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EXAMINING THE INTEGRATION BETWEEN VIETNAMESE STOCK MARKET AND MARKETS FROM US, UK, CHINA, JAPAN AND ASEAN

Ali Malik[1], Minh H. Tran[2], Nasser I. Abumustafa[3] and Arshad Jamal[4]

[1]QFBA - Northumbria University
[2]Northumbria University - London Campus
[3]QFBA - Northumbria University
[4]Northumbria University – London Campus

ABSTRACT: *Portfolio diversification has long been in spotlight, however, the growing integration among stock markets lowers the diversification opportunities. This paper examines the integration of Vietnamese stock market with markets of ASEAN countries as well with the leading global markets such as US, UK, Japan and China. The investigation has taken place over two periods: long-term period 2007-2017 (normal period); and short-term period 2007-2008 (crisis period). The study employs unit root test, Engel and Granger co-integration, and Granger causality in order to test whether Vietnamese stock market has co-integration with stock markets of US, UK, China, Japan and other ASEAN countries. The results reveal that there is no relationship between Vietnam stock market and other stock markets in short-term period. However, in the long-term period, Vietnamese stock market is found to have positive relationship with the Chinese stock market. The result is not unexpected keeping in view the fact that Vietnam and China have close relationships in multiple fields including but not limited to geography, trading, history, and politics. Moreover, Granger causality test results reveal that Vietnam has mono-directional causal relationships with stock markets of US, Japan and Indonesia in short as well as long term.*

KEYWORDS: Diversification, Stock Market Integration, Long-Run Relationship, Granger Causality

INTRODUCTION

Research Background

The stock market integration refers to the fact that identical securities in different stock markets may be exposed to similar risk and risk premium. The integrated stock markets are considered to have long run equilibrium with each other as the movements in one stock market can be used to forecast the fluctuations in the others (Irving, 2005). As the linkages between equity markets increase, the diversification opportunities decrease. This makes the international investors consider their portfolios risk-adjusted returns and explore other investment channels. In general, if the stock markets are integrated, the capital will move to the equity markets offering the highest returns. Likewise, a market can easily become victim of the problems arising in the other markets (Paramati et al., 2015).

There are several factors responsible for the rapid increase in stock market integration. This includes market liberalization, technology improvement, removal of capital controls and deregulation of financial markets. However, Mobarek et al. (2016) suggests that globalisation is the most significant reason of stock markets integration. The term globalization is mostly used in economic field, and implies the rising of interdependence and integration of economies

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via the international flow of services, commodities, technologies and capitals (Gao, 2000). The growth of mergers and acquisitions and emergence of close trading ties have also played a part in integrating markets, creating the co-movement of similar securities in different stock markets (Armanious, 2007).

The literature on stock markets integration has risen significantly over the last couple of decades or so. Researchers such as Friedman and Shachmurove (1997); Quan and Huyghebaert (2006) prove that developed equity markets have significant co-movements. In addition, Taylor and Tonks (1989); Campbell and Hamao (1992) mention that diversification opportunity in the international investment has been lowering because of the increase in markets integration. Despite this, the issue is very much unsettled and variations in study periods and sample countries can result in contradictory findings.

The Vietnam economy shows its potential and strong momentum by the average GDP growth rate of 6.4% of the past 20 years (World Bank, 2017). Vietnam is a part of the global economy since successfully joining economic and trading organizations such as Asia-Pacific Economic Cooperation (APEC) in 1998, World Trade Organization (WTO) in 2007, the Trans-Pacific Partnership (TPP) in 2015, and signing Free Trade Agreements with many countries including Korea, Japan, ASEAN and EU countries. As the contribution of Vietnam economy to global economy becomes significant, it is highly relevant to investigate the integration between Vietnam stock market and other stock markets in the world. The study undertakes to examine this over an extended period from 2007 to 2017. The study period is significant as it includes global crisis time as well as normal time. The main stock markets chosen to test integration are United States, United Kingdom, Japan, China, and other ASEAN countries.

LITERATURE REVIEW

Globalization and equity markets:

According to Armanious (2007), globalization has a huge influence on the integration of equity markets around the world. Infact, he suggests that integration of capital markets is actually the engine of globalization. The pros and cons of globalisation remain area of hot discussion and debate. The proponents mention that globalization helps poor and developing countries to improve their economic and living standards. In contrast, globalization is claimed to benefit only large corporates who takes benefit of cheap labour resources in some countries causing unemployment in the other countries. Economic globalization is described as an irreversible trend and refers to the rising interdependence of world economies due to the growth of multinational trade of goods and services, international capitals flow and advance technologies (Gao, 2000). Moreover, it is also suggested that the rapid development of economic globalization is led by the significant innovations in science and technologies, which allows market economic system to spread out quickly to countries and upgrade the cross-border production and transportation.

