The Co-movement Relationship Between Major Developed And Asian Emerging Stock Markets

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Abstract

Investors are becoming increasingly interested in international diversification due to the emergence of new capital markets and liberalization of stock markets in recent years. This allows them to have a large basket of foreign securities to make choices for their portfolios of assets to increase profits. However, if the international stock markets move together, investors cannot get the full benefits of diversification. Therefore, this paper studies the co-movement relationship between major developed countries' stock markets and stock markets in some Asian emerging markets. In this paper, we use the concept of co-integration and find that there is a co-movement relationship between the developed countries (the US, the UK and Japan) and some emerging markets, but we observe that some emerging markets are different from the developed markets with which they have a common long-run equilibrium relationship. Furthermore, the study also finds that after the 1997 Asian Financial Crisis, the interdependence between most of the developed and emerging markets increased that led to the limitation of the benefits of international diversification.

Keywords: Developed Market, Diversification, Emerging Market, Unit Root Test, Co-integration

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Chapter 1 Introduction

1.1 Need for Study

Through the various trade promotion measures developed by most countries, goods and services markets have become increasingly internationalized. As economic globalization is impacting on the financial market of other economies, the common stocks markets are also similarly becoming increasingly internationalized. To increase returns, institutional and individual investors have started to resort to investment diversification in the stocks of other countries. This has occurred at the same time as the emergence of new capital markets through the relaxation of capital controls. With the liberalization of these new markets resulting from the relaxation of capital controls, this has opened up additional choices for investors, when they choose the foreign securities as part of their portfolio assets so as to increase the reward-to-volatility ratio. Furthermore, by using global depository receipts (GDRs) and American depositary receipts (ADRs), to a certain extent, they help investors to invest in companies from developing or emerging markets more easily.

The purpose of this paper is to study co-movement in stocks of different countries. Since portfolio investment in international markets has an impact on the exchange rate and could result in local currency appreciating in value, co-movement among different markets has thus allowed multinational companies to gain considerable value in making financial policies. In addition, sudden withdrawals in foreign portfolio investments have the potential to cause volatility in a country's economy.

Therefore, developing the investments in foreign countries is important for macroeconomic policies made.

From another aspect, if there is a linkage between different stock markets, then the value of diversification does not work for making the long-run profits to international investors and vice versa. Hence, to examine the dependencies among international stock markets is very essential and necessary for global portfolio managers and international investors. Finally, it is useful for policy makers to study the co-movement among different stock markets. If a close connection is found between stock markets, then there is a danger of shocks in one market spreading out to other markets. In other words, there are some limits for the benefit of international diversification when stock markets are co integrated, because the amount of independent variation is limited by the presence of common factors. As a result, the assets available to investors to obtain optimal portfolio diversification maybe very few and the non-systematic risk is minimized by holding a certain number of stocks as implied by the co integration between national equity markets. Co integration also suggests Granger Causality in levels and would hence suggest market inefficiency. (Hung and Cheung, 1995)

Due to existing such a likelihood that the benefits of international diversification can be reduced, this paper is thus interested in discussing if major developed countries (United States, United Kingdom, Japan) move together with the stock markets of Asian emerging equity markets (Indonesia, Thailand, China, Philippines, Singapore and India). To do this we apply the concept of co-integration, so that we can determine the right market for portfolio diversification.

1.2 Background

A pattern of positive correlation is defined as co-movement, but positive correlation is an unclear term and defines many types of relationships (Barberis, et al, 2002). To be more precise, co-movement describes a phenomenon of an asset price moving with another asset price. The joint movement that is mutual among all assets or movement that all assets have in common is called moving with.

The attention of academics and investors in growing globalization among economies of the world has increased on the subject of co movement among the stock markets around the globe. In the rapidly changing finance world of today, there are many factors integrating financial markets to each other. Factors contributing to financial integration include: the establishment of common trading blocs such as European Union, NAFTA, SAARC and ASEAN, The existence of robust trading and economic links, swift developments in trading systems and telecommunication, the escalation in liberalization activities of governments and the expansion of international finance and trade. Positive impacts have been reported by many on the degree of cross country equity market linkages of financial and trade liberalization reforms and others have claimed that the existence of economic ties and strong policy coordination among related countries indirectly links their stock indices over time.

It is clear from the literature that, not only the financial markets of developing countries but also developed countries have become interrelated. However, the intensity of that interdependence among equity markets varies in

developed and developing economies. The body of empirical evidence suggests significant co movement among equity markets of major developed countries. Linkages among emerging markets and other developed markets appear to be relatively weak. Conversely, some scholars reported that co-movement is increasing between emerging and developed stock markets.

