Financial Market Integration: The Regional and Global Nexus of ASEAN-5

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ABSTRACT

This study examines empirically the financial integration among the ASEAN-5 countries and the integration of the ASEAN-5 financial markets and the global financial markets during the period from March 1995 to June 2017. Using data from 17 stock indexes across the world, the cointegration test suggests incomplete and time-varying connections both among the ASEAN-5 countries and among the ASEAN-5 and global stock markets. Relationships strengthened during the financial crisis and were weak during normal market circumstances. However, the degree of regional and global cointegrations lessened after the Asian financial crisis. Our findings imply that the diversification benefits can be enjoyed by a well-diversified portfolio across the regions during economic expansion but the strong connection during the market turmoil can be very harmful since the similar risk factors are harbored by interconnected financial markets.

Keywords: ASEAN, Financial Markets Integration, Global Portfolio, Regional Investments

INTRODUCTION

In December 1967, the leaders of five southeast Asian countries' leaders gathered in Bangkok to establish the Association of Southeast Asian Nations (ASEAN). The declaration marked the first initiative of the five founder members of the association (also known as ASEAN-5), which included Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Brunei joined ASEAN in 1984, Vietnam in 1995, Laos and Myanmar in 1997, and Cambodia as the latest member in 1999. The development has led ASEAN to be made of a total of ten member states today. ASEAN as a whole is the sixth largest economy in the world and the third largest community by its population, attracting massive capital inflows and trades, most of which are from intra-regional activities (ASEAN Secretariat, 2017). The development of collaboration has begun with the ASEAN Free Trade Area (AFTA) in 1990s and strengthen in recent years with many initiatives such as the establishment of ASEAN Economic Community (AEC) and the ASEAN capital markets. To be recognized as a single market, both liberalization of the financial market and the freer flow of capital are considered as the development milestones. Recently, the integration of financial markets in member states has received attention as the markets have become more interdependent. An understanding of integration among financial markets allows policy makers, fund managers, and investors to make better decisions in investment and risk management. A strengthened cointegration of financial markets implies more market efficiency and less friction in the region (Click & Plummer, 2005). On the contrary, a

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stronger cointegration may lessen the diversification benefits of the portfolios. As regards the policy circle, market cointegration is one of the factors behind market stability and growth. An understanding and financial market cointegration helps devise effective policies and reduce the need of market interventions (Aghion, Howitt, & Mayer-Foulkes, 2005; Bonfiglioli, 2008; Jiang, Nie, & Monginsidi, 2017). Because ASEAN has enjoyed rapid economic growth attracting investment from many parts of the world, the diverse opportunities of ASEAN have gained much attention in the last decades. In this paper, the financial markets of the ASEAN-5 or the so-called Asian Tigers were emphasized due to their openness and interdependence compared.

A number of prior studies have examined the level of interdependence among ASEAN financial markets. For example, Azman-Saini, Azali, Habibillah, and Matthews (2002) and Chen, Gerlach, Cheng, and Yang (2009) explored cointegration among ASEAN-5 financial markets using cointegration analysis. Majid, Meera, Omar, and Aziz (2009) applied the generalized method of moment (GMM). Atmadja (2010) studied the linkage of ASEAN stock markets during a financial crisis. Other studies examine the inter-regional connection between ASEAN financial markets and foreign markets. For instance, Nguyen and Elisabeta (2016) used the dynamic conditional correlation and wavelet correlation analysis to examine the integration and diversification benefits among ASEAN and China. Caporale, Gil-Alana, and You (2017) analyzed the integration among ten Asian financial markets and the U.S. and Japan to determine the global and regional integration. The present study aims to examine empirically the long-run financial cointegration among ASEAN-5 countries and the cointegration of the ASEAN-5 financial markets and global financial markets during the period from March 1995 to June 2017.

LITERATURE REVIEW

The liberalization of capital markets in the last decades has built up a massive flow of capital across regions. Financial markets around the world are becoming more interconnected and interdependent. After the Asian financial crisis in the late 1990s, the stock markets in Asia have grown in terms of importance. The ASEAN community has become the sixth largest economy in the world attracting both FDI and capital investment. The capital market in Asia has seen a rapid development. Firms become to depend less on the traditional bank channel as their source of financing and seek capital from other means and outside. The financial market liberalization that lowers trade barriers and stimulates capital mobility, and a growing demand for more cooperated capital markets among economies, have turned the region into a highly competitive investment destination. Recently, the study of financial market cointegration attracts researchers, investors and policy makers. The cointegration offers benefits to investors for several reasons. First, the capital can be allocated more easily to the more productive location if the markets are integrated. The free cross-border flows of funds can enhance liquidity and therefore reduce market friction faced by investors (Click & Plummer, 2005). As the markets become more efficient, they can attract more foreign investors. Additionally, an increased financial market cointegration which is part of financial development usually comes with development in legal practices and competitiveness in local financial intermediaries. Thus, the interconnected ASEAN capital markets shall help connect the region better with the world equity markets and bring more flows of capital into the region (Freeman, 2001). On the contrary, the cointegration among markets diminishes the benefits of diversification investors might obtain from a segmented financial market and spreads the spillover effects among the interconnected economies. As Goetzmann, Li, and Rouwenhorst (2005)

have indicated, the diversification benefits are greatest when investors have greatest difficulty in diversifying. The contagion, for example, arises when co-movement of the stock prices is large enough to spread the country-specific shock to other economies which are economically stable. The argument is supported by Dewandaru, Masih, and Masih (2016), who suggest that the negative external shocks are transmitted among Asia-Pacific countries via excessive and fundamental linkage. To policy makers, knowledge of financial market cointegration helps design more effective policies and define better timing for market interventions (Jiang et al., 2017). Financial integration offers strong implications for economic stability. A strong integration enhances the ability to absorb shocks and stimulate investments, but it also increases the risk of contagion (Yu, Fung, & Tam, 2010). The market cointegration studied by Aghion et al. (2005) and Bonfiglioli (2008) has significant effects on productivity even though the benefits of the cointegration are distributed disproportionally among countries and industries. Phongthiengtham and Tiankanon (2011) have further suggested that the benefits of financial market cointegration vary with degree of domestic financial development. Unless the country has reached the certain threshold, financial integration can be harmful.

A number of studies have focused on the integration of ASEAN financial markets. Yet the findings are mixed, and the research varies in scope and sample period. The earlier work of Azman-Zaini et al. (2002) and Sharma and Wongbangpo (2002) used data in the 1990s to investigate financial cointegration among ASEAN-5 countries based on a VAR cointegration model. Azman-Zaini et al. (2002) found a bilateral relationship between the Philippines and Singapore and the other between the Philippines and Malaysia, while Sharma and Wongpangpo (2002) revealed long-run co-movement among Indonesia, Malaysia, Singapore, and Thailand. Sharma and Wongpangpo (2002) used the pre-Asian financial crisis data from 1990 to 1996. The crisis period was included in the work of Azman-Zaini et al. (2002) but the effects of the crisis on the market cointegration were not considered explicitly. With an emphasis on the Asian financial crisis, McAleer and Nam (2005) analyzed the exchange rate volatility and the contagion effects among the ASEAN-5 countries. Their study suggested a larger degree of correlation among the ASEAN-5 countries during the Asian financial crisis. The degree of integration after the Asian financial crisis was examined by Click and Plummer (2005), who used a cointegration test to examine relations among the ASEAN-5 financial markets after the Asian financial crisis. Based on daily and weekly stock index closing prices, their empirical results concluded that the stock markets in the ASEAN-5 countries were cointegrated during the period from 1998 to 2002 at high and low frequency analyses but the degree of cointegration was not complete. Thus, the benefits of diversification across the ASEAN-5 markets still existed, though such benefits have been reduced partly due to a certain degree of cointegration. Majid et al. (2009) examined the cointegration in the pre- and post- Asian financial crisis periods. They showed that cointegration among the ASEAN-5 financial markets existed both before and after the Asian financial crisis and the cointegration strengthened in the post-crisis period, using Johansen and Juselius (1990) cointegration and the generalized method of moment (GMM). The findings implied that investors who allocate their investments across the region may not enjoy the long-run diversification benefits as expected as the post period of the crisis strengthened the linkage across markets. Chen et al. (2009) employed a cointegration test that allowed for structural breaks and found a stronger cointegration in the post Asian crisis period suggested by Majid et al. (2009).

