DOES SIZE REALLY MATTER ACROSS TIME? FINANCIAL INTEGRATION DYNAMICS AND STOCK MARKET CAPITALIZATION IN THE ASIA PACIFIC EQUITY MARKETS

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ABSTRACT

The present study argues for size of equity markets, measured by its stock market capitalization, in determining leaders for a fully integrated equity market in the Asia Pacific region. Using cointegration analysis, it was found that Hong Kong SAR could act in such a capacity in the financial integration process. When taking growth-volatility into consideration via the use of Euclidean distance measure, China is diverging from both equity blocks across time and is the least integrated. However, given its growth across time, it is the sole contender for the leadership role surpassing Hong Kong SAR.

EFM Classification: 630, 620, 330

Keywords: Cointegration; Convergence; Euclidean Distance; Financial Integration; Stock Market Capitalization

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1. INTRODUCTION

One of the antecedents of globalization of international financial markets is the continuous deregulation of financial markets around the world which took place in the past few decades (Bekaert, 1997). Successful economic integration has resulted in the formation of various common markets such as the European Union and trading blocks and intensified the process of financial globalization. This, in turn, exacerbates the internationalization and opening up of domestic economies. The ever-integrated financial markets have brought about several advantages for instance the lowering of the cost of capital (Moshirian, 1998) and increased competition and allocative efficiency (Folkerts and Mathieson, 1989). An integrated financial market implies a lack of capital control measures and restrictions and greater ability for investors to diversify their investment portfolios within financial markets that are less segmented (Grubel, 1968; Levy and Sarnat, 1970). This would subsequently stimulate economic growth vis-à-vis ample investment and employment opportunities (Baker, 1992)[1]. From the mid-1980s to the mid-1990s, the value of stocks across the world had increased from $4.7 trillion to $15.2 trillion (Levine, 1996). By the same token, the recent credit crunch, emanating from US, have caused the value of stock market capitalization worldwide to shrink in unison, only to bear witness to the negative impacts of the ever increasing close financial interdependence between the international financial markets. As such, the purpose of this paper is to attempt to provide empirical evidence on measuring the dynamics of interaction of financial interdependence of stock markets in the Asia Pacific region via the stock market capitalization against Emerging Markets and Advanced Markets blocks in the Asia Pacific region across time. Secondly, we can determine

[1] For an excellent survey of the history of financial integration of international financial markets, please refer to the work by Lothian (2001).

which of the individual stock markets, in terms of its growth rate in the stock market capitalization, would cause the growth in the stock market capitalization of the respective equity blocks in the Granger sense. Finally, in order to capture the volatility in the growth rate of stock market capitalization, we have applied the Euclidean distance measure approach where the standard deviation of the growth rate of stock market capitalization is incorporated to ensure that our results are robust. Our contributions to the financial integration are threefold. Firstly, we examine the interdependence of relationship between the stock market capitalization growth rates of individual stock markets within the Emerging and Advanced Markets block framework in the Asia Pacific region. Secondly, our paper identifies the potential leaders within the Asia Pacific region which can potentially act as a leader in bringing the region to a fully integrated equity market. Finally, the findings of this paper would provide an indicator to measure the speed of convergence or divergence of financial integration of these individual equity markets with respect to their equity block(s) using the Euclidean distance measure.

This paper uses stock market capitalization growth rate (given as the change in the natural logarithm of stock market capitalization) as a measure of financial interdependence to investigate the degree of integration of these stock markets. In this respect, the use of Engle-Granger two-step approach enables the estimation of the speed of adjustments for the various pair-wise comparisons and subsequently the speed of adjustment values act as an input in identifying and ascertaining the leading individual equity market within the Emerging Markets and Advanced Markets blocks in the Asia Pacific region. The empirical results are obtained by investigating the stock market capitalization growth rates for twelve countries in the Asia Pacific region via the use of a sample of 215 weekly observations over the period from 22 September 2003 to 29 October 2007. In order to qualify as a leader for the respective region(s), two criteria need to be fulfilled; the potential equity market must be an attractor to the respective equity block and it must be causing the growth in the respective equity block in the Granger sense. As the growth rate of stock market capitalization is sensitive to its volatility, the Euclidean distance measure is used to ensure that our findings are robust with respect to the standard deviation of the stock market capitalization growth rate. We find that all of the stock market capitalization growth rates of individual stock markets have reasonably large speed of adjustment coefficient values. These large estimated speed of adjustment values, which measure the proportion of last period's equilibrium error that is corrected, implies that the distance the system is away from equilibrium from the current period is quickly forced back towards its long-run steady-state growth path. Secondly, the findings in this paper reveal that the equity market of Hong Kong Special Administrative Region (Hong Kong SAR) Granger-causes the growth in the Emerging Markets Block (EMB) while the growth in stock market capitalization of China, Hong Kong SAR, Singapore and Australia Granger-causes the growth in the stock market capitalization of the Advanced Markets Block (AMB). Overall, the stock market capitalization growth in Hong Kong SAR appears to Granger-cause the growth in both equity blocks. These equity markets have the potential to be ear-marked in providing the leading role much needed in the eventual and fully integrated Asian equity market. Thirdly, the speed of convergence as measured by the time slope coefficient regression reveals that China is diverging away from both the EMB and AMB while Korea is converging towards the EMB and AMB with Taiwan converging towards the EMB only. Using this measure of financial integration, China is least integrated to both equity blocks in the region while the rest of the individual equity markets are either integrating or diverging from their respective blocks albeit statistically insignificant. However when measured across time, the speed of divergence as measured by the coefficient in the time trend variable, China would overtake the role of Hong Kong SAR to appear to as the sole contender for the leadership role.

The academic inquiry into this area started to gain momentum when equity flows worldwide increased dramatically in the 1990s. Improved domestic policies, increased economic growth and financial liberalization of domestic financial markets in the form of allowing access to foreigners into domestic markets by removing capital control and trade barriers were cited as reasons for a higher degree of integration of emerging markets into the world financial markets. The stock market capitalization values of these countries grew by leaps and bounds and the relatively quick recovery of these countries from the 1997 Asian financial crisis (Ng, 2002) also provided a strong testament that robust economic growth potentially could be attributed to the development within the domestic country's financial sector; and a more integrated regional capital market is vital to an even faster recovery (Click and Plummer, 2005). This argument which could be traced back to Schumpeter (1911) where the roles in which a financial market provide for, such as reallocation of capital to the highest value use with minimal risk of loss via moral hazard, adverse selection or transaction costs, are deemed to be essential ingredients for spearheading the economic growth of a country (Rajan and Zingales, 1998). Arguably, the inflow of equity investments into the emerging markets with respect to the Asia Pacific region which has provided the initial impetus to the remarkable economic growth has naturally led to important research questions being raised by academicians and policy makers alike. Specifically, the literature on financial integration in the Asian economies has produced a rather contradictory conclusion (Click and Plummer, 2005) or mixed finding at best[2]. Most work carried out on financial integration has applied either the cointegration analysis and/or the vector autoregression framework. A number of these studies have applied the Johansen-Juselius cointegration technique on either composite indices of various equity markets, exchange rates or interest rates (price-based measures of financial integration) while others have incorporated a number of other variables in their study, for example, foreign direct investment, savings-investment correlations, consumption correlations or current account transactions (quantity-based measures of financial integration). The remaining work on financial integration investigates the more qualitative aspects of financial integration, for example, regulatory and institution setup of the Asian capital markets in terms of entry and exit barriers imposed by governing authorities, controls on capital flows and financial services and legislative controls over deposit rates (regulatory and institutional measures of financial integration). In short, most of these studies have provided a partial and abstracted view of the financial integration process and a number of these studies have mainly described the degrees of financial integration within the region without emphasizing the need to identify the leaders in the region with the potential to spearhead the process of financial integration in the region. The question of leadership looms large as issues pertaining to mantle of leadership in the financial integration literature is lacking. It is now timely, instructive and imperative to reexamine the issue of financial integration with the view of identifying potential leaders in the region to provide the leadership much needed to spearhead a closer interdependence within the Asian countries.