Equity markets play a crucial role in the development of an economy. There are number of studies, which provide both theoretical and empirical evidence suggesting that equity markets do not only effect the level but also the growth of an economy (Rajan and Zingales, 1998); Levine and Zervos, 1998). In their study, Levine and Zervos (1998) figure out that the liquidity level of stock markets has a positive correlation with the current and future of capital accumulation and the growth of economy. In addition, they mention that a stimulation in stock

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market liquidity can boost real per capita income and capital accumulation. Armanious (2007) confirms that stock market liquidity has effects on the economy because in a liquid market, the investors will bear lower risk and can trade and raise capital with ease. This will attract more investors from domestic and global markets resulting in superior capital allocation and economic growth in the long run.

The equity markets are becoming more integrated attracting researchers interest in this area. The US and UK markets are evidenced to have significant influence on global equity markets, whereas, China and Japan are found to have integration with some Asian markets (Yang et al., 2004). On the issue of integration, there are limited studies relating to the Vietnamese stock markets and these studies present contradicting results (see for example, Kluaymai-Ngarm and Maharakkhaka, 2018; Vo and Thao, 2014; Tran and Daly, 2012).

Modern portfolio theory (MPT):

Modern portfolio theory (MPT), a seminal work of Harry Markowitz, is an investment framework for investors to select and construct their portfolios. Markowitz (1952) showed that with constant variance, expected returns of portfolios can be maximized and with constant expected returns, the variance can be minimized (Elton and Gruber, 1997). In other words, MPT helps investors to find out their optimum portfolios in which the expected returns are maximized and investment risks are minimized (Mangram, 2013). The critical point of this theory is that investors should not only choose securities based on the performances or characteristics, but they ought to analyse the co-movements of the stocks in the portfolios. In order to achieve that, investors need to diversify their portfolios by selecting different stocks from different industries and even from different markets. The advent of MPT was accepted broadly and became the central topic for economists. However, MPT has its drawbacks such as the assumptions on which the theory stands. Campbell (2000) argued that the theory mentions the use of diversification to minimize risks, but it ignores other important factors. Earlier, Viezer (2000) criticised that the MPT just relies on the investor perspectives and ignores other important aspects making the theory suboptimal. In addition, the increasing stock markets integration challenges MPT as the high co-movements of stock markets reduce the diversification opportunities (Tran and Daly, 2012).

Stock market integration presents the idea that investors can trade, without any restrictions, in stocks or other securities which are issued in other countries. This leads to the fact that securities having similar characteristics will be traded at the similar price across border once the prices are adjusted for exchange rates (Pieper and Vogel, 1997). This study reviews theories which explain the integration of stock markets: Capital asset pricing model (CAPM) and The Generalized Auto Regressive Conditional Heteroscedasticity (GARCH).

Capital asset pricing model (CAPM):

This model was built on modern portfolio theory. The CAPM is applied in calculating theoretical required rate of return of assets and suggests it is possible to predict the price when the expected cash flows can be estimated. As Sharp (1964) and Lintner (1965) highlight, there are two main assumptions in CAPM. The first one is lending and borrowing at risk free rate. The other assumption presents the idea that the expectations of all investors are homogeneous, and thus it leads to similar probability distributions for the investors' returns.

Following the model, it is argued that securities with similar characteristics are traded at same price even in different markets or countries. In the case that stock markets are integrated, the

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stocks in these markets will have the same risks and hence identical stocks will have similar prices within these markets. The implication of this model is quite similar to the law of one price theorem when the theorem implies that two assets should not have different prices when they are identical in characteristics. Despite its wider application, the model has been subject to some staunch criticism and is summed up by Fama and French (2004) who label the model as '*"poor enough to invalidate the way it is used in applications"*.

The Generalized Auto Regressive Conditional Heteroscedasticity (GARCH):

According to GARCH model, if stock markets are in a long-run equilibrium, there exists integration between these equity markets. The appearance of this co-integration can be applied to predict the movement of integrated stock market based on the existence of a valid error correction representation (Armanious, 2007). Generally, the stock markets integration appears once the identical securities in different stock markets fluctuate correspondingly, and thus it is possible to rely on the movements of one involved stock market to forecast the other.

REVIEW OF EMPIRICAL RESEARCH:

Since the advent of Modern Portfolio Theory (MPT), the term "portfolio diversification" has become an integral term in finance literature. Well-diversified portfolios help investors gain higher return for each unit risk, therefore, upgrades these portfolios performance (Flavin, 2004). Grubel (1968) and Levy and Sarnat (1970) support MPT by showing that investors can have higher returns when they diversify their portfolios with low correlation assets from international stock markets. However, the strengthening of globalization and market integration increases asset return correlations, hence leads to significant reduction in portfolio diversification effectiveness (Kearney and Lucey, 2004).

