

INTERNATIONAL LINKAGES TO THE INDONESIAN CAPITAL MARKET:  
COINTEGRATION TEST<sup>1</sup>

Yoopi Abimanyu  
Nur Sigit Warsidi  
Sunu Kartiko  
Ridiani Kurnia  
Tety Mahrani

Jakarta, May 2008  
Capital Market and Financial Institution Supervisory Agency  
Ministry of Finance of Indonesia

---

<sup>1</sup> Forthcoming to be published in an economic journal.

# INTERNATIONAL LINKAGES TO THE INDONESIAN CAPITAL MARKET: COINTEGRATION TEST

Yoopi Abimanyu<sup>2</sup>  
Nur Sigit Warsidi<sup>3</sup>  
Sunu Kartiko<sup>4</sup>  
Ridiani Kurnia<sup>5</sup>  
Tety Mahrani<sup>6</sup>

## Abstract

This paper explores the international linkages of the Indonesian capital market using cointegration tests to examine the long-run equilibrium relationship between the stock markets of Indonesia with China, France, Germany, Hong Kong, Japan, Korea, Malaysia, Netherlands, Philippine, Singapore, Thailand, Taiwan, the United Kingdom, and the United States. The method used in this paper is visual inspection, followed by Johansen cointegration. Our results show that there exist cointegration between these stock market indices except between Indonesia and Philippine.

---

<sup>2</sup> Ministry of Finance's Employee. Lecturer at the Post Graduate School, the Department of Economics of the University of Indonesia, and the Post Graduate School of the University of Moestopo. Member of the Indonesian Economists Association (Ikatan Sarjana Ekonomi Indonesia/ISEI)

<sup>3</sup> Ministry of Finance's Employee.

<sup>4</sup> Ministry of Finance's Employee.

<sup>5</sup> Ministry of Finance's Employee.

<sup>6</sup> Ministry of Finance's Employee.

# INTERNATIONAL LINKAGES TO THE INDONESIAN CAPITAL MARKET: COINTEGRATION TEST

By:  
Yoopi Abimanyu  
Nur Sigit Warsidi  
Sunu Kartiko  
Ridiani Kurnia  
Tety Mahrani

## I. Introduction

For the past several years, analysts have tried to find linkages between international capital markets. These researches on the interaction amongst different countries were done for different reasons and under different underlying assumptions.<sup>7</sup> This short paper is trying to find out which market is particularly linked to the Indonesia's capital market using the cointegration method.

## II. Content

### II.1. General

The abolition of foreign exchange control, the development of technology in communications and trading systems, and the introduction of innovative financial products, have increased the interest of researchers on the interaction among international capital markets. Phylaktis et al (2007) in their paper had found out that for open economies countries there were no linkages nor dynamic interactions between a group of Pacific-Basin capital markets and the industrialized countries of Japan and US in the 80's and the 90's. There was no linkage as well for Hong Kong and Malaysia for the 80's period. This shown that even though there was a relaxation on financial restrictions, other factors such as information availability, accounting standards, or liquidity, and political risk particularly for Hong Kong at that time, might reduce the interest of international investors, thereby affecting the decision on the portfolio diversification. For other semi-open countries where foreign ownership and other restrictions were placed, there was a close financial links for Taiwan and Thailand with both Japan and US. This probably was due to the introduction of

---

<sup>7</sup> See Phylaktis and Ravassolo, 2007; Ou Hu, 2004; Baccheta and van Wincoop, 1998.

innovative financial products. In general, Phylaktis et al (2007) had shown that under open economies, although the linkages have increased in recent years, they do not seem to respond to a common world factors but that of the domestic factors, creating spaces for long-term gains by investing in these markets. On the other hand, under semi-open economies, even though long-term diversifications benefits from exposure to these markets might be limited, substantial transitory fluctuations might resulted in short-run benefits.

Based on sample period of December 1969 until May 2003, using Kalman filter recursive procedure and maximum likelihood estimation, Hu (2004) however had found out that every member of OECD countries capital market price does not have a one-on-one relationship with the world price.<sup>8</sup> The cointegrating vectors between these countries' price indices and the world price index are not {1,1}.<sup>9</sup> In other words, each country has a different degree of sensitivity to the world price, and therefore implies that there is a potential long-run international diversification benefit.

A different approach was done by Baccheta et al (1998) where their paper showed that liberalization and reforms had positive impact on capital inflow despite higher real interest rates in the emerging markets. Incomplete information as a crucial element in liberalization however, can generate considerable volatility. This problem is likely to become less acute over time as investors learn about their new environment. Substantial liberalization and macroeconomic reforms imply a regime change. This creates an environment of uncertainty for foreign and domestic investors alike. Particularly in the beginning there is uncertainty both about the extent of the reforms and their success. However, as time goes by investors will learn and most of the initial uncertainty will be resolved. This paper also had shown that the analysis on incomplete information can be extended to include contagion across countries. Consider the case where several emerging countries liberalize at the same time, assuming that investors think (rightly or not) that events in one emerging country provide information about other countries. Thus, a very low return in certain

---

<sup>8</sup> The OECD countries consists of Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

<sup>9</sup> The world index consists of 23 developed market country indices taken from Morgan Stanley Capital International (MSCI). Those countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States

country will lead to a large decline in inflows to that country accompanied by declines in other countries. The extent of the declines in the other countries will depend on the informational value attributed by investors to that certain country's return. This value will probably vary across countries. A negative shock in Thailand may provide informational value (in the eyes of the investors) about other South East Asian countries than a shock in Mexico (Bucchette et al, 1998). On the contagion, contagion occurs because open economies that are connected through trade, geography, common external shocks, or similar economic structures also have integrated financial markets (Fratzscher, 1999). When one country is hit by a financial crisis, investors may flee from the other countries as well, either because they want to adjust their investment holdings and raise cash ('constitutional' contagion) or because they follow other investors who fear the spread of the crisis to the connected countries ('herding' contagion). The more financially integrated one country is with a country where a currency crisis begins, the more likely it is that the crisis will spread and the more severe crisis will be in the infected country (Abimanyu, 2000).

