STOCK MARKET INTEGRATION AMONG THAILAND, UNITED STATE OF AMERICA, JAPAN AND SINGAPORE

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Stock Market integration among Thailand, United State of America, Japan and Singapore

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An Independent Study

By

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“Stock Market integration among Thailand, United State of America, Japan and Singapore”

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(Dr. Thanapat Chaisantikulawat)

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ABSTRACT

This paper examines the integration of stock market of Thailand, United state of America, Japan and Singapore in period 1999 to 2007. If the result shows no cointegration of Thai stock market among Japan, Singapore and USA, its expresses that no long term relationship among the markets. However, if markets are integrated, it proves that long term relationship exist that markets are globalization and can be predicted.

The paper employs co-integration according to Johansen (1991) methodology and several diagnostic and specification tests. The empirical finding shows no long term relationship among all markets in the investigated time period.

I. INTRODUCTION

There is a growing literature in integration between the world stock market. This is an issue of considerable relevance to investors in an era of globalization where there are increasing flows of capital across countries as greater integration of the world's stock markets implies reduced opportunities for international portfolio diversification.

International diversification suggests that low correlations between international stock markets result in lower risk for a given level of return. Accordingly low correlations between developed and emerging markets have attracted the attention of international investors to the emerging market asset which enhances return opportunities. However, recent studies have proven that correlations are time-varying and accordingly investors need a more accurate measure of international stock market interdependence /comovement.

Cointegration measure answers the question of a long-term common stochastic trend between nonstationary time series. If a linear combination of two nonstationary series that is stationary exists, these series are called cointegrated series and the vector of this relationship is called the cointegrating vector. In this respect it provides a long-term measure of diversification opportunities between international financial markets as well as short-term deviations amongst within an error correction model. As a result, whether stock markets are cointegrated carries important implications for portfolio diversification.

If markets are not cointegrated, this implies that there is no arbitrage activity to bring the market together in the long run. If this is the case, it means that investors can potentially obtain long-run gains through international portfolio diversification (Masih and Masih, 1997, 1999). On the other hand, If markets are cointegrated, this implies that there is a common force, such as arbitrage activity by with out concerning about transaction cost, which brings the stock market together in the long run. Moreover, if markets are cointegrated or have cointegration vector, we will be able to forecast both long term and short term model of their relationships.

This study focuses on the integration of Thai, Japan, Singapore and the United States, stock exchange since these countries are the top lists that contributed in Thai stock market analyzed by Net Flow of Foreign Equity Investment. Table I shows net flow of foreign equity investment in Thailand classified by country ranked by volume (Million U.S. dollars). From the table, the top three highest investment in stock exchange of Thailand came from Japan, Singapore and United States of America; respectively, in almost every year since 1998 to 2006. Then, the index of these countries, Japan, Singapore, the United State and also Thailand have cointegrated or long run relationship would be investigated in this paper. More over, if the result explicits the cointegration, both long run relationship and short run relationship of these indices will be able to analyze in equations shows the affect of one country to other countries and be able to forecast the movement of indices.

Asian financial crisis is1997 to 1998. I concern the effect of this crisis that impact to the both of Thai and foreigner investors. To avoid this effect, time period in this study is eight year, January 1999 to December 2007, post-crisis period. The stock market indices are collected from Reauters as daily data denominate in local currencies.

The remainder of the paper is organized as follows. Section II presents a brief survey of related literatures. Section III describes methodology. Section IV presents data. Section V shows empirical result by illustrated, unit root test, lag length test and cointegration followed Johansan (1991) approach. The final section is the conclusion.

Table I

Net Flow of Foreign Equity Investment in Thailand classified by Country (US$) (Millions of US Dollars)

Rank	Country	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
1	Japan	1,123	420	705	1,712	1,879	2,041	2,703	2,903	2,376	15,863
2	Singapore	449	635	367	373	176	458	575	1,198	4,034	8,265
3	USA	1,328	637	375	539	316	427	526	682	-368	4,462
	Total	4,518	3,551	2,852	3,860	2,733	4,633	5,444	5,448	8,571	41,611
% of Total *		64%	48%	51%	68%	87%	63%	70%	88%	71%	69%

Note : * % of Net Flow from Japan, Singapore and USA to Equity Investment in Thailand

II. LITERATURE REVIEW

Modern portfolio theory bases on the correlation between financial assets where low correlation results in diversification. In the mean-variance framework correlation is the measure of comovement in returns. Yet correlation is a short-term measure and gives no clue about the long term behavior between financial markets. In fact, risk-return analyses in standard mean-variance approach use return data where long-term trends are lost while price data is differenced.