The last three decades have seen a surge in research across the world to study integrations in stock markets. Recently, Lee and Isa (2014) investigate the association of Malaysian equity market with stock markets from United States, Europe and Asian countries. They apply both Johansen co-integration test and Granger Causality test for weekly data from 2002 to 2011. The result shows relationship between Asian and European stock markets in the financial crisis period, but there is no integration among United States and Asian stock markets. On the other hand, the Granger Causality test results shows the causalities of stock markets among Asia countries, and Malaysia stock markets are influenced by one-way granger causes from United States, Japan, and China.

Dhanaraj et al. (2013) examines co-movements n stock markets of United States and emerging countries including China, India, Hong Kong, Singapore, South Korea, and Taiwan. They use daily closing index from these stock markets from 1999 to 2009 and employ Granger causality and FEVD analysis. Their study concludes that stock market of United States causes effects on these emerging stock markets. Especially, the effects become stronger during the global crisis 2007-2008.

Aimprasittichai and Suppakittiwong (2015) conduct a similar research when they use Gregory and Hansen co-integration test to investigate the integration of stock markets in United States, Indonesia, Thailand, Malaysia, and Philippines. Monthly data from stock markets from 2003 to 2015 is used to conduct the test. The result indicates that all stock markets from South East Asian countries except Philippines are under influences of United States stock market.

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Moreover, the researchers apply Engle-Granger two step procedures and Error Correction model to figure out that during the crisis period the long-run equilibrium of South East Asian stock markets reduced dramatically.

A study on relationships among eight stock markets of Asian countries (Philippines, Thailand, Singapore, Malaysia, Hong Kong, Taiwan, Japan, and Korea) and United States stock market was conducted by Heilmann (2010). They use weekly data from 1995 to 2010 and apply 4 tests including Granger Causality, Co-integration Regression Augmented Dickey Fuller (CRADF), Gregory and Hansen, and Vector Error Correction Model (VECM). The result from Granger Causality points out that Japan stock market barely influences other Asian stock markets. However, United States stock market has short-term impacts on stock markets in Asia. Notably, Singapore stock market is concluded to have the most significant influence on Asian stock markets and on the U.S stock market also.

Gupta and Guidi (2012) conduct a study on the co-movement of Indian and other Asian stock markets (Japan, Hong Kong, and Singapore). The authors employ the co-integration methods to test the integration and figure out that these equity markets have conditional correlation over different periods. Notably, they find out the co-movements in short-run instead of long-run relationships. Besides, the co-movements are said to be more significant during the financial crisis and the ending time of the crisis. In general, they conclude that there are potential diversification opportunities for investors in these stock markets due to the lack of long-term interlinks.

There are studies who observed the influences of financial crisis on stock market integrations among emerging and developed stock markets. The research of Huyghebaert and Wang (2010) explores the level of equity markets integration of Taiwan, South Korea, China, Hong Kong, Japan, and the U.S in the period from 1992-2003. The authors focus on the crisis period when they divide the Asian financial crisis of 1997 into three periods: pre-crisis, crisis and post-crisis. The results show that equity markets from Hong Kong and Singapore are considerably influenced by other stock markets in East Asia, especially during the crisis period. On the other hand, after the crisis, Hong Kong and Singapore stock markets have significant impact on the East Asia equity markets. The authors also provide evidence that the U.S stock markets have a huge influence on the returns of other examined stock markets (except Chinese stock markets) during the financial crisis.

Besides emerging equity markets in Asia, stock markets in South America area are also examined for integration. Chen et al. (2002) examine data from six stock markets (Colombia, Venezuela, Chile, Argentina, Mexico and Brazil) over the period from 1995 to 2000. Their result shows that there is relationship among these stock markets from 1995 to 2000. Later, Lahrech and Sylwester (2011) conduct an identical research with stock markets from Latin American countries (Chile, Brazil, Argentina, and Mexico) and U.S stock market over the period of 16 years (1988-2004). The authors explain that there is a significant growth in co-movement level of U.S equity market and the latin markets.

Likewise, Lucey and Muckley (2011) enrich the literature with their research on the independence of stock markets from U.S, Europe (France, Sweden, Italy, the UK and Germany), and Asia (Korea, Singapore, Hong Kong, Japan, and Taiwan). They collect daily closing prices of the equity markets from 1988 to 2007. The study result indicates that short term co-integration level of European and U.S stock markets is higher than that of Asian and U.S stock markets. They also find the existence of long-term co-movements of U.S and Asian

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stock market, however, they cannot figure out any evidence for long term relationship between European and U.S markets.

Similarly, Syriopoulos (2007) conducts a study on the dynamic linkages in emerging European stock markets (Hungary, Poland, Czech Republic, and Slovakia) and U.S and Germany equity markets from 1993 to 2003. The author reports a significant influence of European Monetary Union (EMU) on the relationship in these stock markets. He concludes that there exists long-term relationships among these stock markets base on the Johansen co-integration test results. Moreover, the authors figure out that one of the main reasons for the integration may come from economic reformation which led to the inflows of capital into European economies. Syriopoulos and Roumpis (2009) confirm the existence of long-term relationship of stock markets in South East European countries (Bulgaria, Croatia, Cyprus, Greece, Romania and Turkey) and global leading equity markets from U.S and Germany. In spite of the presence of long-run co-movement in these countries, the authors suggest that it is possible for investors to gain benefits by diversifying their portfolios in short term.