Forbes and Rigobon (1999) differentiated contagion from interdependence. They described contagion as a significant increase in the cross-market correlation during the period turmoil. If an exogenous shock to one market has undulation effects and causes a significant increase in market co-movements between this market and others, then there is a contagion. Forbes and Rigobon (1999) have founded that there is no contagion in South East Asia and Latin America during the crisis periods but those markets were highly interdependent. Tan (1998) investigated the extent of contagion during Asian financial turmoil using a VAR model on stock markets and found out the evidence of contagion during Asian financial crisis.

Eun and Shim (1989), Hamao et al. (1990), Koch and Koch (1991), and Roll (1992), evaluated cross-country correlation. They found out the evidence of significant linkages between stock markets around the world. Kasa (1992) investigated common stochastic trends in the stock markets of the U.S., the U.K., Japan, Germany and Canada. Using Johansen cointegration technique with monthly quarterly data from 1974 to 1990, he found out that there exists a single common stochastic trend driving these countries stock markets. Therefore, there

is a long run relationship between stock markets of these countries. In other words, they tend to move together.

Based on the assumptions used on the above papers, a cointegration analysis of the Indonesian capital market index against several groups of countries would be done in this paper.

## II.2. Indonesia's Case

Indonesian capital market has played an important role on the Indonesian economy. It has become an alternative source of financing due to its relatively low-cost, long-term funding, as well as an engine for the development of the national economy. Capital market is important not only to finance growth but also to provide economic stability. Since the financial crisis in 1997, the collapse of the Indonesia's banking sector, among others, has driven people to turn to the capital market as a source of long-term financing.

The role of the Indonesian capital market to support the Indonesian economics apparently has increased from 2005 until 2007. Table 1 below shows the market capitalization and also the ratio of market capitalization to Gross Domestic Product (GDP) between 2005 and 2007. The value of market capitalization has increased from IDR 1,264 trillion in 2005 to IDR 2,548 trillion in 2007 (101.58%). The ratio of market capitalization to GDP has also increased from 45.39 % in 2005 to 64.40% in 2007.

Table 1: Ratio of Market Capitalization to GDP (2005 until 2007)

Year	Equity (IDR Trillion)	Bond (IDR Trillion)	Market Cap. (IDR Trillion)	GDP (IDR Trillion)	Equity/ GDP Ratio (%)	Bond/ GDP Ratio (%)	Market Cap/GDP Ratio (%)
2005	801,252.70	462,750.65	1,264,003.35	2,784,960.40	28.77	16.62	45.39
2006	1,249,074.50	486,556.74	1,735,631.24	3,338,195.70	37.42	14.58	51.99
2007	1,988,326.20	560,230.81	2,548,557.01	3,957,403.90	50.24	14.16	64.40

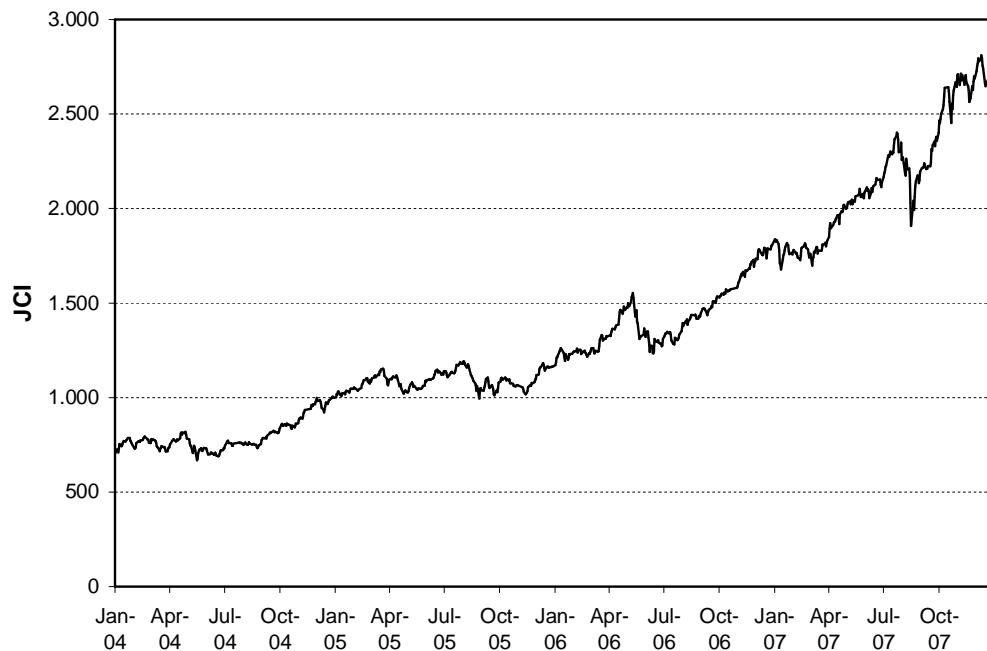
Source: Ministry of Finance of Indonesia

From the trading activities point of view, daily average transaction value has increased by 138.88 % from IDR 1.8 trillion in 2006 to IDR. 4.3 trillion in 2007. Daily average transaction frequency has increased by 142.68 % from

19,880 times in 2006 to 48,244 times in 2007. Transaction volume has increased by 133.33% from 1.8 billion in 2006 to 4.2 billion in 2007.<sup>10</sup>

On the Jakarta Composite Index (JCI), graph 1 below shows the daily movement of the JCI from 2004 until 2007. The performance of the JCI showed relatively rapid growth. The JCI has reached a remarkable level on December 11<sup>th</sup> 2007 where the composite index was closed at the level of 2,810.962. This is the highest level of the composite index in the Bourse's history. This achievement has placed the Indonesia Stock Exchange (IDX) as one of the best performance Bourses in Asia Pacific.

Graph 1: Movement of JCI (2004 until 2007)



Source: Ministry of Finance of Indonesia

The movement of JCI apparently more or less is influenced by the movement of the international economy.

During the 1997's Asian financial crisis, some researches show that the weekly return of the stock markets of Korea, Thailand and Indonesia were closely correlated (Abimanyu, 2000; Fratzscher 1999). Most of these stock markets declined significantly after the crisis struck Thailand on July 1997. This

<sup>10</sup> Indonesia Stock Exchange. "Performance of IDX in 2007 and Outlook 2008". Available online at <http://www.idx.co.id>.

similarity in the movement of stock market indices suggest that there was a contagion effect running from one country to the others.

