A study of long- run theoretical relationship between ASEAN stock market indices and developed stock market indices of US and Japan

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Abstract

Over time the current world financial markets have become more closely correlated and interdependent due to increased market integration. One of the important outcomes of globalization has been economic cross-linkages and the increased co-movement of asset prices across international markets. This paper studies the long run relationship of five founding members of ASEAN-5, namely Malaysia, Singapore, Indonesia, Philippines & Thailand (referred to as ASEAN-5) and developed stock market indices of US and Japan. After the 1997 Asian Financial crisis, the stock markets in this region are expected to open up and become more interdependent. An Autoregressive Distributed Lag Model (ARDL) has been used to empirically test if a long run relationship exists among these indices. Our study finds that the ASEAN-5 stock markets are co-integrated along with developed stock markets of US and Japan which is in line with many studies.

Keywords: *ASEAN-5, ARDL, Co-integration, long run relationship*

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1. Introduction

ASEAN-5 established in 1967 consisting of Malaysia, Thailand, Singapore, Philippines & Indonesia was formed to accelerate economic growth, social progress and cultural development in the region through joint efforts. With more than 600 million people in the ASEAN – 5 and a gross GDP of US$ 2.57 trillion, the Association of South East Asian Nation is the fourth largest trading region in the world (ASEAN, n.d. & Brunei Darussalam, 2015) To increase its competitive edge in the global market, ASEAN created ASEAN free trade to encourage greater economic integration among member economies and attract more foreign direct investments into the region (ASEAN, n.d.).

Also, over the years the ASEAN-5 countries have been jointly working diligently to enhance efficiency and strength of their financial system. For the same purpose, ASEAN-5 countries have de-regularized and liberated their financial markets in the region (Phuan, Lim, & Ooi, 2009). A variety of domestic and international developments can these days' influence movement in share prices as in today's time, world economies and financial markets are becoming interconnected.

One thing that has reduced the international barriers to capital transactions among various countries is globalization. It has also further increased linkages between stock markets movement in various countries (Darbar and Deb, 1997). This process of globalization helps to speed up this interconnection. Several studies have found that co-movement is currently higher due to close economic and financial links that has increased the market integration. The study of linkages and correlations between different markets is imperative for policy makers and fund managers as it influences their financial decisions in relation to investment and risk management and has therefore, received attention and become an important topic of study in modern finance literature.

Several studies have been done to empirically examine the financial integration among the ASEAN-5 stock markets (Ibrahim, 2005, Azman-Saini, Azali, Habibullah, & Matthews, 2002). The objective of this study is to extend this line of research by investigating if the ASEAN-5 countries stock markets are in line with the developed markets of US and Japan as with time the world financial markets are becoming more closely correlated and interdependent over time with increased market integration. The region of ASEAN-5 countries is a very important market in the world currently as these countries have grown faster than Latin America, South Africa and Africa

(World Bank,1993). The US, due to its significant influence on other market across globe has been included in this study. The primary focus is to examine the long run relationships hence, monthly data of stock prices from 2005-2016 has been collected and with the help of Microfit, the co-integration among these countries is tested for. The paper adopts one of the contemporaneous time series analysis techniques, the autoregressive distributed lag (ARDL) model developed by (Pesaran, Shin, & Smith, 2001). ARDL is a popular and standard technique for examining co-integration among financial variables. Using the ARDL model approach, m the results reveal that there is co-movement or co-integration among the ASEAN-5 countries, US and Japan.

This study is vital to different role players. Investor interest in emerging markets appears to have increased significantly over the last few years. It is important for global portfolio managers and international investors to examine if international equity markets are interdependent. The findings of this study may have implications for international portfolio diversification, capital budgeting decisions and on financial stability of a country. If the stock markets are co-integrated, then there is no long run benefit of diversification for international investor (Kasa 1992). This raises an issue of risk minimization for investors through international portfolio in these countries (Ali, Butt, & Rehman, 2011). If the market is found to be completely integrated then this implies an absence of arbitrage opportunities (Akdogan, 1992).

2. Literature Review

Over the past few decades a number of researches have been conducted to study and examine the co-integration among stock market indices of several different regions spread over a range of various time horizon depicting different financial cycles (or periods). One of the reasons could be the growing interest in the integration of international stock markets.

Results from various studies have been varying because of the sample period, choice of markets, frequency of observations and different methodologies applied (Ali et al., 2011). Ibrahim (2005)evaluated the response asymmetries in the international linkages of the ASEAN-5 counties along with US and Japan. He found US to be more influential on ASEAN markets compared to Japan where as in another study by Karim (2010) and Majid (2009) Japan was found to be more important than US over ASEAN markets.