On the other hand, cointegration, first introduced by Engle and Granger (1987), is a long-term measure of diversification based on price data. If there exist a linear combination of two nonstationary series integrated of order one that is stationary, these series are called cointegrated series. It follows that these two series will not drift apart too much, meaning that even they may deviate from each other in the short-term, they will revert to the long-run equilibrium. This fact makes cointegration a very powerful approach for portfolio diversification purposes especially for the long-term. Meanwhile, cointegration does not imply high correlation; two series can be cointegrated and yet have very low correlations.

Kasa (1992) points out that for investors with long term investment horizons, low correlations could suggest overestimated gains if equity markets shared a common stochastic trend in the long term. His investigation of five major international stock market reports find a single common stochastic trend in the (developed) markets of the United States, Japan, England, Germany and Canada.

Corhay, Rad and Urbain (1995) find no evidence of a single common stochastic trend in their examination of the stock markets of Australia, Japan, Hong Kong, New Zealand and Singapore for the period February 1972 through February 1992.

Hung and Cheung (1995) use weekly data from January 1981 through December 1991 to investigate the stock markets of Hong Kong, Korea, Malaysia, Singapore and Taiwan and found no evidence of cointegration.

Kwan, Sim and Cotsomitis (1995) study the stock markets of Australia, Hong Kong, Japan, Singapore, South Korea, Taiwan, the UK, the US and Germany employing monthly data from January 1982 through February 1991. Their evidence suggests that these markets are not weak form efficient as they find significant lead-lag relationships between equity markets.

DeFusco, Geppert, and Tsetsekos (1996) examine weekly data for January 1989–May 1995 denominated in US dollars. They conclude that there is no cointegration in a block of Asia-Pacific countries consisting of U.S., Korea, Philippines, Taiwan, Malaysia, and Thailand. They also conclude that there is no cointegration in the other two other regions they examine, thus capital markets are segmented.

Ghosh, Saidi and Johnson (1999) investigate the relationships of Asian Pacific stock markets; Hong Kong, India, Korea, Taiwan, Malaysia, Singapore**,** Indonesia, Philippines, and Thailand by utilizing the theory of cointegration to investigate which developing markets are moved by the markets of Japan and the United States. The empirical evidence suggests that some countries are dominated by the United States**,** some are dominated by Japan, and the remaining countries, Taiwan and Thailand, are dominated by neither during the time period investigated from 03:1997 to 12:1997.

Masih and Masih (1999) use daily data over 2/14/92–6/19/97 denominated in real US dollars (although they do not explain the conversion to real values for daily data). They find cointegration in a block of OECD and Asian countries including the United States, Japan, UK, Germany, Singapore, Malaysia, Hong Kong, and Thailand, but conclude that there is at most one cointegrating vector, leaving seven independent common stochastic trends.

Verchenko (2000) studies the potential for portfolio diversification across Eastern European Stock markets, presents evidence of non-cointegration and accordingly significant diversification possibilities amongst.

Yuce and Simga-Mungan (2000) present the evidence that Eastern European markets are non-cointegrated across each other and with major stock markets including Russia in the period from 09:1994 to 12:1999. The study also reveals non-cointegration between Turkish and Russian stock markets despite the luggage trade between them.

Dekker, Sen, and Young (2001) use daily data in local currencies and US dollars over the period 1987–1998 in 10-variable to examine linkages among US, Japan, and eight other countries' stock markets including Malaysia, Philippines, Singapore, and Thailand. The results indicate that the four ASEAN markets are linked to the US market, which exerts a great deal of influence, but that the Japanese market is segmented. Furthermore, the Malaysian, Singapore, and Hong Kong markets are closely linked, but the Philippine and Thai markets are segmented.

Manning (2002) examines both weekly and quarterly data over January 1988–February 1999, denominated in both local currency and in US dollars. The system includes Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, and Thailand, and alternately includes/excludes the United States. The general conclusion is that there are two common trends, indicating ''partial convergence'' of the indices.