Other example shows that while on July 2007 the European and Asian markets fell after the trouble on the US sub-prime mortgage, on 16 August 2007 the JCI dropped from 2,211.46 points to 1,908.63 points or 13.69% due to domestic market's concern on the same problem. On that day, the Dow Jones Industrial Average dropped by 2.95%, that is from 13,236.53 points to 12,845.78 points. These turmoil has then engulfed global equities as rising default rates among U.S. mortgage holders with poor credit histories - the so-called sub-prime problem - raised concerns of a spillover effect that might lead to recession in the world's largest economy.

In Indonesia, concern of the possibility of the failure of US sub-prime mortgage settlement has triggered panic selling. Selling of some blue chip stocks dominated the transaction on August. The JCI fell significantly three times in a row in just one week i.e., 42.82 point (1.94%) in the beginning of the week, 139.55 point (6.44%) in the middle of the week and 120.45 point (5.94%) at the end of the week. In contrast, on week three and week four JCI strengthened as a result of a number of huge transactions of big capitalized companies. Market still fluctuated on the fifth week of that month. This tendency was inline with the movement of the regional stock indices. Sentiment on global issues such as the decline of the Fed interest rate, price movement of the mining commodities and credit guarantee on housing by Federal Housing Administration were coloring the transaction of that month. Total transaction at week five was amounting to IDR 3,466.73 billions or decreased by 33.43% compared to past week transaction. However the transactions were dominated by local investors rather than by foreign investors. Local investor's transactions took a portion of 80%, while foreign investors took up 20% of the rest.

The numbers of international issue on one hand, and the local dominated transaction on the other hand raised a question whether Indonesian capital market was really integrated with the regional and the global market. These will be analyzed in the next section.

### II.3. Analysis

We use daily stock market indices reported by Bloomberg. The countries included in this study are China, France, Germany, Hong Kong, Indonesia, Japan, Malaysia, Netherlands, Philippines, Singapore, South Korea, Taiwan, Thailand, the United Kingdom and the United States. Specifically, the stock market index prices used are as follows: Amsterdam Exchange Index (Netherlands), Bangkok S.E.T. (Thailand), CAC 40 (France), Dow Jones Industrial Average (United States), DAX Index (Germany), FTSE 100 Index (United Kingdom), Hang Seng Index (Hong Kong), Jakarta Composite Index (Indonesia), Nikkei 225 Stock Average (Japan), Kuala Lumpur Composite Index (Malaysia), Korea SE Composite (Korea), Philippines Composite (Philippines), Shanghai Composite (China), Shenzhen Composite (China), Singapore Straits Times Index (Singapore), Taiwan SE Weighted (Taiwan). Our sample starts from January 2005 to December 2007.

To examine the international linkages of the Indonesian capital market, the stock indices from the sample are further sub-divided into three groups: amongst the stock markets of Indonesia and ASEAN countries (Malaysia, Singapore, Philippine and Thailand), amongst the stock markets of Indonesia with developed market and Asia-Pacific countries (United States, Japan, Hong Kong, Korea, Taiwan and China), and amongst the stock markets of Indonesia and west Europe countries (United Kingdom, France, Germany and Netherlands).

Cointegration tests in this paper consist of two steps. The first step is to examine the stationarity properties of the various stock indices for the countries using Phillips-Perron Test. The second step is to examine the cointegration using Johansen multivariate cointegration analysis.

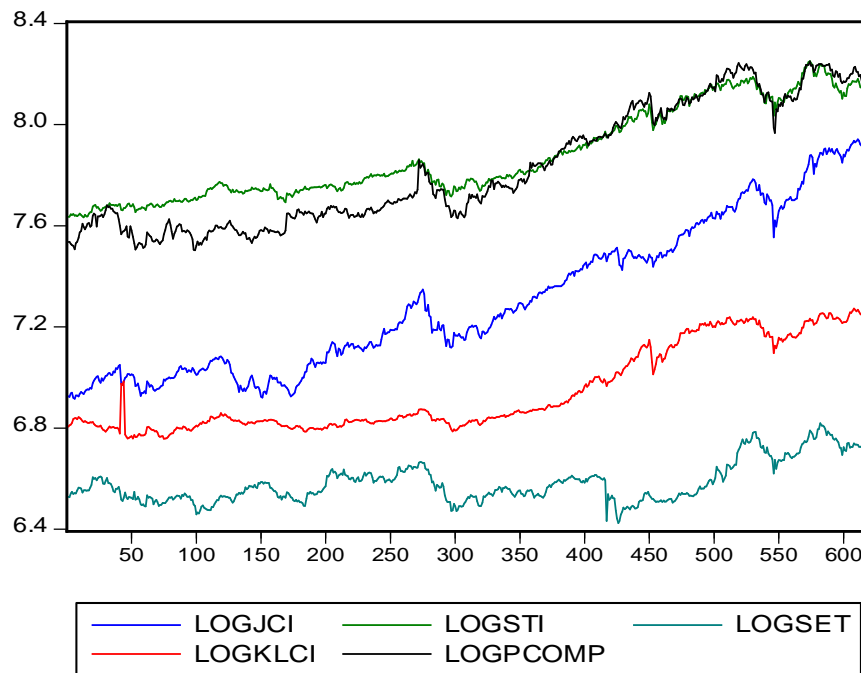
We use two analyses in this paper, that is, the visual inspection and the empirical tests.

### II.3.1. Visual Inspection (Graph)

Graph 2, 3 and 4 below depicts the time series representation of the variables used in this paper in natural logarithms<sup>11</sup>.

These graphs show the movement of JCI relative to the movement of international stock markets indices, where the movement of Indonesia stock market has the same trend with China, France, Germany, Hong Kong, Japan, Korea, Malaysia, Netherlands, Philippines, Singapore, Taiwan, Thailand, the United Kingdom and the United States stock markets. Further analysis using cointegration tests would be done to formalize the visual inspection approach.