Masih and Masih (1999) found Asian markets to be more affected from each other, rather than from the developed markets. Studies by Palac-Mc Miken(1997), (Click & Plummer, 2005) and others have found that there exists a long run relationship among the ASEAN stock markets and are therefore, co-integrated and correlated with each other. However, Roca et all (1998) study showed no evidence of integration among the ASEAN markets. Also, when (Ibrahim, 2005) investigated the integration and long run co-movement from Indonesian market using Vector Auto Regression integration technique, he found the integration was missing among the ASEAN markets. Similarly, earlier studies by Roca et.all (1998) found these markets are not significantly linked to each other in the long run but are in short run.

A few additional studies by Fernandez et. All (2001), Jang et. all (2002) and Darrat et. all (2002) have used co-integration techniques to determine whether the local markets are influenced by the U.S. market, or the Japanese market, or both, and generally add to the confusion. Stock markets are found to react differently to good and bad news. A negative shock to one country could have a negative impact on its neighbouring country as found by Manning 2002 in his study of South East Asian equity market. Such studies tell how shocks are transmitted across markets and is therefore, crucial for financial institutions and policy makers (Lim, 2007).

There appears to be mixed results in terms of integration, hence the topic is still open for further study. Based on past studies, we expect that the equity market inter relationships may vary over time.

3. Data and Methodology

The ASEAN market considered in this paper are those of the 5 founding members of ASEAN, namely Malaysia, Singapore, Thailand, Philippines and Indonesia. Following Indices are used to represent these markets:

- **Malaysia -** The Kuala Lumpur Composite Index (KLCI)
- **Singapore -** The Straight Times Index for Singapore (STI)
- **Indonesia -** Jakarta Composite Index for Indonesia (JSE)
- **Philippines-** The PSE Composite Index for the Philippines (PSE)
- **Thailand-** The SET Index for Thailand (SET)

The two dominant equity markets US and Japan incorporated in this study are represented by

- **US -** Standard & Poor 500 Index (SP500)
- **Japan-** Nikkei 225 Index (NIKKEI225)

Monthly data (from 2005 till 2016) of closing stock prices of the above mentioned indexes are obtained from Thomson Reuters DataStream. Monthly data has been employed for various reasons as daily and weekly data have high frequency and therefore contain too much noise. This can lead to erroneous conclusions in the lead-lag relationships among variables (Ibrahim, 2006). The prices are in their respective local currencies and make a total of 141 observations.

Autoregressive Distributed Lags (ARDL) bound test proposed by (Pesaran et al., 2001) is used to test the integration or long run relationship among ASEAN-5 countries, US and Japan. Since the result from selection of the order of the VAR model showed zero lag (Figure below), we could not go ahead with the time series therefore, we used the ARDL approach to test for the long run theoretical relationship among the variables.

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 Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
*******************************************************************************
 Based on  135 observations from 2005M9 to 2016M11. Order of VAR = 6
 List of variables included in the unrestricted VAR:
 DKLCI           DJSE            DNIK225         DPSE            DSET
 DSP500          DSTI
 List of deterministic and/or exogenous variables:
 INPT
*******************************************************************************
 Order    LL        AIC      SBC              LR test          Adjusted LR test
 6     1965.4    1664.4    1227.1               ------               ------
 5     1924.3    1672.3    1306.2  CHSQ(49)=   82.2003[.002]    56.0180[.228]
 4     1885.7    1682.7    1387.8  CHSQ(98)= 159.3337[.000]   108.5830[.218]
 3     1846.6    1692.6    1468.9  CHSQ(147)= 237.5164[.000]   161.8630[.190]
 2     1814.2    1709.2    1556.7  CHSQ(196)= 302.3111[.000]   206.0194[.298]
 1     1782.8    1726.8    1645.5  CHSQ(245)= 365.0728[.000]   248.7904[.421]
 0     1735.7    1728.7    1718.5  CHSQ(294)= 459.3082[.000]   313.0101[.213]
*******************************************************************************
 AIC=Akaike Information Criterion     SBC=Schwarz Bayesian Criterion
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The ARDL procedure consists of two (02) stages:

- Test the existence of long run relationship between the variables
- Estimate the long run and short run coefficients of equations conditional on whether the variables are co-integrated.

