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# Trading Activity and Financial Market Integration

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**Abstract**

We investigate the effect of trading activity in the Asian emerging markets on the market integration across Asian emerging and major developed markets over the sample period of 1997 to 2009. The empirical evidence confirms that higher trading activity in Asian emerging markets can induce these markets and developed markets to become more integrated. Furthermore, we identify the mediation effect of market volatility on Asian emerging markets. This effect demonstrates that trading activity in Asian emerging markets not only directly enhances market integration, but also intensifies market volatility, indirectly increasing market integration.

*Keywords*: trading activity, market integration, dynamic correlation, Asian markets

*JEL Classifications*: G11, G12, G15

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## 1. Introduction

Financial market integration encompasses a complex interplay of various factors. For example, Bekaert and Harvey (1995) report that a liberalization of capital markets causes markets to become more integrated. Karolyi and Stulz (1996) and Akram, Rime and Sarno (2009) show that financial market integration is highly related to price co-movement among international stock markets, and market integration becomes higher when stock prices in various countries move in similar patterns. That is to say, a higher correlation between equity markets generally implies a higher co-movement and greater integration between the markets (Bekaert and Harvey, 1997; Morana and Beltratti, 2008; Yu, Fung and Tam, 2010).[1] Additionally, Morck, Yeung and Yu (2000) and Jin and Myers (2006) find that the correlation of stock markets is higher in countries with a relatively low gross domestic product (GDP) per capita and less developed financial systems. However, in spite of the recent growth in empirical studies on market integration, not much is known about how the trading activity in emerging markets affects market integration with developed markets.

In this paper, we fill this gap and demonstrate that more trading activity in emerging markets can induce higher market integration with developed markets. However, it is reasonable to expect that more trading activity in an emerging market can cause the correlations with developed markets to become higher. As in the interpretation of Copeland (1976, 1977) and Jennings, Starks and Fellingham (1981), the sequential dissemination of information from trader to trader is correlated with the quantity of trading. Consequently, more information incorporated into the stock price yields a rise in trading volume and cause price movement. Wang (1994) and He and Wang (1995) also develop a multiperiod model with heterogeneous investors and differential information that shows how trading volume is closely related to the flow and nature of information in the market over time. As a result, the information flow generates a high volume in trading, as well as a high movement in stock prices, and this implies that high trading activity incorporates more information, including worldwide information, into the stock price. Furthermore, Dufour and Engle (2000) provide empirical findings to show that trades convey information and affect security price. Chen, Firth and Rui (2001) also indicate that trading activity contributes some information to the stock pricing process. Therefore, more trading activity in an emerging market implies that more information from international financial markets is incorporated into stock prices and induces them to co-move with developed markets. Figure 1 shows the standardized trading volume and standardized pair-wise conditional correlation between the stock returns of Hong Kong and three major developed markets in Japan, the United Kingdom, and the United States during the period 1997–2009. These time

[1] In this study, market integration, in a broad sense, includes correlation. In the literature, stock market integration often occurs when assets with the same risk in different markets have the same expected returns. Therefore, the higher correlation between stock prices in different markets implies there are more common rewards to risk in those markets. In other words, those markets are more integrated.

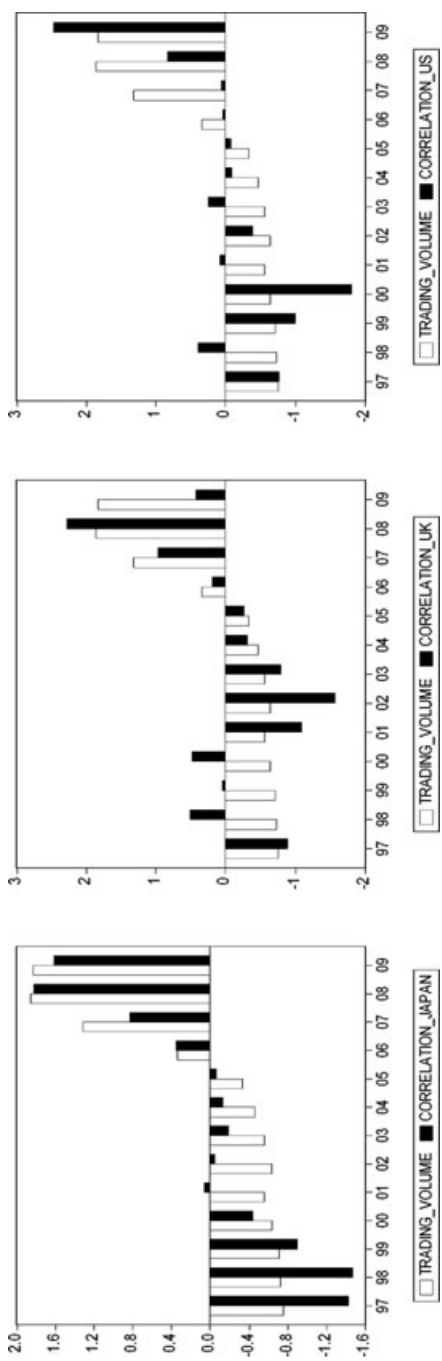


Figure 1
**Trading Activity and Market Integration**
These figures plot the levels of the market integration across Hong Kong and three major markets (Japan, the United Kingdom, and the United States) and the average daily trading volumes from January 1, 1997 to October 30, 2009. Average daily trading volumes represent level of trading activity in Hong Kong stock market. Correlation_Japan, Correlation_UK, Correlation_US represent the levels of market integration across Hong Kong and Japan, the United Kingdom, and the United States, respectively, as measured by dynamic correlation between two markets and estimated by DCC-EGARCH(1,1) Model. Trading volume, Correlation_Japan, Correlation_UK, and Correlation_US have been standardized.

series patterns show that the pattern of standardized trading volume is similar to that of standardized conditional correlation. This observation strengthens our hypothesis about the effect of trading activity on the market integration.

Investigations into the integration of emerging stock markets with developed markets are a significant focus of previous literature. Market integration possibly benefits the emerging market through a more efficient allocation of capital and a higher degree of risk diversification (e.g., Umutlu, Akdeniz and Altag-Salih, 2010). In contrast, intensified financial linkage between emerging and developed markets can generate high world capital mobility, incurring the risk of cross-border financial contagion (e.g., Beine, Cosma and Vermeulen, 2010). Against this background, there are several studies that focus on the financial integration of emerging Central Eastern European markets, such as those by Voronkova (2004), Chelley-Steeley (2005), and Schotman and Zalewska (2006). Hunter (2006) focuses on a group of Latin American emerging markets. However, these studies have not developed an appropriate way to assess the progress of financial integration between emerging and developed markets. Therefore, this paper demonstrates the effects of the trading activity of emerging markets in Asia on their market integration with major developed markets, and demonstrates that high domestic trading activity can induce the stock prices of Asian and developed markets move together and become more integrated. To our knowledge, this is the first paper to address this issue. Our empirical results show that higher trading activity in Asian emerging markets induces the equity markets of Asia and developed countries to become more correlated. Furthermore, we find that both the economic development and legal environment affect the degree of market integration between Asian and developed markets.

We further examine whether the mediation effects of market volatility exist between trading activity in domestic markets and market integration across Asian and developed markets. French and Roll (1986) and Admati and Pfleiderer (1988) suggest that trading activity affects the information exposure and the extent of price discovery, and thus also influences volatility of stock returns. Much empirical evidence also indicates that higher trading activity can increase the volatility of stock returns (e.g., Foster and Viswanathan, 1993; Andersen, 1996; Andersen and Bollerslev, 1998; Lee and Rui, 2002; Llorente, Michaely, Sarr and Wang, 2002; Huang and Masulis, 2003; Xu, Chen and Wu, 2006; Girard and Biswas, 2007; Zousoui, Nouyrigat and Beer, 2011). In addition, Longin and Solnik (1995) find that international stock market correlation is stronger when the market is volatile. Other related studies by Solnik, Boucrelle and Fur (1996), Chen and Zhang (1997), Ramchand and Susmel (1998), and Leong and Felmingham (2003) also find that market integration is affected by market volatility. Summarized these studies, we find that higher trading activity in domestic market may induce stock market to become more volatile, thus leading to an increase in the market integration across Asian and developed markets. This finding implies that the market volatility has the mediation effect on the relation between trading activity and market integration. Through this mediation effect of market volatility, domestic trading activity can indirectly influence the market integration of Asian emerging markets and major developed markets. The findings of this paper

show that most Asian markets present the mediation effect of market volatility in the relation between domestic trading activity and market integration across Asian and developed markets.

The results of this paper deepen the understanding of the relation between trading activity and market integration. We clearly demonstrate the direct and indirect effects of domestic trading activity on the degree of market integration across Asian domestic and developed markets, and imply that higher trading activity in domestic market conveys more information about asset value from international financial market, which improves Asian market integration with developed markets. Meanwhile, higher trading activity in domestic market also encourages the market to become more volatile, increasing market integration. These findings have important implications for asset and risk management, including asset allocation, portfolio diversification, and hedging strategy. According to the studies of Solnik, Boucrelle and Fur (1996), Ramchand and Susmel (1998), Butler and Joaquin (2002), and Fong (2003), the change in the degree of market integration can affect the performance of an internationally diversified portfolio without dynamic rebalancing. Umutlu, Akdeniz and Altag-Salih (2010) also show that financial integration benefits the region through more efficient allocation of capital, a higher degree of risk diversification, and robust market framework. Consequently, the results of this paper can help international investors to comprehend that the increase in the degree of market integration across domestic and developed markets is due to frequent domestic trading activity, which must be taken into account in asset allocation and portfolio composition. Otherwise, the benefits of portfolio diversification will be severely limited.[2]

## 2. Data and methodology

### *2.1. Data*

The core of this study is to explore that the relations between trading activity in Asian emerging stock markets (Hong Kong,[3] Indonesia, South Korea, Malaysia, Taiwan, and Thailand) and their market integration with the major developed markets (United States, United Kingdom, Japan). It is reasonable to observe these three developed markets in connection with Asian markets. Since Japan is a major investor and trading partner and has political influence on many Asian countries, it is expected that financial markets of Tokyo and other Asian countries are related. Likewise, due to the size and world economic importance of the U.S. and U.K. markets, the potential influence of these markets on the emerging markets cannot be ignored. The data used

[2]Market integration also poses some risks and entails costs; one major risk is that of contagion. Greater market integration increases the risk of contagion, as problems in one market segment are likely to be transmitted to other markets with the potential to cause systemic instability. Accordingly, this contagion effect can limit the degree of risk diversification for a portfolio.

[3]Although the inclusion of Hong Kong in the emerging markets category may be doubted by some, it is intended to achieve a more thorough analysis in this paper.

in this study are daily stock indices from January 1, 1997 through October 30, 2009 for six Asian countries. They are the Hang Seng (Hong Kong), Jakarta SE Composite (Indonesia), Korea SE Composite (Korea), Kuala Lumpur Composite (Malaysia), Taiwan SE Composite (Taiwan), and Bangkok S.E.T. (Thailand). In addition, three stock indices from developed countries, S&P 500 Composite (United States), FTSE 100 (United Kingdom), and Nikkei 225 Stock Average (Japan), are included. All national stock price indices are in local currency, dividend-unadjusted, and based on daily closing prices in each national market. The data are obtained from Datastream international.