The linkage between financial markets in the ASEAN and the global financial markets is crucial to investors with portfolios of global assets. When the equity markets are closely linked, the diversification benefits of a global portfolio can be eliminated. There are prior

studies emphasizing on the connection of the ASEAN financial markets and the markets outside the region. Atmadja (2010) applied a vector error correction model to explore the cointegration among the ASEAN-5 and the U.S. financial markets specifically during the financial market turmoil in 1997, 2002, and 2007. The study reported cointegration relationships between the U.S. and ASEAN-5 markets in the 1997 and 2002 crises but failed to detect any cointegration vector during the 2007 crisis. Majeed and Masih (2016) analyzed the long-run relationship between ASEAN stock indexes and the indexes of the U.S. and Japan using an autoregressive distributed lags (ARDL) models. The study supported previous research that cointegration among stock markets in the region had strengthened after the Asian financial crisis. The ASEAN equity markets were integrated along with the developed stock market of the U.S. and that of Japan. The cointegration among the ASEAN-5 and Chinese stock markets were examined in Chien, Lee, Hu, and Hu (2015), which employed the recursive cointegration technique to trace the possible dynamic linkage among the equity markets and explored the period from 1992 to 2013. The results showed only one single cointegration vector suggesting limited level cointegration and opportunities for diversification. These findings, however, were in contrast to some prior research discussed earlier. In Rahman and Shahari (2017), the equity markets of ASEAN+3 were examine in the context of pre- and post- agreement of ASEAN+3 in 1997 and it wass documented that, from Johansen and Juselius (1990) cointegration test, the linkage among the ASEAN countries and China, Japan and Korea (also known as ASEAN+3) was small before the agreement but the nexus was found in the post-agreement period and the cointegration among the markets was one of the factors driving the real sectors of the entire region of the ASEAN+3. Nguyen and Elisabeta (2016) studied the financial integration and diversification benefits between Indonesia, Thailand, Malaysia, and the Philippines, together with China using β and α convergence, dynamic conditional correlation, and wavelet correlation. Their results indicate time varying cointegration and intense relationships between markets during the financial crisis. When concentrating on the industries, the work of Nguyen and Elisabeta (2016) supported Donadelli and Paradiso (2014). The increase in financial market cointegration can be partially attributed to the integration of certain sectors in the region and the contagion effects from the developed economies. The work of Park (2010) and Caporale et al. (2017) extended such studies beyond the ASEAN-5 countries and investigated the long-run relations between a number of Asian countries and the U.S. Using data from 2005 to 2008, Park (2010) indicated strong linkage from the countries with a more developed financial system to the rest of the Asian markets. The spillover of the U.S. financial crisis was significant in Asian markets selected in the study, but the degree of influence varied across the region. Caporale et al. (2017) employed frictional integration to analyze financial integration on both the aggregate and industry levels. Their findings suggested regional integration rather than global integration in the aggregate and industry levels although the global integration was strong during the pre-crisis period than the post-crisis time. Despite of these previous studies on the integration of the ASEAN financial markets, there remain a limited number of studies exploring the cointegration between the ASEAN financial markets and those of other parts of the world. As suggested by Aizenman, Jinjarak, Lee, & Park (2016), the emerging economies can be vulnerable to the spillover of developed markets due to their interdependence in financial markets. On various market conditions, equity and bond markets in emerging countries can be responsive to those of the advanced economies and the correlation between different groups of emerging economies may exist (Forbes & Rigobon, 2002). Therefore, this current study examines the

cointegration between ASEAN-5 financial markets and the degree of cointegration between the ASEAN-5 countries and the major economies in other parts of the world.

DATA AND METHODOLOGY

This study analyzes the regional and global cointegration of the ASEAN-5 stock markets. Data for this study were retrieved from Bloomberg. They include the weekly closing prices of 17 equity indexes from March 17, 1995 to June 23, 2017. The chosen sample includes both the Asian financial crisis between 1997 and 1998 and the global financial crisis between 2007 and 2008. Equity indexes have been considered in the research of financial integration since they are largely and immediately influenced by regional and global shocks (Guidi & Gupta, 2013; Bentes, 2015; Maghyereh, Awartani, & Al Hilu, 2015) The indexes can be classified into six regional groups; ASEAN-5, Asia, the U.S., Europe, South America, and Australia. Except for the ASEAN-5 countries, indexes used are from countries with a larger GDP in their respective region and with the total market value greater than 500 billion U.S. dollar. After the deletion of some the missing data, there are a total of 1,124 observations. The indexes included in the study are reported in Table 1.

TABLE 1

Equity Indexes

	Country	Index
1	Indonesia	Jarkata Stock Exchange Composite Index (JCI)
2	Thailand	Stock Exchange of Thailand Index (SET)
3	Malaysia	Bursa Malaysia KLCI (FBMKLCI)
4	Singapore	Straits Time Index (STI)
5	Philippines	Philippines Equity Exchange Composite Index (PSEI)
6	China	Shanghai Stock Exchange Composite Index (SHCOMP)
7	Japan	Nikkei Index (NIKKEI)
8	Korea	Korea Composite Stock Price Index (KOSPI)
9	India	Bombay Stock Exchange Index (SENSEX)
10	United States	S&P500 (SP500)
11	Germany	Deutsche Boerse AG German Stock Index (DAX)
12	United Kingdom	Financial Times Stock Exchange 100 Index (FTSE100)
13	France	Cotation Assistée en Continu (CAC40)
14	Brazil	Ibovespa Brasil Sao Paulo Stock Exchange Index (IBOVESPA)
15	Mexico	Mexican Bolsa Index (MEXBOL)
16	Argentina	Merval Stock Index (MERVAL)
17	Australia	S&PASX200 Index (SPASX)

Unit Root Test

Before we started the cointegration test of the indexes, we conducted an array of unit root tests onthe variables since the VAR-based cointegration test is applicable when the series are non-stationary in the log form but are stationary in their first difference (Johansen & Juselius, 1990; Johansen, 1991; Johansen, 1995; Sharma & Wongbangpo, 2002; Majeed & Masih, 2016). Engle and Granger (1987) proposed that two or more of the non-stationary series can be stationary in their linear combination. If such a stationary linear combination among the non-stationary series exists, these non-stationary time series are believed to be cointegrated. In the study, the conventional Augmented Dickey-Fuller (ADF) Unit Root Test and Phillips-Perron (PP) Unit Root Test of the time series were conducted to validate that the data series are qualified for cointegration analysis. While the ADF test allows for more dynamics in the regression equation and for being over parameterized in the first order but correctly specified in the higher order, the PP test makes correction to the t-statistics of the γ coefficient (Dickey & Fuller, 1979; Altinay & Karagol, 2004; Majeed & Masih, 2016). Moreover, the PP test employs the non-parametric method to explore the serial correlation in the error terms without any additional lagged difference terms (Phillips & Perron, 1988). Both ADF and PP unit root tests were conduct in the log form and the first difference to examine the stationarity of the data series.