Unit Root Test:

Before we can proceed to analyze the relationship between KLCI, JSE, PSE, STI, SET, SP500 and NIKK225, it is pertinent to conduct a unit root test on the variables to test if the variables are stationary or non-stationary as the stationarity or non-stationarity of a series can strongly influence its behavior and properties. Two tests Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are used to test to check if the variables are stationary and non-stationary in their log and differenced forms respectively.

Augmented Dickey-Fuller (ADF) Test: is simply an extension of DF (Dickey-Fuller) regression. ADF test allows for more dynamics in the DF regression and consequently is over parametrized in the first order case but correctly specified in the higher order cases (Johansen, 1991and Fuller, 1976).

Phillips- Perron (PP) Test: The Phillips-Perron test regression makes a correction to the t-statistic of the γ coefficient. Non-parametric statistical methods are used in considering the serial correlation in the error terms with no lagged difference terms added. Moreover, the PP lag length follows the default available in the quantitative software. The unit root test using both ADF and PP tests, are run at the level and first difference of the series in order to determine the number of unit roots in the series (Phillips et. All, 1988).

Empirical tests for co-integration can only proceed if the time series are non-stationary in their log form and stationary in differenced form.

Autoregressive Distributive Lag (ARDL) Method:

According to Pesaran, the first step in ARDL method is to test the existence of a long run relationship among the variables. In this case:

The long run multivariate ARDL model employed in this study can be written as follows:

Malaysia:

$$\Delta KLCI_t = \alpha_0 + \sum_{i=0}^{n} b_i\ \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i\ \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i\ \Delta STI_{t-1} + \sum_{i=0}^{n} e_i\ \Delta SET_{t-1} + \sum_{i=0}^{n} f_i\ \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i\ \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i\ \Delta NIKK225_{t-1} + \delta_1\ KLCI_{t-1} + \delta_2\ JSE_{t-1} + \delta_3\ STI_{t-1} + \delta_4\ SET_{t-1} + \delta_5\ PSE_{t-1} + \delta_6\ SP500_{t-1} + \delta_7\ NIKK225_{t-1} + \varepsilon_t$$

Singapore:

$$\Delta STI_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

Thailand:

$$\Delta SET_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

Philippines:

$$\Delta PSE_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

Indonesia:

$$\Delta JSE_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

US:

$$\Delta SP500_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

Japan:

$$\Delta NIKK225_t = \alpha_0 + \sum_{i=0}^{n} b_i \, \Delta KLCI_{t-1} + \sum_{i=0}^{n} c_i \, \Delta JSE_{t-1} + \sum_{i=0}^{n} d_i \, \Delta STI_{t-1} + \sum_{i=0}^{n} e_i \, \Delta SET_{t-1} + \sum_{i=0}^{n} f_i \, \Delta PSE_{t-1} + \sum_{i=0}^{n} g_i \, \Delta SP500_{t-1} + \sum_{i=0}^{n} h_i \, \Delta NIKK225_{t-1} + \delta_1 \, KLCI_{t-1} + \delta_2 \, JSE_{t-1} + \delta_3 \, STI_{t-1} + \delta_4 \, SET_{t-1} + \delta_5 \, PSE_{t-1} + \delta_6 \, SP500_{t-1} + \delta_7 \, NIKK225_{t-1} + \varepsilon_t$$

Δ is the first differenced operator, a_0- the drift component and the residual (errort term) is denoted by ε_t. The corresponding long run multipliers of the underlying ARDL models (δ_n) are also added as proxy for lagged error terms.

The null hypothesis of no long-run relationship between the variables is denoted by using F-test models and comparing them with Critical Values in Pesaran et al (2001) to determine the joint significance of the lagged levels of all the variables

i.e.

- F (LKLCI | LJSE, LPSE, LSET, LSTI, LSP500, LNIKK225)
- F (LJSE |LKLCI, LPSE, LSET, LSTI, LSP500, LNIKK225)
- F (LPSE |LKLCI, LJSE, LSET, LSTI, LSP500, LNIKK225)
- F (LSTI |LKLCI, LJSE, LPSE, SET LSP500, LNIKK225)
- F (LSET |LKLCI, LJSE, LPSE, LSTI, LSP500, LNIKK225)
- F (LSP500|LKLCI, LJSE, LPSE, LSET, LSTI, LNIKK225)
- F (LNIKK225 |LKLCI, LJSE, LPSE, LSET, LSTI, LSP500)

Hypothesis Testing:

H_0 : No co-integration or no long- run relationship among variables i.e. $\delta_1 = \delta_s = \delta_3 = \delta_4 = 0$

H_a: Existence of co-integration or long-run relationship among variables i.e. : $\delta_1 \neq \delta_s \neq \delta_3 \neq \delta_4 \neq 0$

