2012 2nd International Conference on Economics, Trade and Development
IPEDR vol.36 (2012) © (2012) IACSIT Press, Singapore

Long Run Relationship among the Southeast Asian Equity Markets

Tran Phuong Thao[1†] and Kevin Daly [1]

Department of Economics and Finance, University of Western Sydney, Sydney, Australia

Abstract. This paper investigates the long-run relationship among six equity markets in the Southeast Asian region, namely Thailand, Malaysia, Singapore, Philippines, Indonesia and Vietnam using daily market indices collected over the period 2006 - 2010. Three testing methods used in the paper include; bivariate co-integration test based on residuals; multivariate co-integration test based on vector autoregressive (VAR) model and co-integration tests with the presence of structural breaks. The objective of the research was to uncover the latest empirical evidence from a study of the long run relationships amongst the equity markets of South East Asia with a view to understanding the probable impact of the recent Global Financial Crisis on those markets. The results reveal evidence for the existence of a number of long-run relationships among several markets, for example there is evidence of a long run relationship between the markets of Thailand and Indonesia and between Philippine and Malaysia; however the study found no evidence of co-integration in the case of Vietnam's equity market and the other markets of South East Asia. The results have implications for investors in these markets in terms of diversification of risks and returns where shocks to any one market may or may not have a contagious effect on other markets in the region.

Keywords: Equity market linkage, long run relationship, global financial crisis, South East Asian markets

1. Introduction Instanteous

This paper examines the long run relationships between the emerging equity markets of Southeast Asia over the period 2006 – 2010. The objective of this study is to investigate whether the pronounced benefits of portfolio diversification namely a reduction in risk and increase in expected returns has changed over the long run for investors aross these markets. The advantages of portfolio diversification arise from the low correlations across equity market returns which inpart are casued by factors such as barriers to international trade and investments, poor quality of information on foreign equity markets or simply home investor bias. Given that significant changes have occurred across Asian equity markets since the Asian financial crash and the more recent Global Financial crisis(GFC) it appears timely to investigate whether the relationships between these markets has changed over these major crises. The 2007 global financial crisis has been documented as one of the most severe crises due to its overwhelming negative impact on equities, real estate, foreign exchange and capital markets [1, 2, 3]. A study by Bartram and Bodnar [3] show that the GFC created the conditions for the current credit crisis with an increased risk premia been imposed on lending across the global banking sector. The crisis had an almost instantaneouse negative impact on equity markets with emerging equity markets been particularly impacted, and some developed countries in Europe such as Greece, Ireland, Portugal, Italy and Iceland seeking emergency assistances from the International Monetary Fund to restore their banking sectors.

Equity market integration todate has been researched during the aftermath of the Asian Financial crises [5, 6, 7]; rather than the GFC.This paper attempts to answer the following questions: Firstly, has the long run relationships across Asian Equity markets changed since 2007? Secondly what does the dynamic relationships between markets over the period indicate? Thirdly has the return and volatility transmission process between these Southeast Asian markets changed over the period? Hence, this paper aims to investigate the linkages among equity markets in the South East Asian region before during and after the GFC. The paper is organized as follow. Section 1 provides an introduction. Section 2 discusses previous

† Corresponding author.
Email address: tranthao@ueh.edu.vn

research. Section 3 describes methodology and data collection. Section 4 summarized findings and discussions. Section 5 concludes the paper.

2. Previous Research

Equity market linkages are examined in a number of studies such as Lucey and Voronkova [8], Huyghebaert and Wang [9], and Cheung et al., [10], however, findings among the studies are mixed and inconclusive. In fact, while some studies show that relationships among markets are likely to have significant effects on neighboring or regional markets, other studies find contradictory results. Chen, Firth and Rui [11], for example, use data from 1995 to 2000 to examine the stock market co-integration of six countries in Latin America, namely Argentina, Brazil, Chile, Colombia, Mexico, and Venezuela, and they find long-term equilibrium relationship among markets. The existence of co-integration is explained by the fact that Latin American countries have adopted several deregulations, privatization plans and trade alliances. Another study by Huang, Yang and Hu [2] investigates the co-integration with an emphasis on structural breaks caused by the Asian financial crisis and finds no supporting evidence for the notion of co-integrating relationships amongst the markets of the China Growth Triangle, including Hong Kong, Shanghai, Taiwan and Shenzhen markets despite their intensified intra-regional trades.