Cointegration Test

We examine the financial integration among the ASEAN-5 countries and their integration with several global financial markets. Thus, the collected data are first classified into five sub-periods to evaluate the level of cointegration during the crisis and non-crisis periods. There are two financial crisis periods included in this study, the Asian crisis during 1997 and 1998, and the global sub-prime crisis during 2007 and 2008. Financial integration among the ASEAN-5 countries and their integration with the selected global financial markets were all analyzed in the five sub-periods. The five sub-sample periods are reported in Table 2.

TABLE 2

Sub-sample Periods

Sub-sample Periods	
1995 - 1997	Non - crisis
1997 - 1998	Asian Financial Crisis
1999 - 2006	Non - crisis
2007 - 2008	Global Financial Crisis
2009 - 2017	Non - crisis

To test for financial cointegration among the ASEAN-5 countries and their cointegration with the global markets, the study, following Azman-Saini et al. (2002), Sharma and Wongbangpo (2002) and Majid et al. (2009), uses the approach of Johansen and Juselius (1990). As a VAR-based cointegration, the model can be described as:

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B x_t + \epsilon_t$$

where y_t is a k-vector of non-stationary $I(1)$ variables, x_t is a d-vector of deterministic variables. The VAR equation can be rewritten as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + B x_t + \epsilon_t$$

where

$$\Pi = \sum_{i=1}^{p} A_i - I$$

and

$$\Gamma_i = -\sum_{J=i+1}^{p} A_j$$

It is proposed that when the coefficient matrix Π has a reduced rank $r < k$, there should exist two $k \times r$ matrices: α and β, and each is of the r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is $I(0)$. r is the number of cointegrating relations and each column of β is the cointegrating vector. The approach of Johansen and Juselius (1990) is to estimate the Π matrix from an unrestricted VAR and to examine whether we can reject the restrictions implied by the reduced rank of Π.

Before implementing the cointegration test, it is required that the optimal lag length in the VAR model is identified. Following the study of Sharma and Wongbangpo (2002), Huyghebaert and Wang (2010), and Rahman and Shahari (2017), this study uses a general-to-specific procedure with 15 lags at maximum and the likelihood ratio (LR) test to determine the optimal lag length for each of the sub-period analysis.

The Johansen and Juselius (JJ) cointegration test examines the number of cointegrating relations r from $r = 0$ to $r = k - 1$ where k is the number of endogenous variables. The results are reported in trace and maximum eigenvalue statistics. The trace statistic reports the test of the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations.

H_0: There are r cointegrating relations.

H_1: There are k cointegrating relations.

The trace statistic for the null hypothesis of r cointegrating relations is computed as

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i)$$

where λ_i is the i-th largest eigenvalue of the Π matrix. On the other hand, the maximum eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of $r + 1$ cointegrating relations

H_0: There are r cointegrating relations.

H_1: There are $r + 1$ cointegrating relations.

The maximum eigenvalue statistic for the null hypothesis of r cointegrating relations is computed as

$$LR_{max}(r|r + 1) = -T \log(1 - \lambda_{r+1})$$

for $r = 0,1, \cdots, k - 1$.

RESULTS AND DISCUSSION

Unit Root Test

The unit root test was conducted in order to examine the stationarity of each data series. Non-stationary data in the log from and stationary data in their first-difference form are required to meet the cointegration analysis assumption. Tables 3 and 4 report the results of both ADF and PP tests respectively. Both tests fail to reject the null hypothesis of unit roots of all data series in the log form and reject the null hypothesis of unit roots at the first difference. These results suggest the appropriateness and feasibility of cointegration analysis.

TABLE 3

Augmented Dickey-Fuller (ADF) Unit Root Test Results

Augmented Dickey-Fuller (ADF) Unit Root Test Results								
		Schwarz Information Criterion				Akaike Information Criterion		
		T-Statistics	Critical Value	Results		T-Statistics	Critical Value	Results
JCI	Log form	-0.606754	-2.863915	Non-Stationary	Log form	-0.443872	-2.863922	Non-Stationary
	1st Difference	-38.20522	-2.863906	Stationary	1st Difference	-11.97727	-2.86392	Stationary
SET	Log form	-1.152292	-2.863908	Non-Stationary	Log form	-1.162388	-2.863925	Non-Stationary
	1st Difference	-21.56236	-2.863908	Stationary	1st Difference	-21.56236	-2.863908	Stationary
FBMKLCI	Log form	-0.883759	-2.863904	Non-Stationary	Log form	-1.268444	-2.863913	Non-Stationary
	1st Difference	-32.16278	-2.863906	Stationary	1st Difference	-14.7336	-2.863913	Stationary
STI	Log form	-1.535533	-2.863904	Non-Stationary	Log form	-1.854952	-2.863918	Non-Stationary
	1st Difference	-32.42918	-2.863906	Stationary	1st Difference	-22.1231	-2.863908	Stationary
PSEI	Log form	-0.188288	-2.863904	Non-Stationary	Log form	-0.434644	-2.863915	Non-Stationary
	1st Difference	-33.61095	-2.863906	Stationary	1st Difference	-22.58161	-2.863908	Stationary
SHCOMP	Log form	-2.199965	-2.863904	Non-Stationary	Log form	-2.050166	-2.863911	Non-Stationary
	1st Difference	-30.41015	-2.863906	Stationary	1st Difference	-4.955925	-2.863953	Stationary
NIKKEI	Log form	-1.681246	-2.863904	Non-Stationary	Log form	-1.576285	-2.863911	Non-Stationary
	1st Difference	-35.15705	-2.863906	Stationary	1st Difference	-22.87089	-2.863908	Stationary
KOSPI	Log form	-0.76364	-2.863906	Non-Stationary	Log form	-1.088784	-2.863913	Non-Stationary
	1st Difference	-35.22643	-2.863906	Stationary	1st Difference	-8.323292	-2.863934	Stationary
SENSEX	Log form	-0.315919	-2.863904	Non-Stationary	Log form	-0.439765	-2.863911	Non-Stationary
	1st Difference	-32.22131	-2.863906	Stationary	1st Difference	-8.363788	-2.863934	Stationary
SP500	Log form	-1.851007	-2.863906	Non-Stationary	Log form	-1.742433	-2.86392	Non-Stationary
	1st Difference	-37.25148	-2.863906	Stationary	1st Difference	-12.53284	-2.863922	Stationary
DAX	Log form	-1.726101	-2.863904	Non-Stationary	Log form	-1.700016	-2.86392	Non-Stationary
	1st Difference	-34.84033	-2.863906	Stationary	1st Difference	-12.981	-2.86392	Stationary
FTSE100	Log form	-2.403322	-2.863911	Non-Stationary	Log form	-2.403322	-2.863911	Non-Stationary
	1st Difference	-35.90046	-2.863906	Stationary	1st Difference	-21.6333	-2.863911	Stationary
CAC40	Log form	-2.528709	-2.863906	Non-Stationary	Log form	-2.528709	-2.863906	Non-Stationary
	1st Difference	-35.90607	-2.863906	Stationary	1st Difference	-35.90607	-2.863906	Stationary
IBOVESPA	Log form	-2.435626	-2.863904	Non-Stationary	Log form	-2.070542	-2.863922	Non-Stationary
	1st Difference	-35.92335	-2.863906	Stationary	1st Difference	-12.30413	-2.86392	Stationary
MEXBOL	Log form	-2.115982	-2.863904	Non-Stationary	Log form	-1.750994	-2.863936	Non-Stationary
	1st Difference	-39.00138	-2.863906	Stationary	1st Difference	-6.99164	-2.863948	Stationary
MERVAL	Log form	0.30324	-2.863904	Non-Stationary	Log form	0.247489	-2.863908	Non-Stationary
	1st Difference	-31.48118	-2.863906	Stationary	1st Difference	-7.366981	-2.863955	Stationary
SPASX	Log form	-1.943943	-2.863904	Non-Stationary	Log form	-1.836762	-2.863911	Non-Stationary
	1st Difference	-35.21191	-2.863906	Stationary	1st Difference	-20.54108	-2.863911	Stationary