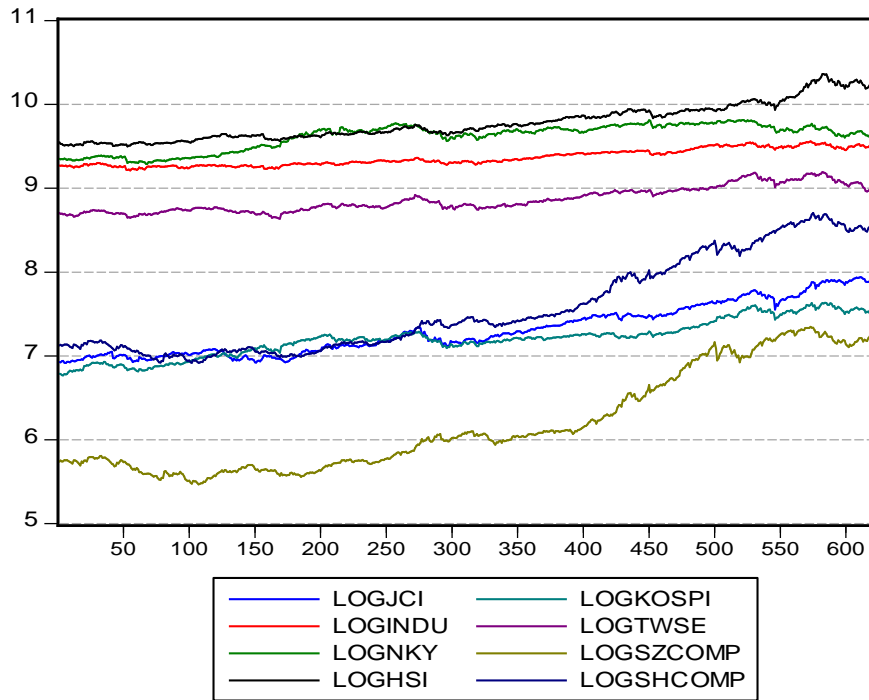
Graph 2: Movement of JCI relative to other ASEAN Countries Indices



Source: Ministry of Finance of Indonesia

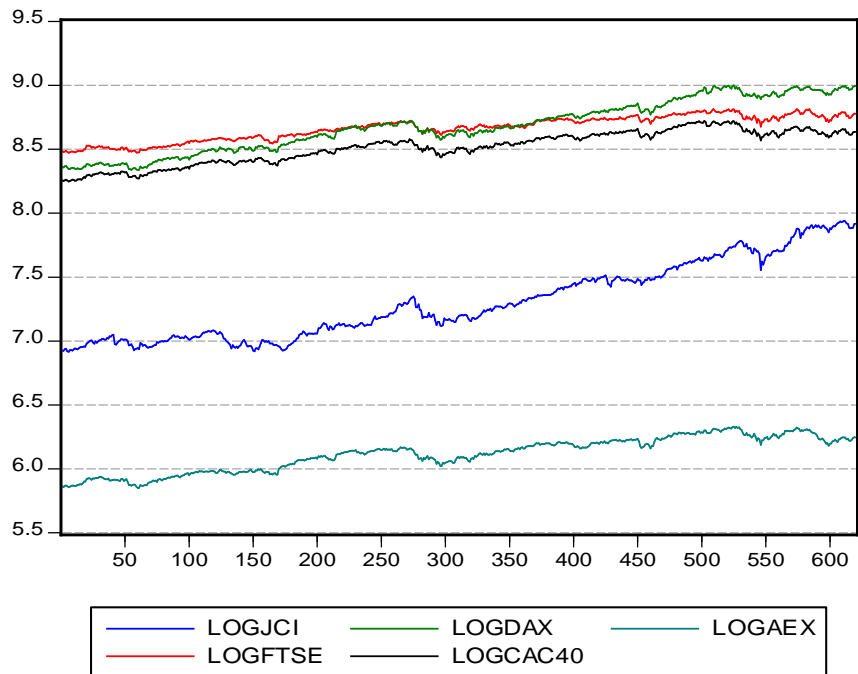
<sup>11</sup> Natural logarithms will linearize the level data.

Graph 3: Movement of JCI relative to Asia Pacific Countries Indices



Source: Ministry of Finance of Indonesia

Graph 4: Movement of JCI relative to European Countries Indices



Source: Ministry of Finance of Indonesia

### II.3.2. Empirical Test (Cointegration)

Before running the cointegration test, the stationarity issues of the series should be determined first. There are some important differences between stationary and non-stationary time series (Enders, 2004). Shocks to a stationary time series are necessarily temporary. Over time, the effects of the shocks will dissipate and the series will revert to its long-run mean level. So, the long-run movement of a stationary series will converge to the unconditional mean of the series. On the other hand, a nonstationary time series necessarily has permanent components. The mean and/or variance of a nonstationary series are time-dependent.

There are several ways to find out the time series properties of a series. Inspection of the correlogram or the autocorrelation function could be served as an indication whether a series is stationary or nonstationary (Box and Jenkins, 1976). The autocorrelation function and its companion function, the partial autocorrelation function, are two of the methods used in the identification of the capital market index series, which is, determining from sample statistics the form of the model that underlies the observed exchange rate data. These so called the Box-Jenkins method of differencing the time series after a visual inspection of the correlogram have been formalized in the tests for unit roots (Maddala, 2000).

This involves testing for the univariate unit root properties and the order of integration of the time series using the Dickey-Fuller, the Augmented Dickey-Fuller, and the Phillips-Perron tests (Murinde, 1996). Following Dickey and Fuller (1981), Greene (2003), Banerjee et al. (1993), and Maddala (2000), the Dickey-Fuller test for unit roots is carried out by testing for first difference of the series and then comparing the result with the appropriate value reported in the Dickey-Fuller table. The equation could be added with either a constant, or a constant and a trend, for unit root test. The augmented Dickey-Fuller test (Banerjee, 1993; Greene, 2003; Maddala, 2000; and Dickey-Fuller, 1981) is the Dickey-Fuller test augmented by higher-order autoregressive process of the dependent variable. As stated in Rao (1994), the augmented Dickey-Fuller test is widely used to test the presence of unit roots in the variables. In this test, sufficient lag of the autoregressive process is added to achieve white noise residuals. Lagrange Multiplier test can be used to test for serial correlation and thus to check whether the chosen lag length is adequate. Another possibility in choosing the lag length is by choosing the minimum value of the Akaike Information Criteria (Holden and Perman, 1994). A constant or a

constant and a trend could be added to test for the presence of a unit root. The distribution theory supporting the Dickey-Fuller test assumes that the errors are statistically independent and have a constant variance (Enders, 2004).