Vietnam stock market is also researched to test its co-movement with other stock markets. Vo and Thao (2014) investigates the integration of VV-index (the major stock exchange in Vietnam) and S&P 500 (U.S stock market) from 2005 to 2012. The researcher uses Johansen co-integration, Granger causality and Correlation test with daily closing price of these two stock markets. The study is divided into 3 periods: first one is crisis period 2007-2008, the second one is post crisis period 2009-2015, and the last one is full period from 2005 to 2012. The result reveals that during the crisis period VN-index and S&P 500 are highly correlated.

Also, Yang et al. (2004) examined the integration of 26 stock markets from Asian, European and American countries. They apply Engle & Granger co-integration test with daily closing price from 2002 to 2012. Moreover, a co-integration network has been employed in order to demonstrate the relationships among these countries. Their test result suggests that during the crisis China stock market has huge influence on Asia stock exchanges while the biggest equity market in Japan has no impact on other Asian markets. Interestingly, the authors have opposite conclusion to Vo and Thao (2014) when they report that the Vietnam stock exchange does not have any association with U.S stock market.

Recently, Kluaymai-Ngarm and Maharakkhaka (2018) examine the nature and extent of integration of two Vietnamese stock markets with other countries in ASEAN. The study uses rather outdated data from 2009-2013 and employs cointegration and Granger Causality approach. The result reveals that there exists some degree of integration between Vietnamese stock markets and other markets in ASEAN. This suggests that investors' gain on diversified portfolios in ASEAN countries is reduced but not completely eliminated.

METHODOLOGY AND METHODS

This is a positivistic study that uses quantitative data and methods. Monthly data is employed in this study from 2007 to 2017. All the data relating to the case stock markets is gathered from their official websites. In case the data of a stock market is not available, that data collected from Yahoo Finance. This study examines the integration of Vietnam stock market with other equity markets from seven countries.

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The main stock index from selected countries will be VN-index (Vietnam), Nikkei index (Japan), S&P500 (U.S), FTSE100 (U.K), Straits Times Index (Singapore), Kuala Lumpur Composite Index (Malaysia), Jakarta Composite Index (Indonesia), and Hang Sheng Index (China). As this research is conducted over a reasonably long period of 11 years, so monthly data is collected instead of daily data. The daily data may have too much noise and gets affected by weekday anomalies (Roca et al., 1999). The monthly data will be selected by the closing price of the index on the last working days of month.

It is essential to consider the different time zones of the observed stock markets because of the heterogeneity in opening and closing time. Moreover, different countries will have their own days off and holidays, and this results in some missing data. To address this, authors follow Hirayama and Tsutsui (1998) and Majid and Kassim (2009) and use Occam's razor method in order to replace the missing data.

The testing procedure:

This paper follows the testing procedure used by Brahmasrene and Jiranyakul (2004). The Unit Root test is employed first to test the stationary of the observed variables. Based on the unit root test results, the following steps are adopted:

- If the examined variables are stationary at level, then there is no need to run co-integration. Instead, Granger Causality will be applied to test the co-movements of stock indices.
- If the unit root test result shows variables are not stationary, co-integration test will be employed as the requirement of this test is that the variables are not stationary at level but stationary at first difference. If the variables are co-integrated, it means that there is a relationship between the two examined variables. However, if the test results show that variables are not co-integrated then there is no two-way relationship between stock markets. If that happens, Granger Causality will be used to test whether the fluctuations in one market can impact the other.

Unit root test model:

This paper applies the augmented Dickey-Fuller (ADF) to test the unit root of the time series. The formula for the ADF regression is:

$$\Delta y_t = \psi y_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta y_{t-i} + u_t \qquad (1)$$

In which:

- Δ: the first difference operator
- ψ: the coefficient
- Ut: white noise error term
- N: the lag order of autoregressive process

It leads to the ADF test hypothesis:

Null Hypothesis: H_0: $\psi=0$

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Alternative hypothesis: $H_\alpha<0$

The value of ADF statistic test will be calculated as the formula:

$$DF=\frac{\hat{\psi}}{SE\hat{\psi}} \qquad (2)$$

Granger Causality test:

The Granger Causality tests the ability to forecast the fluctuations of a variable relying on the empirical information of other variables. As the purpose of this study is to examine the co-movement of Vietnam stock market with other selected stock markets, therefore, it is appropriate to apply Simple Granger Causality test. The test uses these equations:

$$Y_t=\sum_{i=1}^{k}\beta_{11,i}\, y_{t-i} + \sum_{j=1}^{k}\beta_{12,j}X_{t-j} + u_{1t} \qquad (3)$$

$$X_t=\sum_{i=1}^{k}\beta_{21,i}\, y_{t-i} + \sum_{j=1}^{k}\beta_{22,j}X_{t-j} + u_{2t} \qquad (4)$$