[2] For a brief survey of work on financial integration in East Asia, refer to Cavoli et al. (2004) and for works on financial integration in Association of Southeast Asian Nations (ASEAN) and emerging markets, refer to Click and Plummer (2005) and Phylaktis and Ravazzolo (2002). For other works on worldwide financial integration, refer to works by King and Wadhwani (1990), Joen and von Furstenberg (1990), Arshanapalli and Doukas (1993), Eun and Shim (1989) and Kasa (1992).

In order to achieve the status of leader within the region, we believe the size of the equity market plays an important role. Freeman (2000) argues that the total stock market capitalization is vital to portfolio managers who are outside of the Asia Pacific region and that beyond Malaysia and Singapore equity markets, the remaining equity markets in Southeast Asia falls outside of their investment choice radar. As such the argument of size remains a lively debate when it comes to financial integration in more recent research (Desai and Dharmapala, 2008; Cumming et al., 2006; Portes and Rey, 2005; Martin and Rey, 2004; Alves and Ferreira, 2003; Jain, 2003). Among the commonly used measures of financial development include the level of credit and the size of the stock market indicators. The use of stock market capitalization as a measure of financial development in its own right was largely ignored in most literature on financial integration as this measure could lead to interesting findings. In order to measure the widening and deepening of the stock market, the stock market capitalization and its variants is the most widely used indicator. One of its variant, which is typically found in financial and economic development literature, is the stock market capitalization ratio which is given as the stock market capitalization divided by the Gross Domestic Product of a given country. This measure serves to provide a measure of the stock market activity within a country. (Torre et al., 2006; Rajan and Zingales, 1998). It can also be used to predict economic growth due to the anticipation of future growth in the equity market as the equity market capitalizes on the present value of the growth opportunities in the future (Rajan and Zingales, 1998), apart from being used as a measure of public consensus and confidence on the value of the stock market as a whole by investors. Nevertheless, most studies have concentrated on the use of stock market capitalization as an indicator of financial development while at the same time neglected its role in measuring financial integration among financial markets within an international context.

The structure of the paper is the following: In Section 2, we describe the data and methodology used in the empirical study. In Section 3, we present the empirical results for the error correction models which provide the individual leaders or attractors of equity markets within the Asia Pacific zone vis-à-vis the estimated speed of adjustment coefficient values. In Section 4, we investigate the short run causal impact of the bivariate relationships from the pairwise error correction models using the Granger causality test and report its findings. Section 5 discusses the speed of convergence measure of financial integration while Section 6 of the paper concludes by highlighting the main results obtained and by offering some possible conjectures.

2. DATA AND DESCRIPTION OF SUMMARY STATISTICS

The data set used in this study consists of logarithms of daily stock market capitalization provided by *Bloomberg* for 12 countries for the period from 22 September 2003 to 29 October 2007. This period of study is undertaken because most stock markets in the Asia Pacific region are relatively new and as result of ensuring consistency in data availability across the equity markets under investigation, a later start date was used. The data is then converted to weekly interval and a total of 215 weekly observations are used in this study after data cleaning. These countries are then grouped into two categories based on the classification provided by Standard and Poors/IFCG. Countries such as Japan, Hong Kong, Australia, Singapore and New Zealand are grouped as AMB and the remaining countries such as China, Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand are grouped under EMB[3]. Table 1 displays the summary statistics of the data used in this study. The variables EMB and AMB are arithmetic averages of the constituents in the respective blocks. It can be seen from Table 1 that within the EMB, China, Korea and Taiwan appear to be the top three largest equity markets in terms of average weekly stock market capitalization values while in the AMB, Japan, Hong Kong SAR and Australia are the top three. Table 2 charts the changes in the stock market capitalization values of these equity markets across time and their corresponding standard deviation values. It is clear from Table 2 that China experienced a boom in its stock market capitalization in 2006 and the first ten months of 2007. Most equity markets have also experienced large percentage changes in their weekly stock market capitalization values during those two years and this is consistent with previous papers which argues a robust recovery post 1997 Asian financial crisis (Click and Plummer, 2005; Ng, 2002). Further, from Table 1, the weekly average of stock market capitalization value for Japan from 2003 to 2007 appears to dwarf the weekly average stock market capitalization of the remaining equity markets in both blocks. However, from Table 2, the stock market capitalization of China has grown tremendously to narrow the gap between China and Japan and has widen its gap with the remaining countries in those two blocks. Even though in terms of percentage change in the annual weekly average stock market capitalization for several countries such as Philippines, Hong Kong SAR and Singapore are relatively large in 2007 when compared to the other equity markets, the magnitude of growth in the size of China's equity market measured by its percentage change in the annual weekly average stock market capitalization values is at a whopping 283 percent. This quantum leap in size by China has overtaken Hong Kong SAR in 2007

[3] For more information on the Standard and Poors IFCG index, consult the website (www.indices.standardpoors.com)

when in 2006, the size of China's equity market in annual weekly average stock market capitalization was only about half of the size of Hong Kong SAR.

[Insert Table 1 here]

[Insert Table 2 here]

3. COINTEGRATION AND THE SPEED OF ADJUSTMENT

For the purpose of this study which is to identify the potential leader for the Asia Pacific region, the individual equity market will be chosen based on two qualifications. Firstly, the individual equity market must be an attractor equity market. An attractor equity market is the individual equity market which pulls the respective equity block towards itself. To identify the attractor equity market, a pair-wise error-correction model is formulated to compare the relative sizes of the absolute error correction terms. Secondly, for the equity market to be identified as a potential leader, the stock market capitalization growth rate of the individual equity market must Granger-cause the stock market capitalization growth rate of the equity block in question. This can be achieved by performing a Wald test on the coefficients of the lagged independent variables in the error correction model. Only when the individual equity market surpasses these criteria, the individual equity market will be identified as a potential leader in bringing the Asia Pacific equity market into a full-fledged and integrated equity market.

To test for financial integration in the Asia Pacific region using stock market capitalization growth rate, the well-established two-step cointegration procedure introduced by Engle and Granger (1987) is employed using the unrestricted dynamic modeling approach so that the estimates derived in the long-run relationship are unbiased with the appropriate *t*- and *F*-statistics. This technique is selected for analysis as it serves the various considerations in this study. The objective of the study is to identify the leaders in the Asia Pacific region via the cointegration relationship between the individual equity markets against the Emerging and Advanced Market blocks and a pair-wise comparison between individual equity markets against the respective equity blocks is necessary for this purpose. The more popular Johansen (1988) technique is irrelevant here as the object of interest is to determine an attractor between the individual equity markets against the respective equity blocks by comparing the absolute speed of adjustment coefficient values in the various pair of cointegration relationships. Since the number of variables in the model also does not exceed two, there is no theoretical justification to invoke the Johansen approach to test for cointegration. Secondly, in this study, a sufficiently large data set would overcome the problem of biasness in the estimates of the long run relationships as pointed out by Banerjee et al. (1993) through Monte Carlo studies, Phillips and Ouliaris (1990) and Banerjee et al. (1986). In fact, as sample size increases, Stock (1987) shows that the ordinary least square (OLS) estimator of the long-run relationship parameter is superconsistent as the parameter converges to its true value at a much faster rate than the usual OLS estimator with stationary *I(0)* variables. The superconsistency property also ensures that the problems of omitted dynamic terms (and any bias arising from endogeneity) which will be captured in the residual (which will lead to the residual being serially correlated) will be overcome (Verbeek, 2005; Harris, 1995).