TABLE 4

Phillips-Perron (PP) Unit Root Test Results

Phillips-Perron (PP) Unit Root Test Results				
		Bartlett Kernel Criterion		
		T-Statistics	Critical Value	Results
JCI	Log form	-0.368299	-2.863904	Non-Stationary
	1st Difference	-37.88107	-2.863906	Stationary
SET	Log form	-1.054829	-2.863904	Non-Stationary
	1st Difference	-33.57294	-2.863906	Stationary
FBMKLCI	Log form	-1.266891	-2.863904	Non-Stationary
	1st Difference	-32.52868	-2.863906	Stationary
STI	Log form	-1.770399	-2.863904	Non-Stationary
	1st Difference	-32.50157	-2.863906	Stationary
PSEI	Log form	-0.392361	-2.863904	Non-Stationary
	1st Difference	-33.62171	-2.863906	Stationary
SHCOMP	Log form	-2.248086	-2.863904	Non-Stationary
	1st Difference	-30.88143	-2.863906	Stationary
NIKKEI	Log form	-1.645341	-2.863904	Non-Stationary
	1st Difference	-35.12965	-2.863906	Stationary
KOSPI	Log form	-0.993243	-2.863904	Non-Stationary
	1st Difference	-35.20347	-2.863906	Stationary
SENSEX	Log form	-0.361595	-2.863904	Non-Stationary
	1st Difference	-32.23267	-2.863906	Stationary
SP500	Log form	-1.883964	-2.863904	Non-Stationary
	1st Difference	-37.30593	-2.863906	Stationary
DAX	Log form	-1.709805	-2.863904	Non-Stationary
	1st Difference	-34.82644	-2.863906	Stationary
FTSE100	Log form	-2.614481	-2.863904	Non-Stationary
	1st Difference	-36.48766	-2.863906	Stationary
CAC40	Log form	-2.581338	-2.863904	Non-Stationary
	1st Difference	-35.88974	-2.863906	Stationary
IBOVESPA	Log form	-2.436628	-2.863904	Non-Stationary
	1st Difference	-35.84123	-2.863906	Stationary
MEXBOL	Log form	-2.129698	-2.863904	Non-Stationary
	1st Difference	-39.01937	-2.863906	Stationary
MERVAL	Log form	0.177172	-2.863904	Non-Stationary
	1st Difference	-31.45103	-2.863906	Stationary
SPASX	Log form	-1.937132	-2.863904	Non-Stationary
	1st Difference	-35.21191	-2.863906	Stationary

Cointegration Test

Among the ASEAN-5 countries

Table 5 reports the cointegration test results among the ASEAN-5 countries, of the five sub-period analyses. From the table, financial cointegration among the ASEAN-5 countries can be found during the period before the Asian financial crisis, during the Asian financial crisis, and during the global financial crisis in 2007 and 2008. During the period from 1995to 1997, the period before Asian financial crisis, both trace and maximum eigenvalue statistics suggest three cointegrating vectors. These results are consistent with the work of Majid et al. (2009), who found the cointegration among the

ASEAN-5 equity markets before the Asian financial crisis. The same study, however, has suggested some results different from our findings for the post-Asian crisis period. During the Asian financial crisis, the two statistics suggest five cointegrating relations. The trace statistics also reports five cointegrating vectors during the global financial crisis. The stronger cointegration among the ASEAN-5 equity markets during the financial turmoil is also evidenced in the study of Yu et al. (2010). The results in Table 5 suggest that there is less evidence of cointegration during the non-crisis periods of from 1999 to 2006 and from 2009 to 2017. Thus, it can be concluded that, cointegration among the ASEAN-5 financial markets is incomplete and time varying. Cointegration is stronger during crises and weaker during non-crisis periods. Strong market cointegration found for the period of the Asian financial crisis can be attributed to the contagion effects which spread across the region. In the early 1990s, the financial markets in the region were less developed and were highly susceptible to any vulnerability. After the Asian financial crisis, the ASEAN-5 economies have transformed to allow for greater price and financial flexibility. The ASEAN-5 countries have managed to enhance their stability and autonomy after the crisis.

TABLE 5

Results of Cointegration Test: ASEAN-5

Results of Cointegration Test					
		ASEAN-5			
1995 - 1997	**H_0**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**
	r = 0	121.3165*	69.81889	52.40157*	33.87687
	r ≤ 1	68.91491*	47.85613	30.46309*	27.58434
	r ≤ 2	38.45182*	29.79707	24.94669*	21.13162
	r ≤ 3	13.50513	15.49471	12.30036	14.2646
	r ≤ 4	1.204767	3.841466	1.204767	3.841466
1997 - 1998	r = 0	280.6599*	69.81889	113.8574*	33.87687
	r ≤ 1	166.8025*	47.85613	79.98022*	27.58434
	r ≤ 2	86.82228*	29.79707	45.572*	21.13162
	r ≤ 3	41.25028*	15.49471	27.09539*	14.2646
	r ≤ 4	14.15489*	3.841466	14.15489*	3.841466
1999 - 2006	r = 0	72.10307*	69.81889	29.28983	33.87687
	r ≤ 1	42.81324	47.85613	18.00722	27.58434
	r ≤ 2	24.80602	29.79707	13.48592	21.13162
	r ≤ 3	11.3201	15.49471	8.830104	14.2646
	r ≤ 4	2.489995	3.841466	2.489995	3.841466
2007 - 2008	r = 0	84.85906*	69.81889	31.1975	33.87687
	r ≤ 1	53.66156*	47.85613	23.19518	27.58434
	r ≤ 2	30.46639*	29.79707	16.78184	21.13162
	r ≤ 3	13.68454	15.49471	9.561991	14.2646
	r ≤ 4	4.122551*	3.841466	4.122551*	3.841466
2009 - 2017	r = 0	49.85151	69.81889	19.60919	33.87687
	r ≤ 1	30.24232	47.85613	13.71224	27.58434
	r ≤ 2	16.53008	29.79707	8.017295	21.13162
	r ≤ 3	8.512787	15.49471	5.600612	14.2646
	r ≤ 4	2.912175	3.841466	2.912175	3.841466

Between the ASEAN-5 countries and the global financial market

On the other hand, Table 6-8 report the cointegration results between the ASEAN-5 countries and the global financial markets, where global indexes are represented by the five global regions: Asia, the U.S., Europe, South America, and Australia. The results are reported when each equity index was added to the cointegration test.

Asia. Table 6 reports the cointegration test results among ASEAN-5 and four countries in Asia including Japan, China, Korea, and India. Overall, the results suggest that there is a maximum of five cointegration vectors among ASEAN-5 countries and the four Asian financial markets during the period from 1995 to 1997. During the pre-Asian financial crisis period, the cointegration is stronger among between the ASEAN-5 countries and Japan as the five cointegration relations are suggested by both the trace and maximum eigenvalue statistics. The trace statistics also report the five cointegrating vectors between the ASEAN-5 countries and China as well as India during the same period. There are four cointegrating relations among the ASEAN-5 countries and South Korea. During the Asian financial crisis in 1997 and 1998, the trace and maximum eigenvalue statistics suggest five cointegration relations between the ASEAN-5 countries and Japan and between the ASEAN-5 countries and China, and six cointegration vectors between the ASEAN-5 countries and South Korea as well as India respectively. Therefore, strong cointegrating relations can be concluded between the ASEAN-5 countries and the four Asian financial markets during the Asian financial crisis. These findings contradict the study of Rahman and Shahari (2017), who found no cointegrating relation among the ASEAN+3 countries during the period before 1997. After the Asian financial crisis, the cointegrating relations among the ASEAN-5 countries and the four Asian financial markets are less conclusive. During the period from 1999 to 2006 when the Asian financial markets were recovering from the crisis, the trace statistics indicate only a maximum of one cointegration vector among the ASEAN-5 countries and Japan as well as India respectively. The cointegration between theASEAN-5 countries and the four Asian markets strengthened again during the global financial crisis but weakened after 2008. The results of cointegration analysis both among the ASEAN-5 countries themselves and between the ASEAN-5 countries and the four Asian financial markets support the findings of Huyghebaert and Wang (2010), in which the strengthen cointegration among the Asian financial markets during crises could be found but they were temporary, and the relation disappeared in the post-crisis period.