Phillips and Perron developed a generalization of the Dickey-Fuller procedure that allows for fairly mild assumption concerning the distribution of the errors. Instead of the Dickey-Fuller assumptions of independence and homogeneity, the Phillips-Perron test allows the disturbance to be weakly dependent and heterogeneously distributed. This test arise from the consideration of the limiting distribution of the various Dickey-Fuller statistics when the assumption that the residual is assumed to define a sequence of independently and identically distributed (IID) process is relaxed (Holden and Perman, 1994). In addition to that consideration, in the augmented Dickey-Fuller test, power of the unit root test may be adversely affected by misspecifying the lag length in the augmented Dickey-Fuller regression, where the Phillips-Perron tests have the advantage that this choice does not have to be made (Holden and Perman, 1994). Also, the standard augmented Dickey-Fuller test may provide somewhat biased result toward nonrejection of unit root due to major changes in the data, such as oil shock, financial deregulation, and major intervention in the monetary policy by the Central Bank, where these changes could have created a permanent change in the series. In this case, the Phillips-Perron test could provide a more appropriate test (Christiano, 1992; Chu and White, 1992; Perron and Vogelsang, 1992a; Perron and Vogelsang, 1992b; Perron, 1990; Perron, 1989). The equation could be added with a constant or a constant and a trend before tested for the presence of a unit root. Based on the above consideration, the more robust Phillips-Perron test will be done here to test for the presence of a unit root in the capital market index (Abimanyu, 2004).

#### II.3.2.1. Unit Roots

We tested for unit roots in all stock market indices in our study by using the Phillips-Perron test. The Phillips-Perron test bandwidth selection is based on Newey-West. Newey and West (1987) have proposed a more general covariance estimator that is consistent in the presence of both heteroskedasticity and autocorrelation of unknown form.

Table 2, 3 and 4 below present the results of the unit root tests for each country. The results show that the stock prices indices for all of the markets which are being analyzed have unit roots. The results also show significant results on the null hypothesis at 5% and 1% respectively. We found that the null hypothesis of the existence of unit root in level data was accepted in all cases.

Table 2: Result of Phillips-Perron unit root's tests using level data

Variable	Phillips-Perron		
	constant	constant and trend	no constant no trend
JCI	0.494739	-2.228026	2.818321
KLCI	0.460484	-1.964623	2.127266
STI	-0.572497	-2.164978	2.066311
PCOMP	-0.499658	-2.739865	1.760951
SET	-1.628420	-2.433662	0.672242
Critical values 1%	-3.440685	-3.972949	-2.568703
Critical values 5%	-2.865991	-3.417095	-1.941335
Critical values 10%	-2.569199	-3.130925	-1.616355

Table 3: Result of Phillips-Perron unit root's tests using level data

Variable	Phillips-Perron		
	constant	constant and trend	no constant no trend
JCI	0.494739	-2.228026	2.818321
INDU	-0.571840	-3.331635	1.341628
NKY	-1.715508	-0.933311	0.950781
HSI	0.371451	-2.372991	2.200903
KOSPI	-1.161230	-2.316794	-2.316794
SZCOMP	1.170805	-2.083824	2.899723
SHCOMP	1.157867	-2.201685	3.075593
TWSE	-0.938888	-2.833272	1.110349
Critical values 1%	-3.440685	-3.972949	-2.568703
Critical values 5%	-2.865991	-3.417095	-1.941335
Critical values 10%	-2.569199	-3.130925	-1.616355

Table 4: Result of Phillips-Perron unit root's tests using level data

Variable	Phillips-Perron		
	constant	constant and trend	no constant no trend
JCI	0.494739	-3.290423	2.818321
FTSE	-1.557555	-1.964623	1.641630
DAX	-0.571247	-2.989485	2.867900
CAC40	-1.810146	-2.389132	1.828578
AEX	-1.630338	-2.514508	1.828578
Critical values 1%	-3.440685	-3.972949	-2.568703
Critical values 5%	-2.865991	-3.417095	-1.941335
Critical values 10%	-2.569199	-3.130925	-1.616355

We then proceed to test unit roots in first difference. We found that the null hypothesis of a unit root for the first difference can be rejected for all series (as shown in table 5, 6 and 7). Thus, as most financial series, the stock market levels are  $I(1)$ , which means that they are stationary after first difference.

Table 5: Result of Phillips-Perron unit root's tests using first difference data

Variable	Phillips-Perron		
	constant	constant and trend	no constant no trend
JCI	-25.74358	-25.78074	-25.42599
KLCI	-27.50571	-28.74835	-26.30128
STI	-27.77755	-27.75506	-27.59197
PCOMP	-24.35357	-24.33861	-24.22160
SET	-28.06129	-28.06073	-28.05605
Critical values 1%	-3.440702	-3.972973	-2.568709
Critical values 5%	-2.865999	-3.417107	-1.941336
Critical values 10%	-2.569203	-3.130932	-1.616355

Table 6: Result of Phillips-Perron unit root's tests using first difference data

Variable	Phillips-Perron		
	constant	constant and trend	No constant no trend
JCI	-25.74358	-25.78074	-25.42599
INDU	-27.39331	-27.38491	-27.22977
NKY	-24.78399	-24.87096	-24.75845
HSI	-26.07026	-26.09052	-25.86987
KOSPI	-25.58634	-25.57447	-25.35923
SZCOMP	-24.48261	-24.65203	23.04769
SHCOMP	-25.35913	-25.53111	-24.13572
TWSE	-25.14333	-25.12263	-25.10663
Critical values 1%	-3.440702	-3.972973	-2.568709
Critical values 5%	-2.865999	-3.417107	-1.941336
Critical values 10%	-2.569203	-3.130932	-1.616355

Table 7: Result of Phillips-Perron unit root's tests using first difference data

Variable	Phillips-Perron		
	constant	constant and trend	No constant no trend
JCI	-25.74358	-25.78074	-25.42599
FTSE	-28.82037	-28.89150	-28.42969
DAX	-25.87170	-25.84906	-25.35209
CAC40	-27.33773	-27.49850	-27.02460
AEX	-25.47500	-25.49066	-25.38746
Critical values 1%	-3.440702	-3.972973	-2.568709
Critical values 5%	-2.865999	-3.417107	-1.941336
Critical values 10%	-2.569203	-3.130932	-1.616355

In conclusion, the Phillips-Perron unit root tests indicate that the null hypothesis of a unit root in the level series cannot be rejected in all series, which indicates nonstationarity in all the time series. However, the null hypothesis of a unit root in the first difference of the same data is clearly rejected. Therefore, each of the stock price indices are integrated of order I(1). We then proceed with the cointegration tests for these countries in the next section.