Following the conventional approach, daily stock-index returns in the market $i$ are represented by the continuously compounded return or log return of the index at time $t$ such that $R_{it} = \log(\frac{p_{it}}{p_{it-1}}) \times 100$, and the returns are expressed as percentages. When data were unavailable, because of national holidays or other reasons, stock prices were assumed to stay the same as those of the previous trading day. The summary statistics of daily stock-index returns in the six Asian markets are presented in Table 1. Indonesia has the highest average daily stock-index returns, and the variation in daily stock-index returns in South Korea is larger than that of the other five Asian markets. Another noteworthy statistic of the stock-return series shown in Table 1 is the rejection of the Ljung-Box $Q$-tests. This suggests that almost all of the stock-return series are found to have first-order auto-correlation for the daily data. The existence of this autocorrelation may result from nonsynchronous trading of the stocks that make up the index. This may also be due to price limitations imposed on the index or other types of market friction, producing a partial adjustment process.

We also collected other explanatory variables to proxy for the market structure of Asian markets, and their definitions are described in the following subsections.

### 2.2. Trading activity

The literature on trading activity in financial markets is extensive and a number of volume measures have been proposed and studied, for example, shares traded, dollars traded, number of transactions, etc. However, Berk's (1995) observation indicates that any price-related variable will be related to returns under improper risk-adjustment. Therefore, the analysis of price/volume and volatility/volume relations often uses the share trading volume as proxy for trading activity (see Epps and Epps, 1976; Lamoureux and Lastrapes, 1990; Gallant, Rossi and Tauchen, 1992; Hiemstra and Jones, 1994; Andersen, 1996; Chordia, Subrahmanyam and Anshuman, 2001). This aspect leads us to believe that using share trading volume does not drive our results, since it does not involve the price level. Accordingly, we used daily share trading volume ($V_{it}$) to serve as a proxy for market-wide trading activity.[4] We constructed time series indices of market-wide trading activity over the 13 year period from 1997

[4]On the other hand, transaction data of Asian markets are not widely available and due to the limited database, we only used share trading to measure market trading activity.

Table 1

**Summary statistics**

This table summarizes our dependent and independent variables across Asian emerging markets. The sample period covers January 1, 1997 to October 30, 2009. $\rho_{it}$ is the daily correlation across major developed market (Japan, the United Kingdom, and the United States) and domestic market; $R_{it}$ is the daily domestic market return; $\sigma_{it}$ is the daily return volatility of domestic market; $V_{it}$ is the daily domestic trading volume in Billions share; and $MV_{it}$ is the daily domestic stock market value in Billions U.S. dollars. $GDP_{it}$ is the GDP per capita of domestic country in U.S. dollars.

| | $\rho_{it}^{Japan}$ | $\rho_{it}^{UK}$ | $\rho_{it}^{US}$ | $R_{it}$ (%) | $\sigma_{it}$ | $V_{it}$ (Billions) | $MV_{it}$ (Billions) | $GDP_{it}$ ($) |
|---|---|---|---|---|---|---|---|---|
| Hong Kong | | | | | | | | |
| Mean | 0.508 | 0.386 | 0.213 | 0.014 | 3.499 | 0.742 | 313.135 | 26,333.53 |
| S.D. | 0.080 | 0.036 | 0.055 | 1.843 | 4.902 | 0.936 | 84.429 | 2,323.63 |
| Skewness | 0.195 | 1.715 | 1.592 | 0.152 | 4.903 | 2.068 | 0.661 | 0.698 |
| Kurtosis | 2.914 | 19.351 | 10.705 | 12.466 | 36.035 | 7.663 | 2.483 | 2.163 |
| L-B Q(1) | 3,306.3*** | 3,039.9*** | 3,250.1*** | 9.5544** | 3,257.6*** | 2,300.3*** | 3,342.2*** | 3,343.8*** |
| Indonesia | | | | | | | | |
| Mean | 0.300 | 0.197 | 0.072 | 0.039 | 3.238 | 1.606 | 6.158 | 1,213.98 |
| S.D. | 0.110 | 0.076 | 0.037 | 1.764 | 3.528 | 2.291 | 1.996 | 512.88 |
| Skewness | 0.497 | 0.664 | 0.464 | −0.146 | 3.125 | 4.150 | 0.455 | 0.601 |
| Kurtosis | 2.309 | 3.168 | 8.780 | 10.016 | 14.794 | 30.389 | 2.175 | 2.146 |
| L-B Q(1) | 3,338.5*** | 3,334.7*** | 3,081.1*** | 84.97*** | 3,105.1*** | 2,102.9*** | 3,341.7*** | 3,343.7*** |
| South Korea | | | | | | | | |
| Mean | 0.485 | 0.275 | 0.155 | 0.026 | 4.442 | 0.357 | 248.932 | 13,939.27 |
| S.D. | 0.211 | 0.067 | 0.040 | 2.069 | 4.110 | 0.254 | 80.730 | 4,140.72 |
| Skewness | −0.725 | 0.552 | 1.420 | −0.192 | 2.223 | 1.621 | 0.304 | 0.228 |
| Kurtosis | 2.679 | 3.752 | 6.398 | 6.819 | 9.315 | 9.750 | 2.171 | 1.632 |
| L-B Q(1) | 3,330.3*** | 3,309.9*** | 3,328.5*** | 9.9076** | 3,262.3*** | 2,116.8*** | 3,344.3*** | 3,345.5*** |
| Malaysia | | | | | | | | |
| Mean | 0.295 | 0.181 | 0.027 | 0.000 | 4.031 | 0.098 | 5.018 | 5,034.13 |
| S.D. | 0.111 | 0.109 | 0.055 | 1.553 | 17.395 | 0.097 | 0.190 | 1,428.91 |
| Skewness | 0.621 | 0.220 | 1.393 | 0.475 | 17.568 | 2.605 | −0.226 | 0.741 |
| Kurtosis | 2.512 | 4.105 | 4.524 | 49.584 | 402.009 | 12.460 | 2.686 | 2.356 |
| L-B Q(1) | 3,317.5*** | 3,283.9*** | 3332.2*** | 6.6665** | 2,764.0*** | 2,288.4*** | 3,335.8*** | 3,344.7*** |
| Taiwan | | | | | | | | |
| Mean | 0.372 | 0.186 | 0.103 | 0.002 | 2.652 | 0.003 | 266.522 | 14,655.72 |
| S.D. | 0.170 | 0.101 | 0.045 | 1.602 | 1.869 | 0.001 | 37.065 | 1,479.19 |
| Skewness | −0.003 | 0.053 | 0.324 | −0.124 | 1.973 | 0.672 | 0.455 | 0.423 |
| Kurtosis | 1.571 | 3.030 | 4.286 | 5.482 | 9.382 | 4.263 | 2.747 | 1.867 |
| L-B Q(1) | 3,337.0*** | 3,316.1*** | 3,267.9*** | 10.213*** | 3,217.4*** | 2,073.1*** | 3,276.4*** | 3,343.9*** |
| Thailand | | | | | | | | |
| Mean | 0.277 | 0.236 | 0.127 | −0.006 | 3.089 | 1.614 | 130.807 | 2,625.11 |
| S.D. | 0.090 | 0.057 | 0.071 | 1.761 | 2.831 | 1.646 | 38.840 | 766.81 |
| Skewness | 0.204 | 1.649 | 0.895 | 0.110 | 4.379 | 1.422 | 0.252 | 0.735 |
| Kurtosis | 3.663 | 7.789 | 7.337 | 9.845 | 30.953 | 5.544 | 1.732 | 2.106 |
| L-B Q(1) | 3,314.1*** | 3,317.6*** | 3,187.0*** | 21.846*** | 3,000.9*** | 2,325.3*** | 3,345.6*** | 3,345.3*** |

** and *** indicate statistical significance at the 0.05 and 0.01 level, respectively.

to 2009 inclusive, or almost 3,450 trading days. The summary statistics of daily share trading volume of each of the six Asian markets are reported in Table 1. The highest average daily share trading volumes are in the Thailand and Indonesia stock markets, while the lowest is in the Taiwanese market. Further, the Indonesian stock market has the highest variation in daily share trading volume and the Taiwanese stock market has the lowest. Overall, these results indicate that the stock markets of Thailand and Indonesia are more active than the other Asian stock markets.

### *2.3. Market integration*

Since market interdependence has been widely used to measure the degree of market integration (e.g., Forbes and Rigobon, 2002; Bekaert, Harvey and Ng, 2005; Goetzmann, Li and Rouwenhorst, 2005; Panchenko and Wu, 2009), it is convenient to investigate financial market integration by checking the simple pair-wise correlation among the stock returns of various countries. However, financial market integration is widely propelled by market forces often influenced by structural changes in the financial system or by investment barriers, and the extent of integration is not constant over time (Kim, Moshirian and Wu, 2005; Chiang, Jeon and Li, 2007; Lee, Doong and Chou, 2011). To capture the time-varying degrees of market integration, and effectively describe the evolution of the changes on financial market co-movement over time, we used the dynamic conditional correlation (DCC) proposed by Engle (2002), from the multivariate generalized autoregressive conditional heteroskedasticity (GARCH) model. The DCC-GARCH model brings a significant methodological departure from the existing literature by demonstrating a more direct indication of evolution of market integration, where the dynamics of correlation are modeled together with those of the volatility of market returns (see Forbes and Rigobon, 2002).[5] The DCC method can bring some advantages to this study. First, DCC can effectively describe the conditional correlations among the Asian and the developed stock markets over time which measures the degree of market integration. Furthermore, the estimated DCC enables us to analyze the relation between trading activity and market integration among Asian and developed markets.

We used the dynamic correlation, estimated by DCC model, to measure the degree of market integration between the Asian markets and major developed markets. The summary statistics of daily correlation between six Asian markets and three developed markets (Japan, the United Kingdom, and the United States) are presented in Table 1. $\rho_{it}^{Japan}$, $\rho_{it}^{UK}$, *and* $\rho_{it}^{US}$ represent the correlations between Asian domestic markets and Japan, the U.K., and the U.S. markets, respectively. In this paper, we used these correlations to measure the degrees of market integration, respectively, across six Asian countries and the Asian, American, and European regions. Not

[5]The cross-market correlations are conditional on market volatility, and if such test does not account for heteroskedasticity, the estimated conditional correlation can be biased.

surprisingly, Table 1 shows that the degree of market integration across domestic markets and Asian region is higher than that in the American region and European region in all six Asian countries. We also found that Hong Kong has the highest correlation with Japan market, and South Korea has the highest standard deviation of the correlation with Japan market. Hong Kong also has the highest correlation with the U.K. market and the U.S. market among all six countries. This finding implies that Hong Kong stock market is highly open and has only minor investment barriers. On the other hand, the Malaysia stock market has the lowest correlation with Japan, the U.K., and the U.S. markets. Thus, Malaysia stock market has more investment barriers and a lower degree of market integration with the three major developed markets.

