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Is There Any International Diversification Benefits in ASEAN Stock Markets?

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Abstract

This study finds that there is a common force which brings all the five ASEAN stock markets together in the long run by the nonparametric tests. This suggests that shocks from any of these five markets may spillover to the other markets in the same region. The recent Asian financial crisis bears a good testimony to this ‘contagion effect'. Subsequently, there would be no long run gain from international portfolio diversification. Specifically, investors with long run horizons may not benefit from an investment made across the countries in this ASEAN region. One possible explanation for this intra-ASEAN stock markets integration is their strong economic ties, especially intra-ASEAN trade and investment that has indirectly linked their stock indices.

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1. INTRODUCTION

One of those significant developments occurred in the ASEAN economies is the implementations of deregulation and liberalization of financial markets in this region. Specifically, in the latter half of the 1980s and early years of the 1990s, most of the governments of ASEAN gradually liberalized their stock markets, giving foreign investors the opportunity to invest in domestic securities. Singapore, however, abolished foreign exchange controls and foreign ownership regulations much earlier in 1978 (refer Table 1)[1]. On the other hand, the rapid developments of telecommunications networks have greatly facilitated the dissemination of information, hence providing easier access for domestic and international investors to these markets. All these have served to attract the flow of international portfolio investment into the emerging ASEAN stock markets, and the results have been quite dramatic, as shown by the statistics in Table 2. For example, in 1988, the flow of net private capital into the ASEAN region was only US$2165.6 million. However, it has increased to a remarkable US$57948.7 million before the Asian financial crisis hit most of the ASEAN countries in 1997.

Table 1: Liberalization of Equity Markets in ASEAN

Country	Official Liberalization Date
Indonesia	September 1989[a]
Malaysia	December 1988[a]
Philippines	June 1991[a]
Singapore	June 1978[b]
Thailand	September 1987[a]

Sources: [a] Bekaert and Harvey (2000)
[b] Exchange Arrangements and Restrictions, IMF publications

The process of financial liberalization should, at least from the theoretical point of view, bring about a more integrated market among stock markets in ASEAN and with global stock markets. Empirically, there has been increasing interest among researchers to examine the degree to which stock markets are, or are becoming integrated. In finance, markets are said to be integrated when assets of identical risk in different countries lead to a similar level of expected return. Even though the debate is still ongoing between proponents and critics of capital market liberalization (see, for example, Levine and Zervos 1998, Kawakatsu and Morey 1999, Henry 2000a, Henry 2000b, Kim and Singal 2000, Stiglitz 2000, Bekaert *et al.* 2001), it is not the intention of this paper to continue the debate on this broader issue. A more fundamental issue, at least from the perspective of investors in developed countries, is the potential benefits of diversification in these emerging ASEAN stock markets.

In modern portfolio theory, the main theme advocates investors to diversify their assets across national borders, as long as returns to stock in these other markets are less than perfectly correlated with the domestic market. For example, from the viewpoint of U.S. investors, if foreign securities do not perfectly correlate with U.S.

[1] There are different views in the literature on the opening dates of liberalization, partly because liberalization is a gradual process. Three important sources available in the literature are Bekaert and Harvey (2000), Henry (2000a) and Kim and Singal (2000). This study uses Bekaert and Harvey (2000) as the main reference. Since Singapore is not included in all the above-mentioned sources, we resort to the IMF publications.

securities, then they will benefit from international diversification. It is well established that greater diversification benefits exist the less correlated the markets are. Generally, there are two popular measures of diversification benefits: gain in expected returns and reduction in risk. However, the concept of integrated markets has strong consequences for international investors as it implies that the benefits of international portfolio diversification would disappear.