1.3 Structure of the research

The structure of the research includes five chapters, which are organized as follows. This current chapter provides an introduction. Chapter 2 reviews the related literature and Chapter 3 describes the statistical data, conceptual framework and elaborates on the methodology used. Chapter 4 discusses the empirical findings and interprets the results and Chapter 5 summarizes and makes concluding remarks.

Chapter 2 Literature review

2.1 The benefit of international diversification

When making investment decisions, different types of diversification may be chosen by investors. Levy and Sarnat (1970) found that the tendency for returns on individual securities within one economy to move together is one of the reasons why international diversification is undertaken rather than just domestic diversification. Grubel and Fadner (1971) state that movements across a number of countries are usually not related and gains from international diversification arise when returns in one country get influenced by disasters, government policies and business cycles which have a significant impact on the economy of affected country. The capital value of assets also changes due to exchange rate variations which influence the returns of assets held in different foreign countries.

The advantage of international diversification is further explained by Bodie, et al. (1999), who stated that the risk of a portfolio that is diversified internationally can be decreased to less than half the level of a diversified United States portfolio. The value of portfolio diversification is enhanced by this marked reduction in risk for a portfolio that includes foreign as well as United States stocks and implies that international diversification is profitable.

2.2 Data and methodology choose

Most investigations that have focused on the equity markets of the developed countries reveal relationships between the stock markets of the world and the co movements among them. Co movement between markets has been of significant interests to practitioners and academics. The research conducted to examine the interdependence between stock indices across various stock markets over different time periods indicate a lack of consistency and the results vary based on the sample period chosen, the frequency of observations (monthly, daily or weekly) and the choice of market.

Solnik (1987) used regression analysis on monthly data for eight industrialized countries from 1979-1983 and found a positive, but weak relationship among real domestic stock returns and real exchange rate movements. The impact of the ending of UK exchange controls in 1979 on the degree of integration of UK and overseas stock market such as US, Netherlands, West Germany and Japan was tested using the Grangers Causality and Engel Granger Co integration test over the two sub periods from April 1973 to September 1979 and October 1979 to June 1986 respectively (see Taylor, 1988).

Using monthly data from 1973 to 1983 on six major industrialized countries, Ma and Kao (1990) found that domestic currency appreciation has a positive impact on an import dominant economy and negative impact on the movement of the domestic price of the stock in an export dominant economy. The interdependence of the equity market in Pakistan with seven major equity markets of Japan, USA, UK,

Singapore, Hong Kong, France and Germany was probed by Husain, and Saidi, (2000). The engle and Granger co-integration technique was used to examine the integration using weekly stock price indices from January 1988 to December 1993 and revealed little support towards integration of the Pakistani equity market as an attractive tool of diversification for international investors.

Monthly data from December 1987 to December 1997 were used by Hee, (2002) and found there was lack of evidence of long-run relationship between five ASEAN countries Thailand, Singapore, Malaysia, Philippines and Indonesia. The price linkages between Asian stock markets during January 1988 to February 2000 were investigated by Worthington, (2003). Three developed markets (Japan, Singapore and Hong Kong) and Six emerging markets (Taiwan, Thailand, Indonesia, Philippines, Korea and Malaysia were included in the analysis. Multivariate Co integration analysis results revealed that lower causal relationships existed among developed and emerging stock markets and suggesting that opportunities for international diversification in stock markets of Asia still prevail.

The variance in results was not only due to differences in data but also due to the different methodologies applied to inspect the relationship between different stock markets. Early investigators who studied relationships between different stock markets have found evidence of co-movements among the world stock markets. Most of these early studies used pair-wise analysis.

Factor analysis was used by Ripley (1973) to explore interrelationships among stock prices, Panton, et al. (1976) applied cluster analysis to examine similar relationships, while Hillard (1979) applied spectral methods to study the relationships between international stock markets. Maldonado and Saunders (1981)

examined inter-temporal patterns of the correlation coefficients among international stock markets and concluded that pair-wise correlation coefficients are low and unstable.

The Granger Causality test was used by Rittenberg, (1993) to examine the relationship between exchange rate changes and stock price level changes in the context of Turkey. Since causality tests are sensitive to lag selection, therefore three different specific methods for optimal lag selection were arbitrarily selected; the Hsiao method (1979), and the SMART or subset model auto regression method of Kunst and Martin (1989). In all cases, they found that causality runs from price level change to exchange rate changes, but there is no feedback causality from exchange rate to price level changes.

