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THE CORRELATIONS OF THE EQUITY MARKETS IN ASIA AND THE IMPACT OF CAPITAL FLOW MANAGEMENT MEASURES

Pornpinun Chantapacdepong

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Pornpinun Chantapacdepong was a research fellow at the Asian Development Bank Institute at the time of writing and is currently assistant director at the Monetary Policy Group of the Bank of Thailand.

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Please contact the authors for information about this paper.

Email: pornpinc@bot.or.th

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Asian Development Bank Institute
Kasumigaseki Building, 8th Floor
3-2-5 Kasumigaseki, Chiyoda-ku
Tokyo 100-6008, Japan

Tel: +81-3-3593-5500
Fax: +81-3-3593-5571
URL: www.adbi.org
E-mail: info@adbi.org

Abstract

This paper examines the international transmission of volatility in the stock markets of countries in emerging Asian economies (EAEs). The time period of the study is from before the Asian financial crisis until after the global financial crisis. Over two decades the degree of volatility interdependence of equity markets among Asian economies has been increasing. There has been stronger financial integration during calm periods, which could intensify the contagion effects across markets during turbulent times. The equity markets of the EAEs exhibit stronger correlations during the global financial crisis, confirming the existence of contagion and the intensification of systemic risk. The introduction of capital flow management (CFM) measures is associated with a reduction in the volatility dependence within the region.

JEL Classification: E42, E44, F32, G12, G15,

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INTRODUCTION

One of the major concerns of policy makers in emerging Asia is the problem of volatile capital flows, especially short-term flows, such as debt flows and portfolio flows, which can change abruptly. A surge in inflows is harmful to the recipient countries in several ways, for example by creating an asset price surge as well as the risk of capital pull-out. Facing capital inflows, national authorities have relied on various unilateral macro-prudential measures, such as taxes on certain inflows, minimum holding periods, and reserve requirements. The variation of the measures mainly depends on the institutional set-up, the policy constraints, the resilience to shocks of the real sectors, and the financial conditions.

Over the past decades, the behavior of the portfolio inflows and outflows of the Asian economies has exhibited a unique pattern. Minor cross-country differences have arisen, mainly determined by the global risk sentiment rather than the domestic factors.[1] Foreign investors have increased their appetite for financial assets in the region for several reasons: the expected appreciation of the local currency, the low exchange rate volatility, the strong economic fundamental, and the low interest rate environment in the advanced economies. This phenomenon suggests that the correlation of the portfolio flows has tended to increase recently. The growing financial inter-linkages could create vulnerability to the surge of inflows to the region. A negative shock to one country could easily transmit to other countries in the region, even if there are few real linkages between the two countries and the economic fundamental of the second country is strong. Unfortunately, the arrangement at the regional level remains well within the area of monitoring, consultation, and reserve pools. Studying whether the financial markets in Asia are subject to common risk is thus crucial, especially in the situation of huge and volatile capital flows. This would have policy implications for the appropriateness of regional coinsurance and the possible side effects of the unilateral capital flow management measures.

This paper adds to the previous literature by examining the financial inter-linkages within EAEs and determining whether the recent financial distress has become systemic. The study can be undertaken through the volatility co-movements of financial variables for the countries in the region. The co-movements can be measured by the conditional correlation of volatility or shocks in asset prices. The dynamic conditional correlation (DCC) GARCH model by Engle (2002) is employed jointly to analyze the volatility of Asian financial markets and to assess the link between them. The model accounts for the time-varying correlation behavior of the Asian financial market data and can suggest the development of the degree of financial interdependence over time.