There are four possible outcomes for the Granger Causality test:

1) Mono-directional causality from variable X to variable Y
2) Mono-directional causality from variable Y to variable X
3) Bi-directional causality of both variable X and Y
4) Variable X and Y are independent

According to Granger (1969), Granger Causality test will employ the hypothesis:

H0: variable A does not Granger-cause variable B

Hα: variable A Granger causes variable B

Co-integration test:

This study follows Yang et al. (2004) and uses Engle & Granger co-integration test. According to Granger (1969), the first condition to test co-integration of two variables is the data cannot be stationary at level but stationary at first different. Base on the regression model of Engle and Granger (1987), we use the formula:

$$y_t =\delta_0 + \delta_1 x_{1t} + \delta_2 X_{2t} + u_t \qquad (5)$$

Change the side of all variables in the formula above to the left except u_t. The equation will be:

$$Y_t - \delta_0 - \delta_1 x_{1t} - \delta_2 X_{2t} = u_t \qquad (6)$$

According to the formula above, the residual u_t can be described as the linear combination of all the examined variables. Normally, if the non-stationary variables are integrated, the linear combination is also non-stationary. However, if the non-stationary variables have their linear

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combination or residual variable stationary then it can be concluded that the examined variables are co-integrated (Brooks, 2008). In this event, the non-stationary variables have impact on each other and this could push them to move together. In practice, the tested series can separate from each other in a short period but they will move together steadily in long run, and Engle and Granger (1987) classify this as the long term equilibrium phenomenon.

This paper applies Error Correction Model in the co-integration test, and the equation for the model will be:

$$\Delta Y_t = \delta_0 + \delta_1 \Delta x_t + \delta_2(y_{t-1} - \alpha - \gamma x_{t-1}) + u_t \qquad (7)$$

RESULTS, FINDINGS AND DISCUSSION

Descriptive analysis:

The descriptive analysis focuses on both descriptive statistic of level data and first difference data. These Table 1 and Table 2 below present the results.

Table 1: Descriptive analysis on level data

	VN-ind	***S&P500***	***JSEC***	***KLCI***	***NIKKEI***	***SSE***	***STI***	***FTSE***
Mean	-0.0004	0.00473	0.0098	0.00315	0.0021	0.0013	0.00085	0.00163
Median	0.00678	0.01043	0.0154	0.00638	0.0065	0.0070	0.00546	0.00705
Max	0.24675	0.10230	0.1834	0.12703	0.1209	0.1876	0.19300	0.08113
Min	-0.2745	-0.1856	-0.3771	-0.1651	-0.272	-0.282	-0.2736	-0.1395
Std.Dev	0.0842	0.04305	0.06155	0.03489	0.0591	0.0865	0.05369	0.04002
Skew	-0.5681	-0.9948	-1.9185	-0.8101	-0.985	-0.779	-0.9687	-0.6168
Kurtosis	4.5646	5.51990	14.188	7.49228	5.6159	4.4413	8.82566	3.71327
Obs	131	131	131	131	131	131	131	131

Note: VN-ind = Vietnam; S&P500 = U.S; JSEC = Indonesia; KLCI = Malaysia;

Nikkei = Japan; SSE = China; STI = Singapore; FTSE = UK

The results depict the highest mean return for JSEC which shows that the index of Indonesia is attractive to invest. After JSEC, the S&P500 and KCLI have the highest average returns. The Vn-index is the least attractive index and it is the only index with negative mean of -0.0004. Unlike skewness of first difference data, the skewness values of level data are all negative suggesting that the data is skewed to the left. Besides, kurtosis values of the data are quite high, especially with JSEC, KLCI, and STI. The reason behind is that the data includes the crisis period which made all indexes fluctuated sharply.

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Table 2: Descriptive analysis on first difference data

	VN-ind	***S&P500***	***JSEC***	***KLCI***	***NIKKEI***	***SSE***	***STI***	***FTSE***
Mean	575.192	1605.404	3866.96	1524.55	13901.1	2907.34	2998.33	6083.04
Median	540.73	1477.565	4136.57	1604.99	13855.4	2799.38	3045.51	6209.28
Max	1137.69	2673.61	6355.65	1882.71	22764.9	5954.78	3763.57	7687.78
Min	245.74	735.09	1241.54	863.61	7568.42	1728.79	1594.87	3830.1
Std.Dev	187.427	467.3931	1322.03	262.813	4135.65	789.512	394.929	821.786
Skew	1.16409	0.333227	-0.2983	-0.7806	0.17467	1.34168	-1.5698	-0.5649
Kurtosis	3.9437	2.133711	1.9513	2.82298	1.7222	5.25775	6.17022	3.03769
Obs	132	132	132	132	132	132	132	132