Compare the F-statistic from the output with the values from F Table of Pesaran. F-statistic value is not standard, and suggests different critical values for this system. If the *F* test statistic exceeds their respective upper bound of critical values, we can conclude that there is evidence of a long-run relationship between the variables regardless of the order of integration of the variables. If the test statistic is below the lower bound of critical value, we fail to reject the null hypothesis of no co-integration and if it lies between the bounds, a conclusive inference cannot be made without knowing the order of integration of the underlying regressors. (Pesaran et. all, 2001)

Before proceeding to the next step, we first define the order of distributed lag on the dependent variable and the regressors which is selected using either Akaike Information Criterion (AIC) or the Schwartz Bayesian Criterion (SBC). After the existence of integration has been established, the coefficients of the long-run relations are estimated using Error Correction Model.

We simulate Variance Decomposition (VDC) followed by Impulse response function (IRF) for further inferences. Both IRF and VDC serve as tools to evaluate the dynamic interactions and strength of causal relations among variables in the system. The VDC indicates the percentages of a variable's forecast error variance attributable to its own innovations and innovations in other variables. From VDC we can measure the relative importance of the index variables. The IRF traces the directional response of a variable to a shock of another variable. (IRFs) essentially produce the same information as the VDCs, except that they can be presented in graphical form. In this respect, we study the Generalized IR graph of each variable shocked into the system. We will be able to see the degree of response and how long it will take for the system to get back to normal.

4. Empirical Results:

Each of the seven variables (KlCI, JSE, PSE, STI, SET, SP500 & NIKK225) are tested for non-stationarity and stationarity in their level and differenced forms respectively using both ADF and PP tests. Out of the three conditions in the ADF and PP test, it was found that the most suitable for our study was the 3rd condition - "Random process includes Intercept and Trend". The results in Table 1a-1d show that all the variables are non-stationary or I(1) in their level form and stationary or I(0) when in their differenced form for ADF and PP tests.

Unit Root Test Results:

Table 1a: ADF Test

	Variable	ADF Result	T-Stat	C.V	Result
LOG FORM	**LKLCI**	ADF(1)=SBC ADF(4)=AIC	- 1.911 - 2.691	- 3.434	Non-Stationary
	LJSE	ADF(1)=AIC ADF(3)=SBC	- 2.726 - 2.310	- 3.434	Non-Stationary
	LPSE	ADF(1)=SBC ADF(4)=AIC	- 1.878 - 2.664	- 3.434	Non-Stationary
	LSTI	ADF(1)=SBC ADF(4)=AIC	- 2.663 - 3.303	- 3.434	Non-Stationary
	LSET	ADF(1)=SBC ADF(4)=AIC	- 2.039 - 2.812	- 3.434	Non-Stationary
	LSP500	ADF(1)=SBC ADF(5)=AIC	- 1.614 - 2.252	- 3.434	Non-Stationary
	LNIKK225	ADF(1)=AIC ADF(1)=SBC	- 1.290 - 1.290	- 3.434	Non-Stationary

Table 1b: ADF Test

1ST DIFFERENCED FORM

Variable	ADF Result	T-Stat	C.V	Result
DKLCI	ADF(1)=SBC ADF(2)=AIC	- 7.400 - 5.242	- 3.434	Stationary
DJSE	ADF(1)=SBC ADF(2)=AIC	- 7.412 - 5.240	- 3.434	Stationary
DPSE	ADF(1)=SBC ADF(2)=AIC	- 7.890 - 5.560	- 3.434	Stationary
DSTI	ADF(1)=SBC ADF(5)=AIC	- 7.892 - 4.673	- 3.434	Stationary
DSET	ADF(1)=SBC ADF(5)=AIC	- 7.568 - 4.725	- 3.434	Stationary
DSP500	ADF(1)=SBC ADF(5)=AIC	- 7.948 - 4.427	- 3.434	Stationary
DNIKK225	ADF(1)= AIC ADF(1)= SBC	- 8.027 - 8.027	- 3.434	Stationary

Table 1c: PP Test Results

LOG FORM

Variable	T-Stat	C.V	Result
LKLCI	- 1.7937	-3.4285	Non-Stationary
LJSE	- 1.762	-3.4285	Non-Stationary
LPSE	- 2.199	-3.4285	Non-Stationary
LSTI	- 2.134	-3.4285	Non-Stationary
LSET	- 2.105	-3.4285	Non-Stationary
LSP500	- 1.682	-3.4285	Non-Stationary
LNIKK225	- 1.614	-3.4285	Non-Stationary

Table 1d: PP Test Results

1ST DIFFERENCED FORM

Variable	T-Stat	C.V	Result
DKLCI	- 10.2183	-3.3932	Stationary
DJSE	- 9.0317	-3.3932	Stationary
DPSE	- 11.766	-3.3932	Stationary
DSTI	- 9.743	-3.3932	Stationary
DSET	- 9.809	-3.3932	Stationary
DSP500	- 9.809	-3.3932	Stationary
DNIKK225	- 12.129	-3.3932	Stationary

The calculated F statistics for the co-integration test that shows the ARDL bound tests can be seen in Table 2.