The research questions of this paper are the following. **1) How connected/linked are these volatilities in emerging Asia?** This question requires an assessment of the degree of volatility interdependence between countries in EAEs through the level of market correlation. The high correlation among countries implies that the markets move together; the exposure to common risk among EAEs' financial markets tends to increase. In contrast, if the individual countries' financial markets move independently, their financial market risk is driven mainly by country-specific factors. **2) Do these periods of highly correlated stock market movements provide the possibility/evidence of contagion among the countries in the region?** During

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[1] From 2005 until the Lehman Brothers' crisis, most Asian economies experienced higher equity inflows. However, during the eruption of the global financial crisis, all the economies in the region experienced severe portfolio outflows. During the post-crisis period, the global liquidity surge led many economies in the region to experience strong portfolio inflows again.

normal circumstances the resulting higher correlation reveals greater financial interdependence and integration within the region. However, during a crisis the greater calculated conditional correlation suggests the contagion of the risk factor. Financial distress can become systemic. **3) What are the major factors determining the recent development of the degree of financial dependence?** The analysis will examine the importance of each factor, such as the country-specific factor, global risk sentiment, and regional factor. The impact of the introduction of the capital flow management (CFM) measures will also be examined.

With the introduction of CFM measures, the correlation behavior and the response of the flows could change in response to the barriers to the flows. It may be possible that the CFMs introduced by a country could create uncertainty and effectively stop the flow or drive it away from other countries in the region. If the financial markets in the region move differently after the measure's implementation, the negative externality from the CFM measure will be examined. The methodology is to assess whether the control of capital inflows can significantly reduce the volume of certain types of capital flows into a country or simply shift the challenges of large inflows, such as asset price bubbles and currency appreciation, into other countries. In contrast, if markets move together, it could imply that foreign investors regard EMEs' financial markets as a common market and make investment decisions based on the global or regional factors rather than the domestic factors.

This paper does not prove whether coordinated action is superior to unilateral capital flow measures, nor does it assess the effectiveness of capital flow measures in relation to their objective. Instead it identifies the mechanism of the spread of turmoil across countries in the region and assesses whether CFM affects these relationships, which could create the possibility of externalities. If the spread of turmoil and externalities exists, it could suggest that the multilateral arrangement can be justified,[2] for instance the coordinated restriction on capital flows to avoid discriminate actions that would simply redirect flows to other countries and the circumvention of capital controls.

The paper starts with the background of emerging Asia's challenge in coping with volatile capital flows. The following section analyzes the connectedness of the volatile capital flows in emerging Asia and the mechanism for the connection. Subsequently the paper discusses the multilateral impacts of CFM and concludes.

1. VOLATILE CAPITAL FLOWS AND AUTHORITIES' RESPONSES

Policy makers in many emerging Asian economies (EAEs) have had to cope with **increasingly volatile capital flows**. In the aftermath of the global financial crisis, capital flows into emerging economies, especially Asia, have bounced back strongly from their slump in 2008. Investors with exceptionally low interest rates in developed countries and even investors in EAEs themselves have regained their appetite for risk and, in particular, the carry trade practice. Liberalization of the capital account in EAEs and certain push and pull factors are among the main factors behind the surge in

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[2] This is in the same spirit as the argument by Forbes and Rigobon (1999), who suggested that evidence of contagion could justify multilateral (IMF) intervention, as the aid could prevent the second economy from experiencing a financial crisis. On the other hand, if two countries are linked to each other through the economic fundamental, the transmission of shocks would not constitute contagion. The second economy should adjust to this shock itself. A multilateral arrangement, such as a bail-out fund, would just prolong the adjustment and be a sub-optimal solution. A multilateral arrangement would thus be less effective and harder to justify in this case.

capital flows in the region. The push factors include factors determining the supply of the global liquidity surges, such as low interest rates in advanced countries resulting from easing monetary and fiscal policies, and their slow growth and lack of investment opportunities. The pull factors are the robust economic performance, the improved investment climate, and the expectation of currency appreciation in the EAEs. Some researchers have argued that the push factor is important in driving inflows, as countries with different economic fundamentals and cyclical positions have all attracted large inflows (Pradan et al. 2011). Others have given more importance to the pull factors, as the better economic prospect is a key driver of the surges. Brockmeijer and Husain (2011) concluded that global push factors play a significant role in explaining the emergence of a surge, while pull conditions determine the magnitude of a surge.