The co-movement of Bangladesh stock market with USA, Japan and India by employing JJ test of co-integration was investigated by Hoque, (2007), the Impulse Response Function and the Vector Error Correction Model were used on daily data that ranged from January 1990 to December 2000. No benefit from diversification was possible as the results revealed co-integration from cross border investments. Impulse response analysis revealed that shocks to the US, India and market had strong, weak and no impact on the Bangladesh market respectively. Similarly, Aktar, (2009) used the same model and the Grange Causality test to examine the co movement of stock prices among the markets of Turkey, Russia and Hungary. He used the daily data from January 2000 to October 2008. The findings explained that co movement existed among stock indices of countries. From the Granger Causality test it was reported that there was bidirectional causality for the Turkish and Russian stock indices and in the Hungarian stock market, the Turkish stock market

was affected but not vice versa. Granger causality tests and Co-integration tests were used by Majid, et al, (2009) and the dynamic linkage among the ASEAN- 5 emerging stock markets namely Malaysia, Indonesia, Thailand, Philippines and Singapore was studied through utilizing daily data from January 1988 to December 2006 which was further sub-divided into pre-crisis period from January 1988 to December 1996 and post-crisis period from January 1998 to December 2006. Stock markets in the ASEAN region were co-integrated both during pre- and post 1997 financial crisis as demonstrated by the results. During the post 1997 financial crisis, however, the markets were moving towards greater integration.

2.3 Hypothesis of the common trend in stock markets

The existence of a mutual trend for world stock markets is supported by some studies, while some reject this hypothesis. The stock markets of the United States, United Kingdom, France, Germany and Japan were analyzed by Arshanapalli and Doukas (1993) analyze using daily closing stock market index time series, in local currency units, from the period of January 1980 through May 1990, and reported that the interdependence among world capital markets since the 1987 stock market crash was increasing, with Japan's Nikkei Index being an exception. Results consistent with the findings of Harvey (1991), Kasa (1992) and Chan, et al (1997) were found. However, Koop (1994) used various Bayesian methods to analyze co-integration properties and unit root of two different finance data sets, and concluded that no mutual trends exist in stock prices or exchange rates across countries. Corhay, (1995) studied the stock markets of Australia, Japan, Hong Kong, New

Zealand and Singapore over the period February 1972 through to February 1992 and found no evidence of a single stochastic trend for the countries.

Studies have been conducted in the 1990s when Asian capital markets emerged and include research on the co- movements between Asian markets and the stock markets in developed countries. The stock markets of Australia, Hong Kong, Japan, Singapore , South Korea, Taiwan, United Kingdom, United States and Germany were studied by Kwan, et al. (1995). Results indicated that these markets were not weak form efficient as they found significant lead-lag relationships among these equity markets. However, Chan, et al. (1992) and Hung and Cheung (1995) concluded that Asian markets are not co integrated. Ghosh, et al. (1999) found that some Asian stock markets shared a long- run equilibrium relationship with major stock markets, while some did not. Tuluca and Zwick (2001) used Granger-causality technique and studied differences in stock indices and applied factor analysis to study the stock indices returns between 13 Asian and non-Asian stock markets before and after the 1997 Asian financial crises. They concluded that markets developed a stronger co-movement after the crisis.

The above studies are not directly comparable as different time intervals (daily, weekly, monthly, quarterly) and the methodologies used with different market indices as measures of the respective markets. As these studies draw different conclusions about the relationships between the Asian emerging markets and the major developed stock markets, they provide opportunities for future research.

2.4 The impact of global financial crisis

The global economic crisis made a great attack on stock markets and rang alarm bells to investors. Most of the scholars are interested in investigating the co movements, interrelationship and interdependency of world's major stock indices after solid crisis.

For example， Singh (2010) found that both Chinese and Indian market are correlated with all the selected developed markets, namely U.S., U.K., Japan and Hong Kong, after the subprime mortgage crisis in 2008, based on the analysis of Granger causality. Rodriguez (2007) highlighted a particular approach of financial contagion based on models dependence with switching-parameter copulas. Technically, the empirical analysis is based on daily returns from five East Asian stock indices during the Asian crisis and from four Latin American stock indices during the Mexican crisis. The results demonstrated the existence of changing dependence during periods of financial turmoil. An investigation also was made on BRICA countries (Brazil, China, Russia, India and Argentina). This investigation finds that China and India have co-movement relationship with the US market after the 2008 subprime crisis on the basis of daily indices from January 2002 to February 2009, by Aktan, et al.