Note: VN-ind = Vietnam; S&P500 = U.S; JSEC = Indonesia; KLCI = Malaysia;

Nikkei = Japan; SSE = China; STI = Singapore; FTSE = UK

The Table 2 shows that Nikkei (Japan) has the highest mean with 13901.01, and FTSE takes the second place with 6083. On the other hand, Vn-index (Vietnam), KLCI (Malaysia), and S&P 500 (U.S) show their mean figures quite low with 575.192, 1524.55, and 1605.404 respectively. The result shows that Nikkei is also the riskiest market to invest in with the standard deviation of 4135 while Vietnam is one of the safest market for investors with 187.4 standard deviation. In general, the skewness of all data is in the acceptable range in which JSEC, KLCI, STI, and FTSE are skewed to the left while the others (VN-index, S&P500, Nikkei, and) are skewed to the right.

Correlation test result:

Table 3 shows the correlation among the examined stock markets. According to the correlation test result, Vietnam is observed to have strong correlations with the U.S (0.500), Singapore (0.48), and the U.K (0.439). However, Vietnam has shown a low correlation with China (0.213) and Japan (0.434), which is significant as these countries are thought to have a significant influence on Vietnam economy.

Table 3: correlation of all indexes

Correlation	FTSE	JSEC	KLCI	NIKKEI	S_P_500	SSE	STI	VN_INDEX
FTSE	1							
JSEC	0.59953876...	1						
KLCI	0.58501865...	0.73352274...	1					
NIKKEI	0.60787688...	0.52255809...	0.47992418...	1				
S_P_500	0.82953920...	0.61698180...	0.56872068...	0.70663528...	1			
SSE	0.35000742...	0.40223809...	0.45493022...	0.40826125...	0.41696354...	1		
STI	0.69664139...	0.75064369...	0.69690991...	0.65664132...	0.76629992...	0.54574730...	1	
VN_INDEX	0.43930893...	0.36121689...	0.30804073...	0.43429309...	0.50037841...	0.21346084...	0.48010057...	1

Note: VN-ind = Vietnam; S&P500 = U.S; JSEC = Indonesia; KLCI = Malaysia;

Nikkei = Japan; SSE = China; STI = Singapore; FTSE = UK

Unit root test:

To examine if the data is stationary at both level and first difference, the Augmented Dickey-Fuller is applied as a tool in the unit root test. Besides, the lag length of the test is based on

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Schwarz Information Criterion (SIC). Table 4 and Table 5 present result for the two study periods.

Table 4: unit root test result (2007-2017)

Stock markets	t-statistical at level	t-statistical at first difference	Result
U.K	-0.97018	-12.34573	Non-stationary at level but stationary at first difference
Malaysia	-0.414317	-9.868147	Non-stationary at level but stationary at first difference
Indonesia	-1.132066	-10.46478	Non-stationary at level but stationary at first difference
Japan	-0.112209	-9.580640	Non-stationary at level but stationary at first difference
U.S	1.170202	-10.33165	Non-stationary at level but stationary at first difference
China	-2.081577	-10.64680	Non-stationary at level but stationary at first difference
Singapore	-1.947876	-10.02978	Non-stationary at level but stationary at first difference
Vietnam	-2.597817	-9.627442	Non-stationary at level but stationary at first difference

Note: the significant level of this test will be 5% with the critical value: -2.89.

According to the results in Table 4, all the data series of stock markets are non-stationary at level but they are stationary at first difference. And hence it is possible to run co-integration test for all of the stock markets above in the period 2007-2017.

Table 4: unit root test result (2007-2008)

Stock markets	t-statistical at level	t-statistical at first difference	Result
U.K	0.162208	-4.246932	Non-stationary at level but stationary at first difference
Malaysia	-0.439163	-3.204747	Non-stationary at level but stationary at first difference
Indonesia	0.422467	-3.65869	Non-stationary at level but stationary at first difference
Japan	0.331695	-3.877306	Non-stationary at level but stationary at first difference
U.S	1.846761	-3.890935	Non-stationary at level but stationary at first difference
China	-0.550529	-2.037754	Non-stationary at level and non-stationary at first difference
Singapore	0.573935	-3.494630	Non-stationary at level but stationary at first difference
Vietnam	-0.340513	-4.427314	Non-stationary at level but stationary at first difference

Note: the significant level of this test will be 5% with the critical value: -3.004861.

The unit root test results for short period 2007-2008 show that most of the examined data (except China) are non-stationary at level but stationary at first difference. Thus, the co-integration test is applied for Vietnam versus Malaysia, Indonesia, Japan, U.S, and Singapore in order to find out the short-term relationship of these equity markets. In order to check co-integration of stock markets, Engel-Granger two-step method is employed.