Sharma and Wongbangpo (2002) examine monthly data from January 1986 through December 1996 for the ASEAN-5 markets denominated in local currencies. They find a long-run cointegrating relationship among the stock markets of Indonesia, Malaysia, Singapore, and Thailand, but conclude that the Philippine market does not share the relationship. Furthermore, there is only one cointegrating vector among the four markets, leaving three common trends. One particularly interesting finding is that Malaysia and Singapore move together one-for-one in the cointegrating vector, ostensibly because of the distribution of inward foreign direct investment flows, the strength of trade between the two economies, the geographical proximity, and cultural factors.

Tan and Tse (2002) use daily data in local currencies over 1988–2000 in a nine-variable to examine the linkages among US, Japan, and seven Asian stock markets including Malaysia, Philippines, Singapore, and Thailand. By truncating the data at the end of 1996 and restarting the data in mid-1998 to create a pre-crisis and post-crisis comparison, they find that markets appear to be more integrated after the crisis than before, and that Asian markets are most heavily influenced by the United States but that the influence of Japan is increasing. The most noteworthy effect among the ASEAN-5 is that Malaysia is apparently an outlier; Malaysia is less affected by the United States and Japan after the crisis, which can be attributed to the influence of its capital and currency controls, but Singapore and Malaysia still affect each other strongly, which can be attributed to geographic proximity, economic linkages, and structural symmetry.

Bessler and Yang (2003) investigate the cointegration among Australia, Japan, Hong Kong, UK, Germany, France, Switzerland, US and Canada and present evidence of one cointegrating vector and suggest that US has a consistent long-run impact on the other markets.

Click and Plummer (2005) demonstrate that the stock markets of Indonesia, Malaysia, Philippines, Singapore, and Thailand in the period after the Asian financial crisis (July 1, 1998 through December 31, 2002) are cointegrated whether analyzed using daily data or weekly data, and whether analyzed in local currencies, the US dollar, or the Japanese yen and concluded that ASEAN-5 stock markets are integrated in the economic sense, but that integration is not complete.

III. Methodology

Cointegration concept was introduced by Granger (1987) stated that cointergration is a long-term measure of diversification based on price data. If there exist a linear combination of two nonstationary series integrated of order one that is stationary, these series are called cointegrated series. On the other hand, cointegration is an econometric property of time series variables. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be cointegrated.

In order to test cointegration of stock indices, three methodologies have to be employed, starting with unit root test for checking stationary properties. Later that, appropriate lag length has to be investigated for optimal lag time in cointegration analysis.

1. Unit root Test for stationary

First, we need to check for the stationary of the data. Several unit root tests exist to check for stationary. In order to proceed for the cointegration analysis, one must establish that the variables possess the same order of integration. A variable is called integrated order of d, I(d), if it has to be differenced d times to become stationary (Kennedy, 1996: 253). Accordingly, unit root tests of Augmented Dickey-Fuller (1981) test the stationary characteristics of the series. Unit root tests are first applied to levels and then to first differences of series.

The Augmented Dickey-Fuller (ADF) (1979) consists of running a regression of the first difference of the series against the series lagged once, lagged difference terms, and optionally, a constant and a time trend. This can be expressed as:

$$\Delta y_t = \alpha + \delta t + \rho y_{t-1} + \sum_{j=1}^{m} \beta_j \Delta y_{t-j} + u_t \qquad (1)$$

Where Δ is difference operator, α, δ, ρ and β are parameters to be estimated, t is a time trend and u is an error term following white noise process. The testing hypothesis are:

$H_0 : \rho = 0$ (non – stationary or unit root test)

$H_1 : \rho < 0$ (Stationary)

If the ρ, coefficient y_{t-1} is significantly different from zero then the hypothesis that y contains a unit root is rejected. Rejection of the null hypothesis implies stationarity. The result shows at Table II.

2. Lag length test

Optimal number of lag has to ascertain due to the number of lags has been shown to affect the number of cointegrating vectors detected (e.g., Richards, 1995). Including too many lags reduce the power of test to reject the null hypothesis due to loss degree of freedom. However, too few lag will not appropriately capture the actual error process (Ender, 1995) Thus AIC (Akaike information criterion) and SC (Schwarz information criterion) have to be employed to investigate the optimal lag, illustrated in Table III.