Table 2: Net Private Capital Flows to ASEAN Region, 1988-2000 (US$ Million)

	Indonesia	Malaysia	Philippines	Singapore	Thailand	ASEAN-5
1988	– 422.2	557.9	– 2.6	1681.8	350.7	2165.6
1989	1063.3	548.3	– 165.6	2899.2	1504.9	5850.1
1990	3235.3	769.8	639.2	3216.7	4380.2	12241.2
1991	3449.4	4158.7	398.1	1443.2	4994.3	14443.7
1992	4550.7	6070.0	– 769.3	3320.2	4285.2	17456.8
1993	1058.6	11260.9	3267.4	3463.7	7548.1	26598.7
1994	7745.1	8457.6	3867.8	5866.5	4456.6	30393.6
1995	11521.6	10148.7	4309.0	4274.1	10046.9	40300.3
1996	16162.5	12804.9	4988.2	10285.7	13707.4	57948.7
1997	10855.4	9342.6	4413.8	5049.1	3759.6	33420.5
1998	– 3385.2	5451.3	3594.3	7285.6	8205.7	21151.7
1999	– 8493.8	3247.4	5350.7	18724.9	3069.9	21899.1
2000	– 11209.8	3228.5	2458.8	8516.5	– 1382.8	1611.2

Source: Key Indicators of Developing Asian and Pacific Countries, Asian Development Bank.

In a selected survey of the literature, the empirical works on stock markets integration and interdependencies can be divided into two major groups. One group looked at the co-movements of stock market indices around the world, applying the correlation and cointegration tests (see, for example, Levy and Sarnat 1970, Solnik 1974, Taylor and Tonks 1989, Kasa 1992, Chung and Liu 1994, Corhay *et al.* 1995, Da Costa *et al.* 2005, Chen *et al.* 2008, Jayasuriya and Shambora 2008). The primary interest in these initial works was related to the issue of whether stock markets share long run relationship over time, which is linked to the question of international portfolio diversification benefits. The second group utilized recent developments in time series econometric literature that have permitted a more rigorous analysis to be conducted, such as cointegration tests, vector autoregression (VAR) modelling, vector error correction modelling (VECM)[2], Granger causality, variance decomposition and impulse response analysis (see, for example, Masih and Masih 1997, Masih and Masih 1999, Sheng and Tu 2000, Masih and Masih 2001, Masih and Masih 2002, Roca and Selvanathan 2001, Ratanapakorn and Sharma 2002, Shachmurove 2005). Instead of just evaluating the co-movements of stock price

[2] VECM is a VAR that incorporates cointegration restrictions. Specifically, if cointegration is found, the Granger causality, variance decomposition and impulse response analyses must be done based on error correction model, instead of a standard VAR model.

indices, this group of studies looked at both the long run and short run aspects of market linkages and to further investigate the structure of these linkages, in terms of the speed and persistence of the interaction between markets.

The main focus of the empirical research works has been the national stock markets of industrialized countries, which are considered as fundamentally established markets. Recently, the Asian stock markets are getting more attention from researchers, partly as a result of their high rates of economic growth and the 1997 Asian financial crisis. In this context, Masih and Masih (1997, 1999, 2001) have made a significant contribution to the literature, not only addressing the fundamental issue of stock markets interdependencies, but to provide further understanding of the patterns of these linkages and the nature of the propagation mechanism driving the Asian stock market fluctuations. In the work of Masih and Masih (1997), the cointegration results revealed that all the Asian Newly Industrializing Countries (NIC) of Hong Kong, Singapore, South Korea and Taiwan share long run relationship with the more established market (Japan, U.S., U.K. and Germany). Further analysis using the dynamic VECM consistently appeared to suggest the relatively leading role of all established markets in driving the fluctuations in the Asian NIC stock markets. Masih and Masih (1999) applied recent time series econometric techniques, including VECM and level VAR model due to Toda and Yamamoto (1995) to examine the long- and short-term dynamic linkages among a set of eight international stock market indices, with a particular focus on four Asian emerging stock markets: Hong Kong, Singapore, Thailand and Malaysia. In addition to the evidence of significant interdependencies among these markets, their analysis revealed the leading role of the US at the global level, while Hong Kong is the leader in the Southeast Asian region. Applying similar methodology, Masih and Masih (2001) investigated the dynamics causal linkages amongst nine major international stock indices. One interesting statistical finding that came out from their work is the growing role of the Japanese market as a long run leader in influencing the propagation mechanism driving international stock market linkages, including the emerging Asian stock markets.