Chapter 3 Data and Methodology

3.1 Source of data

The data used in this study are monthly stock prices for the period of July 1997 to July 2013 consisted of 192 observations obtained from the websites of stock markets and Yahoo Finance. These data include the stock market indices of six Asian emerging countries, together with the stock market indices of the U.S. Japan and UK which represent three developed stock markets. The six Asian emerging stock market indices are: Indonesia, Thailand, China, Philippines, Singapore and India. More specifically, the indices sampled include the S&P 500 Composite (United States), FTSE 100 (United Kingdom), Nikkei 225 (Japan), Jakarta Composite Index (Indonesia), SET Index (Thailand), Hang Seng Index (China), PSE Composite Index (Philippines), Straits Times Index (Singapore) and BSE Sensex (India)

Table 3.1: Indices used for the study

Country	Stock Market	Index	Nature	Structure
Indonesia	Jakarta stock exchange	Jakarta composite index	Value weighted	Demutualized
Thailand	Thailand stock exchange	SET Index	Market capitalization weighted	Demutualized
China	Hong Kong stock exchange	Hang Seng index	Market capitalization weighted	Demutualized
Philippines	Philippine Stock Exchange	PSE Composite Index	Market capitalization weighted	Demutualized
Singapore	Singapore exchange	Straits times index	Value weighted	Demutualized
India	Bombay Stock Exchange	BSE Sensex	Value Weighted	Demutualized
USA	New York stock exchange	S&P500	Value weighted	Demutualized
UK	London Stock Exchange	FTSE 100	Free float market capitalization	Demutualized
Japan	Tokyo Stock Exchange	Nikkei 225	Price Weighted	Demutualized

There are some reasons for the study to use monthly indices rather than daily, quarterly and/or annual indices. Quarterly and annual data may have the false correlation problem when not compromising on the available degrees of freedom required in selecting appropriate lag structures (Patra, and Poshakwale, 2006). The problem of daily data is that if used non-synchronous trading will happen as they may be influenced by some thinly traded stocks. An erroneous representation of the true relationships among these markets may thus result if daily indices are used (Hung and Cheung, 1995).

3.2 Stationary test

This paper establishes a relationship between the stock indices of major developed countries and Asian emerging markets to study the question of co-movements between them. This model consists of the dependent variables: Indonesia, Thailand, China, Philippines, Singapore and India and independent variables: United States, United Kingdom and Japan. The following equation is used to analyse this relationship:

$$YE\ (t) = \alpha + \beta\ XD\ (t) + e\ (t) \qquad 3.1$$

In Equation 3.1 the subscript E represents the emerging market's stock indices which are the stock indices for Indonesia, Thailand, China, Philippines, Singapore and India. The subscript D denotes the developed country's stock index, such as the stock indices for the United States, United Kingdom and Japan and $e(t)$ is the error term. To judge the effectiveness and reliability of the relationship mentioned above, we use the concept of co-

integration. Co-integration requires getting the result of a stable equilibrium relationship between the stock markets of the developed and emerging markets.

The concept of co-integration, which is used to analyze if variables share a long-run equilibrium relationship will be used in our study. In order to test for co integration, a unit root test (Dickey Fuller and Augmented Dickey Fuller tests) first has to be performed to confirm that the variables are indeed stationary. Following is the unit root test process.

$$Yt = \rho Yt\text{-}1 + ut \qquad 3.2$$

subtracting Yt-1 from both sides of Equation (3.2), we get the new equation:

$$Yt - Yt\text{-}1 = (\rho - 1)\, Yt\text{-}1 + ut \qquad 3.3$$

which can be alternatively written as:

$$\Delta Yt = \Theta\, Yt\text{-}1 + ut \qquad 3.4$$

where $\Theta = (\rho - 1)$ and Δ is the first-difference operator. Then we do the hypothesis test that

$$H0: \ \Theta = 0 \ (\rho = 1)$$

$$H1: \ \Theta < 0$$

If $\Theta = 0$, which is $\rho = 1$, in the case of the unit root, it becomes a random walk model without drift and we can determine that the time series is non-stationary.

However, the actual procedure of implementing the DF test has some decisions. The random walk process may have no drift, or it may have both deterministic and stochastic trends. Here are the different forms of the DF test:

Yt is a random walk: $\Delta Yt = \Theta\, Y_{t-1} + ut$ 3.5

Yt is a random walk with drift: $\Delta Yt = \alpha_1 + \Theta\, Y_{t-1} + u_t$ 3.6

Yt is a random walk with drift and trend: $\Delta Yt = \alpha_1 + \Theta\, Y_{t-1} + \lambda t + u_t$ 3.7

All the three forms assume that the error term, u_t is uncorrelated. If the u_t is correlated, we need to use another test. To take into account autocorrelation, we can use the Augmented Dickey-Fuller (ADF) test. Equation 3.8 is the regression for this.

$$\Delta Yt = \Theta\, Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta\, Y_{t-i} + \varepsilon_t \qquad 3.8$$

where ε_t is a pure white noise error term and $\sum_{i=1}^{m} \alpha_i \Delta\, Y_{t-i}$ is the lags of ΔYt which made enough difference terms so that the error term in the equation is uncorrelated. In the ADF test we still test whether $\Theta = 0$ and use the same asymptotic distribution as the DF test.