The U.S. Table 7 displays the financial cointegration analysis between the ASEAN-5 countries and the U.S. Before the Asian financial crisis, the trace and maximum eigenvalue statistics suggest a maximum of three cointegrating vectors between the ASEAN-5 countries and the U.S. There are six cointegrating vectors between the ASEAN-5 countries and the U.S. during the Asian crisis period, indicating the strengthened relations between the ASEAN-5 countries' financial markets and that of the U.S. The strong cointegration during the crisis is consistent with the finding of Atmadja (2010), who examined the contagion effects between the ASEAN-5 countries and the U.S. during the crisis periods. However, the relations disappeared after the Asian financial crisis and were evidenced again at a weaker extent during the global crisis in 2007 and 2008. The trace statistics indicate three long-run relations between the markets during the global financial crisis period. It can be concluded that there is little evidence of financial cointegration among the ASEAN-5 countries and the U.S. during the period from 1999 to 2006 and from 2009 to 2017.

TABLE 6

Results of Cointegration Test: ASEAN-5 and Asian Markets

Results of Cointegration Test																	
		ASEAN-5 and Japan				ASEAN-5 and China				ASEAN-5 and Korea				ASEAN-5 and India			
1995 - 1997	**H_0**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**
	r = 0	194.4029*	95.75366	66.6269*	40.07757	179.3922*	95.75366	60.27021*	40.07757	195.7278*	95.75366	60.44911*	40.07757	191.0983*	95.75366	76.39313*	40.07757
	r ≤ 1	127.776*	69.81889	52.34789*	33.87687	119.122*	69.81889	49.91623*	33.87687	135.2787*	69.81889	55.19268*	33.87687	114.7052*	69.81889	40.63064*	33.87687
	r ≤ 2	75.42813*	47.85613	35.77174*	27.58434	69.2058*	47.85613	30.33981*	27.58434	80.086*	47.85613	43.61611*	27.58434	74.07453*	47.85613	39.94697*	27.58434
	r ≤ 3	39.65639*	29.79707	21.14258*	21.13162	38.86599*	29.79707	21.28834*	21.13162	36.46989*	29.79707	21.46982*	21.13162	34.12756*	29.79707	18.07886	21.13162
	r ≤ 4	18.51382*	15.49471	18.32973*	14.2646	17.57766*	15.49471	13.91342	14.2646	15.00008	15.49471	11.42302	14.2646	16.0487*	15.49471	12.67235	14.2646
	r ≤ 5	0.184086	3.841466	0.184086	3.841466	3.664231	3.841466	3.664231	3.841466	3.57706	3.841466	3.57706	3.841466	3.376345	3.841466	3.376345	3.841466
1997 - 1998	r = 0	595.0224*	95.75366	234.0243*	40.07757	726.7676*	95.75366	276.8283*	40.07757	754.2523*	95.75366	307.038*	40.07757	647.8881*	95.75366	255.173*	40.07757
	r ≤ 1	360.9981*	69.81889	147.2146*	33.87687	449.9394*	69.81889	185.9926*	33.87687	447.2143*	69.81889	151.4847*	33.87687	392.7151*	69.81889	193.3925*	33.87687
	r ≤ 2	213.7836*	47.85613	101.8738*	27.58434	263.9467*	47.85613	123.3233*	27.58434	295.7296*	47.85613	127.9314*	27.58434	199.3226*	47.85613	83.12653*	27.58434
	r ≤ 3	111.9098*	29.79707	61.22811*	21.13162	140.6234*	29.79707	100.1124*	21.13162	167.7982*	29.79707	65.03011*	21.13162	116.196*	29.79707	68.87626*	21.13162
	r ≤ 4	50.68165*	15.49471	48.92194*	14.2646	40.51097*	15.49471	37.24563*	14.2646	102.768*	15.49471	63.04166*	14.2646	47.31978*	15.49471	38.33348*	14.2646
	r ≤ 5	1.759711	3.841466	1.759711	3.841466	3.265334	3.841466	3.265334	3.841466	39.72638*	3.841466	39.72638*	3.841466	8.986305*	3.841466	8.986305*	3.841466
1999 - 2006	r = 0	102.8024*	95.75366	38.72102	40.07757	93.42172	95.75366	37.2674	40.07757	87.47165	95.75366	29.43733	40.07757	104.8144*	95.75366	36.66118	40.07757
	r ≤ 1	64.08137	69.81889	24.84536	33.87687	56.15432	69.81889	20.34744	33.87687	58.03432	69.81889	23.21857	33.87687	68.15325	69.81889	20.30756	33.87687
	r ≤ 2	39.23601	47.85613	18.97912	27.58434	35.80688	47.85613	13.6415	27.58434	34.81575	47.85613	18.58729	27.58434	47.84569	47.85613	19.16867	27.58434
	r ≤ 3	20.25689	29.79707	9.93565	21.13162	22.16538	29.79707	12.63723	21.13162	16.22846	29.79707	8.970149	21.13162	28.67702	29.79707	14.92464	21.13162
	r ≤ 4	10.32124	15.49471	9.269669	14.2646	9.528152	15.49471	8.236604	14.2646	7.258309	15.49471	4.943343	14.2646	13.75238	15.49471	12.64552	14.2646
	r ≤ 5	1.051575	3.841466	1.051575	3.841466	1.291548	3.841466	1.291548	3.841466	2.314966	3.841466	2.314966	3.841466	1.106856	3.841466	1.106856	3.841466
2007 - 2008	r = 0	130.8025*	95.75366	45.03631*	40.07757	146.9464*	95.75366	47.962*	40.07757	125.714*	95.75366	40.73934*	40.07757	131.8417*	95.75366	47.48934*	40.07757
	r ≤ 1	85.76614*	69.81889	35.79081*	33.87687	98.98439*	69.81889	41.92817*	33.87687	84.97463*	69.81889	29.99123	33.87687	84.35231*	69.81889	26.58736	33.87687
	r ≤ 2	49.97533*	47.85613	19.76254	27.58434	57.05622*	47.85613	23.29655	27.58434	54.9834*	47.85613	23.37897	27.58434	57.76495*	47.85613	24.42212	27.58434
	r ≤ 3	30.21279*	29.79707	18.74112	21.13162	33.75967*	29.79707	20.47226	21.13162	31.60443*	29.79707	19.46041	21.13162	33.34283*	29.79707	21.85617	21.13162
	r ≤ 4	11.47167	15.49471	9.73761	14.2646	13.28741	15.49471	12.57251	14.2646	12.14403	15.49471	10.62319	14.2646	11.48665	15.49471	10.29949	14.2646
	r ≤ 5	1.734058	3.841466	1.734058	3.841466	0.714903	3.841466	0.714903	3.841466	1.520843	3.841466	1.520843	3.841466	1.187158	3.841466	1.187158	3.841466
2009 - 2017	r = 0	91.3974	95.75366	34.60717	40.07757	87.02984	95.75366	39.94881	40.07757	74.28658	95.75366	27.93269	40.07757	81.35925	95.75366	35.13488	40.07757
	r ≤ 1	56.79023	69.81889	27.77097	33.87687	47.08103	69.81889	19.30284	33.87687	46.3539	69.81889	22.71372	33.87687	46.22438	69.81889	17.00137	33.87687
	r ≤ 2	29.01926	47.85613	13.69484	27.58434	27.77819	47.85613	14.37933	27.58434	23.64017	47.85613	10.12431	27.58434	29.22301	47.85613	13.03123	27.58434
	r ≤ 3	15.32442	29.79707	8.182627	21.13162	13.39886	29.79707	6.530066	21.13162	13.51586	29.79707	8.571027	21.13162	16.19178	29.79707	9.438005	21.13162
	r ≤ 4	7.141796	15.49471	4.822779	14.2646	6.868796	15.49471	4.083231	14.2646	4.944837	15.49471	4.392046	14.2646	6.753771	15.49471	4.902349	14.2646
	r ≤ 5	2.319016	3.841466	2.319016	3.841466	2.785565	3.841466	2.785565	3.841466	0.552791	3.841466	0.552791	3.841466	1.851422	3.841466	1.851422	3.841466