The contribution of other researchers to the body of empirical literature involving Asian stock markets should not be neglected. Bilson *et al.* (2000) found that the regional integration among stock markets in Malaysia, the Philippines, South Korea, Taiwan and Thailand is faster than their integration with the global markets. Roca and Selvanathan (2001) analyzed the price linkages between the equity markets of Australia and Hong Kong, Singapore and Taiwan. Using cointegration test, Granger causality, variance decomposition and impulse response analyses, they found that there is no significant short-term and long-term linkage between the equity markets of Australia and the three little dragons. Regional stock market linkages, in the context of Asian financial crisis, have been empirically investigated by Ratanapakorn and Sharma (2002). The authors investigated both the short run and long run relationships among stock indices of the U.S., Europe, Asia, Latin America, and Eastern Europe-Middle East for the pre-Asian crisis and for the crisis period. Their results showed that the five regional composite stock indices share common stochastic trends only during the crisis period, but no such long run relationship is observed in the pre-crisis period. As for short run relationship, their analyses indicated stronger interactions between regional markets during the Asian crisis than during the pre-Asian crisis period.

It appears that an impasse has been reached in the empirical literature of stock markets integration employing time series techniques. In both group of studies, the Johansen cointegration test has been widely employed, either addressing the issue of long run relationship among stock markets, or proceed to examine the dynamics of these linkages. This popular cointegration test is built on the basis of linear autoregressive model and implicitly assumes that the underlying dynamics are in linear form or can be made linear by a simple transformation. However, there is ample empirical evidence against the linear paradigm. Theoretically, there is no reason to believe that economic systems must be intrinsically linear (see, for example, Pesaran and Potter 1993, Campbell *et al.* 1997, Barnett and Serletis 2000). Empirically, there are a great number of studies showing that financial time series exhibit non-linear dependencies (see, for example, Hsieh 1989, Hsieh 1991, Scheinkman and LeBaron 1989, De Grauwe *et al.* 1993, Abhyankar *et al.* 1995, Abhyankar *et al.* 1997, Steurer 1995, Brooks 1996, Barkoulas and Travlos 1998, Opong *et al.* 1999).

Over the past few decades, numerous studies have documented the existence of non-linear dependencies in stock returns series (see, for example, Scheinkman and LeBaron 1989, Hsieh 1991, Abhyankar *et al.* 1995, Abhyankar *et al.* 1997, Barkoulas and Travlos 1998, Opong *et al.* 1999). Many researchers started asking themselves to what extent one should trust the results of linear methods like the conventional cointegration tests if the underlying data generating process is non-linear. The Monte Carlo simulation evidence in Bierens (1997) indicated that the standard Johansen cointegration framework presents a mis-specification problem when the true nature of the adjustment process is non-linear and the speed of adjustment varies with the magnitude of the disequilibrium. The work of Balke and Fomby (1997) suggested a potential loss of power in standard cointegration tests under threshold autoregressive data generating process.

Motivated by the above consideration, this study uses the non-parametric cointegration test recently proposed by Bierens (1997) to re-examine the issue of stock markets integration, with a particular focus on the long run relationship[3]. Similar methodology has been employed by Kanas (1998) to examine the linkages between the U.S. and European stock markets. Generally, this non-parametric test is in the same spirit with Johansen and Juselius (1990) approach. The test statistics involved in both approaches are obtained from the solutions of a generalized eigenvalue problem, but in the Bierens' approach a data generating process does not need to be specified and thus this test is completely non-parametric. Therefore, in principle, both approaches should generate a similar outcome. However, the Bierens's method is selected in this study due to its potential superiority at detecting cointegration when the error correction mechanism is non-linear. This is supported by the empirical works of Ma and Kanas (2000) and Coakley and Fuertes (2001), which attributed the discrepancy between the results of Johansen and Bierens approach to the presence of non-linearity.

[3] The limitation of the Bierens (1997) approach should not be ignored. This non-parametric test does not permit us to proceed to examine the dynamics of these linkages. Bierens (1997) acknowledged that Johansen's method may provide additional information on the presence of linear trends in the cointegrating relation(s) and can also be employed in innovation response analysis and forecasting.