### II.3.2.2. Cointegration Tests

Cointegration is the existence of a long run equilibrium relationship among time series variables. In this study, we test for cointegration for the three groups of stock market indices by applying Johansen multivariate cointegration method.

The Johansen procedure, determines the rank of  $\pi$ . The maximum likelihood estimation used in the procedure circumvents the use of two-step estimators in the error correction method and can estimate and test for the presence of multiple cointegrating vectors. Also, this test can be used to test restricted versions of the cointegrating vectors and speed of adjustment parameters. Johansen (1988) relies on the relationship between the rank of a matrix and its characteristic roots.

The first test for the presence of cointegration is done for the first group, i.e. Indonesia, Malaysia, Philippine, Singapore and Thailand. We proceed by setting the appropriate lag-length in order to ensure the Gaussian structure of the residuals in the VECM. The lag length is one and is based on the Schwarz Information Criterion (SIC) for the selection of the correct order VAR systems. Reimers (1992) found that the SIC does well in selecting the optimal lag length.

Table 8: Multivariate Johansen cointegration tests for JCI, KLCI, STI, PCOMP and SET

Null Hypothesis	Eigenvalue	$\lambda$ Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0$ *	0.050452	83.27287	76.07	84.45
$r \leq 1$	0.037160	51.27962	53.12	60.16
$r \leq 2$	0.020933	27.87719	34.91	41.07
$r \leq 3$	0.016358	14.80335	19.96	24.60
$r \leq 4$	0.007432	4.610316	9.24	12.97

Note: \* denotes rejection of the hypothesis at 5% level

Table 8 shows the Johansen trace statistics for cointegration. The results indicate that the null hypothesis of no significant cointegrating vector cannot be rejected at the 1% significance level. However, the null hypothesis of no significant cointegrating vector is clearly rejected at the 5% significance level. In other words, there is a long-run relationship amongst stock market of Indonesia, Malaysia, Singapore, Philippine and Thailand at the 5% significance level but not at the 1% significance level.

Because of the results, we proceed to analyze two-variable, three-variable and four-variable cases. The results of the trace statistics, when considering the system of four markets of Indonesia, Singapore, Malaysia and Thailand, show the presence of one cointegrating vector at the 1% and 5% significance level. The results indicate that the null hypothesis of no significant cointegrating vector cannot be rejected at the 1% and 5% significance level. In other words, there is a long-run relationship amongst stock market of Indonesia, Malaysia, Singapore, and Thailand. The results of cointegration are shown in table 9 below.

In conclusion, we find no cointegration between the stock markets of Philippine, Indonesia, Malaysia, Singapore, and Thailand at the 1% significance level. When we exclude Philippine, the Johansen trace statistics indicate that there is a long-run relationship amongst stock markets of Indonesia, Malaysia, Singapore, and Thailand.

Table 9: Multivariate Johansen cointegration tests for JCI, KLCI, STI and SET

Null Hypothesis	Eigenvalue	$\lambda$ Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0$ **	0.047030	63.81473	53.12	60.16
$r \leq 1$	0.027739	34.04443	34.91	41.07
$r \leq 2$	0.017093	16.65977	19.96	24.60
$r \leq 3$	0.009670	6.005263	9.24	12.97

Note: \*\* denotes rejection of the hypothesis at 1% level and 5%

Therefore, we have proven that most Asian countries were financially integrated with each others.

Next, we proceed to analyze the cointegration for the second groups, i.e. the stock markets of Indonesia, the United States, Japan, Hong Kong, Korea, China and Taiwan. The lag length is also one and based on the Schwarz Information Criterion (SIC). Table 10 shows the Johansen trace statistics for cointegration. The results indicate that the null hypothesis of no significant cointegrating vector can be rejected at the 1% and 5% significance level. In other words, the null hypothesis of no significant cointegrating vector can be rejected and the alternative hypothesis of significant cointegrating vector cannot be rejected.

Table 10: Multivariate Johansen cointegration tests for JCI, INDU, NKY, HSI, KOSPI, SZCOMP, SHCOMP and TWSE

Null Hypothesis	Eigenvalue	$\lambda$ Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0$ **	0.100534	202.8158	165.58	177.20
$r \leq 1$ *	0.071059	137.3362	131.70	143.09
$r \leq 2$	0.057822	91.78312	102.14	111.01
$r \leq 3$	0.033382	54.97434	76.07	84.45
$r \leq 4$	0.023573	33.99218	53.12	60.16
$r \leq 5$	0.016284	19.24983	34.91	41.07
$r \leq 6$	0.007599	9.103479	19.96	24.60
$r \leq 7$	0.007077	4.389364	9.24	12.97

Notes:

1. \* denotes rejection of the hypothesis at 5% level
2. \*\* denotes rejection of the hypothesis at 1% and 5% level

In conclusion, the Johansen trace statistics indicate that there is a long-run relationship between stock markets of Indonesia, the United States, Japan, Hong Kong, Korea, China and Taiwan.

Next, we examine the third groups which are Indonesia, the United Kingdom, France, Germany and Netherlands. We also have selected the number of lags based on the Schwarz Information Criterion (SIC). Table 11 reports the results of the multivariate cointegration tests. The results indicate that the null hypothesis of no significant cointegrating vector can be rejected at the 1% and 5% significance level. In other words, the null hypothesis of no significant cointegrating vector can be rejected and the alternative hypothesis of significant cointegrating vector cannot be rejected.