The estimation details of the bivariate EGARCH model with DCC (Engle, 2002) are described as follows. At first, we used the following vector autoregressive model to capture the dynamic relation in market returns:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + u_t, \tag{1}$$

where $R_t = (r_t, r_t^D)'$ is a matrix of daily market returns of Asian domestic ($r_t$) and developed markets ($r_t^D$). $\alpha_0$ is a $2 \times 1$ matrix of constants. $\alpha_1$ is a $2 \times 2$ matrix of which the off-diagonal elements capture the mean transmission across the market returns, and $(u_t \| \Im_{t-1} \sim N(0, H_t))$. From the above equation, an AR(1) term is included in the mean equation. The AR(1) is employed to account for the autocorrelation of stock returns, which was found in almost all Asian markets under this investigation, as reported in Table 1. Next, we specified a multivariate conditional variance $H_t$ as:

$$H_t = D_t C_t D_t, \tag{2}$$

where $D_t$ is the diagonal matrix of time-varying standard deviations from univariate EGARCH models with $\sqrt{h_{ii,t}}$ on $i$th diagonal; $C_t$ is the time-varying correlation matrix. Since the volatility transmission in international markets is asymmetric (Koutmos and Booth, 1995), the conditional variances in each market are modeled as an exponential function of past standardized innovations (Nelson, 1991) as follows:

$$h_{i,t} = \exp\left[\beta_{i0} + \sum_{j=1}^{n} \beta_{ij} f(z_{j,t-1}) + \delta_i \ln(h_{t-1})\right], \tag{3}$$

$$f_j(z_{j,t-1}) = |z_{j,t-1}| - E(|z_{j,t-1}|) + \gamma_j Z_{j,t-1}, \tag{4}$$

where the conditional variance in each market is an exponential function of past standardized innovations ($Z_{j,t-1} = \frac{u_{j,t-1}}{\sqrt{h_{j,t-1}}}$). The volatility spillovers are captured by the coefficients $\beta_{it}$, while asymmetry implies negative $\gamma_j$. One of the most important advantages of the EGARCH model is that it does not need parameter restrictions to ensure positive variances. The DCC model proposed by Engle (2002) involves two-stage estimation of the conditional covariance matrix $H_t$, and the evolution of

the correlation in the DCC model is given by

$$Q_t = (1 - q_a - q_b)\bar{Q} + q_a Z_{t-1} Z'_{t-1} + q_b Q_{t-1}, \tag{5}$$

where $Q_t = (qi_{j,t})$ is the $(n \times n)$ is the conditional variance–covariance matrix of $z_t$, $\bar{Q}_t = E(z_t z'_t)$ is the $(n \times n)$ unconditional variance matrix of $z_t$. $q_a$ and $q_b$ are nonnegative scalar parameters satisfying $q_a + q_b < 1$. Since $Q_t$ does not have unit diagonal elements, it is then scaled to obtain a proper correlation matrix $C_t$:

$$C_t = diag(Q_t)^{\frac{1}{2}} Q_t diag(Q_t)^{\frac{1}{2}}, \tag{6}$$

where $diag(Q_t)^{\frac{1}{2}} = diag(\frac{1}{\sqrt{q_{11,t}}}, \ldots, \frac{1}{\sqrt{q_{nn,t}}})$. The conditional correlation coefficient $\rho_{ij,t}$ between two markets $i$ and $j$ is then computed as follows:

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t} q_{jj,t}}}, \quad i, j = 1, 2, \ldots, n \quad \text{and} \quad i \neq j, \tag{7}$$

This dynamic correlation is the key element in this methodology, as it represents the time-varying conditional correlation between stock market returns. We used this dynamic correlation to measure the degree of market integration between the Asian markets and major developed markets.

### *2.4. Economic development and legal environment*

Since financial market integration is influenced by economic development and legal environment of domestic markets (see Morck, Yeung and Yu, 2000; Jin and Myers, 2006), we can apply the related variables to more obviously distinguish the relation between trading activity and market integration. Following the suggestion of Morck, Yeung and Yu (2000) and Jin and Myers (2006), we used the country's GDP per capita, $GDP_{it}$, in U.S. dollars each year as a proxy for the level of economic development. The summary statistics of $GDP_{it}$ of six Asian countries are reported in Table 1. We can easily find that the six Asian countries are divided into two groups, namely average GDP per capita of more than 10,000 and less than 10,000. Hong Kong, South Korea, and Taiwan belong to the high economic development group, and Indonesia, Malaysia, and Thailand belong to the low economic development group. This particular characteristic of samples makes it easy to distinguish the relation between market integration and economic development.

Further, we used the legal environment variables as control variables. Legal environment of stock market can affect the accuracy of market-wide information, and stronger legal environment can improve market efficiency. Hope (2003) suggests that higher quality enforcement of laws makes financial reporting more credible and reliable. Therefore, we considered the two measures of shareholder protection, the anti-director rights and the quality of accounting standards of each Asian domestic market, as proxies for the degree of legal environment in domestic markets. These two variables were obtained from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998).

The anti-director rights index ($AD_i$) is reported by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) and is calculated by aggregating six important shareholder rights. Anti-director rights provide effective investor protection when a country has functional political and legal systems. It is therefore plausible that the anti-director rights index is most relevant in countries with good government and where the rule of law prevails. The index ranges from 0 to 6 with higher values reflecting more rights and better protection of minority shareholders. On the other hand, high quality accounting standards influence investors' perception about quality of financial information, and also provide investors consistent, comparable, relevant and reliable financial information to make effective investment decisions. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) argue that high quality accounting can mitigate the negative effects of weak investor protection on the development of financial markets. Thus, we used the quality of accounting standards ($AS_i$) as the other measure of the legal environment. This variable is an index that ranges from 0 to 90 with higher scores indicating a better legal environment. Summary statistics of $AD_i$ and $AS_i$ have shown in Table 2, which presents that the $AD_i$ of Asian emerging markets ranges between 2 and 5, and the $AS_i$ of Asian emerging markets ranges between 57 and 76.

Finally, we also considered market characteristics in our empirical model. We used market volatility, measured by GARCH (1, 1) model, and market size, measured by market capitalization in Billions U.S. currency, of each Asian market as a proxy

Table 2

**Summary statistics for all six asian emerging markets**

This table summarizes our dependent and independent variables for all Asian emerging markets. The sample period covers January 1, 1997 to October 30, 2009. $\rho_{it}$ is the daily correlation across major developed market (Japan, the United Kingdom, and the United States) and domestic market; $R_{it}$ is the daily domestic market return; $\sigma_{it}$ is the daily return volatility of domestic market; $V_{it}$ is the daily domestic trading volume in Billions share; and $MV_{it}$ is the daily domestic stock market value in Billions U.S. dollars. $GDP_{it}$ is the GDP per capita of domestic country in U.S. dollars. $AS_i$ is the quality index of accounting standards; and $AD_i$ is the anti-director rights index reported by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). $IP_i$ is the strength of investors protection index from Global Competitiveness Report.

| | Mean | Median | Maximum | Minimum | SD | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|
| $\rho_{it}^{Japan}$ | 0.373 | 0.359 | 0.838 | −0.104 | 0.165 | 0.241 | 2.269 |
| $\rho_{it}^{UK}$ | 0.243 | 0.234 | 0.695 | −0.110 | 0.106 | −0.046 | 3.005 |
| $\rho_{it}^{US}$ | 0.116 | 0.113 | 0.574 | −0.108 | 0.079 | 0.425 | 3.986 |
| $R_{it}$ (%) | 0.012 | 0.000 | 20.817 | −24.153 | 1.775 | 0.012 | 13.217 |
| $\sigma_{it}$ | 3.497 | 2.093 | 513.717 | 0.140 | 7.860 | 32.344 | 1, 621.742 |
| $V_{it}$ (Billions) | 0.738 | 0.239 | 29.395 | 0.000 | 1.388 | 4.959 | 50.347 |
| $MV_{it}$ (Billions) | 186.563 | 185.507 | 530.315 | 2.685 | 115.749 | 0.131 | 2.582 |
| $GDP_{it}$ ($) | 10,663.08 | 7,991.598 | 30,680.0 | 508.200 | 8,995.541 | 0.653 | 2.171 |
| $AS_i$ | 65.505 | 65.000 | 76.000 | 57.000 | 5.918 | 0.433 | 2.408 |
| $IP_i$ | 6.669 | 5.700 | 9.000 | 5.300 | 1.567 | 0.639 | 1.516 |
| $AD_i$ | 3.003 | 3.000 | 5.000 | 2.000 | 1.155 | 0.644 | 1.869 |

for the influence of market characteristics. We aimed to clearly specify the relation between trading activity and financial market integration by adding the effect of market specific risk. Summary statistics of market volatility and market size are reported in Table 1, which shows that the average market volatility of Asian markets ranges between 2.652 and 4.442.

## 3. Empirical results

In this section, we use the explanatory variables developed in Section 2 to examine the relation between trading activity and market integration in six Asian markets. Next, we further show that market volatility exists as mediation effect in the relation between trading activity and market integration among the Asian and developed markets. Finally, we provide an explanation to interpret the relation among trading activity, market volatility, and market integration.

### *3.1. Correlation analysis*

First, we analyzed the cross-sectional correlations among variables used in our empirical models. Through this analysis, we distinguished the preliminary pair-wise relations between explanatory variables. Further, we compared the difference in pair-wise correlations between Asian countries to observe the country effect. Table 3 presents the estimates of pair-wise correlations between variables, employed in this study, for each Asian market. In full samples, market trading activity is significantly and positively associated with degree of market integration between domestic market and each of the following markets: Japan (0.096), the United States (0.204), and the United Kingdom (0.166). In each country sample, market trading activity and degrees of market integration between domestic market and three major developed markets are also significantly and positively correlated. This finding implies that trading activity in domestic market and market integration with Japan, the United States, and the United Kingdom are positively correlated. On the other hand, in full samples, the correlations between the logarithm market capitalization and the level of market integration of domestic market with three major developed markets are significantly positive and range from 0.323 to 0.391. Economic development of domestic market is also significantly and positively associated with degrees of market integration between domestic market and three major developed markets (0.624, 0.593, and 0.625, respectively). We observed similar results in each country sample, which demonstrates that the logarithm market capitalization, GDP per capita of domestic market and the level of market integration of domestic market with three major developed markets are significantly and positively correlated. Consistent with previous research (e.g., Morck, Yeung and Yu, 2000; Jin and Myers, 2006), economic development and market size of domestic market are positively associated with international financial market integration. Table 3 also indicates that the degrees

Table 3

**Correlation matrices**

This table summarizes correlations between dependent and independent variables. The abbreviations of the explanatory variables are explained in Table 1. The sample period covers January 1, 1997 to October 30, 2009.