It is common knowledge that a necessary pre-requisite for cointegration testing requires the variables under consideration to be stationary to avoid the problem of spurious regression. The Augmented Dickey Fuller (ADF) test which corrects for autocorrelation using an autoregressive representation (Said and Dickey, 1984) and Phillips-Perron (PP)(Phillips and Perron, 1988) test which adjusts for autocorrelation using a nonparametric correction are applied to the natural logarithm transformed weekly stock market capitalization variable.

[Insert Table 3 here]

The ADF and PP are performed by varying the inclusions of the intercept and time trend variables. The number of lags selected for these tests is important as the size and power properties of the ADF are sensitive to the number of lagged terms included in the unit root test. The usual information based rule, namely the Akaike Information Criterion (AIC), is used to determine the optimal lag length[4]. The estimated values of the relevant *t*-ratios (constructed, alternatively, with a constant and with a constant and time trend) are reported in Table 3. The natural logarithm transformed weekly stock market capitalization variable is not stationary in its level form but upon taking the first difference, which is the growth rate in the stock market capitalization, these series appear to be stationary for all countries in the Asia Pacific region. The same is true for the EMB and AMB with one negligible exception. We have expected the series to be integrated of order one as this finding is consistent with findings from most previous studies in the finance literature arguing that financial time series variables are more often than not integrated of order one.

Under the Engle-Granger two-step procedure framework, it is essential in the first step to determine whether the stochastic trends in the natural logarithm of the weekly stock

[4] For a detailed examination into the various guidelines on determining the optimal lags for inclusion in the unit root tests, refer to Ng and Perron (1995).

market capitalization variable for the twelve countries and the two equity blocks that contained unit root in the level have long-run relationship. This can be accomplished by regressing a non-stationary level dependent variable against a non-stationary level independent variable. The resulting error of the cointegration regression is then subjected to stationary testing in the second step. The cointegrating equations are of the form:

$$\begin{aligned} y_t &= \gamma_0 + \gamma_1 x_t + \varepsilon_{1t} \\ x_t &= \kappa_0 + \kappa_1 y_t + \varepsilon_{2t} \end{aligned} \tag{1}$$

where y_t measures the natural logarithm of weekly stock market capitalization of individual equity market, x_t measures the natural logarithm of weekly stock market capitalization of the respective blocks, namely the EMB and AMB; γ_0 and κ_0 are the intercepts while γ_1, and κ_1 are the long-run relationship parameters and ε_{1t} and ε_{2t} are the error terms to be tested for stationary. In Table 4, the Engle-Granger two-step cointegration test reveals the existence of the cointegration relationships between the individual equity markets against the two equity blocks. Therefore, the adequacy of the cointegration model in this study is confirmed by the statistically significant results of the ADF test on the residuals on each equation in Eq. (1) as presented in Table 4.

[Insert Table 4 here]

The Granger Representation Theorem (Granger, 1983; Engle and Granger, 1987) postulates that if two (or more) variables are linked to form an equilibrium relationship spanning the long run or cointegrated, then there exists an error-correction representation of the data even though the series themselves may contain stochastic trends. From a practical standpoint, the Granger Representation Theorem for dynamic modeling safeguards the error correction model from the problem of spurious regression. Therefore, if y_t and x_t are *I(1)*, the following error-correction models can be set up respectively as:

$$\begin{aligned} \lambda(L)\Delta y_t &= \alpha_1\varepsilon_{1t-1} + \eta(L)\Delta x_{t-1} + u_{1t} \\ \pi(L)\Delta x_t &= \alpha_2\varepsilon_{2t-1} + \varphi(L)\Delta y_{t-1} + u_{2t} \end{aligned} \tag{2}$$

where $\lambda(L)$, $\eta(L)$, $\pi(L)$ and $\varphi(L)$ are polynomials in the lag operator L given as $\lambda(L) = 1 - \lambda_1 L^1 - \ldots - \lambda_p L^p$, $\eta(L) = \eta_0 - \eta_1 L^1 - \ldots - \eta_{q+1} L^{q+1}$, $\pi(L) = 1 - \pi_1 L^1 - \ldots - \pi_p L^p$, $\varphi(L) = \varphi_0 - \varphi_1 L^1 - \ldots - \varphi_{q+1} L^{q+1}$; at least one of the speed of adjustments coefficients, α_1 or α_2, is significantly different from zero; ε_{1t} and ε_{2t-1} are the error-correction terms (ECTs) in the model. The formulation in Eq. (2) above allows us to estimate the corresponding ECT coefficients which indicate the strength and speed of adjustment towards its long run equilibrium. These speed of adjustment values measure the proportion of last period's equilibrium error that is corrected by the narrowing of the distance of the system in the current period from its equilibrium. In other words, the speed of adjustment is a mechanism which enables the system to correct the disequilibrium in the system quickly by forcing the system to return to its long-run steady-state growth path. Two important properties of the speed of adjustment coefficients are worth mentioning. The α_1 measures the speed the natural logarithm of the stock market capitalization of the individual equity market adjusts to the corresponding natural logarithm of the stock market capitalization of the equity block. In this case, the equity block appears to be the attractor to the individual equity market. Secondly, the speed of adjustment parameter will take an absolute value between zero and one where the closer the estimated value to zero implies a lesser desire for the system to correct the disequilibrium to its long run equilibrium and an estimated value closer to one demonstrates a strong tendency for the system to narrow the distance of the system in the current period from its long run equilibrium path. Likewise, α_2 captures the speed the natural logarithm of the stock market capitalization of the equity block is correcting towards the natural logarithm of the stock market capitalization of the individual equity market. In this case, the individual equity market acts as the attractor. By comparing the relative sizes of the absolute ECTs from Eq. (2), $|\alpha_1|$ and $|\alpha_2|$, we can identify which of the variables are correcting to the other. The independent variable with the larger absolute ECT value is the attractor.

The results in the last column of Table 5 and 6 shows the pair-wise estimated coefficients of the speed of adjustment of individual stock markets against the respective equity block and vice versa. The adequacy of the error correction models is confirmed by the negative and statistically significant ECT coefficients are presented as the estimated speed of adjustment coefficients in the last column in Table 5 and 6. In Panel (a) of Table 5, it is clear that with the exception of China, the speed of adjustment estimates of all individual equity markets are statistically significant at 1 percent for the EMB. In the case of China, the natural logarithm of stock market capitalization for China is correcting towards the EMB but not the other way round as the speed of adjustment estimate $|\alpha_2|$ is not statistically significant. In Panel (b) of Table 5, all of the estimates for the speed of adjustment pairs are statistically significant at 1 percent for the AMB. When considering the adjustments between the equity blocks, it appears that these two equity blocks are also adjusting to each other at 1 percent level of significance and this is shown in Panel (c) of Table 5. In identifying the attractor via comparing the relative sizes of the absolute ECTs, a list of attractor is shown in second column of Table 7. For EMB, Korea, Hong Kong SAR and Singapore seem to be the attractors and for AMB, China, Malaysia, Hong Kong SAR, Australia, Singapore and New Zealand are the attractors. As indicated above, the results from this test only provide the fulfillment of the first criteria in identifying the leader. It is obvious that the natural logarithm of stock market capitalization of the equity blocks need to correct towards the natural logarithm stock market capitalization of the individual equity market in order for the equity market in question to provide the leadership role. The findings clearly show that Hong Kong SAR and Singapore can act as the collective leaders of this Asia Pacific region as the natural logarithm of stock market capitalization of the two equity blocks are correcting towards the natural logarithm of stock market capitalization of Hong Kong SAR and Singapore.