Table 2: Test for Long-run relationship

SN	Models	F-statistics	Outcome
1	F (LKLCI | LJSE, LPSE, LSET, LSTI, SP500, LNIKK225)	3.9388	Co-integration
2	F (LJSE |LKLCI, LPSE, LSET, LSTI, LSP500, LNIKK225)	4.9273	Co-integration
3	F (LPSE |LKLCI, LJSE, LSET, LSTI, LSP500, LNIKK225)	1.5454	No Co-integration
4	F (LSTI |LKLCI, LJSE, LPSE, SET LSP500, LNIKK225)	2.7229	Inconclusive
5	F (LSET |LKLCI, LJSE, LPSE, LSTI, LSP500, LNIKK225)	3.0436	Inconclusive
6	F (LSP500|LKLCI, LJSE, LPSE, LSET, LSTI, LNIKK225)	3.6056	Co-integration
7	F (LNIKK225 |LKLCI, LJSE, LPSE, LSET, LSTI, LSP500)	3.3877	Inconclusive

*Intercept and no trend *Significance Level - 95%, * Critical Bound = (2.365 - 3.553)

Table 2 shows that when LKLCI, LJSE and LSP500 are kept as dependent variables, there is co-integration among the variables indicating a theoretical long run relationship. The estimated f statistic in these 3 cases exceeded the upper bound of critical value at 95% significance level (2.365-3.553). In this case, the null hypothesis of no co-integration between the variables ($H_0 : \delta_1 = \delta_s = \delta_3 = \delta_4 = 0$) is rejected seeing as generally there is a long-run relationship that exists between all the variables. Therefore, it can be said that there is evidence of integration among the ASEAN-5 stock markets and US and Japan markets. These results are in line with Chen et al. (2003) and Majid et al. (2008). Geographic proximity of the ASEAN-5 countries, close relationship and ties among themselves and with US and Japan could be a reason of the long run relation (Ng,2002).

After the variables have been tested for co-integration, the long run coefficient of the variables in are estimated. Both Schwartz Bayesian Criterion (SBC) and Akaike Information Criterion (AIC) indicate the number of lag to be zero which could be due to the data ot the type of indexes chosen.

However, in order to proceed we need to have at least the order of lag to be 1, therefore we assume the lag length to be 1.

The long-run coefficient estimates are reported in Table 3. Negative coefficients imply that the markets are competing with each other while the positive coefficients imply that the markets are complementary in nature (Ibrahim, 2003). Singapore and Philippines have a significant positive impact on Malaysian Stock market. Singapore's strong impact on Malaysia can be attributed to geographic proximity, economic linkages, and structural symmetry (Click & Plummer, 2005). Although it was expected for the US to have a significant impact on the Malaysia, US is negative and insignificant. This could be due to the data or the kind of market indices chosen. The negative sign of US is in line with other studies as any good news in US could affect Malaysia in a negative way.

For Singapore stock market, Malaysia and US are found to have a positive significant impact indicating that the Malaysia and US markets are complimentary in nature. Singapore has maintained am open capital account where there is no restriction on movements of portfolio capital and direct investment, therefore, Singapore is found to be co-integrated with its neighboring country Malaysia and US (Monetary Authority of Singapore, 2000). Accordingly, Indonesia and Philippines both being comparatively less developed than the other three markets, are not vulnerable to negative shocks in the US. Also, surprisingly, the downturns of the Japanese markets do not also exert significant influence on the ASEAN markets in the long run. The findings also indicated that stock markets of Malaysia, Indonesia, Philippines are significantly influenced by Singapore market.