Table 11: Multivariate Johansen cointegration tests for JCI, FTSE, DAX, CAC40 and AEX

Null Hypothesis	Eigenvalue	$\lambda$ Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
$r = 0$ **	0.055038	92.92568	76.07	84.45
$r \leq 1$ *	0.037068	57.94049	53.12	60.16
$r \leq 2$	0.028768	34.59721	34.91	41.07
$r \leq 3$	0.018258	16.55770	19.96	24.60
$r \leq 4$	0.008331	5.170119	9.24	12.97

Notes:

1. \* denotes rejection of the hypothesis at 5% level
2. \*\* denotes rejection of the hypothesis at 1% and 5% level

In conclusion, the Johansen trace statistics indicate that there is a long-run relationship between stock markets of Indonesia, the United Kingdom, Germany, France and Netherlands.

All of the results above are consistence with Tan (1998), Eun and Shim (1989), Hamao et al. (1990), Koch and Koch (1991), Roll (1992) and Kasa (1992).

### III. Conclusion

This study investigates the international linkages of the Indonesian Capital Market, that is the cointegration of Indonesia stock market with the four Asean countries stock market (Malaysia, Philippine, Singapore and Thailand), the cointegration of Indonesia stock market with United States and Asia – Pacific countries (China, Korea, Japan, Hong Kong, and Taiwan), and the cointegration of Indonesia stock market with the four West Europe countries (France, Germany, Netherlands and United Kingdom).

We have examined these issues by applying Phillips-Perron unit-root tests and the Johansen multivariate cointegration model. Phillips-Perron unit-root test indicated that all stock market indices series in our study are integrated in order one. Using cointegration method with daily data from 2005 until 2007, we have found that for ASEAN capital market, Indonesia was cointegrated with Malaysia, Singapore and Thailand. For Asia-Pacific capital market, there were a long run equilibrium relationship between Indonesia, Hong Kong, Korea, China, and Taiwan with the developed market of the United States and Japan. For European capital market, there existed long run equilibrium relationship between Indonesia, the United Kingdom, France, Germany, and Netherlands. In the long-run, they tend to move together in the same direction. These findings are in line with Tan (1998), Eun and Shim (1989), Hamao et al. (1990), Koch and Koch (1991), Roll (1992) and Kasa (1992). Generally, one might imply that all of the above countries adopt open or semi open economies. Also, a shock which temporally affect the path in one country will not necessarily affect the long-run trend in the others, unless it turns out that the shock is permanent.

Further study is needed to measure the magnitude of impact of changes of one country to the others and the determining factors such as, among others, contagious effect.

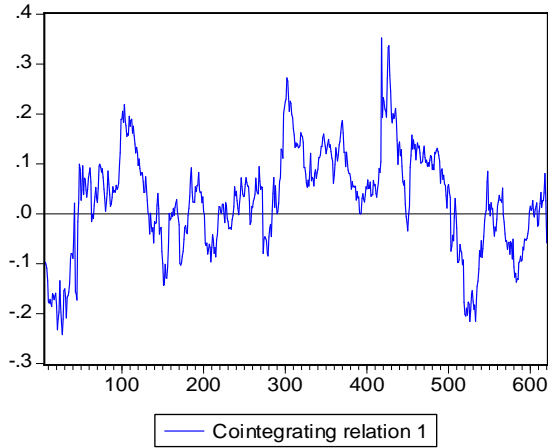
#### IV. References

1. Abimanyu, Yoopi. 2004. *Memahami Kurs Valuta Asing*. Lembaga Penerbitan Fakultas Ekonomi Indonesia.
2. \_\_\_\_\_. 2000. From Currency to Economic Crisis. In Masuyama, Seiichi, Donna Vandenbrink and Chia Siow Yue (eds). *Restoring East Asia's Dynamism*, p. 1-29. Singapore.
3. \_\_\_\_\_. 1997. *Open Economy Macroeconomics*. Unpublished Ph.D thesis, the University of Birmingham, UK.
4. Bacchetta, Philippe and Eric van Wincoop. 1998. Capital Flow to Emerging Markets: Liberalization, Overshooting, and Volatility. *National Bureau of Economic Research*. Cambridge, Massachusetts, USA.
5. Baig, Taimur and Ilan Goldfajn. 1999. Financial Market Contagion in the Asian Crisis. *IMF Working Paper*, Vol. 46 No. 2.
6. Banerjee, A., J.J. Dolado, J.W. Galbraith, and D.F. Hendry (1993), *Co-Integration, Error Correction, and the Econometric Analysis of Non-Stationary Data*; Oxford University Press.
7. Box, G.E.P., and Jenkins, G. 1976. *Time Series Analysis: Forecasting and Control*. Holden-Day. San Francisco.
8. Christiano, L.J. 1992. Searching for a break in GNP. *Journal of Business and Economic Statistics*, 10, 237-250.
9. Chu, C.S. James and Halbert White. 1992. A Direct Test for Changing Trend. *Journal of Business and Economics Statistics* 10, 289-299.
10. Dickey, D.A., and W.A. Fuller. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica* 49, 1057-1072.
11. Enders, Walter. 2004. *Applied Econometric Time Series*. 2<sup>nd</sup> Edition. New York: John Wiley and Sons, Inc.
12. Eun, C.S. and S. Shim. 1989. *International Transmission of Stock Market Movements*. *Journal of Financial and Qualitative Analysis* 24, 241-256.
13. Forbes, K. and R. Rigobon. 1999. *No Contagion, only Interdependence: Measuring Stock Market Co-movements*. NBER Working Paper 7267.
14. Fratzsher, Marcel. 1999. *What Causes Currency Crises: Sunspots, Contagion or Fundamentals*. European University Institute, San Domenico, Italy.
15. Greene, W.H. 2003. *Econometric Analysis*. Fifth Edition. Prentice Hall.
16. Hamao, Y., R. Masulis and V. Ng. 1990. Correlation in Price Changes and Volatility across International Stock Markets. *Review of Financial Studies* 3, 281-308,
17. Holden, D.R. and R.J. Perman. 1994. Unit Roots and Cointegration for the Economist in *Cointegration for the Applied Economist* by B. Bhaskara Rao, Ed. St. Martin's Press: New Yoek, 47-112.
18. Hu, Ou. December 2004. *Common and Country-Specific Components in National Stock Prices*. Department of Economics, Youngstown State University, Youngstown, OHIO, USA.