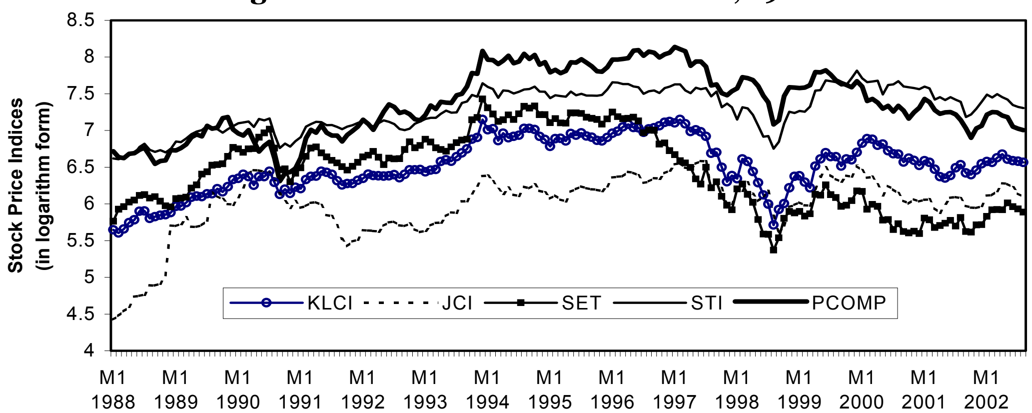
This paper is organized as follows. Following this introduction, a brief description on the methodology used in this study is given. This is followed in Section III by a discussion on the empirical results. Concluding remarks are given at the end of the paper.

2. METHODOLOGY

2.1 Data

This study employs monthly stock price indices from 1988M1 to 2002M8 for five major ASEAN stock markets, namely Jakarta Composite Index (JCI), Kuala Lumpur Composite Index (KLCI), Philippines Composite Price (PCOMP), Strait Times Index (STI) and Stock Exchange of Thailand (SET). All the data are collected from Kuala Lumpur Stock Exchange (KLSE). The indices are denominated in local currency units. Prior to the analysis, all stock price indices are transformed into logarithm form, and the graphical depiction is provided in Figure 1.

Figure 1: ASEAN Stock Price Indices, 1988-2002



Source: Kuala Lumpur Stock Exchange

2.2 Bierens's (1997) Non-parametric Cointegration Test

The Bierens non-parametric cointegration test considers the general framework as:

$$z_t = \pi_0 + \pi_1 t + y_t \tag{1}$$

where $\pi_0 (q \times 1)$ and $\pi_1 (q \times 1)$ are optimal mean and trend terms, and y_t is a zero-mean unobservable process such that Δy_t is stationary and ergodic. The general framework assumes that z_t is observable q-variate process for $t = 0, 1, 2, \ldots, n$.

Apart from some mild regularity conditions, or estimation of structural and/or nuisance parameters, further specification of the data-generating process for y_t are not required and thus this test is completely non-parametric.

The Bierens' method is based on the generalized eigenvalues of matrices A_m and $\left(B_m + n^{-2} A_m^{-1}\right)$, where A_m and B_m are defined in the following matrices:

$$A_m = \frac{8\pi^2}{n}\sum_{k=1}^{m} k^2 \left(\frac{1}{n}\sum_{t=1}^{n}\cos\left(2k\pi\left(t-0.5\right)/n\right)z_t\right)\times\left(\frac{1}{n}\sum_{t=1}^{n}\cos\left(2k\pi\left(t-0.5\right)/n\right)z_t\right)'$$

$$B_m = 2n\sum_{k=1}^{m}\left(\frac{1}{n}\sum_{t=1}^{n}\cos\left(2k\pi\left(t-0.5\right)/n\right)\Delta z_t\right)\times\left(\frac{1}{n}\sum_{t=1}^{n}\cos\left(2k\pi\left(t-0.5\right)/n\right)\Delta z_t\right)' \qquad (2)$$

which are computed as sums of outer-products of weighted means of z_t and Δz_t, and n is the sample size. To ensure invariance of the test statistics to drift terms, the weight functions of $\cos(2k\pi(t-0.5)/n)$ is recommended here. Note that the condition $m \geq q$ must be satisfied and the optimal value of m can be chosen based on Table 1 of Bierens (1997).

Similar to the properties of the Johansen and Juselius likelihood ratio method, the ordered generalized eigenvalues of this non-parametric method are obtained as solution of the problem det[$P_n - \lambda Q_n$] = 0 when the pair of random matrices $P_n = A_m$ and $Q_n = \left(B_m + n^{-2}A_m^{-1}\right)$ are defined. Thus it can be used for testing hypotheses about the cointegration rank r.