Note: * Indicates rejection of the null hypothesis at 5% significance level.

TABLE 7

Results of Cointegration Test: ASEAN-5 and the U.S. and European Markets

Results of Cointegration Test																	
		ASEAN-5 and U.S.				ASEAN and Germany				ASSEAN-5 and U.K.				ASEAN-5 and France			
1995 - 1997	**H_0**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**
	r = 0	194.8865*	95.75366	83.56995*	40.07757	193.822*	95.75366	71.57394*	40.07757	196.8007*	95.75366	68.92154*	40.07757	182.7463*	95.75366	56.34949*	40.07757
	r ≤ 1	111.3165*	69.81889	48.75264*	33.87687	122.2481*	69.81889	44.95683*	33.87687	127.8792*	69.81889	48.50763*	33.87687	126.3968*	69.81889	44.45514*	33.87687
	r ≤ 2	62.56388*	47.85613	32.86634*	27.58434	77.29128*	47.85613	36.96791*	27.58434	79.37156*	47.85613	42.08342*	27.58434	81.94169*	47.85613	37.69554*	27.58434
	r ≤ 3	29.69754	29.79707	20.29232	21.13162	40.32336*	29.79707	28.56373*	21.13162	37.28814*	29.79707	24.79973*	21.13162	44.24615*	29.79707	26.83377*	21.13162
	r ≤ 4	9.405225	15.49471	9.24623	14.2646	11.75963	15.49471	11.75858	14.2646	12.48841	15.49471	11.96554	14.2646	17.41238*	15.49471	10.26089	14.2646
	r ≤ 5	0.158994	3.841466	0.158994	3.841466	0.001048	3.841466	0.001048	3.841466	0.52287	3.841466	0.52287	3.841466	7.151489*	3.841466	7.151489*	3.841466
1997 - 1998	r = 0	549.6529*	95.75366	169.3413*	40.07757	510.8352*	95.75366	204.1414*	40.07757	839.9322*	95.75366	369.7283*	40.07757	656.577*	95.75366	231.565*	40.07757
	r ≤ 1	380.3116*	69.81889	157.0703*	33.87687	306.6938*	69.81889	127.9819*	33.87687	470.2039*	69.81889	232.6643*	33.87687	425.012*	69.81889	179.5977*	33.87687
	r ≤ 2	223.2413*	47.85613	90.08108*	27.58434	178.7119*	47.85613	72.95343*	27.58434	237.5396*	47.85613	93.21369*	27.58434	245.4143*	47.85613	134.0383*	27.58434
	r ≤ 3	133.1602*	29.79707	71.42203*	21.13162	105.7585*	29.79707	67.72851*	21.13162	144.3259*	29.79707	72.30884*	21.13162	111.3761*	29.79707	66.63537*	21.13162
	r ≤ 4	61.73821*	15.49471	47.09364*	14.2646	38.03001*	15.49471	34.61499*	14.2646	72.01709*	15.49471	52.72478*	14.2646	44.74072*	15.49471	33.4387*	14.2646
	r ≤ 5	14.64457*	3.841466	14.64457*	3.841466	3.415021	3.841466	3.415021	3.841466	19.29231*	3.841466	19.29231*	3.841466	11.30201*	3.841466	11.30201*	3.841466
1999 - 2006	r = 0	87.97836	95.75366	30.36597	40.07757	99.39845*	95.75366	31.97721	40.07757	88.53197	95.75366	30.07973	40.07757	94.86775	95.75366	32.22063	40.07757
	r ≤ 1	57.61239	69.81889	24.04124	33.87687	67.42124	69.81889	28.09373	33.87687	58.45223	69.81889	21.58709	33.87687	62.64712	69.81889	26.35277	33.87687
	r ≤ 2	33.57115	47.85613	17.17326	27.58434	39.32751	47.85613	17.64267	27.58434	36.86514	47.85613	19.36511	27.58434	36.29435	47.85613	17.77984	27.58434
	r ≤ 3	16.39788	29.79707	8.764881	21.13162	21.68484	29.79707	12.97184	21.13162	17.50003	29.79707	10.60076	21.13162	18.51451	29.79707	11.36009	21.13162
	r ≤ 4	7.633003	15.49471	7.284428	14.2646	8.712997	15.49471	6.540481	14.2646	6.899263	15.49471	6.454844	14.2646	7.154424	15.49471	5.427698	14.2646
	r ≤ 5	0.348575	3.841466	0.348575	3.841466	2.172516	3.841466	2.172516	3.841466	0.444419	3.841466	0.444419	3.841466	1.726726	3.841466	1.726726	3.841466
2007 - 2008	r = 0	140.1197*	95.75366	63.69737*	40.07757	126.2922*	95.75366	38.7917	40.07757	127.4483*	95.75366	40.78323*	40.07757	130.6796*	95.75366	46.33044*	40.07757
	r ≤ 1	76.42233*	69.81889	26.64439	33.87687	87.50053*	69.81889	31.33753	33.87687	86.66503*	69.81889	24.91497	33.87687	84.34917*	69.81889	28.50767	33.87687
	r ≤ 2	49.77794*	47.85613	20.10301	27.58434	56.163*	47.85613	23.41173	27.58434	61.75005*	47.85613	24.09174	27.58434	55.8415*	47.85613	25.14559	27.58434
	r ≤ 3	29.67494	29.79707	18.9223	21.13162	32.75127*	29.79707	21.24162	21.13162	37.65831*	29.79707	22.00953*	21.13162	30.6959*	29.79707	18.78984	21.13162
	r ≤ 4	10.75263	15.49471	7.896815	14.2646	11.50965	15.49471	9.429636	14.2646	15.64878*	15.49471	11.54314	14.2646	11.90606	15.49471	7.710702	14.2646
	r ≤ 5	2.855819	3.841466	2.855819	3.841466	2.080014	3.841466	2.080014	3.841466	4.105638*	3.841466	4.105638*	3.841466	4.195363*	3.841466	4.195363*	3.841466
2009 - 2017	r = 0	76.35991	95.75366	28.84822	40.07757	72.75865	95.75366	28.0512	40.07757	69.44054	95.75366	27.26288	40.07757	72.50055	95.75366	29.06624	40.07757
	r ≤ 1	47.51169	69.81889	21.95432	33.87687	44.70744	69.81889	18.01607	33.87687	42.17766	69.81889	15.92716	33.87687	43.43431	69.81889	18.50163	33.87687
	r ≤ 2	25.55738	47.85613	10.38869	27.58434	26.69138	47.85613	11.72923	27.58434	26.25049	47.85613	12.8347	27.58434	24.93268	47.85613	10.40374	27.58434
	r ≤ 3	15.16869	29.79707	9.135507	21.13162	14.96215	29.79707	9.451228	21.13162	13.41579	29.79707	7.345172	21.13162	14.52894	29.79707	8.367182	21.13162
	r ≤ 4	6.033179	15.49471	5.233	14.2646	5.51092	15.49471	4.888783	14.2646	6.070621	15.49471	4.886962	14.2646	6.161756	15.49471	5.095777	14.2646
	r ≤ 5	0.800179	3.841466	0.800179	3.841466	0.622137	3.841466	0.622137	3.841466	1.183659	3.841466	1.183659	3.841466	1.065979	3.841466	1.065979	3.841466

Note: See Table 6.