[Insert Table 5 here]

[Insert Table 6 here]

4. COINTEGRATION AND CAUSALITY

Another benefit which can be derived from an error-correction model formulation as given in Eq. (2) is that it provides a channel for investigating the short-run causal impact between the growth rate of the stock market capitalization of the individual stock market and the respective equity block and vice versa. Granger (1988) maintained that long-run equilibrium is a concern for cointegration while short-run forecastability is the concern of Granger causality. In order for a pair of series to have an attainable equilibrium in the error correction model, the existence of the dynamics is ensured due to some Granger causation between the variables (Maddala and Kim, 1998). In our study, the joint significance testing of the coefficients for lagged differences of the independent variable $\left(\eta_0 = \ldots = \eta_{q+1}\right)$ implies the causality running from Δx_t to Δy_t. Similarly, in order to test the causality running from Δy_t to Δx_t, one can achieve this by jointly testing for $\left(\varphi_0 = \ldots = \varphi_{q+1}\right)$. The optimal number of lags for *p* and *q* are selected based on AIC following the sequential procedure outlined by Hsiao (1979a, b). This procedure requires the addition of *q* lags to the error correction model once the number of *p* lags which minimizes the AIC is chosen. Due to nature of multiple pair-wise testing which gives rise to the possibility of committing a higher type I error, only results from Wald test which show significance at 1 percent level of significance are considered and not the usual 5 percent level of significance.

From Table 5 and 6, the results from Wald test of jointly testing for all lagged independent variable are reported. The list which reports the direction of causality is summarized in column 3 of Table 7. Allowing for bidirectional causality, Panel (a) of Table 5, the stock market capitalization growth rate in Indonesia appears to be causing the growth in the stock market capitalization of the EMB in the Granger sense at 1 percent level of significance. Panel (b) of Table 5 presents the finding that the stock market capitalization growth rate of Hong Kong SAR appears to be Granger causing the growth in the EMB. By comparing EMB and AMB, the stock market capitalization growth rate of EMB is Granger causing the growth in stock market capitalization in AMB. This is shown in Panel (c) of Table 5. From Panel (a) Table 6, the stock market capitalization growth rate of all emerging equity markets, with the exception of Korea, are Granger causing the growth in the AMB at 1 percent level of significance. With the exception of Japan and New Zealand, the growth rate of stock market capitalization of the individual advanced equity markets is Granger causing the growth in the AMB at 1 percent level of significance. This is exhibited in Panel (b) of Table 6.

To reiterate, in order to fulfill the condition of becoming a potential leader in the Asia Pacific region in terms of financial integration, the individual equity market must be an attractor and it must Granger cause the respective equity block. When these two conditions are jointly considered, Hong Kong SAR appears to be the overall leader as it fulfills both conditions in both equity blocks. For the AMB, China, Malaysia, Hong Kong SAR, Australia and Singapore are the possible potential leaders. Malaysia is an exception as the relative absolute values of its speed of adjustment derived from the pairwise error correction model are close. If Malaysia is ruled out, then the final list will consist of China, Hong Kong SAR and Australia in the AMB. However, if only uni-directional causality is allowed, then China and Hong Kong SAR will emerge as the final candidates for the AMB. The final list is provided in the last column of Table 7.

[Insert Table 7 here]

5. FINANCIAL INTEGRATION AND SPEED OF CONVERGENCE

One important consideration which is often neglected in the cointegration technique as applied above is that the technique does not capture the volatility in the growth rate in the stock market capitalization variable. In order to ensure that our findings are robust and meaningful with respect to the volatility in the growth rate of stock market capitalization as measured by the standard deviation of the weekly stock market capitalization, we have applied the Euclidean distance measure analysis to our data. Distance measures are commonly used in cluster analysis specifically and multivariate statistics in general[5]. The application of measures of distances can bring about several benefits. One salient characteristic, as a result of using distance measure, is that it is essentially model free since neither asset pricing nor return-generating factors is used in its computation. The other

[5] For details on distance measures used in multivariate analysis, refer to any standard text on multivariate statistics texts. For applied multivariate text, refer to Johnson and Wichern (2007), Hair et al. (2006) and Sharma (1996)

benefit is that it can incorporate multidimensional attributes inherent in the data with ease (Eun and Lee, 2006). In applying this technique to our dataset, firstly we derive three measures of distance, namely, the stock market capitalization growth rate distance measure (growth-distance measure), the standard deviation of growth rate in the stock market capitalization distance measure (volatility-distance measure) and finally a composite between the stock market capitalization growth rate distance measure and the standard deviation of growth rate in the stock market capitalization distance measure (growth-volatility-distance measure). In the next step a simple linear regression is performed against a linear time trend with the growth-volatility distance measure as the dependent variable. The measures were first developed by Eun and Lee (2006) in measuring the worldwide mean-variance convergence phenomenon.

The growth-distance measure, ψ_{jt} is given as below:

$$\psi_{jt} = \left| \bar{\delta}_{jt} - \frac{1}{N}\sum_{j=1}^{N}\bar{\delta}_{jt} \right|, j = 1,\ldots,N; t = 1,\ldots,T \tag{3}$$

and the volatility-distance, υ_{jt} measure is given as follows:

$$\upsilon_{jt} = \left| \sigma_{jt} - \frac{1}{N}\sum_{j=1}^{N}\sigma_{jt} \right|, j = 1,\ldots N; t = 1,\ldots T \tag{4}$$

where $\bar{\delta}_{jt}$ is the stock market capitalization growth rate for equity market j for time period t. The cross-market average for stock market capitalization growth rate for the respective equity blocks is given as $\left(\frac{1}{N}\sum_{j=1}^{N}\bar{\delta}_{jt} \right)$. The σ_{jt} is the standard deviation for stock market capitalization growth rate for equity market j for time period t and $\left(\frac{1}{N}\sum_{j=1}^{N}\sigma_{jt} \right)$ gives the corresponding cross-market average for the standard deviation for stock market capitalization growth rate. To avoid the problem of variable with larger dispersions creating a larger impact on (dis)similarity measure, these variables would need to be normalized before the growth-volatility-distance measure is constructed. In developing the appropriate weights, we have followed the construction of weights by Eun and Lee (2006) which is given as the proportion of a variable to the sum of the two variables. The corresponding weights are given as follows:

$$\omega(\psi) = \sqrt{\frac{\sum_{j=1}^{N}\sum_{t=1}^{T}\psi_{jt}^{2}}{\sum_{j=1}^{N}\sum_{t=1}^{T}\psi_{jt}^{2} + \sum_{j=1}^{N}\sum_{t=1}^{T}\upsilon_{jt}^{2}}} \qquad (5)$$

and

$$\omega(\upsilon) = \sqrt{\frac{\sum_{j=1}^{N}\sum_{t=1}^{T}\upsilon_{jt}^{2}}{\sum_{j=1}^{N}\sum_{t=1}^{T}\psi_{jt}^{2} + \sum_{j=1}^{N}\sum_{t=1}^{T}\upsilon_{jt}^{2}}} \qquad (6)$$

where $\omega(\psi)$ is the weight for the growth-distance measure variable and $\omega(\upsilon)$ is the weight for the volatility-distance measure variable. Having stated these variables, we are now ready to compute the composite variable, the growth-volatility-distance measure, $(\psi - \upsilon)_{jt}$ as follows:

$$(\psi - \upsilon)_{jt} = \sqrt{\left(\frac{\psi_{jt}}{\omega(\psi)}\right)^{2} + \left(\frac{\upsilon_{jt}}{\omega(\upsilon)}\right)^{2}} \qquad (7)$$

With Eq. (7) constructed, we can now proceed to perform a simple linear regression against a time trend. A statistically significant negative time trend coefficient value would suggest that across time, the individual equity market is converging to its respective equity block. On the other hand, if a statistically significant positive time trend coefficient value is obtained, it would necessarily imply that the individual equity market is diverging away from its respective equity block. The formal test of the hypothesis is given as:

$$(\psi - \upsilon)_{jt} = \beta_0 + \beta_1 T + v_{jt} \tag{8}$$

where β_0 is the intercept and β_1 is the time trend regression slope and T is the time trend variable. The adequacy of Eq. (8) requires the error term, v_{jt} to be stationary and hence, the ADF test is carried out on the error term and subsequently the time trend coefficient β_1 can be interpreted in the usual way. To test for the significance of β_1, the Newey-West heteroskedastic autocorrelation consistent *t*-statistic is used.