Table 3: Estimated ARDL models, long run coefficient based on Schwarz Bayesian Criterion (SBC) results

Independent Variable	Dependent variable						
	LKLCI	LJSE	LPSE	LSTI	LSET	LSP500	LNIKK225
LKLCI		1.37 [0.173]	3.28* [.001]	4.88* [.000]	0.79 [.427]	-1.99* [.048]	-1.22 [.224]
LJSE	-0.46 [0.646]		2.62* [.010]	3.03* [.003]	1.72 [.087]	0.34 [.730]	-2.26* [.025]
LPSE	5.34* [.000]	1.93 [.055]		4.47* [.000]	5.81* [.000]	-0.105 [.916]	1.34 [.180]
LSTI	8.62* [.000]	3.07* [.003]	3.38* [.001]		0.584 [.560]	6.71* [.000]	3.26* [.001]
LSET	-1.61 [.110]	-0.55 [.586]	4.13* [.000]	0.76 [.447]		2.71* [.008]	0.15 [.882]
LSP500	-1.11 [.269]	1.73 [.086]	0.46 [.645]	6.62* [.000]	3.82* [.000]		6.32* [.000]
LNIKK225	-1.01 [.316]	-0.011 [.991]	0.12 [.906]	1.1 [.273]	-1.87 [.064]	6.41* [.000]	
INPT	2.93* [.004]	-0.17 [.863]	0.93 [.356]	-0.078 [.938]	-0.33 [.742]	-1.48 [.140]	1.38 [.169]
CHSQ (12) SC	13.12 [.360]	8.92 [.710]	18.27 [.108]	20.92 [.052]	15.79 [.201]	17.69 [.125]	9.023 [.701]
CHSQ (1) FF	0.42 [.515]	7.31 [.007]	0.58 [.447]	0.96 [.327]	0.252 [.616]	5.22 [.022]	1.3 [.256]
CHSQ (1) H	0.3 [.597]	3.8 [.051]	3.2 [.074]	0.35 [.553]	6.82 [.009]	1.27 [.259]	0.52 [.471]

* significance level-5%

The estimates of the error correction model are used to confirm the existence of a stable long run relationship among the variables. Except for FF of LJSE and LSP500 and Heterokedasticity of LSET, all other diagnostics show that the equations in general are well specified as their p-value is greater than 5%. As per our tests, the coefficients of ECM confirm the long run findings. Table 4 presents the results of the ECM (-1) coefficient of Error Correction model. Almost all coefficients in the ECM, except Philippines are significant at 5% significant level. All the lagged error terms ECT (-1) in our results are negative and greater than 1 at 5% significant level. The coefficients indicate high rate of convergence to equilibrium. This is what is expected if there is a co-integration between the ASEAN-5 indexes and US and Japan. This confirms the existence of a stable and a long-run relationship among the variables. The significance of the ECM also shows evidence of causality in atleast one direction and indicates all variables are endogenous except Philippines. The empirical results also reveal that all the major stock market returns of ASEAN-5 economies are significantly influenced by each other and with US and Japan, suggesting a stronger long-run bilateral relationship among ASEAN-5 and major stock markets of US (Palamalai, M., & Devakumar, 2013).

Table 4: Estimated ARDL models, short run error correction model based on Schwarz Bayesian Criterion (SBC) results

Independent Variable	Dependent variable						
	LKLCI	**LJSE**	**LPSE**	**LSTI**	**LSET**	**LSP500**	**LNIKK225**
ECM (-1)	-5.21* [.000]	-3.05* [.003]	-1.89 [.060]	-2.97* [.004]	-3.03* [.003]	-4.48* [.000]	-3.45* [.001]

*Significance Level- 5%

Variance Decomposition (VDC):

Table 5: Variance Decomposition (VDC) results

Variable	DKLCI	DJSE	DPSE	DSTI	DSET	DSP500	DNIK225	Total
DKLCI	32.74%	13.43%	14.76%	15.42%	8.04%	9.34%	6.27%	100.00%
DJSE	9.35%	29.90%	11.58%	14.89%	14.87%	10.67%	8.74%	100.00%
DPSE	11.29%	10.98%	30.21%	16.40%	12.33%	9.42%	9.38%	100.00%
DSTI	10.46%	12.13%	14.67%	23.09%	10.80%	15.89%	12.96%	100.00%
DSET	10.42%	13.03%	13.89%	12.76%	30.31%	10.35%	9.24%	100.00%
DSP500	6.39%	9.53%	11.14%	17.67%	10.40%	28.45%	16.43%	100.00%
DNIK225	4.77%	6.23%	11.31%	16.46%	11.62%	18.15%	31.45%	100.00%