| | $\rho_{it}^{Japan}$ | $\rho_{it}^{UK}$ | $\rho_{it}^{US}$ | $R_{it}$ | $\sigma_{it}$ | $V_{it}$ | $LogMV_{it}$ |
|---|---|---|---|---|---|---|---|
| All | | | | | | | |
| $R_{it}$ | 0.015** | 0.006 | 0.001 | – | | | |
| $\sigma_{it}$ | −0.048*** | 0.070*** | 0.014** | 0.022*** | – | | |
| $V_{it}$ | 0.096*** | 0.204*** | 0.166*** | 0.037*** | −0.002 | – | |
| $LogMV_{it}$ | 0.391*** | 0.323*** | 0.369*** | −0.002 | −0.020*** | −0.229*** | – |
| $GDP_{it}$ | 0.624*** | 0.593*** | 0.625*** | −0.001 | −0.013* | −0.167*** | 0.482*** |
| Hong Kong | | | | | | | |
| $R_{it}$ | 0.033* | −0.031* | 0.010 | – | | | |
| $\sigma_{it}$ | 0.181*** | 0.347*** | 0.325*** | 0.025 | – | | |
| $V_{it}$ | 0.659*** | 0.247*** | 0.381*** | 0.015 | 0.257*** | – | |
| $LogMV_{it}$ | 0.779*** | 0.103*** | 0.201*** | 0.022 | −0.067*** | 0.719*** | – |
| $GDP_{it}$ | 0.588*** | 0.203*** | 0.303*** | −0.007 | 0.292*** | 0.746*** | 0.723*** |
| Indonesia | | | | | | | |
| $R_{it}$ | 0.019 | 0.013 | −0.012 | – | | | |
| $\sigma_{it}$ | 0.024 | 0.141*** | 0.142*** | 0.026 | – | | |
| $V_{it}$ | 0.558*** | 0.561*** | 0.327*** | 0.055*** | −0.011 | – | |
| $LogMV_{it}$ | 0.793*** | 0.717*** | 0.288*** | 0.018 | −0.198*** | 0.531*** | – |
| $GDP_{it}$ | 0.903*** | 0.846*** | 0.376*** | 0.005 | −0.099*** | 0.589*** | 0.889*** |
| South Korea | | | | | | | |
| $R_{it}$ | 0.013 | 0.008 | 0.022 | – | | | |
| $\sigma_{it}$ | −0.375*** | −0.026 | −0.044** | 0.010 | – | | |
| $V_{it}$ | 0.353*** | 0.149*** | 0.221*** | 0.055*** | −0.120*** | – | |
| $LogMV_{it}$ | 0.778*** | 0.630*** | 0.321*** | 0.018 | −0.558*** | 0.215*** | – |
| $GDP_{it}$ | 0.774*** | 0.723*** | 0.561*** | −0.004 | −0.424*** | 0.119*** | 0.911*** |
| Malaysia | | | | | | | |
| $R_{it}$ | 0.010 | 0.014 | −0.016 | – | | | |
| $\sigma_{it}$ | −0.093*** | 0.096*** | −0.074*** | 0.043** | – | | |
| $V_{it}$ | 0.534*** | 0.478*** | 0.567*** | 0.077*** | 0.022 | – | |
| $LogMV_{it}$ | 0.562*** | 0.310*** | 0.560*** | 0.020 | −0.240*** | 0.502*** | – |
| $GDP_{it}$ | 0.720*** | 0.518*** | 0.782*** | −0.002 | −0.138*** | 0.616*** | 0.850*** |
| Taiwan | | | | | | | |
| $R_{it}$ | 0.017 | 0.015 | 0.011 | – | | | |
| $\sigma_{it}$ | −0.194*** | 0.020 | 0.057*** | 0.014 | – | | |
| $V_{it}$ | 0.441*** | 0.389*** | 0.316*** | 0.130*** | −0.099*** | – | |
| $LogMV_{it}$ | 0.671*** | 0.429*** | 0.121*** | 0.024 | −0.317*** | 0.405*** | – |
| $GDP_{it}$ | 0.779*** | 0.592*** | 0.245*** | −0.010 | −0.101*** | 0.322*** | 0.843*** |
| Thailand | | | | | | | |
| $R_{it}$ | 0.017 | −0.002 | −0.008 | – | | | |
| $\sigma_{it}$ | −0.051*** | 0.085*** | 0.067*** | 0.030* | – | | |
| $V_{it}$ | 0.385*** | 0.436*** | 0.281*** | 0.080*** | −0.104*** | – | |
| $LogMV_{it}$ | 0.369*** | 0.437*** | 0.211*** | 0.020 | −0.254*** | 0.657*** | – |
| $GDP_{it}$ | 0.495*** | 0.620*** | 0.365*** | −0.009 | −0.107*** | 0.594*** | 0.859*** |

*, **, *** indicate statistical significance at the 0.1, 0.05 and 0.01 level, respectively.

of market integration between Asian and developed markets are uncorrelated with stock market returns whether in full samples or each country sample.

In summary, the level of market integration between Asian markets and developed markets is positively associated with the trading activity, economic development, and market size of domestic market. According to these findings, we took into account variables which are related to trading activity, economic development, and market size of domestic market in our empirical model to examine the determinants of the level of market integration between Asian market and three major developed markets.

### *3.2. Impacts of trading activity on market integration*

The theme of this paper is to demonstrate that trading activity in domestic market impacts on market integration between the Asian and the developed markets. Chordia, Roll and Subrahmanyam (2001) and Chordia, Subrahmanyam and Anshuman (2001) indicate that stock price reflects market-wide information through the trading process of investors. Higher domestic trading activity implies that stock price reflects more information and faster price adjusting process than lower trading activity. Similarly, higher domestic trading activity can incorporate more international financial market information into the stock price, and causes the degree of market integration to rise. In addition, financial market integration is influenced by investment barriers, legal environment, and economic development of domestic market (Bekaert and Harvey, 1995; Morck, Yeung and Yu, 2000; Bekaert, Harvey and Lumsdaine, 2002; Jin and Myers, 2006). According to the above reasons, we used empirical regression model to examine the effects of trading activity, legal environment, and economic development of domestic market on market integration between Asian markets and developed markets. The regression model is defined as follows:

$$\rho_{it} = \alpha + \beta_1 V_{it} + \beta_2 \sigma_{it} + \beta_3 \log MV_{it} + \beta_4 \log GDP_{it} + \beta_5 AS_i + \beta_6 IP_i + \beta_7 AD_i + \varepsilon_{it}, \tag{8}$$

where $\rho_{it}$ is the daily correlation across major developed market (Japan, the United Kingdom, and the United States) and domestic market $i$ at day $t$; $V_{it}$ is the daily trading share volume of domestic market which proxies for trading activity in domestic market; $\sigma_{it}$ is the daily domestic market volatility; and $MV_{it}$ is the daily domestic market value. $GDP_{it}$ is the GDP per capita of domestic market which proxies for economic development of domestic market. $IP_i$ is the strength of Investor Protection Index taken from the Global Competitiveness Reports for 2008, used as the proxy for the degree of information disclosure. $AD_i$ and $AS_i$ are used as the proxies for the extent of legal enforcement (the anti-director rights index) and quality of accounting standards from La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998). $IP_i$, $AD_i$, and $AS_i$ are proxies for legal environment of domestic market. We estimated Equation (8) for each Asian market by using ordinary least squares, and obtained robust standard

errors (Newey and West, 1987). The dependent variable is market integration between the Asian and developed markets which are measured by dynamic correlation across each domestic market and three developed markets. The regression results of all Asian samples are reported in Table 4 and the regression results of each Asian country are presented in Table 5.

Table 4 shows the regression results of three different dependent variables in full samples. Column (1), column (6), and column (11) show the effect of trading activity in domestic markets on market integration with Japan, the U.K., and the U.S. markets with coefficients of 0.0115, 0.0156, and 0.0094, respectively. The results showed that trading activity significantly and positively affects market integration. Furthermore, the average standard deviation of daily trading volume in Asian market is 1.388 (Billions share), and implied that the average effect of trading activity on market integration with Japan, the U.K., and the U.S. markets can reach 1.59%, 2.17%, and 1.31%, respectively. Column (2), column (7), and column (12) show that trading activity still significantly and positively affects market integration after taking into account market-specific risk, such as market volatility and market size. These results support our conjecture that higher trading activity in domestic market increases the level of market integration with developed markets. Further, from column (3), column (8), and column (13), economic development of domestic market can significantly and positively influence the market integration between the stock markets of Asia and each of the developed markets: Japan (0.1324), the United Kingdom (0.0734), and the United States (0.0531). This indicates that higher economic development of domestic market attracts international investors to invest in the domestic market, and leads the integration of domestic market with developed markets. Next, we considered both trading activity and economic development of domestic markets in the regression model. Column (4), column (9), and column (14) present that both trading activity and economic development of domestic market significantly and positively influence market integration with developed markets. The average effect of trading activity on market integration with Japan, the U.K., and the U.S. markets are 3.77%, 3.43%, and 2.31%, respectively. Meanwhile, the coefficients of economic development in domestic markets on market integration with Japan, the U.K., and the U.S. markets are 0.1366, 0.0772, and 0.0556, respectively. Compared with column (2), column (3), column (7), column (8), column (12), and column (13), the effects of trading activity and economic development in domestic market on market integration increase when both effects exist at the same time. This indicates that the effects of trading activity and economic development in domestic market are nonsubstitutable. Column (5), column (10), and column (15) show that legal environment of domestic market has significant impact on market integration across Asian domestic markets and developed markets. The coefficients of both $AD_i$ and $AS_i$ are significantly negative, and imply that the more legal restrictions that exist the higher the barrier to international investment in the domestic market, leading to more segmentation in domestic and developed markets. However, the coefficient of $IP_i$ is significantly positive, which means that higher degree of information disclosure enhances entry of international investors into

Table 4

**Multivariate regressions**

This table presents the coefficient estimates and robust standard errors (in parentheses) from multivariate regressions of the level of market integration between Asian market and major developed market. All dependent and independent variables are defined in Table 1. The regression model is as follows:

$$\rho_{it} = \alpha + \beta_1 V_{it} + \beta_2 \sigma_{it} + \beta_3 LogMV_{it} + \beta_4 LogGDP_{it} + \beta_5 AS_i + \beta_6 IP_i + \beta_7 AD_i + \varepsilon_{it}.$$

In Panel A the dependent variable is the correlation between Asian market and Japan market; in Panel B the dependent variable is the correlation between Asian market and the U.K. market; in Panel C the dependent variable is the correlation between Asian market and the U.S. market. The sample period covers January 1, 1997 to October 30, 2009.

| | *Panel A: Dependent variable:* $\rho_{it}^{Japan}$ | | | | | *Panel B: Dependent variable:* $\rho_{it}^{UK}$ | | | | | *Panel C: Dependent variable:* $\rho_{it}^{US}$ | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
| Intercept | 0.3643*** (0.0013) | 0.1142*** (0.0040) | -0.5702*** (0.0092) | -0.6428*** (0.0090) | -1.0622*** (0.0320) | 0.2319*** (0.0008) | 0.0812*** (0.0026) | -0.2808*** (0.0064) | -0.3465*** (0.0060) | 0.1560*** (0.0189) | 0.1093*** (0.0006) | -0.0109*** (0.0019) | -0.2750*** (0.0046) | -0.3192*** (0.0044) | 0.5809*** (0.0137) |
| $V_{it}$ | 0.0115*** (0.0008) | 0.0232*** (0.0008) | | 0.0272*** (0.0007) | 0.0165*** (0.0007) | 0.0156*** (0.0005) | 0.0224*** (0.0005) | | 0.0247*** (0.0004) | 0.0110*** (0.0004) | 0.0094*** (0.0004) | 0.0150*** (0.0004) | | 0.0166*** (0.0003) | 0.0047*** (0.0003) |
| $\sigma_{it}$ | | -0.0008*** (0.0001) | -0.0008*** (0.0001) | -0.0008*** (0.0001) | -0.0008*** (0.0001) | | 0.0011*** (0.0001) | 0.0010*** (0.0001) | 0.0011*** (0.0001) | 0.0011*** (0.0001) | | 0.0002*** (0.0001) | 0.0002*** (0.0001) | 0.0002*** (0.0001) | 0.0004*** (0.0001) |
| Log$MV_{it}$ | | 0.0518*** (0.0008) | -0.0454*** (0.0012) | -0.0420*** (0.0012) | -0.0539*** (0.0021) | | 0.0301*** (0.0005) | -0.0260*** (0.0008) | -0.0229*** (0.0008) | 0.0165*** (0.0012) | | 0.0244*** (0.0003) | -0.0159*** (0.0006) | -0.0138*** (0.0006) | 0.0429*** (0.0008) |
| Log$GDP_{it}$ | | | 0.1324*** (0.0016) | 0.1366*** (0.0015) | 0.2040*** (0.0026) | | | 0.0734*** (0.0011) | 0.0772*** (0.0010) | 0.0681*** (0.0016) | | | 0.0531*** (0.0008) | 0.0556*** (0.0007) | 0.0165*** (0.0011) |
| $AS_i$ | | | | | -0.0043*** (0.0004) | | | | | -0.0159*** (0.0002) | | | | | -0.0169*** (0.0001) |
| $IP_i$ | | | | | 0.0091*** (0.0018) | | | | | 0.0976*** (0.0011) | | | | | 0.0509*** (0.0008) |
| $AD_i$ | | | | | -0.1432*** (0.0029) | | | | | -0.0709*** (0.0017) | | | | | -0.0154*** (0.0013) |
| Adj. $R^2$ | 0.009 | 0.190 | 0.377 | 0.427 | 0.506 | 0.041 | 0.191 | 0.275 | 0.374 | 0.582 | 0.028 | 0.203 | 0.294 | 0.375 | 0.603 |
| F-statistic | 188.59*** | 1572.93*** | 4041.73*** | 3723.93*** | 2933.30*** | 867.51*** | 1585.31*** | 2543.23*** | 2991.33*** | 3996.33*** | 571.19*** | 1702.56*** | 2787.23*** | 3012.55*** | 4352.78*** |