The nature of the capital flows to emerging Asia has been changing, especially their composition and behavior. ***The composition*** changes towards portfolios and banking flows are raising concerns among policy makers in the region, as these are more volatile and short-lived. For instance, the People's Republic of China (PRC) has seen a shift from foreign direct investment to banking flows, while India has experienced a change in the composition of inflows from banking flows to portfolio flows. In NIEs, except the Republic of Korea, the recent surge is dominated by extraordinary banking-related flows. The portfolio flows dominate the current surge in the case of the Republic of Korea and the ASEAN 5. The portfolio investment was strong in the first half of 2011 but reversed in the second half of the year following the international investor sentiment. The ***behavior of flows*** has changed in such a way that the pace of inflow surges has risen markedly. In addition, the shift in attitudes towards risk has led to large swings in global portfolio investment flows and increased the volatility in global equity and bond markets.

Although the recent trend of sustained large capital inflows has become less severe due to the better recovery of the US economy, the sovereign debt crisis in Europe remains to be monitored. With the changing nature and pattern of the flows, questions about the impact of the capital pull-out in the future are likely to surface.

Previously, the sustained large capital inflows posed a challenge to the conducting of monetary policy and the management of capital flows in several ways. First, it placed considerable pressure on the exchange rate. The combination of persistent current account surpluses, rising capital inflows, and the accumulation of foreign exchange reserves in EAEs with persistent US deficits exerted upward pressure on exchange rates. As the pressure could be either one way or two way, it could hamper the international trade and investment activity. Second, it created a fiscal burden from the management of sustained large capital inflows, such as sterilized intervention. Third, it could hamper the monetary transmission mechanism. Fourth, it imposed risk on financial stability, such as pressure in asset markets, bank lending booms, volatile foreign exchange markets, and capital flow reversals. The capital inflows could result in credit booms and create economic overheating by pushing the inflation expectation upwards, while the risk of capital flows suddenly stopping or reversing within a short period could result in sharp currency depreciation or reserve depletion.

The surge in foreign capital has led to a renewed focus on capital controls, which is a policy option to manage large inflows in addition to exchange rate policy and monetary policy. It has been widely agreed that EMs share a common concern about surges and volatile capital flows; however, their policy responses have varied widely with respect to the difference in their economic fundamentals and policy limitations. The limitations can be political economy issues (such as opposition to nominal appreciation) and institutional concerns (such as the cost of sterilization).

Policy makers in emerging Asia have responded to the capital inflows by allowing appreciation in their currency while intervening to slow its pace. As the inflows have been large and persistent, foreign exchange intervention seems to be an arduous task. For instance, Thailand and Indonesia allowed significant exchange rate appreciation, though the reserves increased rapidly and are currently 60% above their pre-crisis levels. Pradan et al. (2011) argued that, as long as the expectation of currency appreciation is maintained and the inflows are persistent, the inflows may be even stronger with the reserve accumulation and resisting exchange rate appreciation.

Recipient countries have used macroeconomic policies to deal with the recent surges in inflows; more direct measures, capital flow management (CFM) measures, have also gained in popularity, and the IMF has recognized them as a legitimate part of toolkits to manage large capital inflows. This was motivated by the concerns about overheating, external competitiveness, financial stability, and the sterilization costs of reserve accumulation (Pradan et al. 2011). Many researchers have agreed that the measures have been effective in altering the composition of inflows and in limiting credit growth and asset price inflation, while the aggregate capital flows were not affected.[3] CFM measures are more desirable for policy makers than traditional outright capital control measures. The measures allow the domestic capital market to remain integrated with the global capital market while insulating the market against the short-term and volatile capital flows, as mentioned. However, one should be aware that CFM measures have limitations, as they can be regarded as temporary tools. In addition, they should be employed under specific circumstances when the economy is approaching its potential and the exchange rate is not undervalued (Ostry et al. 2010).