To estimate r, two test statistics are proposed by Bierens (1997). First, Bierens (1997) derives the 'lambda-min' ($\lambda_{\min}$), $\hat{\lambda}_{n-r_0,m}$ which corresponds to the Johansen's maximum likelihood test to test for the null hypothesis of $H_o(r)$ against the alternative hypothesis of $H_1(r+1)$ and tabulates the critical values for this test.

Second, Bierens' approach also provides the $g_m(r)$ which is computed from the Bierens's generalized eigenvalues:

$$\begin{aligned}
\hat{g}_m(r) &= \left(\prod_{k=1}^{q}\hat{\lambda}_{k,m}\right)^{-1} && \text{if } r = 0,\\
&= \left(\prod_{k=1}^{q-r}\hat{\lambda}_{k,m}\right)^{-1}\left(n^{2r}\prod_{k=q-r+1}^{q}\hat{\lambda}_{k,m}\right) && \text{if } r = 1, \ldots\ldots, q-1,\\
&= n^{2q}\prod_{k=1}^{q}\hat{\lambda}_{k,m} && \text{if } r = q \qquad (3)
\end{aligned}$$

where m is chosen from Table 1 of Bierens (1997) for $r < q$, and $m = q$ is chosen when $r = q$. It is noted in Bierens (1997) $\hat{g}_m(r)$ converges in probability to infinity if the true number of cointegrating vector is unequal to r, and $\hat{g}_m(r) = O_p(1)$ if the true number of cointegrating vector is equal to r. Therefore, we have $\lim_{\lim n\to\infty} P(\hat{r}_m = r) = 1$, when $\hat{r}_m = \arg\min_{0\leq r\leq 1}\{\hat{g}_m(r)\}$. Thus, this test statistic is useful as a tool to double-check on the determination of r.

Finally, a linear restriction on the cointegrating vectors is needed because not all of the series will enter the cointegrating vector system. To address this issue, Bierens (1997) proposed the trace and lambda-max statistics. The critical values of trace (m =

$2q$, $F_k(x) = \cos(2k\pi x)$) and lambda-max tests ($m = 2q$, $F_k(x) = \cos(2k\pi x)$) are given in Bierens (1997, Tables 3 and 4).

3. EMPIRICAL RESULTS

In this section, three types of empirical testing are conducted, namely unit root tests, Bierens's (1997) nonparametric cointegration test and finally the test of restriction. The unit root tests serve as preliminary step to determine the order of integration for each of these stock price indices. It is important to determine the characteristics of the individual series before conducting the cointegration analysis. This is due to the fact that only variables of the same order of integration may constitute a potential cointegration relationship. Following this, we proceed with the Bierens's non-parametric cointegration test to examine the long run relationship among the five ASEAN stock markets. If these markets are cointegrated, further investigation is needed to determine which of the price index will enter the cointegrating vector system. This can be done by imposing the restriction test on each of the cointegrating parameter.

3.1 Unit Root Tests

To test the order of integration for each of the five ASEAN stock price indices, we use the non-parametric PP ρ-test (Phillips and Perron 1988) and KPSS test (Kwiatkowski *et al.*, 1992). The null hypothesis for PP test is non-stationarity. To avoid the problem of size distortion, the p-value of the test is presented after 1000 simulations based on the basis of a Gaussian AR(p) model.

It is widely acknowledged that the PP test is not very informative in distinguishing between a unit root and a near unit root case. To complement the PP test, we also employ the KPSS test proposed by Kwiatkowski *et al.* (1992). The KPSS test assumes that the null is stationary against the alternative that the variable does have a unit root. We present the value of the test for both cases- null hypotheses of level stationarity and trend stationarity. These values are determined by the lag truncation parameter, l. In this study, we follow the suggestion of Kwiatkowski *et al.* (1992) by setting at most $l = 8$.

The unit root tests results are presented in Table 3, Table 4 and Table 5 respectively. Both the PP and KPSS tests show that each of these stock price indices is a non-stationary process in level form but attain stationary in their first difference. Specifically, the PP test statistics are able to reject the null hypothesis at 1% significance level for all series in first-difference form. Similarly, the KPSS test values fail to reject the null hypothesis at 5% significance level, when the series are in their first-difference. Putting all these results into perspective, all the indices are integrated of the same order one or $I(1)$, and permit us to proceed with the non-parametric cointegration test.