***indicates statistical significance at the 0.01 level.

Table 5

**Multivariate regressions**

This table presents the coefficient estimates and robust standard errors (in parentheses) from multivariate regressions of the level of market integration between each Asian market and major developed market. All dependent and independent variables are defined in Table 1. The regression model is as follows:

$$\rho_{it} = \alpha + \beta_1 V_{it} + \beta_2 \sigma_{it} + \beta_3 LogMV_{it} + \beta_4 LogGDP_{it} + \varepsilon_{it}.$$

The sample period covers January 1, 1997 to October 30, 2009.

| | | Intercept | $V_{it}$ | $\sigma_{it}$ | $LogMV_{it}$ | $LogGDP_{it}$ | Adj. $R^2$ | $F$-statistic |
|---|---|---|---|---|---|---|---|---|
| All | $\rho_{it}^{Japan}$ | −0.6428*** | 0.0272*** | −0.0008*** | −0.0420*** | 0.1366*** | 0.427 | 3723.93*** |
| | | (0.0074) | (0.0007) | (0.0001) | (0.0005) | (0.0015) | | |
| | $\rho_{it}^{UK}$ | −0.3465*** | 0.0247*** | 0.0011*** | −0.0229*** | 0.0772*** | 0.374 | 2991.33*** |
| | | (0.0060) | (0.0004) | (0.0001) | (0.0008) | (0.0010) | | |
| | $\rho_{it}^{US}$ | −0.3192*** | 0.0166*** | 0.0002*** | −0.0138*** | 0.0556*** | 0.375 | 3012.55*** |
| | | (0.0044) | (0.0003) | (0.0001) | (0.0006) | (0.0007) | | |
| Hong Kong | $\rho_{it}^{Japan}$ | 1.0122*** | 0.0115*** | 0.0044*** | 0.2606*** | −0.1981*** | 0.678 | 1759.48*** |
| | | (0.1463) | (0.0014) | (0.0002) | (0.0054) | (0.0156) | | |
| | $\rho_{it}^{UK}$ | 0.5058*** | 0.0068*** | 0.0023*** | 0.0031 | −0.0147 | 0.147 | 144.42*** |
| | | (0.1072) | (0.0010) | (0.0001) | (0.0039) | (0.0115) | | |
| | $\rho_{it}^{US}$ | 0.3052* | 0.0201*** | 0.0027*** | −0.0042 | −0.0091 | 0.200 | 209.69*** |
| | | (0.1569) | (0.0015) | (0.0002) | (0.0057) | (0.0168) | | |
| Indonesia | $\rho_{it}^{Japan}$ | −1.1169*** | 0.0047*** | 0.0058*** | 0.0409*** | 0.1879*** | 0.774 | 2878.41*** |
| | | (0.0693) | (0.0005) | (0.0003) | (0.0066) | (0.0051) | | |
| | $\rho_{it}^{UK}$ | −0.7704*** | 0.0047*** | 0.0062*** | 0.0067 | 0.1323*** | 0.725 | 2207.18*** |
| | | (0.0201) | (0.0003) | (0.0002) | (0.0050) | (0.0039) | | |
| | $\rho_{it}^{US}$ | −0.1430*** | 0.0029*** | 0.0020*** | −0.0112** | 0.0318*** | 0.179 | 183.59*** |
| | | (0.0171) | (0.0003) | (0.0001) | (0.0043) | (0.0033) | | |
| South Korea | $\rho_{it}^{Japan}$ | −3.8151*** | 0.1783*** | 0.0026*** | 0.1964*** | 0.3318*** | 0.679 | 1776.32*** |
| | | (0.0945) | (0.0083) | (0.0006) | (0.0172) | (0.0178) | | |
| | $\rho_{it}^{UK}$ | −1.5012*** | 0.0124*** | 0.0068*** | 0.0315*** | 0.1651*** | 0.631 | 1433.30*** |
| | | (0.0322) | (0.0028) | (0.0002) | (0.0058) | (0.0061) | | |
| | $\rho_{it}^{US}$ | −1.1508*** | 0.0362*** | 0.0008*** | −0.1432*** | 0.2181*** | 0.552 | 1030.33*** |
| | | (0.0211) | (0.0018) | (0.0001) | (0.0038) | (0.0039) | | |
| Malaysia | $\rho_{it}^{Japan}$ | −1.7512*** | 0.2195*** | −0.0002* | −0.1099*** | 0.3037*** | 0.509 | 866.99*** |
| | | (0.0528) | (0.0173) | (0.0001) | (0.0152) | (0.0111) | | |
| | $\rho_{it}^{UK}$ | −1.0110*** | 0.3083*** | 0.0006*** | −0.2241*** | 0.2690*** | 0.336 | 424.31*** |
| | | (0.0600) | (0.0196) | (0.0001) | (0.0172) | (0.0127) | | |
| | $\rho_{it}^{US}$ | −1.1276*** | 0.1014*** | −0.0001 | −0.1256*** | 0.2092*** | 0.629 | 1424.47*** |
| | | (0.0228) | (0.0074) | (0.0001) | (0.0065) | (0.0048) | | |
| Taiwan | $\rho_{it}^{Japan}$ | −12.0983*** | 22.3456*** | −0.0123*** | −0.1928*** | 1.4085*** | 0.660 | 1625.83*** |
| | | (0.2155) | (1.0948) | (0.0010) | (0.0263) | (0.0338) | | |
| | $\rho_{it}^{UK}$ | −6.1252*** | 16.1403*** | 0.0012 | −0.2435*** | 0.7940*** | 0.422 | 611.15*** |
| | | (0.1667) | (0.8471) | (0.0007) | (0.0204) | (0.0262) | | |
| | $\rho_{it}^{US}$ | −1.3976*** | 8.7635*** | 0.0001 | −0.1497*** | 0.2407*** | 0.179 | 183.13*** |
| | | (0.0894) | (0.4545) | (0.0004) | (0.0109) | (0.0141) | | |
| Thailand | $\rho_{it}^{Japan}$ | −0.8634*** | 0.0126*** | −0.0011** | −0.1082*** | 0.2101*** | 0.256 | 287.53*** |
| | | (0.0506) | (0.0011) | (0.0005) | (0.0108) | (0.0108) | | |
| | $\rho_{it}^{UK}$ | −0.7979*** | 0.0076*** | 0.0021*** | −0.0889*** | 0.1844*** | 0.423 | 615.07*** |
| | | (0.0283) | (0.0006) | (0.0002) | (0.0060) | (0.0061) | | |
| | $\rho_{it}^{US}$ | −0.6814*** | 0.0095*** | 0.0011*** | −0.1275*** | 0.1794*** | 0.189 | 196.80*** |
| | | (0.0415) | (0.0009) | (0.0004) | (0.0088) | (0.0089) | | |

*, **, *** indicate statistical significance at the 0.1, 0.05 and 0.01 level, respectively.

domestic market, then induces domestic and developed markets to become more integrated. In addition, Table 4 shows that the effect of trading activity on market integration between Asian market and developed market increases when the empirical model takes into account these control variables. This implies that market trading activity indeed influences market integration between emerging market and developed market.

Table 5 shows the regression results of market integration between each Asian market and Japan, the U.K., and the U.S. markets, respectively. From this table, the effects of trading activity on market integration in each Asian domestic market can be observed. The results indicated that the impact of trading activity in domestic market ($V_{it}$) on market integration across domestic and Japan market ($\rho_{it}^{Japan}$) is significantly positive in each Asian market (Hong Kong, Indonesia, South Korea, Malaysia, Taiwan, and Thailand). The trading activity of domestic market also significantly and positively impacts on market integration across domestic market and the U.S. market in all Asian markets. Similarly, the relation between trading activity and market integration across domestic and the U.K. market is also significant and positive in all Asian markets. Therefore, market trading activity in all Asian domestic markets impacts on market integration which supports our conjecture that with higher trading activity in domestic markets there is more integration with developed markets. Further, economic development of domestic market affects market integration in Asian markets excluding Hong Kong. Since Hong Kong is one of the world's most open economies, and has a free market and reduction in trade barriers, the market integration across Hong Kong and developed markets is not affected by economic development. In the other five Asian markets, the results support that economic development of domestic market can influence the market integration across domestic and developed markets.

From the above, we emphasize that trading activity, legal environment, and economic development of domestic market significantly impact on market integration, even when controlling for the market-specific volatility, market size, and individual country effect. These findings imply that higher trading activity increases international common financial information in stock prices of domestic market, thus raising the level of market integration. Furthermore, improving legal environment and increasing economic development of domestic market enhance investment by international investors in domestic market. This then raises the level of market integration across domestic markets and major developed markets.