3. Cointegration Test

Two basic methodologies are evident for testing cointegration; Engle-Granger and Johansen methodologies. Engle-Granger (1987) building upon the representation theorem of Granger (1983) introduce a two-step procedure where first an OLS regression is estimated on the integrated (1) data and then residuals of the regression are checked for stationarity. Granger (1983) representation theorem suggests that in a bivariate system of I(1) series *x* and *y*, if lagged *x* improves the estimation of *y* , then *x is said to Granger cause y.* The Engle-Granger (1987) test for causality is

$$\begin{aligned} x_t &= \alpha_0 + \sum \alpha_i x_{t-i} + \sum \beta_j y_{t-j} + \varepsilon_t \\ y_t &= \alpha_0 + \sum a_i x_{t-i} + \sum b_j y_{t-j} + u_t \end{aligned} \tag{2}$$

Granger causality suggests a lead-lag relationship between time series and there may be granger causality between asset prices without the presence of a cointegrating vector. However, cointegration implies a granger casual flow between the integrated assets.

On the other hand as mentioned by Alexander (2001) it is only valid to regress log asset prices on log prices when these prices are cointegrated, then the regression will define the long-run equilibrium amongst. Yet Engle-Granger (1987) methodology, based on OLS regression, is most suitable for bivariate settings where the choice of the dependent variable is not a question and it can identify only one cointegration vector while there can be more in multivariate analyses.

Johansen Multivariate Cointegration Test

Johansen (1988) and Johansen and Juselius (1990) proposed another approach to test for cointegration. While Engle-Granger test relies on testing the residuals of equilibrium regression, this method is based mainly on relationship between the rank of matrix and its characteristic roots. Moreover, this process can determine the number of cointegrating vectors among interested variables.

The Johansen techniques applied maximum likelihood methods for the analysis of cointegration in Gaussian vector autoregressive (VAR) models which allow for constant term and seasonal dummies. For simplicity, the deterministic part is excluded from VAR model. It should also note that this method is designed to handle I(1) and I(0) variables. If some of the series are I(2), standard Johansen approach cannot be applied.

Consider the following VAR model of order k:

$$X_t = \Pi_1 X_{t-1} + \Pi_2 X_{t-2} + \cdots + \Pi_k X_{t-k} + u_t \quad (t = 1,\ldots,T) \tag{3}$$

Where X_t is (n x1) vector of variables containing in the VAR model and $X_{-k+1}, \ldots, X_0$ + are fixed :

Π_i is (n x n) matrix of coefficients

u_t is (n x 1) vector of residuals and u_1 ,…, u_t are independent Gaussian variables with mean zero and variance matrix .

The model in equation (2) can be rewritten as

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \cdots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-1} u_t \tag{4}$$

Where $\Gamma_i = -I + \Pi_1 + \Pi_2 +, \ldots, \Pi_i$ -I , (i = 1,…,k-1)

$\Pi = -I + \Pi_1 + \Pi_2 +, \ldots, \Pi_k$

Equation (4) is expressed as a traditional first difference VAR model except for the term ΠX_{t-k}. This is the key point of this method. The matrix is the long run impact matrix. The main purpose of this method is to investigate whether the matrix contains any information about the long run relationships between the X. This can be achieved by considering the rank of variables in the data vector X_t . Since Π is (n x n) matrix, the rank of Π can be at most n. There are three possible cases:

(a) If rank(Π) = n, i.e. the matrix Π has full rank, the vector process X_t is stationary.

(b) If rank(Π) = 0, i.e. the matrix is null, the equation (4) is the usual X is non-stationary and VAR model in first difference. The process X_t there is no cointegrating vector.

(c) If rank(Π) = r, 0 < r < n , then there are r cointegrating vectors and equation (4) can be interpreted as an error correction model.

Moreover, there are n x r matrices α and β such that $\Pi = \alpha\beta'$ where α is a matrix of error correction coefficients (speed of adjustment) and β is a matrix of cointegrating vectors (long run coefficients). The cointegrating vectors have the property that is stationary even though X_t itself is non-stationary. This can write in vector to vector error correction models (VECMs) as follows :

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-1} + \delta_t + \varepsilon_t \qquad (5)$$

Details of procedure can be found in the original papers. The concept of finding the rank of Π is described here. Rank of an (n x n) matrix is equal to the number of linearly independent Eigenvectors of the matrix. Therefore, to obtain the rank of Π, we need to find all characteristic roots of Π . If rank of Π is zero, all these characteristic roots are zero and this implies no cointegration. Otherwise, if there exist non zero roots, the roots can be ordered such that $\lambda_1 > \lambda_2 > \cdots > \lambda_n$. In practice, we can obtain only the estimates of Π ($\hat{\Pi}$) and the characteristic roots ($\hat{\lambda}_t$).