The various test results are shown in Table 8 and Table 9. These results indicate that some individual equity markets are either converging to or diverging away from their respective equity blocks. For each market in Table 8, the ADF test rejects the null hypothesis which implies that the errors are stationary at 1 percent level of significance based on the Newey-West adjusted *t*-statistic. From the Newey-West adjusted *t*-statistics in Table 8, the coefficients for time variable are significant for China at 1 percent level of significance and Korea at 5 percent level of significance and the slope of the regressions are positive for China and negative for Korea respectively. This leads us to conclude that China has the tendency to diverge significantly away from the EMB while Korea is converging towards the EMB. In Table 9, China, Korea and Taiwan have statistically significant time slope against the AMB at 1 percent level of significance. The slope of the time trend regression is positive for China while the slopes for Korea and Taiwan are negative. This finding suggests that China has the tendency to diverge significantly from the AMB while Korea and Taiwan are converging towards the AMB. Taken as a whole, from Table 9, the two equity blocks appear to be diverging to each other albeit statistically insignificant. For the remaining countries in

EMB in Table 8, Indonesia, Philippines, Thailand, Japan, Australia, Singapore and New Zealand are converging to the EMB while Malaysia, Taiwan and Hong Kong SAR are diverging away from the EMB although statistically insignificant. In Table 9, with the exception of statistically significant individual equity markets, Malaysia, Philippines, Japan, Hong Kong SAR and Australia are diverging away from the AMB. For individual equity markets such as Indonesia, Thailand, Singapore and New Zealand, the growth-volatility-distance appears to be converging towards the AMB across time.

[Insert Table 8 here]

[Insert Table 9 here]

In our discussion so far, we have presented two sets of techniques to identify the potential leader in acting as a beacon for financial integration in the Asia Pacific region. The cointegration analysis shows that Hong Kong SAR is the dominant equity market as it seems to be Granger causing the growth rates in stock market capitalization for both equity blocks and the stock market capitalization growth rates of both equity blocks seems to be adjusting towards the stock market capitalization growth rate of Hong Kong SAR. However, the cointegration analysis did not take into account the possible volatility as measured by its standard deviation in the stock market capitalization growth rate in the stock market capitalization growth rate. A second technique is offer via the use of Euclidean distance measure. From this measure, we were able to show that China is diverging from both equity markets across. In fact, it would seem as if China is the least integrated to both equity blocks across time. Nonetheless, after taking into account the volatility aspect of the stock market capitalization growth rate, we would like an individual equity market which could provide the lead in growth in the stock market capitalization. Since stock market capitalization growth rate in China is growing further and naturally faster than the stock market capitalization growth rate produced by both equity blocks across time, we believe that China can provide this leadership role. Not to mention, China without considering its volatility in its growth rate in stock market capitalization is Granger-causing the EMB, taken across time, it will outgrow all its members in the Asia Pacific region and become the sole dominant leader in the region.

6. CONCLUDING REMARKS

We believe the size of a particular equity market plays an important role in deciding the status of a leader within a region and this study tests for financial integration in the Asia Pacific region using the Engle-Granger two-step approach on the stock market capitalization growth rate. The results show that the size of the equity markets measured by its stock market capitalization growth rate matters in determining the potential leaders within the Asia Pacific region to spearhead the region into a full-fledged and integrated capital market block. In general, countries such as China, Indonesia, Korea, Malaysia, Philippines, Taiwan and Thailand which are grouped under EMB should lead the Asia Pacific region equity markets in the next phase of the financial integration. Specifically, Hong Kong SAR ought to be the leading country within the EMB and countries such as China, Hong Kong SAR, Australia and Singapore appear to be the potential leaders in the AMB. The overall leader in both blocks seems to be Hong Kong SAR as it appears on both equity blocks as a potential leader.

In dealing with the volatility in the stock market capitalization growth rate which is not taken care by the cointegration analysis, the Euclidean distance measure is employed. This measure gives the speed of convergence or divergence as measured by the time slope regression coefficient. It is clear that China is the least integrated as far as both equity blocks are concerned. Korea is converging to both equity blocks while Taiwan is only converging towards the EMB. All remaining individual equity markets are either converging or diverging albeit statistically insignificant to their respective equity blocks. However, the speed of convergence estimated from the simple linear regression model with the time trend as independent variable, it shows that the speed of China's stock market capitalization will outgrow all the members in the Asia Pacific region across time. This relative size as measured by the stock market capitalization will grow large enough to not only overtake Hong Kong SAR (which it has by the October 2007), but will guarantee that no individual equity market will come close to its size. This quality is fundamental to ensuring a fully integrated equity market across time. As such, even though Hong Kong SAR for now seems to offer the most influence on the growth rate in both equity blocks in the Asia Pacific region, nonetheless, this role will be overtaken by China across time.

ACKNOWLEDGEMENT

The work described in this paper was supported partially by a joint grant from the School of Management at the University of Southampton and Nottingham University Business School at the University of Nottingham. Any error and omission are the sole responsibility of the authors.

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TABLES

Table 1: Summary Statistics[a-c]

Equity Market/Block	Mean	Standard Deviation	Minimum	Maximum	Median	Skewness	Kurtosis
	Panel (a): Individual Emerging Equity Markets and Emerging Markets Block						
China	859,339.9	783,987.2	362,637.0	3,739,097	503,104.5	2.069262	6.307563
Indonesia	94,100.60	38,718.32	46,727.96	201,433.1	79,567.71	0.905176	2.841049
Korea	606,256.1	247,202.1	282,619.5	1,195,187	573,325.7	0.506756	2.310217
Malaysia	202,021.2	44,775.00	144,713.4	312,584.9	184,652.8	1.286932	3.353484
Philippines	44,928.59	22,594.54	21,239.22	101,527.2	35,818.50	1.004048	2.811286
Taiwan	526,593.3	106,419.1	380,495.5	801,275.0	499,750.6	0.891024	2.986958
Thailand	125,783.3	28,291.05	76,951.17	214,648.2	118,586.7	1.095028	4.084578
Emerging Markets Block[b]	351,289.0	173,431.7	204,126.8	935,103.0	265,988.2	1.718007	4.978653
	Panel (b): Individual Advanced Equity Markets and Advanced Markets Block						
Japan	4,176,392	693,112.3	2,883,982	5,390,379	422,8675	-0.117703	1.531836
Hong Kong SAR	1,175,104	503,597.0	608,095.5	2,797,638	966,881.2	1.165813	3.646933
Australia	741,406.9	203,349.7	466,074.2	1,299,449	682,914.7	0.942433	2.986030
Singapore	273,797.8	100,422.8	151,012.6	53,9294.7	237,627.9	1.017398	2.929018
New Zealand	37,819.85	5,025.586	26,802.48	50,048.79	38,014.25	0.129995	2.469354
Advanced Markets Block[c]	1,280,904	282,720.7	84,3167.3	1,889,271	1,222,547	0.283106	1.796165

[a]The weekly stock market capitalization values are in US thousand dollars.
[b]The Emerging Markets Block variable is computed as an average of the individual emerging markets within the Emerging Markets Block.
[c]The Advanced Markets Block variable is computed as an average of the individual advanced markets within the Advanced Markets Block.