Equity market linkages amongst the markets of South East have been conducted in several studies [9, 13, 14]. The study by Huyghebaert and Wang [9], for instance, investigates the integration among seven major East Asia stock market from July 1, 1992 to June 30, 2003. The results show that the 1997 – 1998 Asian financial crises did not enhance the co-movement of stock market in East Asia. However, due to different characteristics between the two crises, the GFC might be expected to cause some changes to the linkages amongst Southeast Asian equity markets. To contribute to the above literature this paper aims to investigate the long-term relationships among six countries in the Southeast Asian region, including Malaysia, Singapore, Thailand, Indonesia, the Philippines and Vietnam under impacts of the GFC. The paper fills a gap in the literature amongst emerging markets by examining the impacts of the GFC on the emerging markets of South East Asia, and moreover, it extends previous studies by including the Vietnamese equity market in the sample.

3. Methodology and Data Collection

In the paper, long-run relationships among equity markets in the South East Asian region are examined by employing unit root tests, bivariate and multivariate co-integration tests, and co-integration tests with a present of structural break. Particularly, unit root tests are firstly employed to examine stationary of time series variables. Both Augmented Dickey Fuller test [15] and Phillip Perron [16] test are used in the paper. Next, co-integration techniques including bivariate method suggested by Engle and Granger [17] and multivariate method suggested by Johansen [18, 19] are performed to analyze co-integration among markets. However, as discussed by Gregory and Hansen [12], the power of co-integration test is reduced if a break in the relationship occurs; therefore, co-integration tests allowing for breaks in the co-integration relationship proposed by Gregory and Hansen [12] are employed in the paper.

The study uses daily MSCI market indices of Bursa Malaysia Stock Exchange (KLCI), Singapore Stock Exchange (STI), Bangkok Stock Exchange (SET), Indonesia Stock Exchange (IDX), Philippine Stock Exchange (PSE) and Ho Chi Minh Stock Exchange (VSE) collected on DataStream from the 30 November 2006 to the end of 2010. The rationality for choosing data set is based on the availability of data on the source. Both the logarithm of market indices and the different of logarithm of market indices (market returns) are examined. Details on characteristics of the stock market indices are shown in Table 1.

Table 1: Characteristics of the logarithm of stock market indices

	L_IND	L_ML	L_PP	L_SG	L_TL	L_VN
Mean	6.275293	5.804426	5.581378	8.116806	5.374519	6.410096
Median	6.361953	5.847199	5.606963	8.185175	5.405956	6.290741
Skewness	-0.9256	-0.72465	-0.62402	-1.30746	-0.7086	0.422543

Kurtosis	3.273664	2.736779	2.676834	3.782058	3.120905	2.237634
Jarque-Bera	155.6871	96.46441	73.89132	331.188	89.94296	57.59012

A simple test to investigate co-movements between stock markets is to consider co-relation coefficients. The results in Table 2 show high correlation coefficients among the markets except for Vietnam. The highest correlation is found in the relationship between Thailand and Malaysia and the lowest relationship is between the Vietnam and Indonesia. However, these measures are not adequate to support for the long-run relationship among the markets [20].

Table 2: Correlations of market indices

	Indonesia	Malaysia	Philippine	Singapore	Thailand	Vietnam
Indonesia	1	0.928	0.823	0.838	0.944	0.258
Malaysia	0.928	1	0.940	0.913	0.954	0.466
Philippines	0.823	0.940	1	0.925	0.892	0.670
Singapore	0.838	0.913	0.925	1	0.907	0.647
Thailand	0.944	0.954	0.892	0.907	1	0.371
Vietnam	0.258	0.466	0.67	0.647	0.371	1

4. The results of Hypotheses Testing.

4.1. Unit Root Tests

The unit root tests are used to test for stationary of variables, and both Augmented Dickey Fuller test (ADF) and Phillip Perron test (PP) are examined in the paper. According to the results of unit root test shown in Table 3, no evidence on unit root or stationary in the first level of differences of the market indices. Therefore, the results support for the stationary of markets in order 1.