3.3 Co-integration tests

Co integration tests, which are important in determining the presence and nature of an equilibrium economic relation, were first introduced by Granger (1981) and later developed by Granger (1987). It incorporates the presence of non-stationary, long-term relationships and short-run dynamics in the modeling process. Testing for co-integration, we use the Johansen's test which uses the vector autoregression (VAR) of order p which is given by

$$Yt = u + A1Yt\text{-}1 + \ldots + ApYt\text{-}p + ut \qquad 3.9$$

where Yt is an n ×1vector of variables which are integrated of order one – commonly denoted I(1) – and μt is a zero mean white noise vector process. This VAR can be re-written as:

$$\Delta Yt = \alpha + \Pi\ Yt\text{-}1 + \sum_{i=1}^{p-1} ri\ \Delta\ Yt - i\ + \varepsilon t \qquad 3.10$$

where $\Pi = \sum_{i=1}^{p-1} Ai - I$ and $ri = -\sum_{j=i-1}^{p-1} Ai$.

If the coefficient matrix Π has reduced rank r < n, then there are n × r matrices α and ß respectively with rank r such that Π =αß' and ß'Yt is stationary. The number of co-integration relationships is r, the elements of α are supposed to be the adjustment parameters in the vector error correction model and each column of ß is a co-integrating vector. It can be explained that for a given r, the maximum likelihood estimator of ß defines the combination of Y_{t-1} that makes the r largest canonical correlations of ΔYt, with Y_{t-1} after correcting for lagged differences and deterministic variables when present. Johansen proposed two different likelihood ratio tests of the significance of these canonical correlations and thereby the reduced rank of the Π matrix. They are trace test and maximum ei genvalue test (Francesco, 2012) as given in Equations 3.11 and 3.12.

$$Ztrace = -\ T \sum_{i=r+1}^{n} \ln(1 - zi) \qquad 3.11$$

$$Zmax = -\ T \ln(1\text{-}zi) \qquad 3.12$$

where T is the sample size and zi is the estimated values of the characteristic roots obtained from the Π matrix. The trace test tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of n co-integrating vectors. However, the maximum eigenvalue tests the null hypothesis of r co-integrating vectors against the alternative hypothesis of r +1

co-integrating vectors. Both critical values of eigenvalue test and trace test are based on a pure unit-root assumption. If the variables in the system are near-unit-root, the results will be incorrect.

3.4 Granger causality test

In this part, we use the Granger causality test to discuss: are the stock markets of developed countries caused by the emerging stock markets or the emerging stock markets are caused by the stock markets of developed countries? In order to test for Granger causality, we considered two stock market indices Y_E (t) and X_D (t). Then we estimated the following equations:

$$YE\ (t) = \sum_{i=1}^{n} \alpha i\ \ XD\ (t) + \sum_{i=1}^{n} ß\ i\ YE\ (t) + \varepsilon t1 \qquad 3.13$$

$$XD\ (t) = \sum_{i=1}^{n} \lambda i\ \ YE\ (t) + \sum_{i=1}^{n} \rho\ i\ XD\ (t) + \varepsilon t2 \qquad 3.14$$

These two equations suppose that X_D (t) is related to its past value and the Y_E (t), the same suppose to the Y_E (t). The steps to implement the Granger causality test are as follow:

- Performing the regression of current Y_E (t) and lagged Y_E (t) terms, do not include the lagged X_D (t). We can get the restricted residual sum of squares (RSS_R) from this regression.
- Performing the regression include the lagged X_D (t) terms. We get the unrestricted residual sum of squares (RSS_{UR}).

- Making a hypothesis test. H_0: $\sum_{i=1}^{n} \alpha i = 0$, which means lagged X_D (t) terms do not belong in the regression.
- To test the hypothesis, we run an F-test for joint insignificance of the coefficients. If F value exceeds the critical value at the chosen level of significance, we can reject the null hypothesis. In the other words, Y_E (t) is caused by X_D (t).

Chapter 4 Results and Discussions

This chapter has four sections. The first provides the summary statistics of the time series data. Section 4.2 provides the results of the ADF unit root test that is used to study the stationary of time series data. The results of the Johansen co-integration test are given in 4.3 and section 4.4 demonstrates the results of the Granger causality test.