Appendix Table 1 presents series of CFM measures and their details, classifying them by their choice of policy tools. The choice of CFM measure varies depending on the nature of the problem. Indonesia; the Republic of Korea; the Philippines; Taipei,China; and Thailand used CFM to stem volatile capital flows. Some measures are the re-introduction or intensification of the existing measures rather than the introduction of new instruments. The measures range from limiting the foreign exchange exposure of the private sector to limiting foreign access to domestic financial assets, restricting external borrowing, withholding tax on bonds, and introducing minimum holding periods. The PRC; Hong Kong, China; and Singapore have used CFM mainly to stem credit growth and to prevent bubbles in the housing market. Malaysia has only liberalized capital outflows and has not introduced any of the capital flow measures. This partly reflects the resilience of the economies (especially the real sectors) in these countries to foreign exchange rate appreciation.

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[3] In principle the effectiveness of capital controls depends on the **time horizon** and **tool selection**. The effectiveness of capital controls tends to diminish over time, as the market could find a way to circumvent them, so the measure is only temporarily ideal. The type of capital control is also important. Many studies have agreed that capital control is more effective in changing the composition of inflows and their maturity structure than in reducing the volume. Unfortunately, suggestions regarding the ideal tools are lacking. There are only a few guidelines. For instance, the measure should be designed such that it can last long enough to counter the capital flow surge and can be withdrawn quickly when it is no longer needed. The measure should be flexible enough to adapt to sudden changes in investor sentiment.

2. REVIEW OF THE EARLIER LITERATURE

Spillovers and contagion via global asset prices are typically found to dominate trade channels (IMF 2011a). In addition, spillovers via financial market channels could be significant regardless of the geographical location and extensive capital controls. The volatility spillover effect is the primary process to transmit financial risk. Many research papers have found that contagion was present during every major financial crisis in the last decade or so (King and Wadhwani 1990; Lee and Kim 1993; Calvo and Reinhart 1996).

The earlier literature has examined volatility spillovers in the stock market in the case of developed countries (Karolyi and Stulz 1996; Harris and Pisedtasalasai 2006), Asia (Chou, Lin, and Wu 1999; Joshi 2011), and other EMs (Scheicher 2011). These research papers found significant volatility spillovers between developed countries and EMs and spillovers among EMs. Shamiri and Isa (2009) examined volatility spillovers from the US to South East Asia using stock return data and the bivariate GARCH model. The results showed that Singapore; the Republic of Korea; and Hong Kong, China are among the South East Asian markets that are vulnerable to shocks generated by US investors due to the large proportion of US investors participating in the stock markets. The studies on intra-regional financial spillovers remain limited.

Reviewing the previous literature shows that there is no consensus on the precise definition of contagion. It is mostly defined as the spread of market turmoil from one country to other financial markets.[4] An early work by Masson (1998) defined three non-exclusive characteristics to explain the contagion. The first is **“monsoonal”**; crises may be the result of a common factor or common shocks that affect all countries simultaneously. For instance, during Black September of 1982, the economic policy from developed economies created macroeconomic effects in emerging markets. The second refers to **“spillovers”** resulting from interdependence between countries. Once a crisis hits a country, it affects the fundamentals of its neighboring countries through trade or financial linkages, such as exchange rate devaluation or a liquidity crisis. Studies have found trade and financial links to be the main crisis-transferring mechanism, and these links are expected to remain unchanged before, during, and after a crisis.[5] The last characteristic is **“pure contagion”**; a crisis is triggered and spread by investors’ psychological behavior or panic movements rather than being induced by economic fundamentals/links, for instance liquidity shocks, in which agents divest their assets in countries as a function of the crisis in another countries[6] (Forbes and Rigobon 1999). Masson (1998) found that changes in investors’ expectations are important in transferring crises from one country to others, as monsoonal and spillover effects do not seem to be sufficient to explain the spread of contagion in Latin America and East Asia. Forbes and Rigobon (1999) and Pesaran and Pick (2003) further interpreted monsoons and spillovers as **interdependence**. The definitions of contagion and spillovers in some other research are slightly different.[7]

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[4] Masson (1998); Allen and Gale (2004); Kyle and Xiong (2001); Kiyotaki and Moore (2002); Kaminsky, Reinhart, and Vedh (2003); Brunnermeier and Pedersen (2005); and Naoui, Liouane, and Brahim (2010).