TABLE 8

Results of Cointegration Test: ASEAN-5 and Asian Markets

Results of Cointegration Test																	
		ASEAN-5 and Brazil				ASEAN-5 and Mexico				ASEAN-5 and Argentina				ASEAN-5 and Australia			
1995 - 1997	**H_0**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**	**Trace**	**C.V.**	**Max-Eigen**	**C.V.**
	r = 0	157.7524*	95.75366	61.18809*	40.07757	193.0054*	95.75366	76.31355*	40.07757	163.1914*	95.75366	62.74477*	40.07757	175.2854*	95.75366	58.02545*	40.07757
	r ≤ 1	96.56432*	69.81889	30.94537*	33.87687	116.6919*	69.81889	44.40987*	33.87687	100.4466*	69.81889	39.70561*	33.87687	117.26*	69.81889	55.07434*	33.87687
	r ≤ 2	65.61894*	47.85613	27.95115*	27.58434	72.28201*	47.85613	40.59897*	27.58434	60.74104*	47.85613	31.32949*	27.58434	62.18562*	47.85613	31.0717*	27.58434
	r ≤ 3	37.66779*	29.79707	23.24398*	21.13162	31.68304*	29.79707	20.59152	21.13162	29.41155	29.79707	19.34788	21.13162	31.11392*	29.79707	22.7524*	21.13162
	r ≤ 4	14.42381	15.49471	11.69897	14.2646	11.09151	15.49471	10.56977	14.2646	10.06367	15.49471	8.258327	14.2646	8.361514	15.49471	8.302436	14.2646
	r ≤ 5	2.724844	3.841466	2.724844	3.841466	0.521744	3.841466	0.521744	3.841466	1.805345	3.841466	1.805345	3.841466	0.059078	3.841466	0.059078	3.841466
1997 - 1998	r = 0	645.358*	95.75366	233.345*	40.07757	650.7027*	95.75366	185.9085*	40.07757	593.1853*	95.75366	226.9958*	40.07757	825.7414*	95.75366	379.0625*	40.07757
	r ≤ 1	412.013*	69.81889	202.8517*	33.87687	464.7942*	69.81889	155.2751*	33.87687	366.1894*	69.81889	144.0518*	33.87687	446.6789*	69.81889	202.4352*	33.87687
	r ≤ 2	209.1612*	47.85613	97.74899*	27.58434	309.5191*	47.85613	139.889*	27.58434	222.1376*	47.85613	89.85868*	27.58434	244.2438*	47.85613	93.14098*	27.58434
	r ≤ 3	111.4123*	29.79707	57.10773*	21.13162	169.6301*	29.79707	112.6641*	21.13162	132.279*	29.79707	81.68682*	21.13162	151.1028*	29.79707	80.08126*	21.13162
	r ≤ 4	54.30452*	15.49471	34.32754*	14.2646	56.96608*	15.49471	44.51368*	14.2646	50.59214*	15.49471	46.0432*	14.2646	71.02151*	15.49471	39.94132*	14.2646
	r ≤ 5	19.97698*	3.841466	19.97698*	3.841466	12.4524*	3.841466	12.4524*	3.841466	4.548942*	3.841466	4.548942*	3.841466	31.08019*	3.841466	31.08019*	3.841466
1999 - 2006	r = 0	103.6807*	95.75366	32.51601	40.07757	120.8998*	95.75366	41.0885*	40.07757	106.6833*	95.75366	32.3072	40.07757	106.2769*	95.75366	35.61939	40.07757
	r ≤ 1	71.16474*	69.81889	25.43908	33.87687	79.81129*	69.81889	28.59227	33.87687	74.37608*	69.81889	29.4159	33.87687	70.65749*	69.81889	25.4669	33.87687
	r ≤ 2	45.72566	47.85613	18.43664	27.58434	51.21902*	47.85613	23.39809	27.58434	44.96018	47.85613	19.66229	27.58434	45.1906	47.85613	18.12007	27.58434
	r ≤ 3	27.28902	29.79707	13.48168	21.13162	27.82092	29.79707	15.68731	21.13162	25.29789	29.79707	14.77875	21.13162	27.07053	29.79707	14.39784	21.13162
	r ≤ 4	13.80734	15.49471	12.8387	14.2646	12.13361	15.49471	12.09116	14.2646	10.51915	15.49471	9.775039	14.2646	12.67269	15.49471	11.97814	14.2646
	r ≤ 5	0.968637	3.841466	0.968637	3.841466	0.042446	3.841466	0.042446	3.841466	0.744107	3.841466	0.744107	3.841466	0.694556	3.841466	0.694556	3.841466
2007 - 2008	r = 0	143.7034*	95.75366	54.15199*	40.07757	160.023*	95.75366	66.98918*	40.07757	117.7339*	95.75366	36.29957	40.07757	139.587*	95.75366	49.66611*	40.07757
	r ≤ 1	89.55145*	69.81889	33.42686	33.87687	93.03382*	69.81889	33.74262	33.87687	81.43436*	69.81889	27.99996	33.87687	89.92092*	69.81889	35.38037*	33.87687
	r ≤ 2	56.12459*	47.85613	26.95711	27.58434	59.2912*	47.85613	24.82839	27.58434	53.4344*	47.85613	20.74393	27.58434	54.54055*	47.85613	20.94338	27.58434
	r ≤ 3	29.16749	29.79707	15.13052	21.13162	34.46282*	29.79707	17.77612	21.13162	32.69047*	29.79707	16.59858	21.13162	33.59718*	29.79707	17.81227	21.13162
	r ≤ 4	14.03696	15.49471	11.92069	14.2646	16.68669*	15.49471	13.74881	14.2646	16.09189*	15.49471	13.52816	14.2646	15.78491*	15.49471	13.90813	14.2646
	r ≤ 5	2.116274	3.841466	2.116274	3.841466	2.937885	3.841466	2.937885	3.841466	2.563725	3.841466	2.563725	3.841466	1.876781	3.841466	1.876781	3.841466
2009 - 2017	r = 0	89.22959	95.75366	32.84697	40.07757	77.40341	95.75366	25.27114	40.07757	78.5786	95.75366	26.33883	40.07757	67.25338	95.75366	26.95091	40.07757
	r ≤ 1	56.38262	69.81889	20.84902	33.87687	52.13227	69.81889	23.83217	33.87687	52.23977	69.81889	22.88615	33.87687	40.30246	69.81889	15.7368	33.87687
	r ≤ 2	35.53359	47.85613	18.50955	27.58434	28.3001	47.85613	13.97532	27.58434	29.35363	47.85613	12.35798	27.58434	24.56566	47.85613	9.330803	27.58434
	r ≤ 3	17.02405	29.79707	9.192606	21.13162	14.32478	29.79707	8.325147	21.13162	16.99565	29.79707	9.080109	21.13162	15.23486	29.79707	6.601587	21.13162
	r ≤ 4	7.831439	15.49471	5.699385	14.2646	5.999634	15.49471	4.588826	14.2646	7.91554	15.49471	7.850771	14.2646	8.633273	15.49471	5.491163	14.2646
	r ≤ 5	2.132054	3.841466	2.132054	3.841466	1.410809	3.841466	1.410809	3.841466	0.06477	3.841466	0.06477	3.841466	3.14211	3.841466	3.14211	3.841466

Note: * See Table 6.