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Engle-Granger first step:

According to the unit root results, we have two possible events:

- The examined variables are not co-integrated when their residual is not stationary.
- The examined variables are co-integrated when their residual is stationary.

In other way, the results above can be converted into hypothesis statements:

- H_0 (null hypothesis): there is no co-integration of the examined variables
- H_α (alternative hypothesis): there is a co-integration of the examined variables

As the unit root test table for each stock market figures out that all examined stock market is non-stationary at level but they are stationary at first difference, and hence all stock markets, except China for 2007-08, are qualified for the co-integration test with Engel-Granger two-step method. Table 6 and Table 7 present results.

Table 5: Co-integration test result (2007-2017)

Residual variables	***T statistic***	***Result***
Vietnam and UK	-2.226578	There is no co-integration
Vietnam and Malaysia	-1.025806	There is no co-integration
Vietnam and Indonesia	-1.606665	There is no co-integration
Vietnam and Japan	-1.886363	There is no co-integration
Vietnam and U.S	-1.221412	There is no co-integration
Vietnam and China	-3.408180	Co-integration
Vietnam and Singapore	-2.567425	There is no co-integration

Note: the significant level 5% with the critical value -3.37.

Base on the results of the unit root test, Vietnam stock market has no pairwise co-integration with UK, Malaysia, Indonesia, Japan, U.S, and Singapore as their t-statistic value cannot exceed the critical value (-3.37) at 5% significant level. However, there is a pairwise co-integration of Vietnam stock market and China stock market.

Table 6: Co-integration test results (2007-2008)

Residual variables	**T statistic**	**Result**
Vietnam and UK	-1.498114	There is no co-integration
Vietnam and Malaysia	-1.021301	There is no co-integration
Vietnam and Indonesia	-1.245421	There is no co-integration
Vietnam and Japan	-1.498496	There is no co-integration
Vietnam and U.S	-0.802954	There is no co-integration
Vietnam and Singapore	-1.128891	There is no co-integration

Note: the significant level 5% with the critical value -3.37.

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In the short-term period, most of the data is qualified for the Engel-Granger test except China. In the co-integration test, all the examined stock markets are failed to have co-integration with Vietnam stock markets as their t-statistics cannot exceed the critical value.

In general, there is no co-integration found in short-term period during the Global crisis 2007-2008 between Vietnam stock market and other leading stock markets. However, this study finds out the pairwise co-integration between Vietnam stock market and China stock market at significant level 5% in long-term period (2007-2017). And hence, Vietnam and China stock market data will be run in the second step of Engel-Granger method to find out the existence of long-term relationship of these two stock markets.

Engel-Granger second step:

In the second part of Engel-Granger method, the data set of the co-integrated stock markets (Vietnam and China) is tested to find out the long-term relationship from 2007 to 2017. By applying Error Correction model, the equation for the test is:

$\Delta y_t = \delta_1 \Delta x_t + \delta_2(u_{t-1}) + \rho_t$

In which:

- u_{t-1}: the correction factor
- ρ_t: the error term

Results are presented in Table 7.

Table 7: Error Correction model result

Dependent Variable: VN_INDEX
Method: Least Squares
Date: 08/28/18 Time: 12:37
Sample: 2007M01 2017M12
Included observations: 132

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D2	-0.356446	3.54E-17	-1.01E+16	0.0000
C	-461.1152	7.80E-14	-5.91E+15	0.0000
D1	0.356446	2.64E-17	1.35E+16	0.0000

R-squared	1.000000	Mean dependent var	575.1920
Adjusted R-squared	1.000000	S.D. dependent var	187.4274
S.E. of regression	1.59E-13	Sum squared resid	3.26E-24
F-statistic	9.11E+31	Durbin-Watson stat	0.968254
Prob(F-statistic)	0.000000		

According to the result above, the coefficient D2 is negative (-0.356446) and the P-value is significant at 5%. It can be concluded that there is a long-term equilibrium relationship between Vietnam stock market and China stock market. This implies that if there is a gap between the performances of these two stock markets, one stock market will adjust in the next period and jump back to the equilibrium point (Aimprasittichai and Suppakittiwong, 2015). According to the statistics from World Bank, China is the second biggest importer from Vietnam with 10.23% share and also the biggest exporter to Vietnam with nearly 30% share. Therefore, China

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has the largest influence on Vietnam economy, and also Vietnam has some role in China economy. The findings of this study compliments Yang et al. (2004) who reported that China stock market has a close relationship with Asian stock market including Vietnam.

Granger Causality test:

In order to check the one-way influence of stock markets on Vietnam and vice versa, Granger Causality test is employed. As the test is check the causality of stock markets, and hence the co-integrated stock markets will not be included which means there is no need to test the causality of China and Vietnam in the period 2007-2017. Thus, Granger causality will be applied for all stock markets in both periods except China in period 2007-2017. The decision whether to accept or reject the null hypothesis will be based on the P-value from the test result. The results are presented in Table 8 and Table 9.