Table 2: Annual Weekly Average Stock Market Capitalization[a-e]

	2003[c]	2004	2005	2006	2007[d]
Panel (a): Individual Emerging Equity Markets					
China	484,748	520,350	410,527	597,022	2,285,669
	N.A.	7.34	-21.11	45.43	282.85
Indonesia	49,632	59,840	76,249	106,231	159,058
	N.A.	20.58	27.42	39.32	49.73
Korea	305,791	345,764	519,699	742,745	971,698
	N.A.	13.07	50.30	42.92	30.83
Malaysia	156,872	172,723	182,211	198,666	284,484
	N.A.	10.10	5.49	9.03	43.20
Philippines	21,955	24,818	34,972	49,041	84,732
	N.A.	13.04	40.91	40.23	72.78
Taiwan	398,373	439,514	476,696	556,639	702,869
	N.A.	10.33	8.46	16.77	26.27
Thailand	90,749	102,695	114,868	134,069	170,043
	N.A.	13.16	11.85	16.72	26.83
Panel (b): Individual Advanced Equity Markets					
Japan	3,051,683	3,463,248	3,968,942	4,845,661	4,871,493
	N.A.	13.49	14.60	22.09	0.53
Hong Kong SAR	668,009	751,507	914,951	1,308,621	2,038,983
	N.A.	12.50	21.75	43.03	55.81
Australia	499,065	561,054	657,827	793,136	1,088,440
	N.A.	12.42	17.25	20.57	37.23
Singapore	161,697	187,205	229,738	292,081	450,735
	N.A.	15.78	22.72	27.14	54.32
New Zealand	29,096	34,385	40,250	35,795	44,532
	N.A.	18.18	17.06	-11.07	24.41

[a]The annual weekly average stock market capitalization values are in US thousand dollars.
[b]The figures below the annual weekly average stock market capitalization values are the percentage change in the annual weekly average stock market capitalization values.
[c]Denotes that there are only 3 months of data collected for 2003.
[d]Denotes that there are only 10 months of data collected for 2007.
[e]N.A. denotes data unavailable.

Table 3: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Unit Root Tests – Level and First Difference of Stock Market Capitalization[a-c]

Equity Market/Block	Level			First Difference		
	Without constant and trend	**With constant**	**With constant and trend**	**Without constant and trend**	**With constant**	**With constant and trend**
Panel (a): Individual Emerging Equity Markets within the Emerging Markets Block						
China	0.130 (0.127)	-1.128 (-1.146)	-0.426 (-0.451)	-13.951*** (-13.951)***	-13.918*** (-13.918)***	-14.084*** (-14.078)***
Indonesia	0.285 (0.290)	-1.795 (-1.816)	-1.023 (-1.083)	-19.021*** (-19.426)***	-18.983*** (-19.387***)	-19.142*** (-19.908)***
Korea	0.341 (0.356)	-2.176 (-2.018)	-1.887 (-1.581)	-17.056*** (-17.161)***	-17.025*** (-17.142)***	-17.111*** (-17.355)***
Malaysia	1.236 (1.089)	-2.471 (-2.410)	-1.243 (-1.342)	-12.929*** (-12.945)***	-12.967*** (-12.982)***	-13.177*** (-13.177)***
Philippines	0.634 (0.552)	-2.303 (-2.233)	-2.525 (-2.506)	-12.449*** (-12.451)***	-12.443*** (-12.441)***	-12.429*** (-12.425)***
Taiwan	0.567 (0.570)	-1.637 (-1.636)	-1.210 (-1.211)	-14.736*** (-14.735)***	-14.725*** (-14.725)***	-14.781*** (-14.781)***
Thailand	0.904 (0.889)	-2.267 (-2.267)	-1.322 (-1.282)	-14.779*** (-14.782)***	-14.804*** (-14.806)***	-15.134*** (-15.145)***
Panel (b): Individual Advanced Equity Markets within the Advanced Markets Block						
Japan	0.613 (0.668)	-1.722 (-1.663)	-2.356 (-2.205)	-16.295*** (-16.307)***	-16.292*** (-16.272)***	-16.259*** (-16.243)***
Hong Kong SAR	1.037 (1.037)	-2.838 (-2.838)	-2.404 (-2.438)	-12.665*** (-12.604)***	-12.682*** (-12.620)***	-12.779*** (-12.704)***
Australia	1.064 (1.064)	-2.029 (-2.035)	-1.387 (-1.464)	-12.953*** (-12.977)***	-12.992*** (-13.011)***	-13.104*** (-13.083)***
Singapore	1.216 (1.121)	-2.409 (-2.390)	-1.642 (-1.774)	-14.146*** (-14.210)***	-14.213*** (-14.267)***	-14.391*** (-14.416)***
New Zealand	0.953 (0.924)	-2.390 (-2.310)	-1.694 (-1.692)	-18.535*** (-18.586)***	-18.557*** (-18.825)***	-18.713*** (-19.303)***

Panel (c): Emerging Markets Block and Advanced Markets Block

Emerging Markets Block	3.877 (4.056)	3.162 (3.346)	0.675 (0.728)	-5.968*** (-10.511)***	-11.043*** (-11.083)***	-9.784*** (-11.601)***
Advanced Markets Block	2.610 (3.083)	-0.234 (-0.508)	-3.661** (-3.320)	-7.378*** (-11.181)***	-10.716*** (-11.379)***	-10.700*** (-11.351)***

[a]***denotes significance at 1 percent.
[b]The critical values of the ADF and PP tests are based on MacKinnon (1996) one-sided *p*-value.
[c]Figures in parentheses under estimated values of ADF signify the estimated values of the corresponding PP test.

Table 4: Evidence of Cointegrations between Stock Market Capitalization[a, b]

Panel A			Panel B		
Dependent Variable	**Independent Variable**	**ADF test for error term ε_{1t}**	**Dependent Variable**	**Independent Variable**	**ADF test for error term ε_{2t}**
Advanced	Emerging	-10.97698***			
Emerging	Advanced	-10.44088***			
China	Emerging	-10.48966***	China	Advanced	-10.52523***
Emerging	China	-10.80155***	Advanced	China	-11.38939***
Korea	Emerging	-11.53484***	Korea	Advanced	-10.71497***
Emerging	Korea	-10.97625***	Advanced	Korea	-10.70644***
Taiwan	Emerging	-12.44908***	Taiwan	Advanced	-11.80322***
Emerging	Taiwan	-11.88555***	Advanced	Taiwan	-11.82253***
Malaysia	Emerging	-10.80441***	Malaysia	Advanced	-11.25781***
Emerging	Malaysia	-11.07645***	Advanced	Malaysia	-12.10385***
Hong Kong SAR	Emerging	-11.74802***	Hong Kong SAR	Advanced	-10.89655***
Emerging	Hong Kong SAR	-11.54707***	Advanced	Hong Kong	-11.26243***
Australia	Emerging	-11.7161***	Australia	Advanced	-12.13906***
Emerging	Australia	-11.50786***	Advanced	Australia	-12.51191***
Japan	Emerging	-11.07372***	Japan	Advanced	-10.30662***
Emerging	Japan	-10.27571***	Advanced	Japan	-10.03986***
Singapore	Emerging	-11.64643***	Singapore	Advanced	-10.93365***
Emerging	Singapore	-11.93938***	Advanced	Singapore	-11.77724***-
Thailand	Emerging	-10.96524***	Thailand	Advanced	-11.47755***
Emerging	Thailand	-11.38406***	Advanced	Thailand	-12.49676***
Indonesia	Emerging	-10.95785***	Indonesia	Advanced	-11.44084***
Emerging	Indonesia	-10.7926***	Advanced	Indonesia	-11.8343***
New Zealand	Emerging	-12.08614***	New Zealand	Advanced	-11.8394***
Emerging	New Zealand	-11.2854***	Advanced	New Zealand	-11.60804***
Philippines	Emerging	-11.41276***	Philippines	Advanced	-11.66571***
Emerging	Philippines	-10.75137***	Advanced	Philippines	-11.55514***

[a]*** indicates significance at the 1 percent.
[b]The critical values for the test are based on MacKinnon (1996) one-sided *p*-value.