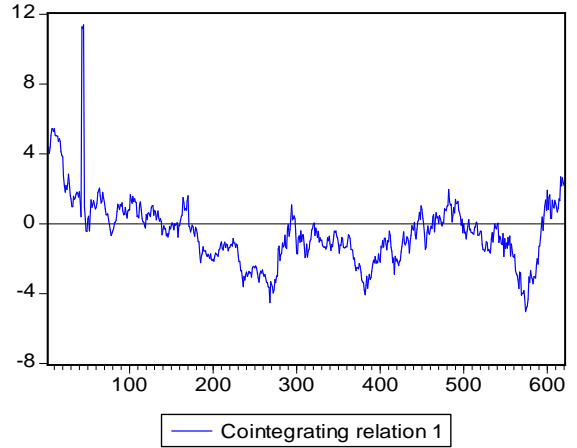
19. Indonesia Stock Exchange. “Performance of IDX in 2007 and Outlook 2008”. <http://www.idx.co.id/MainMenu/Announcement/tabid/216/lang/en-US/language/en-US/Default.aspx>. January 01<sup>st</sup>, 2008.
20. Johansen, S. 1991. Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. *Econometrica* 59, 1551-1581.
21. Kasa, K. 1992. Common Stochastic Trends in International Stock Markets. *Journal of Monetary Economics* 29, 95-124.
22. Koch, P. D. and Koch, T.W. 1991. Evolution in Dynamic Linkage across Daily National Stock Indexes. *Journal of International Money and Finance*, 10, 231-51.
23. Maddala, G.S. 2000. *Introduction to Econometrics*. Third Edition. Prentice-Hall.
24. Murinde, V. 1996. Financial Market and Endogenous Growth: An Economic Analysis for Pacific Basin Countries. In Hermes, N. and Lensink, R. (Eds). *Financial Development and Economic Growth Theory and Experiences from Developing Countries*. London, Routledge, 94-114.
25. Newey, W. K., and K. D. West (1987). “A Simple Semidefinite, Heteroscedasticity and Auto-correlation Consistent Covariance Matrix.” *Econometrica* 55, 703–708.
26. Perron, P. 1990. Testing for a Unit Root in a Time Series with a Changing Mean. *Journal of Business and Economic Statistics*, 8, 153-162.
27. \_\_\_\_\_. 1989. The Great Cash, the Oil Price Shock and the Unit Root Hypothesis. *Econometrica* 57, 1361-1401.
28. Perron. P. and T.J. Vogelsang (1992): “Nonstationarity and Level Shifts with an Application to Purchasing Power Parity”, *Journal of Business and Economic Statistics*, 10(3), 301-320.
29. Phylaktis, Kate and Fabiola Ravassolo. 2007. *Stock Market Linkages in Emerging Markets: Implications For International Portfolio Diversifications*. City University Business School, London, the United Kingdom.
30. Phylaktis, K. and Ravazzolo. 2001. Measuring Financial and Economic Integration with Equity Prices in Emerging Markets. Mimeo. City University Business School.
31. Rao, W. 1994. *Cointegration: Expository Essays for the Applied Aconomist*. Macmillan.
32. Reimers, H.E. 1992. Comparisons of Tests for Multivariate Cointegration. *Statistical Papers* 33, 335-346.
33. Roll, R. 1992. Industrial Structure and the Comparative Behavior of International Stock market Indices. *Journal of Finance* 47, 3-41.
34. Tan, J. 1998. Contagion Effect during the Asian Financial Crisis: Some Evidence from Stock Price Data. Federal Reserve Banks of San Fransisco Pacific Basin Working Paper 98-06.

V. Attachments

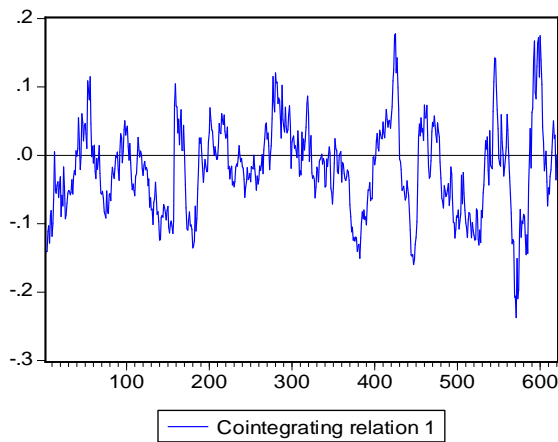
Cointegration Graphs



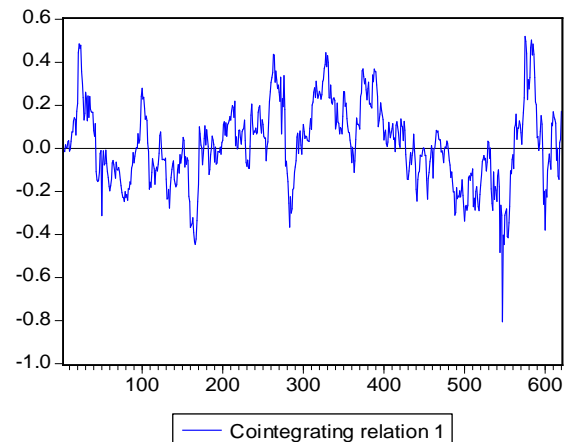
Cointegration graph for the stock markets of Indonesia, Malaysia, Singapore, Philippine and Thailand (at the 5% significance level)



Cointegration graph for the stock markets of Indonesia, Malaysia, Singapore and Thailand (at the 1% and 5% significance level)



Cointegration graph for the stock markets of Indonesia, the United States, Japan, Hong Kong, Korea, China and Taiwan (at the 1% and 5% significance level)



Cointegration graph for the stock markets of Indonesia, the United Kingdom, France, Germany and Netherlands (at the 1% and 5% significance level)