influenced by other ASEAN-5 countries.

CONCLUSION

Information about financial crisis is transmitted daily from one capital market to anotheracross the world. Differing time zones and trading hours may lead to differences in the speed of the flow of information and investor reaction. The US stock market consistentlyled change globally before, during, and after financial crisis. However, after the crisis, the US and UK stock markets led the ASEAN-5 stock markets and the interdependence became stronger compared to other Asian stock markets like Korea, Hong Kong, and Japan, evenwithin ASEAN countries themselves. The financial crisis changed the lead-lag relationship and interdependence among the stock markets in ASEAN-5, Korea, Japan, Hong Kong, the US, and the UK.

No lead-lag relationship within ASEAN capital markets existed after the 2008 financialcrisis. This is particularly evident in Indonesia, which had no interdependence with other capital markets except for the US stock market. This result differs from the results of Roy et al. (2009), Majid (2008), and Yang et al. (2003), who found that after the 1998 crisis, the interdependence relationship between the stock markets became stronger, even in the Asian countries.

If the stock market lead-lag relationship and interdependence within ASEAN-5 is not strong enough, then the ASEAN financial market integration will facegreat challenges in its implementation.

REFERENCES

Akaike, H.(1981). Likelihood of a model and information criteria, *Journal of Econometrics,* Vol. 16, Issue 1, May 1981.

Arshanapalli, Doukas,& Lang. (1995). Pre and post-October 1987 stock market linkages between U.S. and Asian markets. *Pasific-Basin Finance Journal*, 3, 57-73.

Azman, Azali, Habibullah, &Matthews, K. G. (2002). Financial integration and the ASEAN-5 equity markets, *Applied Economics,* 34.

Cheng, Lang,&Lian. (2003). Financial crisis and intertemporal linkages across theASEAN-5 stock markets, FEA Working Paper, 2003(4).

Choudhry, Lu, &Peng. (2007). Common stochastic trends among Far East stock prices: Effects of the Asian financial crisis. *International Review of Financial Analysis,* 16, 242-261.

Click, &Plummer. (2005). Stock market integration in ASEAN after the Asian financial crisis, *Journal of Asian Economics,* 16, 5-28.

Chung, &Ariff. (2015). ASEAN financial market integration: A rainbow on the horizon?, *Taylor's Business Review*, Vol. 5, Issue 1-02-2015, pp. 51–80.

Daly, K. J. (2003). Southeast Asian stock market linkages: Evidence from pre- and post October 1997, *ASEAN Economic Bulletin*, 20, pp.75-85.

Dickey &Fuller. (1979). Distribution of estimators for autoregressive time series with a unit root, *Journal of the American Statistical Association,* 74, 427-431.

Dunis, &Shannon. (2005). Emerging markets of south-east and central Asia: Do they still offer a diversification benefit? *Journal of Asset Management,* 6(3), pp. 168_190.

Grange., (1969). Investigating causal relations by econometric models and cross-spectral methods, *Econometrica,* 37, Issue 3, pp. 424-38.

Granger. (1988). Some recent developments in a concept of causality, *Journal of Econometrics,* Vol. 39, 1988, pp. 199–211.

Hee, N. T.(2002). Stock market linkages in south East Asia, *Asian Economic Journal,* 16(4).

Hou, K. (2007). Industry information diffusion and the lead-lag effect in stock returns, *Review of Financial Studies,* Vol. 20, No. 4 (Jul., 2007), pp. 1113-1138.

Ibrahim, M. H.(2000). Financial integration and diversification among ASEAN equity markets: A Malaysia perspective, *Capital Market Review,* 8(1), pp. 25-40.

Ibrahim, M. H.(2005). International linkage of stock prices: The case of Indonesia, *Management Research News,* 28(4), pp. 93-115.

Karim, Jais,&Karim. (2011). The subprime crisis and stock index futures market integration, *Journal of Risk Finance,* Vol. 12 No. 5, pp 406.

Kuo, Chen-Yin. (2016). Does the vector error correction model perform better than others in forecasting stock price? An application of residual income valuation theory, *Economic Modelling*, 52, Issue PB, pp. 772-789.

Lauand McInnis. (1993). Co-movements of international equity return: A comparison of the pre- and ppost-October 19, 1987, periods, *Global Finance Journal,* Vol. 4, No.1, p 16.

Lane, P.R. (2012). The European sovereign debt crisis, *Journal of Economic Perspective,* Vol. 26, No. 3.

Lo, A. W., &A. C. MacKinlay.(1990). When are contrarian profits due to stock market overreaction? *Review of Financial Studies,* 3, 175-205.

Majid, Meera &Omar, M.A. (2008) Interdependence of ASEAN-5 stock markets from the US and Japan, *Global Economic Review,* 37(2), pp. 201-225.

Mak, &Cheung. (1992). The international transmission of stock market fluctuation between the developed market and the Asian-Pasific markets, *Applied Financial Economics,* Volume 2, pp 43-47.

Masih, &Masih. (1999). Are the Asian stock market fluctuations due mainly to intra-regional contagion effects? Evidence based on Asian emerging stock markets, *Pacific-Basin Finance Journal,* Vol. 7.

MacKinnon, Haug, &Michelis. (1999). Numerical distribution functionsof likelihood ratio tests for co-integration. *Journal of Applied Econometrics,*14, pp. 563–577.

Mech, T. S. (1993). Portfolio return autocorrelation, *Journal of Financial Economics.*

McQueen, G., M. Pinegar, &S. Thorley.(1996). Delayed reaction to good news and the cross-autocorrelation of portfolio returns, *Journal of Finance,* 51.

Mei-Se,Chien-Chiang,Te-Chung, &Hui-Ting. (2015). Dynamic Asian stock market convergence: Evidence from dynamic cointegration analysis among China and ASEAN-5, *Economic Modelling*, Vol. 51, December 2015, pp. 84–98.

Meric, Lentz, Smeltz, &Meric. (2012). International evidence onmarket linkages after 2008 stock market crash, *International Journal of Business and Finance Research.*

Mersud &Naida, (2013). Understanding of the financial crisis. *Business Consultant Poslovni Konsultant,* 5(30).

Ming-Chieh Wang, Ming Fang, and Jin-Kui Ye. (2013). Financial integration of large- and small-cap stocks in emerging markets, *Emerging Markets Finance and Trade,* September 2013, 49(4), pp. 17-31.

Mishkin, F.S.(2011). Over the cliff: From the subprime to the global financial crisis, *Journal of Economic Perspective*, Vol. 25, pp. 49-70.

Palac-McMiken, E. D. (1997). An examination of ASEAN stock market, *ASEAN Economic Bulletin,* 13(3), pp. 299-310.

Pongsaparn &Unteroberdoerster. (2011). Financial integration and rebalancing in Asia, IMF Working Paper.

Reavis, C. (2012). The global financial crisis of 2008: The role of greed, fear, and oligarchs, *MITS Loan Management, Rev.* March 16, 2012.

Royfaizal, Lee, &Azali. (2009). ASEAN-5+3 and US stock markets interdependence before, during and after Asian financial crisis, *International Journal of Economics and Finance.*

Sheng, H.C. &Tu, A.H. (2000). A study of cointegration and variance decomposition among national equity indices before and during the period of the Asian financial crisis, *Journal of Multinational Financial Management,* 10, pp. 345-365.

Tswei, K. (2013). Is transaction price more value relevant compared to accounting information? An investigation of a time-series approach, *Pacific Basin Finance Journal,* 21, pp. 1062-1078.