### *3.3. Mediation effects of market volatility*

It should be noted that the mediation effect of market volatility exists in the relation between trading activity in domestic market and market integration across domestic and developed markets. As with the findings of French and Roll (1986) and Admati and Pfleiderer (1988), trading activity can increase price volatility due to the heterogeneity of traders. Numerous empirical evidence also suggests that

higher trading activity is associated with faster price revision and higher information content in trades, and thus increases the volatility of stock returns (e.g., Foster and Viswanathan, 1993; Lee and Rui, 2002; Huang and Masulis, 2003; Xu, Chen and Wu, 2006; Kurov, 2008; Angelidis, 2010). In addition, Solnik, Boucrelle and Fur (1996) find that cross-market correlation increases in periods of high volatility, since international investors rebalance their portfolio to diversify their risk when markets become more volatile. Many researchers also have found that market integration is affected by market volatility (e.g., Ramchand and Susmel, 1998; Longin and Solnik, 2001; Ang and Bekaert, 2002; Ang and Chen, 2002; Bartram and Wang, 2005). Synthesizing these studies, we speculate that trading activity in domestic market not only directly but also indirectly affects market integration through mediation effect of market volatility. To examine the mediation effect of market volatility, we follow the method of Baron and Kenny (1986) and Judd and Kenny (1981) and construct the simultaneous regression model as follows:

$$\rho_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 \sigma_{it} + \beta_3 \log MV_{it} + \beta_4 \log GDP_{it} + \varepsilon_{it}, \tag{9}$$

$$\sigma_{it} = \beta_5 + \beta_6 V_{it} + \beta_7 \sigma_{it-1} + u_{it}, \tag{10}$$

where $\rho_{it}$ is the daily correlation across major developed markets (Japan, the United Kingdom, and the United States) and domestic market $i$ at day $t$; $V_{it}$ is the daily trading volume of domestic market; $\sigma_{it}$ is the daily domestic market volatility; and $MV_{it}$ is the daily domestic market capitalization. $GDP_{it}$ is the GDP per capita of domestic market. Equation (9) captures the effect of domestic market volatility on the market integration across domestic market and developed market, and controls for the effect of market size and economic development of domestic market. Equation (10) expresses the relation between trading activity and market volatility of domestic market, and includes the volatility clustering effect ($\alpha_{it-1}$) proposed by Mandelbrot (1963). By estimating Equations (9) and (10) simultaneously, we can conveniently examine the mediation effect of market volatility between trading activity in domestic market and market integration across domestic and developed markets. According to the approach of Baron and Kenny (1986), if $\beta_1$ is significant the trading activity in domestic market has a direct effect on the market integration. If both $\beta_2$ and $\beta_6$ are significant, it implies that mediation effect of market volatility exists between trading activity and market integration.

The estimated results for the simultaneous regression model of each Asian market are presented in Table 6. In each of the six Asian markets, $\beta_1$ is significantly positive which implies that trading activity in domestic market directly and positively affects the market integration between domestic and Japan, the U.K., and the U.S. markets, respectively. This evidence is also consistent with the results of the previous section in which higher market trading activity enhances market integration with developed market. Further, this table shows that $\beta_6$ is significantly positive in Hong Kong, Malaysia, Taiwan, and Thailand. This supports the mediation effect of market volatility in stock markets of Hong Kong, Malaysia, Taiwan, and Thailand, but not

Table 6

**Simultaneous equation regressions**

This table presents the coefficient estimates and robust standard errors (in parentheses) from simultaneous equation regressions as follows:

$$\rho_{it} = \beta_0 + \beta_1 V_{it} + \beta_2 \sigma_{it} + \beta_3 LogMV_{it} + \beta_4 LogGDP_{it} + \varepsilon_{it},$$
$$\sigma_{it} = \beta_5 + \beta_6 V_{it} + \beta_7 \sigma_{it-1} + u_{it}.$$

All dependent and independent variables are explained in Table 1. The sample period covers January 1, 1997 to October 30, 2009.

| | | Intercept | $V_{it}$ | $\sigma_{it}$ | $LogMV_{it}$ | $LogGDP_{it}$ | $\sigma_{it-1}$ | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Hong Kong | $\rho_{it}^{Japan}$ | 1.0707*** | 0.0117*** | 0.0045*** | 0.2601*** | −0.2037*** | | 0.6775 |
| | | (0.1456) | (0.0014) | (0.0002) | (0.0053) | (0.0156) | | |
| | $\sigma_{it}$ | −0.0023 | 0.0871*** | | | | 0.9821*** | 0.9726 |
| | | (0.0194) | (0.0154) | | | | (0.0029) | |
| | $\rho_{it}^{UK}$ | 0.4852*** | 0.0067*** | 0.0023*** | 0.0032 | −0.0128 | | 0.1462 |
| | | (0.1071) | (0.0010) | (0.0001) | (0.0039) | (0.0115) | | |
| | $\sigma_{it}$ | −0.0022 | 0.0871*** | | | | 0.9821*** | 0.9726 |
| | | (0.0194) | (0.0154) | | | | (0.0029) | |
| | $\rho_{it}^{US}$ | 0.3534** | 0.0203*** | 0.0028*** | −0.0047 | −0.0136 | | 0.1995 |
| | | (0.1565) | (0.0015) | (0.0002) | (0.0057) | (0.0168) | | |
| | $\sigma_{it}$ | −0.0023 | 0.0871*** | | | | 0.9821*** | 0.9726 |
| | | (0.0194) | (0.0154) | | | | (0.0029) | |
| Indonesia | $\rho_{it}^{Japan}$ | −1.1190*** | 0.0046*** | 0.0060*** | 0.0408*** | 0.1882*** | | 0.7746 |
| | | (0.0263) | (0.0005) | (0.0003) | (0.0065) | (0.0051) | | |
| | $\sigma_{it}$ | 0.1035*** | 0.0102 | | | | 0.9629*** | 0.9269 |
| | | (0.0253) | (0.0072) | | | | (0.0047) | |
| | $\rho_{it}^{UK}$ | −0.7725*** | 0.0048*** | 0.0065*** | 0.0067 | 0.1325*** | | 0.7252 |
| | | (0.0201) | (0.0004) | (0.0002) | (0.0050) | (0.0039) | | |
| | $\sigma_{it}$ | 0.1034*** | 0.0102 | | | | 0.9629*** | 0.9269 |
| | | (0.0253) | (0.0072) | | | | (0.0047) | |
| | $\rho_{it}^{US}$ | −0.1433*** | 0.0030*** | 0.0021*** | −0.0112** | 0.0318*** | | 0.1791 |
| | | (0.0171) | (0.0003) | (0.0002) | (0.0043) | (0.0033) | | |
| | $\sigma_{it}$ | 0.1036*** | 0.0102 | | | | 0.9629*** | 0.9269 |
| | | (0.0253) | (0.0072) | | | | (0.0047) | |
| South Korea | $\rho_{it}^{Japan}$ | −3.8176*** | 0.0945*** | 0.0027*** | 0.1966*** | 0.3320*** | | 0.6792 |
| | | (0.0945) | (0.0083) | (0.0006) | (0.0172) | (0.0179) | | |
| | $\sigma_{it}$ | 0.0331 | 0.0612 | | | | 0.9874*** | 0.9739 |
| | | (0.0245) | (0.0454) | | | | (0.0028) | |
| | $\rho_{it}^{UK}$ | −1.5060*** | 0.0125*** | 0.0070*** | 0.0318*** | 0.1655*** | | 0.6312 |
| | | (0.0322) | (0.0028) | (0.0002) | (0.0059) | (0.0061) | | |
| | $\sigma_{it}$ | 0.0331 | 0.0613 | | | | 0.9874*** | 0.9739 |
| | | (0.0245) | (0.0454) | | | | (0.0028) | |
| | $\rho_{it}^{US}$ | −1.1545*** | 0.0364*** | 0.0009*** | −0.1431*** | 0.2184*** | | 0.5515 |
| | | (0.0211) | (0.0019) | (0.0001) | (0.0038) | (0.0040) | | |
| | $\sigma_{it}$ | 0.0331 | 0.0612 | | | | 0.9874*** | 0.9739 |
| | | (0.0245) | (0.0454) | | | | (0.0028) | |

(*Continued*)

Table 6 (*continued*)

**Simultaneous equation regressions**

| | | Intercept | $V_{it}$ | $\sigma_{it}$ | $LogMV_{it}$ | $LogGDP_{it}$ | $\sigma_{it-1}$ | Adj. $R^2$ |
|---|---|---|---|---|---|---|---|---|
| Malaysia | $\rho_{it}^{Japan}$ | −1.7514*** | 0.2194*** | −0.0001* | −0.1097*** | 0.3036*** | | 0.5086 |
| | | (0.0528) | (0.0173) | (0.0001) | (0.0152) | (0.0112) | | |
| | $\sigma_{it}$ | −0.0159 | 3.8884*** | | | | 0.9083*** | 0.8254 |
| | | (0.1811) | (1.2859) | | | | (0.0072) | |
| | $\rho_{it}^{UK}$ | −1.0120*** | 0.3079*** | 0.0007*** | −0.2230*** | 0.2685*** | | 0.3359 |
| | | (0.0600) | (0.0197) | (0.0001) | (0.0172) | (0.0127) | | |
| | $\sigma_{it}$ | −0.0161 | 3.8890*** | | | | 0.9084*** | 0.8254 |
| | | (0.1811) | (1.2859) | | | | (0.0072) | |
| | $\rho_{it}^{US}$ | −1.1275*** | 0.1016*** | −0.0001** | −0.1259*** | 0.2094*** | | 0.6298 |
| | | (0.0228) | (0.0075) | (0.00003) | (0.0065) | (0.0048) | | |
| | $\sigma_{it}$ | −0.0158 | 3.8879*** | | | | 0.9084*** | 0.8254 |
| | | (0.1811) | (1.2859) | | | | (0.0072) | |
| Taiwan | $\rho_{it}^{Japan}$ | −12.0981*** | 22.3685*** | −0.0122*** | −0.1929*** | 1.4085*** | | 0.6601 |
| | | (0.2153) | (1.0940) | (0.0010) | (0.0263) | (0.0339) | | |
| | $\sigma_{it}$ | 0.0098 | 12.0340*** | | | | 0.9814*** | 0.9606 |
| | | (0.0173) | (3.7595) | | | | (0.0035) | |
| | $\rho_{it}^{UK}$ | −6.1247*** | 16.1885*** | 0.0016** | −0.2436*** | 0.7939*** | | 0.4217 |
| | | (0.1664) | (0.8463) | (0.0008) | (0.0203) | (0.0262) | | |
| | $\sigma_{it}$ | 0.0097 | 12.0372*** | | | | 0.9814*** | 0.9606 |
| | | (0.0173) | (3.7595) | | | | (0.0035) | |
| | $\rho_{it}^{US}$ | −1.3974*** | 8.7843*** | 0.0002 | −0.1498*** | 0.2407*** | | 0.1787 |
| | | (0.0893) | (0.4542) | (0.0004) | (0.0109) | (0.0141) | | |
| | $\sigma_{it}$ | 0.0097 | 12.0347*** | | | | 0.9814*** | 0.9606 |
| | | (0.0173) | (3.7595) | | | | (0.0035) | |
| Thailand | $\rho_{it}^{Japan}$ | −0.8628*** | 0.0127*** | −0.0011** | −0.1081*** | 0.2100*** | | 0.2551 |
| | | (0.0506) | (0.0011) | (0.0005) | (0.0108) | (0.0108) | | |
| | $\sigma_{it}$ | 0.1262*** | 0.0213** | | | | 0.9480*** | 0.8958 |
| | | (0.0293) | (0.0097) | | | | (0.0056) | |
| | $\rho_{it}^{UK}$ | −0.7963*** | 0.0077*** | 0.0023*** | −0.0886*** | 0.1839*** | | 0.4232 |
| | | (0.0283) | (0.0006) | (0.0003) | (0.0060) | (0.0061) | | |
| | $\sigma_{it}$ | 0.1261*** | 0.0213** | | | | 0.9480*** | 0.8958 |
| | | (0.0293) | (0.0097) | | | | (0.0056) | |
| | $\rho_{it}^{US}$ | −0.6790*** | 0.0096*** | 0.0014*** | −0.1270*** | 0.1787*** | | 0.1895 |
| | | (0.0415) | (0.0009) | (0.0004) | (0.0088) | (0.0089) | | |
| | $\sigma_{it}$ | 0.1261*** | 0.0213** | | | | 0.9480*** | 0.8958 |
| | | (0.0293) | (0.0097) | | | | (0.0056) | |

*, **, *** indicate statistical significance at the 0.1, 0.05 and 0.01 level, respectively.

in Indonesia or South Korea. Compared with Table 5, the effect of market volatility ($\beta_2$) of Malaysia, Taiwan, and Thailand stock markets on market integration between domestic and developed markets becomes significant, implying that trading activity in domestic market indirectly influences market integration between domestic and developed markets. This confirms our conjecture that trading activity in domestic market not only has direct and positive impact, but also has indirect impact, through

positive mediation effect of market volatility, affecting the market integration between Asian markets and developed markets. This result also shows that higher trading activity in domestic market can induce the market to become more volatile.