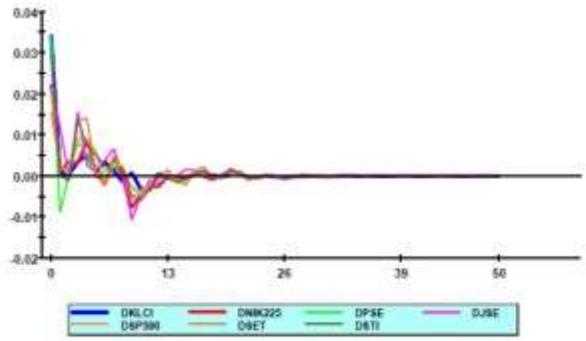
Horizon: 13

Table 5 shows the results of variance decomposition analysis based on Vector error model for the ASEAN-5 stock market along with US and Japan stock market. It can be seen that for the Malaysian stock market, 32.74% of the variation is explained by itself and shocks explained by other markets range between 6-15% in horizon 13. So is the case for all other ASEAN markets (Indonesia- 29.9%, Philippines- 30.2%, Singapore- 23.09%, Thailand-30.31%) including US and Japan (28.45% and 31.45% respectively). these results indicate that all these variables are fairly explained by itself for its own shock. US was expected to be the most influential leader which is not as per the results.

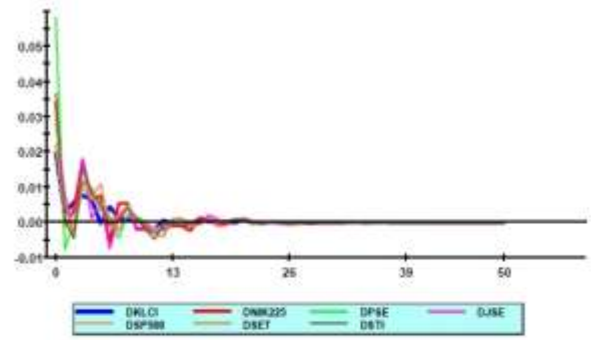
Impulse Response Function (IRF):

The IRF produces the time path of dependent variable to shocks from all explanatory variables. From the graphs below, it can be seen that; at any dependent variable, any shock of the explanatory variables make the IR dies out to zero. The effect of each variable on others when shocked is more or less equal as seen in the graphs below.

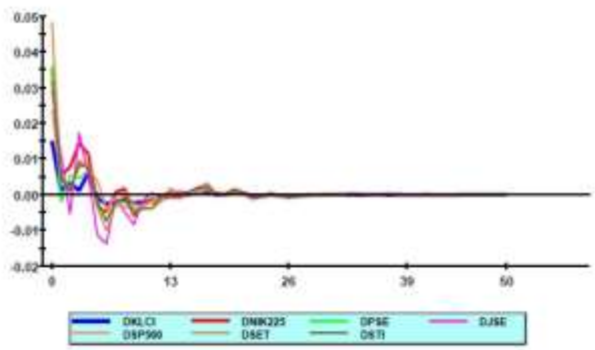
Generalised Impulse Responses to one SE shock in the equation for DKLCI



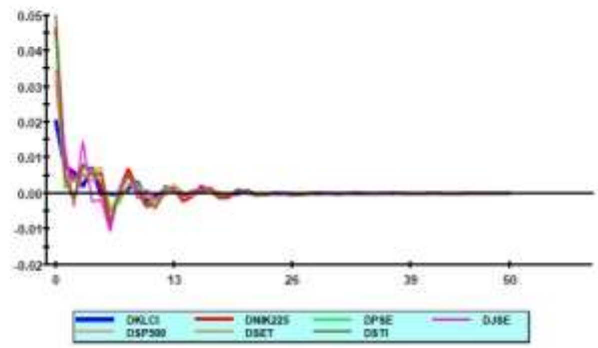
Generalised Impulse Responses to one SE shock in the equation for DPSE



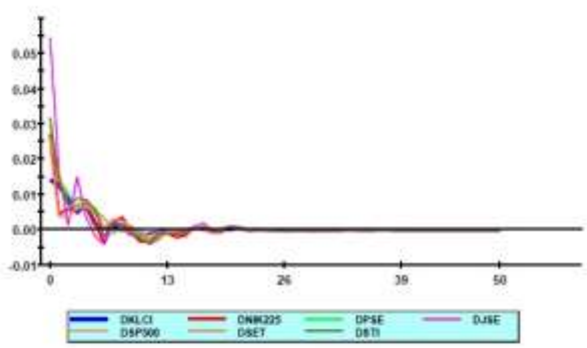
Generalised Impulse Responses to one SE shock in the equation for DSET