Table 3: PP Unit Root Test Results

	Level	First-difference
JCI	– 13.450 (0.031)	– 147.796 (0.000)[a]
KLCI	– 8.740 (0.147)	– 153.793 (0.000)[a]
PCOMP	– 4.487 (0.444)	– 121.454 (0.000)[a]
STI	– 8.046 (0.182)	– 149.491 (0.001)
SET	– 4.862 (0.410)	– 159.973 (0.000)[a]

Note: Values in parentheses are *p*-values. Superscript (a) denotes very small *p*-value.

Table 4: KPSS Unit Root Test Results (Series in Level)

	Lag truncation parameter							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
H_0: Level Stationarity								
JCI	2.845	1.960	1.517	1.252	1.075	0.950	0.857	0.785
KLCI	2.816	1.915	1.465	1.195	1.015	0.886	0.788	0.712
PCOMP	3.418	2.310	1.755	1.422	1.200	1.041	0.921	0.828
STI	4.830	3.283	2.510	2.047	1.737	1.516	1.350	1.220
SET	3.212	2.165	1.641	1.326	1.116	0.965	0.852	0.764
H_0: Trend Stationarity								
JCI	0.634	0.438	0.341	0.282	0.2429	0.215	0.195	0.179
KLCI	1.376	0.936	0.717	0.586	0.4983	0.435	0.388	0.351
PCOMP	1.763	1.196	0.912	0.742	0.6276	0.546	0.485	0.437
STI	0.903	0.622	0.482	0.398	0.3420	0.302	0.272	0.249
SET	1.654	1.119	0.852	0.691	0.5838	0.507	0.449	0.404

Note: 0.463 is 5% critical value for the null of level stationarity. However, 0.146 is 5% critical value for the null of trend stationarity.

Table 5: KPSS Unit Root Test Results (Series in First-Difference)

	Lag truncation parameter							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
H_0: Level Stationarity								
JCI	0.312	0.304	0.304	0.307	0.308	0.305	0.303	0.295
KLCI	0.205	0.182	0.183	0.192	0.202	0.214	0.214	0.213
PCOMP	0.237	0.229	0.231	0.237	0.243	0.257	0.268	0.271
STI	0.150	0.140	0.142	0.146	0.150	0.155	0.156	0.154
SET	0.325	0.300	0.296	0.308	0.327	0.344	0.347	0.348
H_0: Trend Stationarity								
JCI	0.079	0.078	0.079	0.080	0.082	0.082	0.083	0.081
KLCI	0.047	0.042	0.043	0.045	0.048	0.052	0.052	0.052
PCOMP	0.046	0.045	0.046	0.048	0.049	0.053	0.056	0.057
STI	0.031	0.029	0.030	0.031	0.032	0.033	0.034	0.033
SET	0.087	0.082	0.081	0.0853	0.092	0.098	0.100	0.102

Note: 0.463 is 5% critical value for the null of level stationarity. However, 0.146 is 5% critical value for the null of trend stationarity.

3.2 Testing for Cointegration and Restriction Test

In this section, we employ the Bierens's (1997) non-parametric cointegration test to determine whether the five ASEAN stock price indices are cointegrated. This method uses both the $\lambda_{\min}$ and $g_m(r_0)$ statistics to determine the cointegrating rank r. The results from Table 6 show that the $\lambda_{\min}$ statistic is able to reject the null hypothesis of r = 0, but not for the case when the null hypothesis is r = 1. This implies that there exists at most a single cointegrating vector among the five ASEAN stock markets. The findings is further supported by the $g_m(r_0)$ statistics given in Table 7, in which the smallest value (2.588×10^2) appears in the cointegrating rank of r = 1. With this evidence of one cointegrating vector, we can interpret it as the existence of long run relationship among these ASEAN stock markets.

Table 6: Bierens's Non-parametric Cointegration Test Results ($\lambda_{\min}$ statistics)

Hypotheses		
H₀	**H_A**	**λmin**
$r = 0$	$r = 1$	0.005*
$r = 1$	$r = 2$	0.118
$r = 2$	$r = 3$	0.263
$r = 3$	$r = 4$	2.545
$r = 4$	$r = 5$	9.781

Note: * denotes significant at 10% level.