4.1 Descriptive statistics

Table 4.1 summarizes the time series data in terms of observation, mean, skewness, standard deviation and kurtosis for the 9 countries of this study. During the 16 year period among the stock markets that have positive return, China's stock market has the highest mean of 16245.58, followed by Japan 12678.75, India 9836.338, UK 5443.419, Philippines 2597.25, Singapore 2286.969, Indonesia 1648.435, USA 1210.918. The lowest return is Thailand with 660.7943. The skewness value for all the data reveal that stock indices of Indonesia Thailand, China, Philippines, Singapore, India and Japan are positively skewed. However, the indices of USA and UK are negatively skewed. The kurtosis values indicate that all the indices are platykurtic with lower than normal kurtosis except Thailand (3.450864) and Philippines (4.132616). As the values of skewness and kurtosis are not significantly different from zero and three respectively, the departures from normal distribution may not seriously affect the co-integration test.

Table 4.1: Comparative descriptive statistics of data 1997-2013

Market	Observation	Mean	Max.	Min	Standard Deviation	Skewness	Kurtosis
Indonesia	193	1648.435	5068.63	276.15	1369.481	0.8943886	2.489721
Thailand	193	660.7943	1597.86	214.53	312.8993	0.9293852	3.450864
China	193	16245.58	31352.58	7275.04	5033.71	0.3301215	2.236407
Philippines	193	2597.25	7070.99	993.35	1395.877	1.281401	4.132616
Singapore	193	2286.969	3805.7	856.43	686.5939	0.1406248	1.901772
India	193	9836.338	20509.09	2810.66	6230.766	0.3393233	1.449426
USA	193	1210.918	1685.96	735.09	194.2392	-0.0965547	2.38686
UK	193	5443.419	6930.2	3567.4	781.9475	-0.4668539	2.298557
Japan	193	12678.75	20337.32	7568.42	3280.609	0.4059467	1.926303

4.2 Analysis of unit root test

The results of the ADF unit root test are showe in table 4.2-4.4. It is clear that stock indices in the period from July 1997 to July 2013 are non-stationary at the 1% and 5% level of significance in the three models which are variables without constant term model, variables with time trend model and variables with constant term model. However, some countries' stock prices are stationary at the 10% level of significance, such as data for the Philippines in the models of variables without constant term and with variables constant term, data of USA in the model of variables with constant term.

The ADF unit root test is a preparation for the co-integration test that all data need to be non-stationary, however, when converted to first differences, they must stationary.

Therefore, we can chose the 5% level of significance and conclude variables are integrated of order one.

Table 4.2: ADF statistics with variables without constant term

Variables(without constant term)	Time	statistics	1% critical value	5% critical value	10% critical value	Conclusion
Indonesia	1997.7-2013.7	-1.582	-2.605	-1.950	-1.610	Unstationary
Thailand	1997.7-2013.7	1.060	-2.605	-1.950	-1.610	Unstationary
China	1997.7-2013.7	0.315	-2.605	-1.950	-1.610	Unstationary
Philippines	1997.7-2013.7	1.948	-2.605	-1.950	-1.610	Stationary at 10%
Singapore	1997.7-2013.7	0.532	-2.605	-1.950	-1.610	Unstationary
India	1997.7-2013.7	1.583	-2.605	-1.950	-1.610	Unstationary
USA	1997.7-2013.7	0.805	-2.605	-1.950	-1.610	Unstationary
UK	1997.7-2013.7	0.731	-2.605	-1.950	-1.610	Unstationary
Japan	1997.7-2013.7	-1.399	-2.605	-1.950	-1.610	Unstationary

Table 4.3: ADF statistics with variables with time trend

Variables(with time trend)	Time	statistics	1% critical value	5% critical value	10% critical value	Conclusion
Indonesia	1997.7-2013.7	-1.871	-4.069	-3.463	-3.158	Unstationary
Thailand	1997.7-2013.7	-2.898	-4.069	-3.463	-3.158	Unstationary
China	1997.7-2013.7	-2.257	-4.069	-3.463	-3.158	Unstationary
Philippines	1997.7-2013.7	-1.285	-4.069	-3.463	-3.158	Unstationary
Singapore	1997.7-2013.7	-1.830	-4.069	-3.463	-3.158	Unstationary
India	1997.7-2013.7	-1.315	-4.069	-3.463	-3.158	Unstationary
USA	1997.7-2013.7	-1.728	-4.069	-3.463	-3.158	Unstationary
UK	1997.7-2013.7	-1.748	-4.069	-3.463	-3.158	Unstationary
Japan	1997.7-2013.7	-1.399	-4.069	-3.463	-3.158	Unstationary