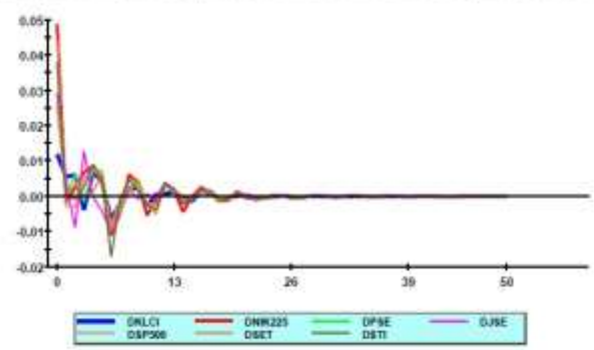
Generalised Impulse Responses to one SE shock in the equation for DSTI

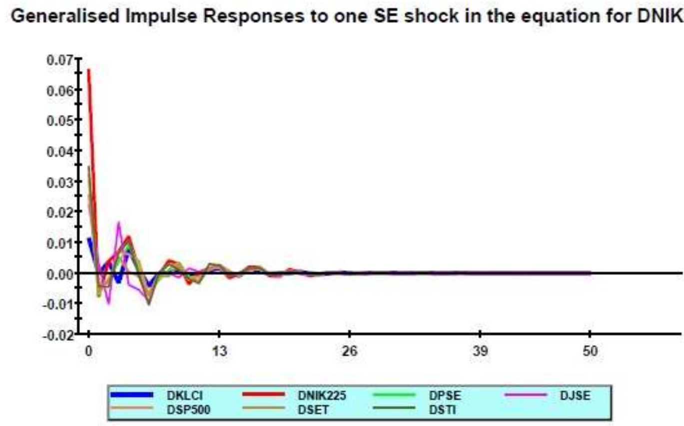


Generalised Impulse Responses to one SE shock in the equation for DJSE



Generalised Impulse Responses to one SE shock in the equation for DSP500





In general, when all the variables in the system are shocked, they effect is seemed to be significant up till year 7 (approximately) and then slowly goes to equilibrium after year 13. It is interesting to see that in graph 1, Philippines index reacts significantly to Malaysia shock followed by Indonesia. In the case of US, all variables move in the same direction indicating the high linkages between US market and other markets. Singapore however, in this case reacts most negatively.

5. Conclusion and Policy Implications

In this paper, we studied the co-movement or the long run theoretical relationship of ASEAN-5 markets along with US and Japan. Monthly data of stock index prices of Malaysia, Singapore, Thailand, Indonesia, Philippines, US and Japan from 2005 to 2016 are used. Using ARDL approach the variables are testing for their long run theoretical relationship and it is found that the ASEAN-5 market indices are co-integrated with each other and with US and Japan. The pattern of responses based on Impulse Response Function further validate that these markets are co-integrated as they move in similar direction in the long-run. The co-integration among the ASEAN-5 countries can be explained by the fact that these countries share a strong bilateral trade (Masih and Masih 1999)- strong economic ties and policy coordination could be other factors (Ratanapakorn and Sharma, 2002). US had a positive significant impact on Singapore and Thailand. Singapore had a positive significant impact on Malaysia as expected. The overall results for US and Japan remain a little puzzled. It is necessary to point out that these results obtained from ARDL approach may be affected by the type of indices chosen, the time frame of the data, the currency and the number of lags chosen.

Financial theory suggests that that an integrated regional market is more efficient than segmented national markets (Zaini & Sok, 2002). The co-integration also allows the ASEAN companies to expand their shareholder base and lower their cost of capital. Regional co-integration also suggests for a unification of currency although other financial and macroeconomic issues are to be considered. But the efficient flow of capital across borders have the capacity to mitigate the effects of any asymmetric macroeconomic shocks. Stock market integration is thus an important component of overall economic integration and might be a useful precondition for monetary unification. It is also feasible to further integrate the stock markets on a policy level and in fact considered to be desirable (Click & Plummer, 2005).

However; from an investor's point of view, the co-integration restricts an investor from diversifying across countries as it is argued that the search for countries with different policies and trade coordination is vital in portfolio diversification across countries (Zaini & Sok, 2002). Also, the strong co-integration during periods of financial distress or market downturn tend to undermine the benefits of international diversification. Since the benefit of long run diversification is less, a regional stock exchange will push investors to spread their money other markets where they otherwise may not. With higher liquidity and low transaction costs, investors outside the region may value the benefits of a regional stock exchange and may allocate more capital to the region than they would otherwise (Click & Plummer, 2005). In a recent study by Karim et all (2010), it is shown that Islamic stock markets provide an opportunity for the potential benefits from international portfolio diversification.

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