The following two statistics are proposed to test for the number of cointegrating vectors, r.

(i) Trace Test (λ_{trace})

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i)$$

H_0 : There are at most r cointegrating vectors.

H_1 : There are more than r cointegrating vectors.

(ii) Maximum Eigenvalue Test (λ_{max})

$$\lambda_{max}(r, r+1) = -\mathrm{Tn}(1 - \hat{\lambda}_{r+1})$$

H_0 : Number of cointegrating vector is r.

H_1 : Number of cointegrating vector is r + 1.

If $\hat{\lambda}_i$ = 0, ln(1-$\hat{\lambda}_i$) = ln(1) = o. Therefore, it is obvious that λ_{trace} equals zero when all $\hat{\lambda}_i$ = 0. If $\hat{\lambda}_i \neq 0$, $\ln(1 - \hat{\lambda}_i)$ is negative and hence is positive. Like λ_{trace} the value of λ_{max} is small if the estimated characteristic root, $\hat{\lambda}_{r+1}$, is closed to zero. The critical values for these statistics are provided in Johansen and Juselius (1990).

IV. DATA

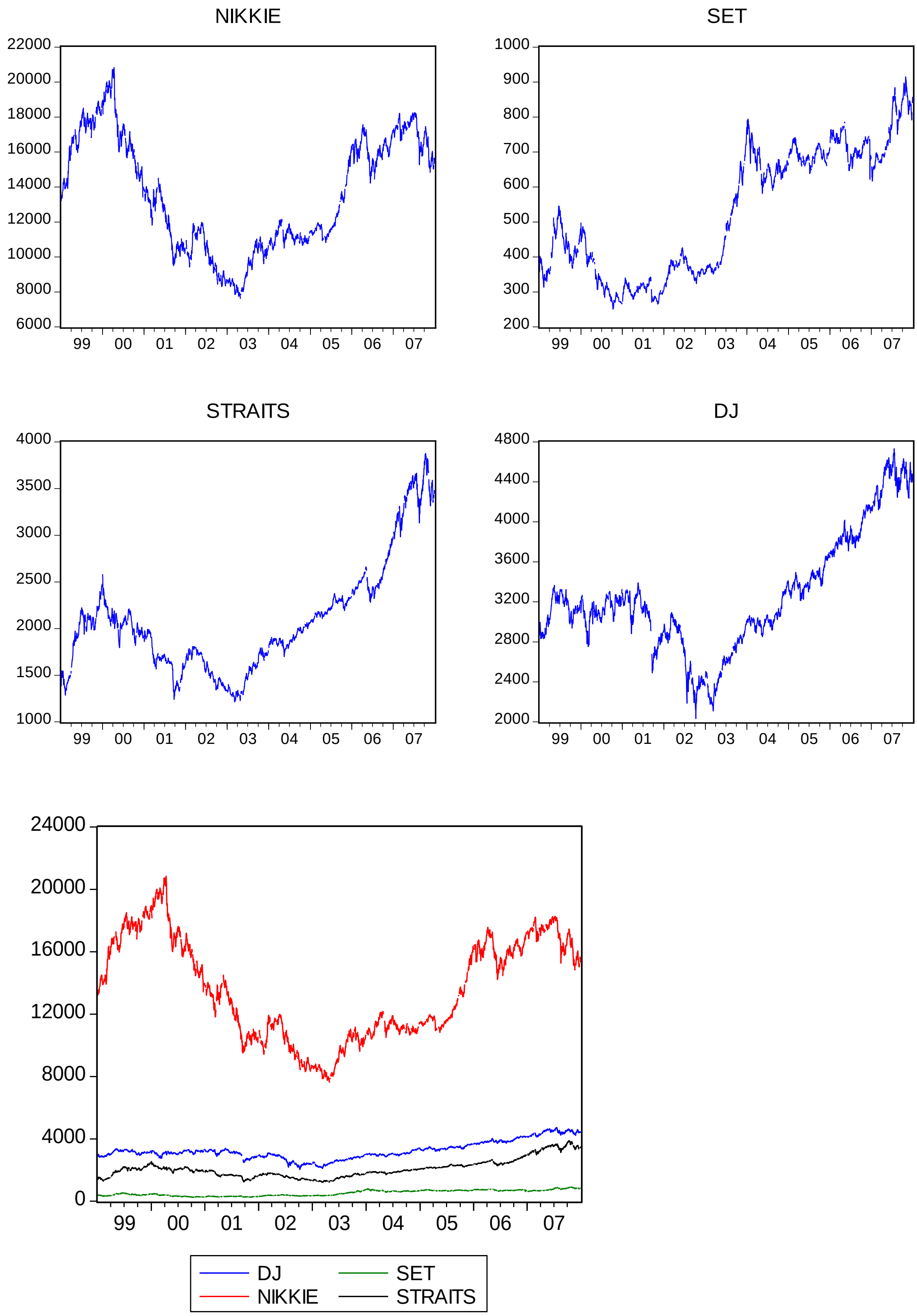
The data of the study includes daily closing stock price series of four countries. First is Thailand stock index, represented by SET (Stock Exchange of Thailand). Second is index of United State of America, represented by DJ (DOW JONES Index). Third is stock market of Japan, represented by NIKKIE Index and the last market is Straits Tine Index of Singapore.