Table 9: Granger causality results 2007-2017

Null hypothesis	***Observations***	***F-statistic***	***p-value***
VN-index does not Granger Cause FTSE	130	0.96216	0.3849
FTSE does not Granger Cause VN-index	130	2.35149	0.0994
VN-index does not Granger Cause JSEC	130	2.51996	0.0845
JSEC does not Granger Cause VN-index	130	3.62528	0.0295*
VN-index does not Granger Cause KLCI	130	3.14182	0.0466*
KLCI does not Granger Cause VN-index	130	1.40460	0.2493
VN-index does not Granger Cause Nikkei 225	130	0.70554	0.4958
Nikkei 225 does not Granger Cause VN-index	130	5.66373	0.0044*
VN-index does not Granger Cause S&P 500	130	0.45955	0.6326
S&P 500 does not Granger Cause VN-index	130	4.72088	0.0106*
VN-index does not Granger Cause STI	130	0.54687	0.5801
STI does not Granger Cause VN-index	130	1.76234	0.1759

Note: Note: VN-ind = Vietnam; S&P500 = U.S; JSEC = Indonesia; KLCI = Malaysia;

Nikkei = Japan; SSE = China; STI = Singapore; FTSE = UK

According to Table 9, Vietnam stock market is found to have mono-directional causality with four stock markets: Japan, U.S, Malaysia, and Indonesia. In general, U.S and Japan are large stock markets at global level, and hence it is apparent that the stock markets from these two countries have significant influence on other stock markets. Besides, Japan is always on top of the countries that have the highest amounts of foreign direct investment in Vietnam. That can explain the significant influence of Japan on both Vietnam economy and stock markets.

Table 10 suggests that in the global crisis period, Vietnam stock market has mono-directional causality with three stock markets: Malaysia, Indonesia, and China. This is not unexpected as these countries historically have significantly close relationship with Vietnam. Therefore, they have impacts on each other in economy and stock index performance.

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Table 10: Granger causality test result 2007-2008

Null hypothesis	*Observations*	*F-statistic*	*p-value*
VN-index does not Granger Cause FTSE	23	1.73747	0.2024
FTSE does not Granger Cause VN-index	23	0.12255	0.7299
VN-index does not Granger Cause JSEC	23	7.18222	0.0144*
JSEC does not Granger Cause VN-index	23	0.73680	0.4009
VN-index does not Granger Cause KLCI	23	8.94831	0.0072*
KLCI does not Granger Cause VN-index	23	0.42329	0.5227
VN-index does not Granger Cause Nikkei 225	23	0.00012	0.9914
Nikkei 225 does not Granger Cause VN-index	23	3.01945	0.0976
VN-index does not Granger Cause S&P 500	23	0.71706	0.4071
S&P 500 does not Granger Cause VN-index	23	0.29833	0.5910
VN-index does not Granger Cause STI	23	1.91785	0.1813
STI does not Granger Cause VN-index	23	0.20613	0.6547
VN-index does not Granger Cause SSI	23	5.70318	0.0269*
SSI does not Granger Cause VN-index	23	0.00574	0.9403

Note: Note: VN-ind = Vietnam; S&P500 = U.S; JSEC = Indonesia; KLCI = Malaysia;

Nikkei = Japan; SSE = China; STI = Singapore; FTSE = UK

Implications to research and practice

The paper has some useful implications for researchers and practitioners. The paper has added to existing research by examining, for the first time, integration of Vietnamese stock market with leading stock markets from US, UK, China, Japan and select countries ASEAN. The paper has complimented existing literature but has also presented differing views. For practitioners, it is suggested that Vietnam stock market can be included in a portfolio to diversify risk and maximise return. However, it is advised that a portfolio consisting of China and Vietnam will not yield the required results as both markets are highly co-integrated.

CONCLUSION AND FUTURE RESEARCH

The paper investigates the co-movement of Vietnam stock market with other leading stock market. The results of various tests reveal that Vietnam has a long-run relationship with Chinese stock market. In addition Vietnam stock market is under influences of leading stock markets from countries such as Japan, U.S, Malaysia, and Indonesia. These findings can be used as a reference point for investors. Base on the fluctuation in the examined stock markets, investors can adjust their portfolios to gain benefits by investing in Vietnam stock market. For instance, Vietnam and China stock markets are found to be co-integrated, and hence investors should not invest in both stock markets to diversify their portfolios. The study extends evidence on the issue of co-integration and diversification in Vietnam and examine the issue in a more specific context as compared to Kluaymai-Ngram and Maharakkhaka (2018), Tran and Daly (2012) and Yang et al. (2004).

Future researchers can explore this topic employing daily or weekly data over an even longer period of time and increasing the number of stock markets in the sample. This study employs

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Granger causality and Engel and Granger Causality tests, and it will be interesting to use other tests like Johansen co-integration or Gregory and Hansen co-integration.

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