## 4. Additional tests

In this section, we provide the robustness tests to highlight our empirical findings. We further examine the impact of foreign investor trading on the relation between market integration and trading activity in Asian emerging market. The empirical results of this paper clearly indicate that more trading activity in Asian emerging markets can increase integration of those markets with developed markets. Richards (2005) finds that foreign investors have impact on the emerging markets. Furthermore, the findings of Domowitz, Glen and Madhavan (1997), Bekaert and Harvey (2000), and Bekaert, Harvey and Lumsdaine (2002) show that the benefit of international diversification possibly encourages foreign investors to invest more in the emerging markets, which induces those markets to become more integrated. Accordingly, the effect of foreign investor trading on market integration may not be ignored. To highlight the findings of this paper, we add the effects of foreign investors into the empirical model (Equation (8)) to better comprehend the relation between market integration and trading activity in Asian emerging markets.

According to the study of Richards (2005), we consider the effect of capital flow and trading activity of foreign investors and employ the daily net purchases of foreign investors ($FN_{it}$) as proxies of capital flow of foreign investors and daily trading volume of foreign investors ($FT_{it}$) as proxies of trading activity of foreign investors. Due to the limitation of Bloomberg database, we only obtain the trading data of foreign investors in four Asian markets, Indonesia, South Korea, Taiwan, and Thailand. We rewrite Equation (8) to reexamine the relation between trading activity and market integration including the influence of foreign investor trading. The modified model is described as follows:

$$\rho_{it} = \alpha + \beta_1 V_{it} + \beta_2 FN_{it} + \beta_3 FT_{it} + \beta_4 \sigma_{it} + \beta_5 \log MV_{it} + \beta_6 \log GDP_{it} + \varepsilon_{it}. \tag{11}$$

The estimated results of Equation (11) are reported in Table 7. This table shows that the effect of capital flow of foreign investors on the market integration is significant in South Korea and Taiwan. However, the results are mixed with positive effect in South Korea and negative effect in Taiwan. Overall, the capital flow of foreign investors in Asian emerging markets has negative impact on their integration with developed market. In addition, the trading activity of foreign investors in Asian emerging markets has significant positive impact on the market integration excluding Thailand. Summarizing these results, we find that the empirical evidence of these Asian emerging markets supports the portfolio rebalancing effect, in contrast with the findings of Richards (2005), and implies that international diversification

Table 7

**The effect of foreign investor trading on market integration**

This table presents the coefficient estimates and robust standard errors (in parentheses) from multivariate regressions of the level of market integration between each Asian market and major developed market. The regression model is as follows:

$$\rho_{it} = \alpha + \beta_1 V_{it} + \beta_2 FN_{it} + \beta_3 FT_{it} + \beta_4 \sigma_{it} + \beta_5 LogMV_{it} + \beta_6 LogGDP_{it} + \varepsilon_{it},$$

where $FN_{it}$ denotes the net purchase of foreign investors in domestic market in Billions U.S. dollars. $FT_{it}$ is the trading value of foreign investors in Billions U.S. dollars. Other explanatory variables are defined in Table 1. The sample period covers January 1, 2000 to October 30, 2009.

| | | Intercept | $V_{it}$ | $FN_{it}$ | $FT_{it}$ | $\sigma_{it}$ | $LogMV_{it}$ | $LogGDP_{it}$ | Adj. $R^2$ | $F$-stat |
|---|---|---|---|---|---|---|---|---|---|---|
| All | $\rho_{it}^{Japan}$ | −0.4547*** | 0.0156*** | −0.0277*** | 0.0877*** | 0.0037*** | −0.0397*** | 0.1116*** | 0.612 | 2703.37*** |
| | | (0.0140) | (0.0006) | (0.0065) | (0.0017) | (0.0004) | (0.0013) | (0.0022) | | |
| | $\rho_{it}^{UK}$ | 0.0666*** | 0.0175*** | −0.0161*** | 0.0391*** | 0.0077*** | 0.0055*** | 0.0096*** | 0.384 | 1065.75*** |
| | | (0.0088) | (0.0004) | (0.0041) | (0.0011) | (0.0003) | (0.0008) | (0.0014) | | |
| | $\rho_{it}^{US}$ | 0.0260*** | 0.0064*** | −0.0047 | 0.0091*** | 0.0040*** | 0.0165*** | −0.0003 | 0.295 | 715.98*** |
| | | (0.0066) | (0.0003) | (0.0031) | (0.0008) | (0.0002) | (0.0006) | (0.0010) | | |
| Indonesia | $\rho_{it}^{Japan}$ | −1.5629*** | −0.0001 | 0.0087 | 0.0085 | 0.0029*** | 0.0514*** | 0.2497*** | 0.884 | 3280.43*** |
| | | (0.0309) | (0.0004) | (0.0125) | (0.0067) | (0.0003) | (0.0074) | (0.0060) | | |
| | $\rho_{it}^{UK}$ | −1.3375*** | 0.0026*** | 0.0073 | 0.0065 | 0.0040*** | −0.0493*** | 0.2266*** | 0.861 | 2634.51*** |
| | | (0.0244) | (0.0003) | (0.0099) | (0.0053) | (0.0003) | (0.0058) | (0.0047) | | |
| | $\rho_{it}^{US}$ | −0.2451*** | 0.0018*** | 0.0182** | 0.0112** | 0.0051*** | −0.0395*** | 0.0527*** | 0.374 | 255.99*** |
| | | (0.0207) | (0.0003) | (0.0084) | (0.0045) | (0.0002) | (0.0049) | (0.0040) | | |
| South Korea | $\rho_{it}^{Japan}$ | −3.0367*** | −0.0014 | −0.0197 | 0.0131** | 0.0035*** | −0.1313** | 0.4500*** | 0.618 | 692.09*** |
| | | (0.1857) | (0.0146) | (0.0130) | (0.0054) | (0.0010) | (0.0517) | (0.0399) | | |
| | $\rho_{it}^{UK}$ | −1.4673*** | −0.0209*** | 0.0146** | 0.0098*** | 0.0086*** | −0.0938*** | 0.2344*** | 0.612 | 673.77*** |
| | | (0.1421) | (0.0068) | (0.0065) | (0.0032) | (0.0008) | (0.0314) | (0.0268) | | |
| | $\rho_{it}^{US}$ | −1.7322*** | 0.0375*** | 0.0144*** | −0.0024 | −0.0003 | −0.2343*** | 0.3322*** | 0.661 | 832.76*** |
| | | (0.1044) | (0.0050) | (0.0053) | (0.0018) | (0.0004) | (0.0195) | (0.0196) | | |

(*Continued*)

Table 7 (*continued*)

**The effect of foreign investor trading on market integration**

| | | Intercept | $V_{it}$ | $FN_{it}$ | $FT_{it}$ | $\sigma_{it}$ | $LogMV_{it}$ | $LogGDP_{it}$ | Adj. $R^2$ | $F$-stat |
|---|---|---|---|---|---|---|---|---|---|---|
| Taiwan | $\rho_{it}^{Japan}$ | −10.584*** | 18.5324*** | −0.0262* | 0.0222* | −0.0144*** | −0.2537*** | 1.2880*** | 0.596 | 631.41*** |
| | | (0.7308) | (2.7679) | (0.0148) | (0.0124) | (0.0031) | (0.0859) | (0.1024) | | |
| | $\rho_{it}^{UK}$ | −5.6071*** | 12.7836*** | −0.0209** | 0.0130 | 0.0028 | −0.2462*** | 0.7422*** | 0.426 | 318.21*** |
| | | (0.5518) | (1.8742) | (0.0101) | (0.0096) | (0.0029) | (0.0689) | (0.0842) | | |
| | $\rho_{it}^{US}$ | −0.9985*** | 7.2919*** | −0.0138** | −0.0061 | 0.0010 | −0.0850** | 0.1628*** | 0.104 | 50.71*** |
| | | (0.3578) | (1.4253) | (0.0060) | (0.0060) | (0.0019) | (0.0348) | (0.0503) | | |
| Thailand | $\rho_{it}^{Japan}$ | −1.4320*** | 0.0049*** | 0.0356 | −0.1683*** | 0.0037* | −0.1462*** | 0.3123*** | 0.441 | 337.11*** |
| | | (0.1324) | (0.0019) | (0.0599) | (0.0268) | (0.0020) | (0.0288) | (0.0287) | | |
| | $\rho_{it}^{UK}$ | −1.2533*** | 0.0072*** | 0.0504 | −0.1231*** | 0.0034 | −0.1087*** | 0.2574*** | 0.655 | 812.59*** |
| | | (0.0972) | (0.0015) | (0.0415) | (0.0171) | (0.0023) | (0.0197) | (0.0214) | | |
| | $\rho_{it}^{US}$ | −1.0642*** | 0.0093*** | 0.0301 | −0.1184*** | 0.0032 | −0.1633*** | 0.2532*** | 0.367 | 249.25*** |
| | | (0.1426) | (0.0020) | (0.0480) | (0.0219) | (0.0031) | (0.0271) | (0.0311) | | |

*, **, *** indicate statistical significance at the 0.1, 0.05 and 0.01 level, respectively.

of foreign investors leads foreign capital to flow out from the emerging markets when these markets become more integrated with developed market. Further, the results indicate that more trading activity of foreign investors in domestic market induces higher degree of market integration. Nonetheless, the results of Table 7 show that trading activity in Asian emerging markets has a significantly positive impact on the market integration even when the effects of foreign investors are significant in Asian emerging markets. This evidence is consistent with the results of Table 5, and this again confirms that higher trading activity in Asian domestic markets can enhance integration of these markets with developed markets. Furthermore, we find that the market size and the economic development of Asian emerging markets significantly impact on the market integration with developed markets. Specifically, the effect of market size on the market integration is negative in all four Asian markets. However, the economic development positive affect their market integration with developed markets and implies that the growth of Asian emerging markets can induce their market to become more integrated with developed market.

Overall, through analysis of the effect of foreign investor trading, this paper brings further evidence to confirm that more trading activity in emerging market induces higher degree of market integration. These results provide a convenient way for investors to comprehend the market integration of emerging markets.

## 5. Conclusions

This paper investigates the effect of trading activity in Asian domestic stock markets on the market integration across domestic and major developed markets using the DCC technique. The DCC measures the contemporaneous conditional correlation between two stock markets and provides an indirect measure of the degree of integration between the stock markets of Asia and major developed markets. Simple correlation analysis and multiple regression analysis demonstrate that higher trading activity in domestic markets can induce higher degree of market integration. Furthermore, economic development and legal environment of domestic market positively influence the degree of market integration between domestic and major developed markets. This finding demonstrates that the level of trading activity, economic development, and legal environment of domestic market are important driving factors for market integration.