The investigation period starts from 4/1/1999 and extends to 31/12/2007, covering the recent eight years data. This paper analyzes data in period after Asian financial crisis which end in 1997, so two years for market adjustment to be normal should be enough and The stock price indices are denominated in local currencies following Voronkova (2003) .

The objective in using local currencies is to obtain co-integration results just based on movements on asset prices by eliminating the effect of exchange rate changes especially if exchange rate is highly volatile. Considering the countries under examination, they have been through various devaluations which could have distorted the findings. Furthermore, Alexander (2001) stresses the importance of making cointegration analysis in local currencies for detecting asset price co-movements.

Figure I

Movement of SET, DJ, NIKKIE and STRAITS TIME Index from 4/1/1997 to 31/12/2007



V. EMPIRICAL RESULT

This chapter consists of three parts. The first describes results of stationary test of the index, SET, NIKKIE, DJ and STRAITS, whether the result are stationary, and then we proceed the cointegration for the further procedure. The second provides optimal lag and the third part illustrated the output of cointegration analysis.

1. Testing for Stationary.

Before the cointegration analysis is applied to analyze long term relationship, the univariate properties of the stock index data need to be examined to verify whether the data series are nonstationary, or contain a unit root. The Augmented Dickey Fuller (ADF) unit root test is used with the optimal lag length is selected by Schwarz Information Criterion (SIC). The test statistics of ADF test on stock index of each country are presented in Table II.

Table II

ADF test for a unit root

Index	Lag	Intercept	Trend	None
At I(0)				
DJCOM	1	-0.561	-1.473	0.808
SET	0	-0.621	-2.872	0.751
STRAITS	0	-0.267	-1.205	1.230
NIKKIE	1	-0.330	-0.336	-0.125
At I(1)				
ΔDJCOM	0	-46.631***	-46.637***	-46.624***
ΔSET	0	-46.074***	-46.101***	-46.061***
ΔSTRAITS	2	-25.900***	-25.934***	-25.869***
ΔNIKKIE	0	-45.287***	-45.274***	-45.303***
Critical value		Intercept	Trend	None
1%		-3.433	-3.963	-2.566
5%		-2.863	-3.412	-1.941
10%		-2.567	-3.128	-1.617

Note : *** Significant at 1% confidence level

The result showed that the null hypothesis of unit root cannot be rejected in all index (I (0)), which means the index are non stationary since there is all statistics has lower value than the critical values of any significant levels and stationary at I(1). Therefore, we can proceed to the next test for cointegration approach.

2. Optimal lag length Selection.

After proving that all indices are non stationary, we have to find the optimal lag length for calculating in cointegration model followed Johansen (1988) and Johansen and Juselius (1990). To test optimal lag, AIC (Akaike information criterion) and SC (Schwarz information criterion) is employed for the analysis since this two method is well known and also is the most practice for optimal lag analysis.