Table 4.4: ADF statistics with variables with constant term

Variables(with constant term)	Time	statistics	1% critical value	5% critical value	10% critical value	Conclusion
Indonesia	1997.7-2013.7	-1.267	-2.371	-1.663	-1.292	Unstationary
Thailand	1997.7-2013.7	0.538	-2.371	-1.663	-1.292	Unstationary
China	1997.7-2013.7	-1.206	-2.371	-1.663	-1.292	Unstationary
Philippines	1997.7-2013.7	1.527	-2.371	-1.663	-1.292	Stationary at 10%
Singapore	1997.7-2013.7	-0.941	-2.371	-1.663	-1.292	Unstationary
India	1997.7-2013.7	0.209	-2.371	-1.663	-1.292	Unstationary
USA	1997.7-2013.7	-1.551	-2.371	-1.663	-1.292	Stationary at 10%

UK	1997.7-2013.7	-1.743	-2.371	-1.663	-1.292	Unstationary
Japan	1997.7-2013.7	-2.838	-2.371	-1.663	-1.292	Unstationary

4.3 Analysis of co-integration test

When test the co-integration of stock markets between developed countries and emerging markets, we use the Johansen co-integration test which is based on two statistics –the maximum eigenvalue statistic and trace statistic. Table 4.5 shows the results.

Table 4.5: Results of co-integration test

Dependent variable	Independent variable	Time	Maximum eigenvalue statistic	Trace statistic	Conclusion
Indonesia	USA	1997.7-2013.7	0.078451	13.02589	non co-integration
	UK		0.135291	25.00786	co-integration
	Japan		0.087453	13.89523	non co-integration
Thailand	USA	1997.7-2013.7	0.078631	13.04681	non co-integration
	UK		0.073157	13.00352	non co-integration
	Japan		0.086425	13.45489	non co-integration
China	USA	1997.7-2013.7	0.107908	17.47049	co-integration
	UK		0.086352	13.45457	non co-integration
	Japan		0.092531	13.76793	non co-integration
Philippines	USA	1997.7-2013.7	0.076434	13.24537	non co-integration
	UK		0.109546	15.56852	co-integration
	Japan		0.116573	15.47049	co-integration
Singapore	USA	1997.7-2013.7	0.096506	13.76782	non co-integration
	UK		0.099311	14.46851	non co-integration
	Japan		0.128908	22.24649	co-integration
India	USA	1997.7-2013.7	0.096438	13.74692	non co-integration
	UK		0.125923	22.02495	co-integration
	Japan		0.064375	11.45724	non co-integration

Note: critical value at 5% is 15.41

From the table, we can get the result that stock markets of some Asian emerging countries do not have the co-integration relationship with the three developed countries,

namely USA, UK and Japan, at the significance level of 5%. This means that when there is no co integration between two stock markets, investors of Asian emerging countries can use the international portfolio diversification in the stock market of the US, UK and Japan. Furthermore, the investors of Asian emerging countries can also minimize risk through international portfolio diversification in these equity markets. However, the stock markets of Indonesia, China, Singapore, India and Philippines are co-integrated with the equity markets of Japan, USA and UK respectively, as trace statistics exceeds the critical value at the 5 % significance value. This means that the investors of China, Singapore and Philippines cannot minimize risk with the investment in the markets of the USA and Japan. Similarly the investors of these countries also cannot achieve international portfolio diversification with investment in USA's and Japan's Equity Markets.

The reasons for countries having co-integrated relationships with developed countries are that after the 1997 Asian Financial Crisis and the Subprime Financial Crisis in 2008, there is a close linkage among the global stock markets. In addition, there has been an overall increase in trade flows from 1997-2013, such as China joining in the World Trade Organization in 2001. Although trade flows declined in 1997 due to the Crisis, the emerging markets had already been officially liberalized, resulting in a further overall increase in trade flows after the crisis. This rise in economic activity between the developed and emerging markets has had an impact on financial markets, with an increase in significant relationships between most of the developed and emerging markets.

In 1997-2002, Japan is a major investor in Singapore this is also a reason to explain why Singapore is co-integrating with the Japanese market. And another reason is that the regulatory structures of Singapore are more closely related to those of Japan than USA and

UK. The reason for India has the co-integration relationship with UK maybe historical in that India was a colony of UK. Even though it is now independent, the idea of people affected by the western culture, still exists in some of the economic relationships and regulatory structures. Therefore, India is still co-moving with the UK.

4.4 Analysis of Granger Causality test

After choosing the appropriate lag order, we start to do the Granger Causality test. The null hypothesis is that the stock markets of developed countries do not cause movement of the emerging stock market (the emerging stock market does not cause movement in the stock market of developed countries). The alternative hypothesis is the stock market of developed countries causes the movement in emerging stock market (the emerging stock market cause movement in the stock markets of developed countries).