Table 3: Augmented Dickey and Fuller unit root tests for the logarithm of stock indices and the first difference of logarithm of stock indices (trend and intercept)

		ADF test		PP test	
Index	Variable	Level	1st difference	Level	1st difference
Indonesia	L_ID	-1.027 (1)	-28.480 (0)	-1.333 (0)	-17.303 (0)
Malaysia	L_ML	-0.817 (1)	-29.200 (0)	-2.456 (0)	-16.760 (0)
Philippines	L_PP	-1.308 (1)	-28.683 (0)	-2.364 (0)	-16.749 (0)
Singapore	l_SG	-1.055 (0)	-32.403 (0)	-2.533 (0)	-18.370 (0)
Thailand	l_TL	-0.684 (0)	-33.389 (0)	-1.243 (0)	-20.486 (0)
Vietnam	l_VN	-1.441 (4)	-13.096 (3)	-1.222 (1)	-13.232 (0)

*, ** Denotes rejection of null hypothesis at 5% and 1% significant level. Figure in parentheses give the lag length based on Schwarz Info Criterion and Newey-West Bandwidth, respectively.

4.2. Co-Integration Tests

Co-integration tests are examined to investigate the relationship among equity markets. The first test, bivariate co-integration tests suggested by Engle and Granger [17], are carried out among a pair of markets. Then, the second test, multivariate co-integration suggested by Johansen [19], examine whether any vector of co-integration relationship exists among markets.

The table 4 displays findings on bivariate relationship among markets in the region. The results reveal some evidence on bi-direction relationship on the relationship between Indonesia and Thailand's market and Malaysia and Philippine's market. Mono-direction relationships are found in the equity markets of Philippine to Thailand; Thailand to Malaysia, Singapore to Philippine, and Malaysia to Thailand.

Table 4: P-value of bivariate co-integration test results between markets

	Indonesia	Malaysia	Philippine	Singapore	Thailand	Vietnam
Indonesia		0.172	0.535	0.687	0.016*	0.901
Malaysia	0.187		0.076**	0.325	0.001*	0.943

Philippine	0.459	0.024*		0.071	0.069**	0.532
Singapore	0.628	0.265	0.087**		0.214	0.731
Thailand	0.016*	0.001*	0.182	0.249		0.931
Vietnam	0.826	0.849	0.691	0.703	0.814	

*, ** denote rejection of the hypothesis at the 5% and 10%.

In the second co-integration test, multivariate method, the order of the Vector Autoregressive Model (VAR) should be determined by either the Akaike Information Criteria (AIC) or the Schwarz Information Criteria (SIC). The SIC is selected in the paper and reported in Table 5. The result shows that 2 lag lengths are chosen for the equity market indices in the sample. Both the Trace and Max – Eigen value indicate a rejection of the null hypothesis of no co-integration; however, due to space limitation, only results of Trace tests are reported in the paper. The results show evidence of one co-integrating vector found among the markets. This result supports for the previous test on bivariate relationship that there is existence of co-integration relationship among the Southeast Asian equity markets.

Table 5: Akaike Information Criteria by Rank (rows) and Model (columns)

0	-33.06777	-33.06777	-33.05803	-33.05803	-33.04810
1	-33.08129	-33.08409	-33.07617	-33.07429	-33.06582
2	-33.08032	-33.08568*	-33.07964	-33.07675	-33.06980
3	-33.07252	-33.07652	-33.07195	-33.07488	-33.06981
4	-33.05617	-33.06639	-33.06367	-33.06497	-33.06146
5	-33.03652	-33.04490	-33.04314	-33.05009	-33.04841
6	-33.01400	-33.02175	-33.02175	-33.02686	-33.02686

4.3. Co-Integration Tests with the Present of a Structural Break

Based on the method of Zivot and Andrew [21], the paper determines a break date on the equity market data, and a break is found on February 12th, 2008. Details of the breaking date results are not reported in the paper