Table 5: Estimates of Error Correction Models against Emerging Markets Block[a-d]

Dependent Variable	Independent Variable	Wald *F*-test (*p*-value)	Speed of Adjustment Coefficient (*p*-value)
Panel (a): Individual Emerging Equity Markets against Emerging Market Block			
China	Emerging	19.70069***	-0.779117***
	(2, 6)	(0.0000)	(0.0000)
Emerging	China	6.679414**	-0.251885
	(5, 2)	(0.0105)	(0.1504)
Indonesia	Emerging	6.443682**	-0.64234***
	(2, 1)	(0.0119)	(0.0000)
Emerging	Indonesia	9.116705***	-0.485543***
	(5, 2)	(0.0029)	(0.0008)
Korea	Emerging	5.149842**	-0.363091**
	(4, 1)	(0.0243)	(0.0236)
Emerging	Korea	0.115936	-0.485083***
	(5, 1)	(0.7338)	(0.0003)
Malaysia	Emerging	11.25897***	-0.843909***
	(4, 4)	(0.0009)	(0.0000)
Emerging	Malaysia	4.515803**	-0.337252**
	(5, 1)	(0.0348)	(0.0129)
Philippines	Emerging	15.05381***	-0.772915***
	(2, 3)	(0.0001)	(0.0000)
Emerging	Philippines	4.52804**	-0.481801***
	(3, 2)	(0.0345)	(0.0001)
Taiwan	Emerging	36.05928***	-0.61523***
	(1, 4)	(0.0000)	(0.0000)
Emerging	Taiwan	0.290822	-0.538728***
	(3, 2)	(0.5903)	(0.0004)
Thailand	Emerging	8.879683***	-0.706711***
	(2, 2)	(0.0032)	(0.0000)
Emerging	Thailand	1.856584	-0.576348***
	(3, 2)	(0.1745)	(0.0000)

Panel (b): Individual Advanced Equity Markets against Emerging Markets Block

Japan	Emerging	19.37817***	-0.643777***
	(2, 3)	(0.0000)	(0.0000)
Emerging	Japan	2.459042	-0.521199***
	(3, 1)	(0.1184)	(0.0000)
Hong Kong SAR	Emerging	9.327231***	-0.597776***
	(4, 4)	(0.0026)	(0.0025)
Emerging	Hong Kong SAR	9.229452***	-0.815902***
	(3, 3)	(0.0027)	(0.0000)
Australia	Emerging	21.14276***	-0.84493***
	(3, 3)	(0.0000)	(0.0000)
Emerging	Australia	2.058858	-0.618561***
	(3, 1)	(0.1528)	(0.0000)
Singapore	Emerging	32.93215***	-0.766225***
	(4, 6)	(0.0000)	(0.0000)
Emerging	Singapore	4.30954**	-0.788452***
	(3, 2)	(0.0392)	(0.0000)
New Zealand	Emerging	5.641265**	-0.810908***
	(1, 1)	(0.0184)	(0.0000)
Emerging	New Zealand	0.402935	-0.649744***
	(2, 1)	(0.5263)	(0.0000)

Panel (c): Advanced Markets Block against Emerging Markets Block

Advanced	Emerging	20.6137***	-0.683884***
	(4, 3)	(0.0000)	(0.0001)
Emerging	Advanced	4.302481**	-0.618691***
	(3, 2)	(0.0393)	(0.0000)

[a]***denotes significance at 1 percent; **denotes significance at 5 percent; *denotes significance at 10 percent.
[b]Figures in parentheses under the independent variables signify the number of lags *p* and *q* which minimizes the AIC.
[c]The *F*-values in column 3 denotes the Wald test of restricted model where all lagged independent terms are equal to zero under the null hypothesis. The *p*-values are in parentheses.
[d]The speed of adjustment coefficients are reported along with their respective *p*-values.

Table 6: Estimates of the Error Correction Models against Advanced Market Block[a-d].

Dependent Variable	Independent Variable	Wald *F*-test (*p*-value)	Speed of Adjustment Coefficient (*p*-value)
Panel (a): Individual Emerging Equity Markets against Advanced Market Block			
China	Advanced	0.096184	-0.563683***
	(2, 1)	(0.7568)	(0.0000)
Advanced	China	12.29548***	-0.733785***
	(2, 3)	(0.0006)	(0.0000)
Indonesia	Advanced	14.08945***	-0.87125***
	(2, 4)	(0.0002)	(0.0000)
Advanced	Indonesia	16.13188***	-0.716338***
	(3, 2)	(0.0001)	(0.0000)
Korea	Advanced	13.84236***	-0.737018***
	(3, 2)	(0.0003)	(0.0000)
Advanced	Korea	3.773704*	-0.407259**
	(4, 1)	(0.0534)	(0.0105)
Malaysia	Advanced	5.495756**	-0.728974***
	(3, 2)	(0.0200)	(0.0000)
Advanced	Malaysia	17.29416***	-0.755547***
	(3, 3)	(0.0000)	(0.0000)
Philippines	Advanced	1.541935	-0.729709***
	(2, 1)	(0.2157)	(0.0000)
Advanced	Philippines	23.98597***	-0.719533***
	(3, 3)	(0.0000)	(0.0000)
Taiwan	Advanced	13.26778***	-0.801936***
	(1, 2)	(0.0003)	(0.0000)
Advanced	Taiwan	9.762198***	-0.687157***
	(3, 1)	(0.002)	(0.0000)
Thailand	Advanced	10.0047***	-0.84583***
	(2, 2)	(0.0018)	(0.0000)
Advanced	Thailand	7.210975***	-0.817329***
	(2, 2)	(0.0078)	(0.0000)

Panel (b): Individual Advanced Equity Markets against Advanced Market Block

Japan	Advanced	3.098978*	-0.709438**
	(4, 2)	(0.0799)	(0.0295)
Advanced	Japan	0.71199	-0.167401
	(4, 1)	(0.3998)	(0.5740)
Hong Kong SAR	Advanced	2.705466	-0.545825***
	(3, 2)	(0.1015)	(0.0004)
Advanced	Hong Kong SAR	21.72249***	-0.877174***
	(4, 3)	(0.0000)	(0.0000)
Australia	Advanced	15.201***	-0.704868***
	(4, 2)	(0.0001)	(0.0001)
Advanced	Australia	7.741249***	-0.931003***
	(3, 3)	(0.0059)	(0.0000)
Singapore	Advanced	18.3439***	-0.646834***
	(2, 4)	(0.0000)	(0.0000)
Advanced	Singapore	9.944836***	-0.714413***
	(4, 2)	(0.0019)	(0.0000)
New Zealand	Advanced	8.544757***	-0.751229***
	(2, 1)	(0.0039)	(0.0000)
Advanced	New Zealand	6.432093**	-0.798965***
	(2, 2)	(0.0119)	(0.0000)

[a]***denotes significance at 1 percent; **denotes significance at 5 percent; *denotes significance at 10 percent.
[b]Figures in parentheses under the independent variables are signifies the number of lags *p* and *q* which minimizes the AIC.
[c]The *F*-values in column 3 denotes the Wald test of restricted model where all lagged independent terms are equal to zero under the null hypothesis. The *p*-values are in parentheses.
[d]The speed of adjustment coefficients are reported along with their respective *p*-values.