[5] The previous literature examining fundamental-based contagion includes Calvo and Reinhart (1996); Forbes and Rigobon (1999); and Kaminsky and Reinhart (2000).

[6] More specifically, Goldstein and Hawkins (1998) considered signaling to be one of the causes of the Asian financial crisis in 1997.

[7] Dornbusch, Park, and Claessens (2000) defined contagion as the dissemination of market disturbances from one emerging market to another, observed through co-movements in exchange rates, share prices, sovereign risk spread, and capital flows. Their definition of contagion is similar to that in some

This research paper follows the contagion definition by Forbes and Rigobon (1999). They defined **contagion** as a significant increase in cross-market linkages *after a shock* to one country (or a group of countries). **Interdependence or linkages** refers to a situation in which two markets show a high degree of co-movement *during a period of stability*. The examination in this paper aims simply to show that market volatility is transmitted across EAEs. **Contagion** occurs if the cross-market co-movement increases significantly after the shock. If the co-movement does not increase significantly, the continued high level of market correlations suggests strong linkages/interdependence between the two countries. The examination simply tests whether this volatility transmission changes significantly after the shock/crisis.

However, the caveats of the tests for contagion based on cross-market correlation coefficients are the biasedness and inaccuracy due to heteroskedasticity (Forbes and Rigobon 1999).[8] In other words, cross-market conditional correlation coefficients are conditional on market volatility. During a crisis markets are more volatile and the estimates of the conditional correlation coefficients tend to increase and can be biased upwards. Regarding this issue, the ARCH GARCH class frameworks have advantages, as they incorporate heteroskedasticity into their models and can thus correct such bias.

The modern literature has also emphasized the need to consider the dynamic/time-varying aspects of correlations (Engle 2002). The dynamic conditional correlation (DCC) GARCH model has gained popularity in handling this issue. The earlier studies that examined contagion in Asian financial markets using the DCC GARCH model are those by Chiang, Jeon, and Li (2005) and Cho and Parhizgari (2008). The former examined whether there is any significant increase in the DCC during the Asian financial crisis by employing the regression method with dummy crisis variables. The latter employed the mean difference t-test and median difference z-test to identify the contagion by investigating whether there are significant differences in the estimated time-varying correlation coefficients between the periods of stability and turmoil. They also argued that the DCC GARCH model is superior to the volatility-adjusted cross-market correlations employed by Forbes and Rigobon (1999). The main reason is that the DCC GARCH model continuously adjusts the correlation for the time-varying volatility.

A few studies have examined the relationship of the international financial markets after the introduction of capital controls. The International Monetary Fund (2011b) assumed a linear relationship between equity returns/equity fund flows and measures in the region by employing the case of selected Latin American and Asian countries and evaluating the impact of CFM in one country on the level of equity returns and equity fund flows of other countries by linear regression, finding mixed results. Edison and Reinhart (2001) studied the impacts of capital controls in Brazil (1999), Malaysia (1998), and Thailand (1997) on financial variables using the GARCH test with dummy variables of capital controls and found that only in the case of Malaysia were a higher

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other papers that argued that, if there is transmission of shocks from one country to another, contagion occurs, even if there is no significant change in the cross-market relationships. Pritsker (2001) used the terms contagion and spillovers interchangeably and defined contagion as the spread of shocks from one country to others. The transmission of shocks occurs through market participants who follow portfolio strategies. Pericoli and Sbracia (2001) defined an increase in co-movements in prices and quantities between markets given a crisis in one or more markets as contagion.