Table 6: Multivariate co-integration results

Series: L_IND L_ML L_PP L_SG L_TL L_VN
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.042948	115.0657	95.75366	0.0012
At most 1	0.029763	68.35865	69.81889	0.0650
At most 2	0.016176	36.21036	47.85613	0.3858
At most 3	0.014447	18.85805	29.79707	0.5032
At most 4	0.001919	3.374622	15.49471	0.9473
At most 5	0.001250	1.331192	3.841466	0.2486

* denotes rejection of the hypothesis at the 5%. The trace critical value at 5% is 15.49 and 14.26, respectively.

Based on the results of Zivot and Andrew tests, the Gregory and Hansen co-integration method is performed. Table 7 shows some different results between the Gregory and Hansen tests compared to the Engle and Granger tests discussed in Table 4. The results of Gregory and Hansen tests support a bi-direction linkage between the equity indices of Indonesia and Thailand, Singapore and Philippine, and Malaysia and Thailand but appear to indicate no such linkages between the Philippine and Malaysian markets. In addition, another mono-direction relationship is found between the Indonesia and Malaysia market. It is noteworthy that no pair wise co-integration relationship is found in the case of the Vietnam's equity market. It could be explained by the fact that the Vietnam's equity market is fairly new and young compared to regional markets, and moreover, it is likely to be isolated from other markets because of strict regulations imposed by the Government.

The empirical results of the paper, to a certain extent, improve findings in the study by Daly [5] who found little evidence in support of co-integration relationship in the Southeast Asian markets since the October 1987 crisis period. On the other hand, they are supported by Click and Plummer [6] who found

evidence of a co-integrating vector among five Asian stock markets in the period after the Asian financial crisis. It may be concluded that benefits of international portfolio diversification across equity markets in the region are reduced but not eliminated.

Table 7: Results of co-integration tests with the present of a structural break

Independent Dependent	Indonesia	Malaysia	Philippine	Singapore	Thailand	Vietnam
Indonesia		0.063*	0.319	0.407	0.004*	0.756
Malaysia	0.061**		0.029*	0.186	0.001*	
Philippine	0.244	0.019		0.031*	0.026*	0.396
Singapore	0.441	0.152	0.037*		0.108	0.516
Thailand	0.053**	0.000*	0.101	0.142		0.832
Vietnam	0.710	0.749	0.437	0.495	0.716	

*, ** denote rejection of the hypothesis at the 5% and 10%.

5. Summary and Conclusion

In summary the evidence from performing a battery of co-integration tests indicates that a number of long-run relationships are found amongst the six equity market indices of Indonesia, Malaysia, Thailand, Singapore, Malaysia and Vietnam. The empirical findings support a bi-directional relationship between Thailand and Indonesia's market in both pair-wise co-integration tests with and without the presence of a structural break. Other relationships between the markets of the Philippines, Malaysia, Singapore, Indonesia and Thailand change from one-directional relationship to bi-directional relationship in some cases and vice versa in other cases. It is noteworthy that no pair wise co-integrating relationship is found in the case of the Vietnam's equity market. This result may be explained by the fact that the Vietnam's equity market is fairly new and young compared to the other regional markets in this study; moreover, the Vietnam equity market appears to be isolated from the other markets because of strict regulations imposed by the Government. The relaxation of restrictions on foreign exchange and capital flows may induce foreign investors to enter the Vietnamese equity market and father strengthen capital market linkages with neighboring markets. Finally, the empirical findings of the paper have important implications for investors who want to diversify their investment portfolios across the Southeast Asian equity markets. The paper, however, focuses only on co-integration i.e. long-run relationships, further studies taking account of correlation, causality and contagion may provide some further interesting results relating to the degree of integration amongst the equity markets of Southeast Asia.

6. References

[1] H. H. AuYong, C. Gan, and S. Treepongkaruna, "Cointegration and causality in the Asian and emerging foreign exchange markets: Evidence from the 1990s financial crises". International Review of Financial Analysis, vol 13, pp. 479-515, 2004.