Europe. The results of financial cointegration analysis between the ASEAN-5 countries and the selected European financial markets are also reported in Table 7. In the period from 1995 to 1997, the analysis suggests the existence of four cointegrating vectors between the ASEAN-5 and the European financial markets. The number of cointegrating relations are larger than what have been found for the ASEAN-5 countries alone during the same period. Consistent to the financial cointegration between the ASEAN-5 countries and the chosen Asian financial market, and the cointegration among the ASEAN-5 countries and the U.S., the findings indicate strong relations among the financial markets of the ASEAN-5 countries and the selected European countries during the period from 1997 to 1998. Five cointegrating vectors are reported among the ASEAN-5 countries and Germany, and six cointegrating vectors are reported among the ASEAN-5 countries and the U.K., and among the ASEAN-5 countries and France. The cointegration among the ASEAN-5 countries and the European financial markets disappeared after the Asian financial crisis. Only one cointegrating relation indicated by the trace statistic is found among the ASEAN-5 countries and Germany between the period from 1999 to 2006. The relations of the financial markets strengthened again during the global financial crisis. The trace statistics and the maximum eigenvalue indicate four integrating vectors between the ASEAN-5 and Germany, and one integrating vector between the ASEAN-5 countries and the U.K., and between the ASEAN-5 countries and France. After the global financial crisis, any cointegrating relation was not found between the ASEAN-5 countries and these European financial markets in the period from January 2009 to June 2017. So far, we have seen that there was cointegration among the ASEAN-5 countries and the U.S. as well as the European financial markets during the financial crisis periods but the relations are insignificant or inconclusive during other sub-periods considered in this study. The nexus between the ASEAN-5 financial markets and the U.S. as well as the European financial markets during the financial crisis may be justified by two reasons. For many developing economies, the U.S. and Europe are the main trading partners and export destinations. A recession in 2008 could hurt exports and stifled economic growth of the developing world. Second, as the contagion effects have suggested, the financial instability in advanced economies can be contributed to the market instability occurred in the developing regions.

South America. The result of cointegration analysis between the financial markets of the ASEAN-5 countries and the financial markets in South America is shown in Table 8. Similar to how the equity indexes were chosen from the other regions, the three equity indexes in South America are chosen from the countries with a larger GDP in the region. In the first sub-period of the study (before Asian financial crisis), the trace statistics and maximum eigenvalue suggest three cointegrating relations between the ASEAN-5 countries and Mexico, asl well as Argentina. The findings do indicate four cointegrating relations among the ASEAN-5 countries and Mexico in the same period. During the Asian financial crisis, cointegration among the ASEAN-5 countries and the South American financial markets strengthened. Six cointegrating relations are concluded between the ASEAN-5 countries and the three countries in South America, Brazil, Mexico, and Argentina. After the Asian finance crisis, the relation became weaker as indicated by a maximum of three cointegrating vectors between the ASEAN-5 countries and Mexico. The number of the cointegrating vectors is smaller between the ASEAN-5 countries and Brazil, and among the ASEAN-5 countries and Argentina. During the fourth sub-period (from 2007 to 2008), the results suggest five cointegrating relations between the ASEAN-5 countries and Mexico, and between the ASEAN-5 countries and Argentina. Weaker cointegration was found between the financial markets of the ASEAN-5 countries and that of Brazil. In the last sub-

period, no cointegrating relation was found between the ASEAN-5 financial markets and the financial markets of the three countries in South America. Though the cointegration among the ASEAN-5 countries and the three countries in South America was less conclusive, stronger relations were found during crises and the relations varied across countries in the study. However, the findings are comparable to the work of Forbes and Rigobon (2002). They documented high-leveled market interdependence between emerging economies during financial crises. The nexus among the ASEAN-5 countries and the chosen financial markets in South America appeared to strengthen during the crisis periods as they could all be vulnerable to the shocks occurred in the advanced economies (Aizenman et al., 2015).

Australia. Table 8 also reports the cointegration test between the ASEAN-5 financial markets and that of Australia. It can be concluded that cointegration was stronger during the period from 1995 to 1997 and during the period of the Asian financial crisis. After the Asian financial crisis, the cointegration weakened. Although the cointegration strengthened during the global financial crisis period, the relations were weaker than those of the first two sub-periods. The trace and maximum eigenvalue statistics showed four and six cointegrating relations before and during the Asian financial crisis respectively. During the global financial crisis in 2007 and 2008, the trace statistics suggested five cointegrating vectors while the maximum eigenvalue statistics indicated a maximum of two cointegrating vectors. The relations among the ASEAN-5 financial market and the Australian market were not concluded for the last sub-period of the study. No significant cointegrating relation was found in the period after the global financial crisis.

CONCLUSION

This present study examines the regional and global integration of the ASEAN-5 financial markets selecting a sample period from March 1995 to June 2017. Using stock indexes of the ASEAN-5 countries and another 12 countries in total from Asia, the U.S., Europe, South America, and Australia, the study employs the cointegration test of Johansen and Juselius (1990) to analyze financial market cointegration in five sub-periods, two of which represent a period of financial turmoil. The results suggested that cointegration among the ASEAN-5 financial market was time varying and incomplete. Among the ASEAN-5, cointegration existed before the Asian financial crisis, during the Asian financial crisis, and during the global financial crisis. The level of cointegration was highest during the Asian financial crisis in 1997 and1998. No significant financial cointegration between the ASEAN-5 countries is recorded in the study for the non-crisis periods. The analysis of cointegration between the ASEAN-5 and global equity markets reveals the findings consistent with those between the ASEAN-5 countries. Cointegration between the financial markets of the ASEAN-5 countries and those in Asia, the U.S., Europe was strongest during the crisis periods and the relationships were weak or insignificant during the non-crisis periods. The degree of regional and global financial cointegration has lessened after the Asian financial crisis in 1997. This evidence can be explained by the economic transformation in the region after the Asian financial crisis. With a lesson from the crisis, the monetary policy framework of the ASEAN-5 cluster has been evolved to allow for greater stability and autonomy. The transformation of monetary policies in many countries leads to a more flexible exchange rate regime and more effective tools to mitigate risks and uncertainties. During the global financial crisis in 2007 and 2008, both regional and global cointegration of the ASEAN-5 countries increased but remained weak and inconsistent across the study. An increase in cointegration among the ASEAN-5 and

selected global financial markets during the global crisis can be justified by immense roles of the advanced economies as important trading partners and export destinations of many developing economies. The U.S., Europe, and Japan together account for a sizable share of the global economy and have remained the key economic partners for the developing world. Recession and financial instability in these advanced economies can, therefore, hurt exports, growth, and financial markets in emerging markets. The strengthened cointegration among emerging economies during the global crisis is not a surprise since the countries share some fundamentals and can possibly be affected by the same movement of the advanced economies.

Our findings imply that investors holding a well-diversified portfolio across the ASEAN-5 countries or a global portfolio inclusive of ASEAN-5 equities can still expect the benefits of diversification across regions under the normal market condition. A low degree of long-term cointegration among financial markets means the factors driving the movement and the risk hindered in each market can vary. However, the diversified portfolio during crisis periods can be highly susceptible to the contagion risk. The shocks in one economy can spread easily and rapidly throughout the system. To policy makers, it is an important task to consider a policy to maintain stability under different market circumstances. Both a prudent plan to absorb risks during market turmoil when markets are highly interdependent and an ability to promote cross-regional investment during expansion can yield tremendous benefits.

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