Table III

VAR Lag Order Selection Criteria

Lag	AIC	SC
0	59.45227	59.47371
1	38.52133	38.62853
2	38.34157*	38.53452*
3	38.35095	38.62965
4	38.36988	38.73434
5	38.38201	38.83221

* indicates lag order selected by the criterion
AIC: Akaike information criterion
SC: Schwarz information criterion

Table III shows AIC and SC give the optimal lag at two. As a result, two lag will be employed in the next step, cointegration test.

3. Testing for Cointegration base on Johansen Multivariate Test.

The test for co-integration is given in Table IV. The Johansen technique (Johansen, 1988, 1991; and Johansen and Juselius, 1990) has been used to test the existence of co-integration among four indices. Both, the maximum Eigenvalue (λ_{max}) and trace (τ) test statistics have been used to determine the number of co-integrating vectors r. The null hypothesis tested was that there can be no co-integrating vectors among the index of Thailand, USD, Japan and Singapore.

So, if null hypothesis is rejected, there is cointegrating vector which imply to long term equilibrium exists that can be write down in long term and short term equation by VAR (Vector Auto Regressive Model) and VECM (Vector Error Collection Model).

Since the number of null hypothesis equals to the number of variables. So, there are four hypothesizes which number of cointegrating vector starts from 0 to 3 for both Trace and Maximum Eigen value test. Starting process test from the first null hypothesis that r = 0, if it is rejected which mean first alternative is accepted, then the second null hypothesis will be test futher. If the results shows more than one null hypothesis can be rejected, or the other hand there are more than one cointegrating vector, it implies to strong long term relationship among variables. Moreover, every cointegrating vectors can be write down in long term equation, however, Johansen suggests that long term and short term equation should be interpret from cointegrating vector that generates the highest Eigenvalue.

Table IV

Johansen Multivariate Cointegration result

Test by Trace Test					
Hypothesis		Trace statistic	Critical Value*	Eigenvalue	No. of cointegrating vector
Null	Altenative				
Ho : r = 0	H1: r ≥ 1	23.070700	40.174930	0.015268	0
Ho : r ≤ 1	H1: r ≥ 2	3.668785	24.275960	0.002703	
Ho : r ≤ 2	H1: r ≥ 3	0.255999	12.320900	0.000202	
Ho : r ≤ 3	H1: r ≥ 4	0.001100	4.129906	8.72E-07	

Test by Maximum Eigen value					
Hypothesis		Maximum Eigenvalue statistic	Critical Value*	Eigenvalue	No. of cointegrating vector
Null	Altenative				
Ho : r = 0	H1: r ≥ 1	19.401910	24.159210	0.015268	0
Ho : r = 1	H1: r ≥ 2	3.412786	17.797300	0.002703	
Ho : r = 2	H1: r ≥ 3	0.254899	11.224800	0.000202	
Ho : r = 3	H1: r ≥ 4	0.001100	4.129906	8.72E-07	

Note: *Critical values are from MacKinnon-Haug-Michelis (1999)

From table IV, we cannot reject the first null hypothesis that r = 0 both Trace test and Maximum Eigenvalue test because Trace statistic and Maximum Eigenvalue statistic are less than critical value. Then, there is no cointegrating vector, and the long term and short term equation cannot be interpret due to no long term relationship among all variables. So, in the time period 1999 to 2007, There is no long term relationship or equilibrium among SET Index, DOW JONES Index, NIKKIE Index and STRAITS TIMES Index.

This result is quite surprise that no long term relationship among markets since today markets are globalization, and cannot explain why no long term equilibrium in the investigated time period. However, this result may be useful for investors to confirm their investment strategies in part of diversification portfolio management to reduce risk and high return according to modern portfolio theory.

VI. Conclusion

The empirical results in this paper manifests that the stock market of Thailand, United state of America, Japan and Singapore which represented by SET, DOW JONES, NIKKIE and STRAITS TIME index in 1999 to 2007, eight years, have no long term relationship under Johansen (1991) approach.

However, the long term relationship is subjected to selected period. Since, after changing investigation period from 1999 to 2007 to be 2004 to 2007, there is long term relationship in this time. So investigating cointegration by breaking time period will be the further study including with prediction model if long term equilibrium is found.

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