Tables 4.6 and 4.7 show the results of the Granger Causality test at the 5% significance level. From Table 4.6 we can find that the null hypothesis " UK does not Granger Cause Indonesia" and "US dose not Granger Cause China" are rejected, which means the UK market has an effect on the stock market of Indonesia and the US market can influence the Chinese equity market.

Table 4.6: Results of Granger Causality test (significance level of 5%)

Null Hypothesis	F-statistics	P value
Indonesia does not Granger Cause USA	0.49042	0.6133
USA does not Granger Cause Indonesia	2.9497	0.0553
Indonesia does not Granger Cause UK	0.72947	0.4838
UK does not Granger Cause Indonesia	3.3041	**0.0394**
Indonesia does not Granger Cause Japan	2.1848	0.1160
Japan does not Granger Cause Indonesia	0.48135	0.6189
Thailand does not Granger Cause USA	2.1233	0.1231
USA does not Granger Cause Thailand	2.6375	0.0748
Thailand does not Granger Cause UK	0.39485	0.6745
UK does not Granger Cause Thailand	2.9019	0.0579
Thailand does not Granger Cause Japan	2.1752	0.1171
Japan does not Granger Cause Thailand	1.8439	0.1617
China does not Granger Cause USA	0.91288	0.4035
USA does not Granger Cause China	3.23981	**0.0495**
China does not Granger Cause UK	1.6401	0.1973
UK does not Granger Cause China	1.3529	0.2615
China does not Granger Cause Japan	1.7369	0.1795
Japan does not Granger Cause China	0.24357	0.7841

We can find the same results in Table 4.7 that the UK market has a causation effect on the markets of Philippines and India, and Philippines on stock market of Japan. The Japanese market influences the market of Singapore. Therefore, investors of Indonesia, China, Philippines, Singapore and India should consider any development in the countries of UK, US and Japan.

Table 4.7: Results of Granger Causality test (significance level of 5%)

Null Hypothesis	F-statistics	P value
Philippines does not Granger Cause USA	1.9128	0.1512
USA does not Granger Cause Philippines	2.2799	0.1057
Philippines does not Granger Cause UK	0.03582	0.9648
UK does not Granger Cause Philippines	3.17	**0.0448**
Philippines does not Granger Cause Japan	3.2522	**0.0414**
Japan does not Granger Cause Philippines	2.0971	0.1263
Singapore does not Granger Cause USA	0.40072	0.6705
USA does not Granger Cause Singapore	1.1216	0.3284
Singapore does not Granger Cause UK	0.19604	0.8222
UK does not Granger Cause Singapore	1.842	0.1620
Singapore does not Granger Cause Japan	1.1257	0.3271
Japan does not Granger Cause Singapore	3.2361	**0.0451**
India does not Granger Cause USA	0.76958	0.4650
USA does not Granger Cause India	1.5612	0.2132
India does not Granger Cause UK	0.04026	0.9606
UK does not Granger Cause India	3.3641	**0.0494**
India does not Granger Cause Japan	3.0008	0.0527
Japan does not Granger Cause India	0.03053	0.9699

Chapter 5 Conclusion and Recommendations

This study investigates the co-movement relationship between the six Asian emerging stock market of Indonesia, Thailand, China, Philippines, Singapore and India with the major developed markets of United States, United Kingdom and Japan. Using the data of monthly stock indices, we find that China's stock market has the highest average monthly return with higher standard deviation. The country with highest standard deviation is India. The study also obtains the results that Indonesia and India are co-integrating with UK, China is co-integrating with US and Singapore is co-integrating with Japan, while Philippines is co-integrating with the Japan and UK. This phenomenon indicates that these counties do not have good diversification opportunities to attract the international portfolio investors. However, other countries have no long-run co-movement relationship with the developed markets of the United States, UK and Japan which means the stock market of these countries are attractive diversification opportunities for international investors.

After the 1997 Asian Financial Crisis, the positive interdependence is intensified among different countries. Due to more markets moving together, the aim of diversification of international portfolio to minimize risk is more limited after the 1997 Asian Financial Crisis. From this study, we find that detailed insights into socioeconomic connections and useful information to both domestic and foreign investors can be found from the differential co-movements between the developed and emerging markets.

It is evident from the results of co-integration that there is variability due to selection of frequency of observations daily, weekly or monthly. Thus, the potential for further research on the issue of co-movement is in the use of high frequency data (daily, weekly)

and another avenue for future research is to study spillover or contagion effect by the help of volatility models.

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