Table 7: Leaders for Emerging and Advanced Market Blocks at 1 percent level of significance[a-c]

Equity Market/Block	Attractor	Causality	Leading Equity Market
Panel (a): Individual Equity Emerging Markets against Emerging Markets Block			
Developed and Emerging	Emerging	Uni-directional Emerging → Developed	No
China and Emerging	Emerging	Uni-directional Emerging → China	No
Indonesia and Emerging	Emerging	Uni-directional Indonesia → Emerging	No
Korea and Emerging	Korea	No causality	No
Malaysia and Emerging	Emerging	Uni-directional Emerging → Malaysia	No
Philippines and Emerging	Emerging	Uni-directional Emerging → Philippines	No
Taiwan and Emerging	Emerging	Uni-directional Emerging → Taiwan	No
Thailand and Emerging	Emerging	Uni-directional Emerging → Thailand	No
Japan and Emerging	Emerging	Uni-directional Emerging → Japan	No
Hong Kong SAR and Emerging	Hong Kong SAR	Bi-directional Hong Kong ↔ Emerging	Yes
Australia and Emerging	Emerging	Uni-directional Emerging → Australia	No
Singapore and Emerging	Singapore	Uni-directional Emerging → Singapore	No
New Zealand and Emerging	Emerging	No causality	No

Panel (b): Individual Emerging Equity Markets against Advanced Markets Block

China and Advanced	China	Uni-directional China → Advanced	Yes
Indonesia and Advanced	Advanced	Bidirectional Indonesia ↔ Advanced	No
Korea and Advanced	Advanced	Uni-directional Advanced → Korea	No
Malaysia and Advanced	Malaysia	Uni-directional Malaysia → Advanced	No
Philippines and Advanced	Advanced	Uni-directional Philippines → Advanced	No
Taiwan and Advanced	Advanced	Bidirectional Taiwan ↔ Advanced	No
Thailand and Advanced	Advanced	Bidirectional Thailand ↔ Advanced	No
Japan and Advanced	Advanced	No causality	No
Hong Kong SAR and Advanced	Hong Kong SAR	Uni-directional Hong Kong → Advanced	Yes
Australia and Advanced	Australia	Bidirectional Australia ↔ Advanced	Yes
Singapore and Advanced	Singapore	Bidirectional Singapore ↔ Advanced	Yes
New Zealand and Advanced	New Zealand	Uni-directional Advanced → New Zealand	No

[a]The leading equity markets selected are jointly based on a 1 percent level of significance from the Wald test and it being an attractor in the pairwise error correction model in Table 5 and 6.
[b]If uni-directional causality is taken, only China and Hong Kong SAR will appear to be the leaders for AMB and Hong Kong SAR will appear as the overall leader in the Asia Pacific region.
[c]Malaysia is ruled out as the estimated relative absolute size in terms of speed of adjustment coefficient derived from the corresponding error correction models are relatively close.

Table 8: Speed of Convergence of Individual Equity Markets to the Emerging Markets Block[a-c]

Equity Market/Block	**Intercept (β_0 * 100)**	**Time Slope (β_1 *100)**	**t_{HAC} (*p*-value)**	**R^2**	**ADF for Residuals**
China	0.8101	0.00556	3.363638*** (0.0009)	0.076819	-11.33863***
Indonesia	1.1575	-0.000996	-0.839775 (0.402)	0.004109	-11.93001***
Korea	1.0604	-0.00203	-2.370048** (0.0187)	0.039649	-12.57696***
Malaysia	0.6938	0.00209	1.589907 (0.1133)	0.017731	-13.90181***
Philippines	0.8636	-0.000128	-0.153396 (0.8782)	0.000135	-12.9327***
Taiwan	0.7616	0.000159	0.234821 (0.8146)	0.00041	-13.33136***
Thailand	0.9967	-0.000301	-0.291147 (0.7712)	0.000547	-13.96599***
Japan	0.7605	-0.000729	-1.360523 (0.1751)	0.007428	-11.53759***
Hong Kong SAR	0.5986	0.000111	0.21517 (0.8298)	0.000283	-13.14692***
Australia	0.4724	-0.000474	-1.11169 (0.2675)	0.007636	-13.76747***
Singapore	0.5063	-0.000264	-0.722463 (0.4708)	0.002631	-13.17436***
New Zealand	0.6834	-0.000256	-0.291729 (0.7708)	0.000507	-11.00384***

[a]***denotes significance at 1 percent; **denotes significance at 5 percent; *denotes significance at 10 percent.
[b] A positive time slope coefficient implies divergence from the equity block and a negative time slope coefficient implies convergence to the equity block.
[c]The critical values for the test are based on MacKinnon (1996) one-sided *p*-value.

Table 9: Speed of Convergence of Individual Equity Market to the Advanced Markets Block[a-c]

Equity Market/Block	Intercept (β_0 * 100)	Time Slope (β_1 *100)	t_{HAC} (p-value)	R^2	ADF for Residuals
Panel (a): Test of Convergence Hypothesis for Individual Equity Markets against AMB					
China	0.6818	0.00591	3.695751*** (0.0003)	0.094436	-10.7673***
Indonesia	1.2247	-0.00189	-1.53977 (0.1251)	0.01533	-11.5937***
Korea	0.9465	-0.00245	-3.771556*** (0.0002)	0.08629	-13.8936***
Malaysia	0.5522	0.0016	1.220627 (0.2236)	0.01021	-13.8121***
Philippines	0.7106	0.0000285	0.042605 (0.9661)	0.0000008	-13.3572***
Taiwan	0.7617	-0.00172	-2.921758*** (0.0039)	0.065425	-12.5014***
Thailand	1.0377	-0.00133	-1.29739 (0.1959)	0.010675	-8.40744***
Japan	0.7929	0.000369	0.664738 (0.5059)	0.001895	14.2282***
Hong Kong SAR	0.6926	0.000114	0.176467 (0.8601)	0.000212	-13.41118***
Australia	0.6872	0.0000402	0.084238 (0.9329)	0.000033	-14.09981***
Singapore	0.6568	-0.0000884	-0.189032 (0.8502)	0.000247	-12.83138***
New Zealand	0.9259	-0.0000181	-0.020145 (0.9839)	0.000002	-11.28977***
Panel (b): Test of Convergence Hypothesis on Emerging Markets Block					
Advanced	0.5159	0.000146	0.323709 (0.7465)	0.000664	-13.0859***
Panel (c): Test of Convergence Hypothesis on Advanced Markets Block					
Emerging	0.462	0.000188	0.437105 (0.6625)	0.001291	-12.9984***

[a]***denotes significance at 1 percent; **denotes significance at 5 percent; *denotes significance at 10 percent.
[b] A positive time slope coefficient implies divergence from the equity block and a negative time slope coefficient implies convergence to the equity block.
[c]The critical values for the test are based on MacKinnon (1996) one-sided *p*-value.