Another important finding emerging from our investigation of the relation between trading activity and market integration is that the market volatility acts as a mediator in the relation between trading activity and market integration. Higher trading activity in domestic market affects the market, making it more volatile, and thus increases market integration. This implies that trading activity in domestic market not only positively impacts on market integration, but also enhances market volatility. This suggests that, in terms of investment opportunities, higher trading activity in Asian domestic markets narrows the scope for portfolio diversification.

## References

Admati, A.R. and P. Pfleiderer, 1988. A theory of intraday patterns: Volume and price variability, *Review of Financial Studies* 1, 3–40.

Akram, Q.F., D. Rime, and L. Sarno, 2009. Does the law of one price hold in international financial markets? Evidence from tick data, *Journal of Banking and Finance* 33(10), 1741–1754.

Andersen, T.G., 1996. Return volatility and trading volume: An information flow interpretation of stochastic volatility, *Journal of Finance* 50, 169–204.

Andersen, T.G. and T. Bollerslev, 1998. Deutsche mark-dollar volatility: Intraday activity patterns, macroeconomic announcements, and longer run dependencies, *Journal of Finance* 53, 219–265.

Ang, A. and G. Bekaert, 2002. International asset allocation with regime shifts, *Review of Financial Studies* 11, 1137–1187.

Ang, A. and J. Chen, 2002. Asymmetric correlations of equity portfolios, *Journal of Financial Economics* 63, 443–494.

Angelidis, T., 2010. Idiosyncratic risk in emerging markets, *The Financial Review* 45, 1053–1078.

Baron, R.M. and D.A. Kenny, 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations, *Journal of Personality and Social Psychology* 51, 1173–1182.

Bartram, S.M. and Y.-H. Wang, 2005. Another look at the relationship between cross-market correlation and volatility, *Finance Research Letters* 2, 75–88.

Beine, M., A. Cosma, and R. Vermeulen, 2010. The dark side of global integration: Increasing tail dependence, *Journal of Banking and Finance* 34(1), 184–192.

Bekaert, G. and C.R. Harvey, 1995. Time-varying world market integration, *Journal of Finance* 50, 403–444.

Bekaert, G. and C.R. Harvey, 1997. Emerging equity market volatility, *Journal of Financial Economics* 43, 29–77.

Bekaert, G. and C.R. Harvey, 2000. Foreign speculators and emerging equity markets, *Journal of Finance* 55, 565–613.

Bekaert, G., C.R. Harvey, and R.L. Lumsdaine, 2002. Dating the integration of world equity markets, *Journal of Financial Economics* 65, 203–247.

Bekaert, G., C.R. Harvey, and A. Ng, 2005. Market integration and contagion, *Journal of Business* 78, 39–69.

Berk, J., 1995. A critique of size related anomalies, *Review of Financial Studies* 8, 275–286.

Butler, K.C. and D.C. Joaquin, 2002. Are the gains from international portfolio diversification exaggerated? The influence of downside risk in bear markets, *Journal of International Money and Finance* 21, 981–1011.

Chelley-Steeley, P.L. 2005. Modeling equity market integration using smooth transition analysis: A study of eastern European stock markets, *Journal of International Money and Finance* 24, 818–831.

Chen, G., M. Firth, and O.M. Rui, 2001. The dynamic relation between stock returns, trading volume, and volatility, *The Financial Review* 38, 153–174.

Chen, N.F. and F. Zhang, 1997. Correlation, trades and stock returns of the Pacific-Basin markets, *Pacific-Basin Finance Journal* 5, 559–557.

Chiang, T.C., B.N. Jeon, and H. Li, 2007. Dynamic correlation analysis of financial contagion: Evidence from Asian markets, *Journal of International Money and Finance* 26, 1206–1228.

Chordia, T., R. Roll, and A. Subrahmanyam, 2001. Market liquidity and trading activity, *Journal of Finance* 56, 501–530.

Chordia, T., A. Subrahmanyam, and V.R. Anshuman, 2001. Trading activity and expected stock returns, *Journal of Financial Economic* 59, 3–32.

Copeland, T.E., 1976. A model for asset trading under the assumption of sequential information arrival, *Journal of Finance* 31, 1149–1168.

Copeland, T.E., 1977. A probability model of asset trading, *Journal of Financial and Quantitative Analysis* 12, 563–578.

Domowitz, I., J. Glen, and A. Madhavan, 1997. Market segmentation and stock prices: Evidence from an emerging market, *Journal of Finance* 52, 1059–1086.

Dufour, A. and R.F. Engle, 2000. Time and the price impact of a trade, *Journal of Finance* 55, 2467–2498.

Engle, R., 2002. Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models, *Journal of Business and Economic Statistics* 20(3), 339–350.

Epps, T.W. and M.L. Epps, 1976. The stochastic dependence of security price changes and transaction volumes: Implications for the mixture-of-distributions hypothesis, *Econometrica* 44, 305–321.

Fong, W.M., 2003. Correlation jumps, *Journal of Applied Finance* 13, 29–45.

Forbes, K.J. and R. Rigobon, 2002. No contagion, only interdependence: Measuring stock market co-movements, *Journal of Finance* 57(5), 2223–2261.

Foster, F.D. and S. Viswanathan, 1993. Variations in trading volume, return volatility, and trading costs: Evidence on recent price formation models, *Journal of Finance* 48, 187–211.

French, K. and R. Roll, 1986. Stock return variances: The arrival of information and the reaction of traders, *Journal of Financial Economics* 17, 5–26.

Gallant, A.R., P.E. Rossi, and G. Tauchen, 1992. Stock prices and volume, *Review of Financial Studies* 5, 199–242.

Girard, E. and R. Biswas, 2007. Trading volume and market volatility: Developed versus emerging stock markets, *The Financial Review* 42, 429–529.

Goetzmann, W.N, L. Li, and K.G. Rouwenhorst, 2005. Long-term global market correlations, *Journal of Business* 78, 1–37.

He, H. and J. Wang, 1995. Differential information and dynamic behavior of stock trading volume, *Review of Financial Studies* 8, 919–972.

Hiemstra, C. and J. Jones, 1994. Testing for linear and non-linear Granger causality in the stock price-volume relationship, *Journal of Finance* 49, 1639–1664.

Hope, O.-K., 2003. Disclosure practice, enforcement of accounting standards and analyst' forecast accuracy: An international study, *Journal of Accounting Research* 41(3), 235–272.

Huang, R.D. and R.W. Masulis, 2003. Trading activity and stock price volatility: Evidence from the London stock exchange, *Journal of Empirical Finance* 10(3), 249–269.

Hunter, D.M., 2006. The evolution of stock market integration in the post-liberalization period—A look at Latin America, *Journal of International Money and Finance* 25, 795–826.

Jennings, R.H., L.T. Starks, and J.C. Fellingham, 1981. An equilibrium model of asset trading with sequential information arrival, *Journal of Finance* 36, 143–161.

Jin, L. and S. Myers, 2006. $R^2$ around the world: New theory and new tests, *Journal of Financial Economics* 79, 257–292.

Judd, C.M. and D.A. Kenny, 1981. Process analysis: Estimating mediation in treatment evaluations, *Evaluation Review* 5, 602–619.

Karolyi, A. and R. Stulz, 1996. Why do markets move together? An investigation of US–Japanese stock return comovements, *Journal of Finance* 51, 951–986.

Kim, S.J., F. Moshirian, and E. Wu, 2005. Dynamic stock market integration driven by the European monetary union: An empirical analysis, *Journal of Banking and Finance* 29(10), 2475–2502.

Koutmos, G. and G.G. Booth, 1995. Asymmetric volatility transmission in international stock markets, *Journal of International Money and Finance* 14, 747–762.

Kurov, A., 2008. Investor sentiment, trading behavior and informational efficiency in index futures markets, *The Financial Review* 43, 107–127.

Lamoureux, C.G. and W.D. Lastrapes, 1990. Heteroskedasticity in stock return data: Volume versus GARCH effects, *Journal of Finance* 45, 221–229.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny, 1998. Law and finance, *Journal of Political Economy* 106, 1113–1155.

Lee, B.-S. and O. Rui, 2002. The dynamic relationship between stock return and trading volume: Domestic and cross-country evidence, *Journal of Banking and Finance* 26, 51–78.

Lee, C.-H., S.-C. Doong, and P.-I Chou, 2011. Dynamic correlation between stock prices and exchange rates, *Applied Financial Economics* 21(11), 789–800.

Leong S.C. and B. Felmingham, 2003. The interdependence of share markets in the developed economies of East Asia, *Pacific-Basin Finance Journal* 11, 219–237.

Llorente, G., R. Michaely, G. Sarr, and J. Wang, 2002. Dynamic volume-return relation of individual stocks, *Review of Financial Studies* 15, 1005–1047.

Longin, F. and B. Solnik, 1995. Is the correlation in international equity returns constant: 1960–1990? *Journal of International Money and Finance* 14, 3–26.

Longin, F. and B. Solnik, 2001. Extreme correlations in international equity markets, *Journal of Finance* 56, 649–676.

Mandelbrot, B.B., 1963. The variation of certain speculative prices, *Journal of Business* 36, 392–417.

Morana, C. and A. Beltratti, 2008. Comovements in international stock markets, *Journal of International Financial Markets, Institutions and Money* 18, 31–45.

Morck, R., B. Yeung, and W. Yu, 2000. The information content of stock markets: Why do emerging markets have synchronous stock price movements? *Journal of Financial Economics* 58, 215–260.

Nelson, D.B., 1991. Conditional heteroskedasticity in asset returns: A new approach, *Econometrica* 59(2), 347–370.

Newey, W.K. and K.D. West, 1987. A simple positive semi-definite heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703–708.

Panchenko, V. and E. Wu, 2009. Time-varying market integration and stock and bond return concordance in emerging markets, *Journal of Banking & Finance* 33(6), 1014–1021.

Ramchand, L. and R. Susmel, 1998. Volatility and cross correlation across major stock markets, *Journal of Empirical Finance* 5, 397–416.

Richards, A., 2005. Big fish in small ponds: The trading behavior and price impact of foreign investors in Asian emerging equity markets, *Journal of Financial and Quantitative Analysis* 40, 1–27.

Schotman, P.C. and A. Zalewska, 2006. Non-synchronous trading and testing for market integration in central European emerging markets, *Journal of Empirical Finance* 13(4), 462–494.

Solnik, B., C. Boucrelle, and Y.L. Fur, 1996. International market correlation and volatility, *Financial Analysts Journal* 52, 17–34.

Umutlu, M., L. Akdeniz, and A. Altag-Salih, 2010. The degree of financial liberalization and aggregated stock-return volatility in emerging markets, *Journal of Banking and Finance* 34(3), 485–696.

Voronkova, S., 2004. Equity market integration in central European emerging markets: A cointegration analysis with shifting regimes, *International Review of Financial Analysis* 13(5), 633–647.

Wang, J., 1994. A model of competitive trading volume, *Journal of Political Economy* 102, 127–168.

Xu, X.E., P. Chen, and C. Wu, 2006. Time and dynamic volume–volatility relation, *Journal of Banking and Finance* 30, 1535–1558.

Yu, I.-W., K.-P. Fung, and C.-S. Tam, 2010. Assessing financial market integration in Asia—Equity markets, *Journal of Banking and Finance* 34(12), 2874–2885.

Zousoui, M., G. Nouyrigat, and F. Beer, 2011. How does investor sentiment affect stock market crises? Evidence from panel data, *The Financial Review* 46, 723–747.