Table 7:Bierens's Non-parametric Cointegration Test Results ($g_m(r_0)$ statistics)

Cointegration rank (r)	$g_m(r_0)$
$r_0 = 0$	3.0329×10^2
$r_0 = 1$	$\mathbf{2.588} \times 10^2$
$r_0 = 2$	1.186×10^5
$r_0 = 3$	2.166×10^9
$r_0 = 4$	3.972×10^{14}
$r_0 = 5$	8.882×10^{19}

Although cointegration exists among the five ASEAN stock markets, not all of them will enter the cointegrating vector system. To address this issue, we perform test of restriction on each of the cointegrating parameter. The lambda-max statistics proposed by Bierens (1997) are reported here to determine the rejection of the null hypothesis. The results in Table 8 clearly indicate that all the statistics reported are able to reject the null hypothesis that the cointegrating parameter equal to zero, at the conventional 5% level of significance. Thus, it can be concluded that all the five ASEAN stock markets belong to the cointegrating system.

Table 8: Test of Restriction on Each Stock Market

Hypotheses	Lambda-max statistics (H_0: $\beta' = 0$)
$\beta^{JCI} = 0$	5.770**
$\beta^{KLCI} = 0$	56.360**
$\beta^{PCOMP} = 0$	5.850**
$\beta^{STI} = 0$	57.820**
$\beta^{SET} = 0$	5.450**

Note: ** denotes significant at 5% level.

To summarize, results from both the non-parametric cointegration and restriction test reveal the tendency of the ASEAN stock markets to move together in the long run. In this case, the shocks from any of these five markets may spillover to the other markets in the same region. The recent Asian financial crisis bears a good testimony to this 'contagion effect'. Therefore, international investors who are looking for portfolio diversification benefits should be aware of these closely linked markets. More importantly, the results address the fundamental issue of whether there exist potential diversification benefits in these emerging ASEAN stock markets. With a more robust test, the Bierens's (1997) non-parametric cointegration test, this study provides evidence suggesting that there would be no long run gain from portfolio diversification. Specifically, investors with long run horizons may not benefit from an investment made across the countries in this ASEAN region.

4. CONCLUDING REMARKS

Even though an impasse has been reached in the empirical literature of stock markets integration employing time series techniques, the contribution of this study is methodological. In most of these earlier studies, the Johansen cointegration technique, which is built on the basis of linear autoregressive model, has been widely employed. With abounding evidence supporting the presence of non-linearity in stock returns series, coupled with theoretical and empirical works suggesting a potential loss in standard Johansen method if the underlying data generating process is non-linear in nature (see, for example, Bierens 1997, Balke and Fomby 1997, Ma and Kanas 2000, Coakley and Fuertes 2001), this study re-examines the issue of stock markets integration using a more robust test. Specifically, the Bierens's (1997) non-parametric cointegration test is selected in views of its potential superiority over standard linear Johansen and Juselius (1990) method at detecting cointegration when the data generating process is non-linear.

The results from the Bierens's test indicate that there is a common force which brings these ASEAN stock markets together in the long run. Since these markets are interdependent and highly integrated, they will act as if they are constituents of one integrated market (Masih and Masih 1999). This suggests that the benefits of any diversification are limited within the region. Thus, investors with long run horizons may not benefit from an investment made across the countries in this ASEAN region. It is important to take note that there is also an element of risk in integrated financial markets, where the shocks from any of these five markets may spillover to the other markets in the same region. The recent Asian financial crisis is a good testimony to this 'contagion effect'.

However, we do not in any way attribute these results to the effort of financial liberalization undertaken by these ASEAN governments. Though, in theory, the process of financial liberalization should bring about a more integrated market, our analysis does not address this issue as our sample period covers both the pre- and post- liberalization period. In fact, there are many other reasons that can induce such a long run relationship among stock markets. One possible explanation for this intra-ASEAN stock markets integration is their strong economic ties, especially intra-ASEAN trade and investment that has indirectly linked their stock indices. Phylaktis and Ravazzolo (2002) pointed out that economic integration between countries might provide a channel for linking stock markets even in the presence of foreign exchange controls. Specifically, economic integration between countries implies a co-movement in their output, corporate earnings and consequently in their stock markets. There are other reasons that have been postulated in the literature to explain the increasing stock markets interdependencies (see, for example, Dickinson 2000, Masih and Masih 2001, Heimonen 2002). We strongly believe that future research is warranted to shed more light on the underlying forces generating these intra-ASEAN stock market linkages.

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