[2] B.-N. Huang, C.-W. Yang, and J. W.-S. Hu, "Causality and cointegration of stock markets among the United States, Japan and the South China Growth Triangle". International Review of Financial Analysis, vol 9, pp. 281-297, 2000.

[3] S. M. Bartram and G. M. Bodnar, "No place to hide: The global crisis in equity markets in 2008/2009". Journal of International Money & Finance, vol 28, pp. 1246-1292, 2009.

[4] F. Guo, C. R. Chen, and Y. S. Huang, "Markets contagion during financial crisis: A regime-switching approach". International Review of Economics & Finance, vol 20, pp. 95-109, 2011.

[5] K. J. Daly, "Southeast Asian Stock Market Linkages: Evidence from Pre- and Post-October 1997". ASEAN Economic Bulletin, vol 20, pp. 73-85, 2003.

[6] R. W. Click and M. G. Plummer, "Stock market integration in ASEAN after the Asian financial crisis". Journal of Asian Economics, vol 16, pp. 5-28, 2005.

[7] E. Marais and S. Bates, "An empirical study to identify shift contagion during the Asian crisis". Journal of International Financial Markets, Institutions and Money, vol 16, pp. 468-479, 2006.

[8] B. M. Lucey and S. Voronkova, "Russian equity market linkages before and after the 1998 crisis: Evidence from

stochastic and regime-switching cointegration tests". Journal of International Money and Finance, vol 27, pp. 1303-1324, 2008.

[9] N. Huyghebaert and L. Wang, "The co-movement of stock markets in East Asia: Did the 1997-1998 Asian financial crisis really strengthen stock market integration?". China Economic Review, vol 21, pp. 98-112, 2010.

[10] W. Cheung, S. Fung, and S.-C. Tsai, "Global capital market interdependence and spillover effect of credit risk: evidence from the 2007–2009 global financial crisis". Applied Financial Economics, vol 20, pp. 85 - 103, 2010.

[11] G.-m. Chen, M. Firth, and O. M. Rui, "Stock market linkages: Evidence from Latin America". Journal of Banking & Finance, vol 26, pp. 1113-1141, 2002.

[12] A. W. Gregory and B. E. Hansen, "Residual-based tests for cointegration in models with regime shifts". Journal of Econometrics, vol 70, pp. 99-126, 1996.

[13] K.-M. Wang and T.-B. N. Thi, "Does contagion effect exist between stock markets of Thailand and Chinese Economic Area (CEA) during the Asian flu". Asian Journal of Management and Humanity Sciences, vol 1, pp. 16-36, 2006.

[14] C.-S. Tai, "Market integration and contagion: Evidence from Asian emerging stock and foreign exchange markets". Emerging Markets Review, vol 8, pp. 264-283, 2007.

[15] D. A. Dickey and W. A. Fuller, "Distribution of the Estimators for Autoregressive Time Series With a Unit Root". Journal of the American Statistical Association, vol 74, pp. 427, 1979.

[16] P. C. B. Phillips and P. Perron, "Testing for a unit root in time series regression". Biometrika, vol 75, pp. 335-346, 1988.

[17] R. F. Engle and C. W. J. Granger, "Co-Integration and Error Correction: Representation, Estimation, and Testing". Econometrica, vol 55, pp. 251-276, 1987.

[18] S. Johansen, "Statistical analysis of cointegration vectors". Journal of Economic Dynamics and Control, vol 12, pp. 231-254, 1988.

[19] S. Johansen, "Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models ". Econometrica, vol 59, pp. 1551, 1991.

[20] X. V. Vo and K. J. Daly, International financial integration: an empirical investigation into Asian equity markets pre and post -1997 Asian financial crisis, in Asia Pacific financial markets in comparative perspective : issues and implications for the 21st century, T.A. Fetherston and J. Batten, Editors. 2005, Elsevier: Amsterdam. p. 75-100.

[21] E. Zivot and D. W. K. Andrews, "Further Evidence on the Great Crash, the Oil-Price Shock, and the Unit-Root Hypothesis". Journal of Business & Economic Statistics, vol 20, pp. 25 - 44, 2002.