[8] The earlier literature has analyzed correlation using co-movements, causality, error correction models, co-integration, and the vector autoregression methodology (Eun and Shim 1989; Chung and Ng 1992; Parhizgari, Dandapani, and Bhattachayra 1994; Karolyi and Stulz 1996; Darbar and Deb 1997; Bhattacharya and Samanta 2001; Pascaul 2003; Ahmad, Ashraf, and Ahmed 2005; Chelley-Steeley 2005; and others). However, the modern literature has recognized the bias in the simple correlation coefficient that arises from the increased volatility during the crisis (Forbes and Rigobon 1999).

interest rate and greater exchange rate stability achieved after the introduction of capital controls. The capital control dummy variable was placed in the conditional variance equation of the univariate GARCH model to gauge the impact of the control. The results showed that equity markets continue to be linked internationally, despite the introduction or escalation of capital controls during the Asian financial crisis. In addition, following the introduction of capital controls, one should expect the following phenomena in the financial variables: 1) a decline in volatility spillovers; 2) evidence of structural breaks around the introduction of controls; 3) less contemporaneous movement with international variables, especially interest rates and exchange rates; and 4) a weaker causal influence from foreign financial variables on domestic ones. Nevertheless, the analysis of the international transmission of shocks and the international financial linkages in their work can be improved using the multivariate GARCH analysis. There is room for further research by allowing the interaction of individual country shocks in the calculations of the conditional mean and variance of the financial variables.

3. DATA AND RESEARCH METHODOLOGY

Stock index data and foreign fund flows into stock markets are employed in this study due to the availability of cross-country data with high frequency and a long time span and the importance of the data in explaining financial markets. Volatile flows, especially portfolio flows, into bond and equity markets are frequently viewed as a destabilizing force in asset markets and financial systems. Hence, the aim of reducing the volatility in asset prices is one of the main reasons for the introduction of controls.

The data descriptions are presented in Appendix Table 2. The daily returns of the stock index (closing price) are examined in the analysis of the cross-country correlations. The daily returns are identified as the first difference in the natural logarithm of the closing index value for two consecutive trading days. The period of analysis for the stock index is from November 1992, when all the data are available, through August 2013. The starting date of November 1992 is considered as the stable period. The sample period includes the Asian financial crisis[9] (January 1997–December 1998), the pre-global financial crisis period (January 1999–December 2007), the eruption of the US[10] crisis (January 2008 to September 2009),[11] the intensification of the global financial crisis through the euro sovereign debt crisis (October 2009 to 2011), and the economic recovery from crisis period (2012 to 2013). In the last part of the paper, the event study of the impact of CFM on foreign equity flows is also examined. Both the data for the stock prices and the data for the foreign flows into stock markets are obtained from Bloomberg LP.[12]

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[9] The turmoil periods are 2 July 1997, when the Thai baht was devalued, and 17 October 1997, when the Hong Kong, China stock market crashed.

[10] The period includes the collapse of Lehman Brothers on 22 August 2008.

[11] Prior to the current capital inflow surges, there were two waves of large inflows into emerging Asian economies: 1) the early 1990s until the Asian financial crisis in 1997 and 2) the early 2000s until the global financial crisis in 2008.

[12] The gross foreign equity flow provided by Bloomberg is the transaction by institutional investors. In contrast, EPFR's data is mainly mutual funds. EPFR presents the net flows, while the data from Bloomberg provide the gross flows.

The dynamic conditional correlation (DCC) GARCH model by Engle and Sheppard (2001) and Engle (2002) is employed to examine the time-varying correlation coefficients, since it has the flexibility of univariate GARCH models coupled with the parsimonious parametric model for correlations. In addition, it takes time-varying volatility into account and addresses possible feedback effects. It also helps in avoiding the bias in examining volatility spillovers and contagion that would occur with the standard correlations, as stated by Forbes and Rigobon (1999). The DCC GARCH model assumes time-varying correlation, which is dynamic enough to account for the continuous change in the market and to fit the transmission process of contagion. The DCC GARCH estimation is simple and consists of two steps: the first is the univariate GARCH calculation and the second is the correlation estimates allowing for the interaction of the innovations in the conditional variance equations.

Step 1: Univariate GARCH Model

Consider a log return series (r_t) of the stock index[13]; let $a_t = r_t - \mu_t$ be the innovation at time t. Then a_t follows a univariate GARCH (p,q) model if

$$a_t = \sigma_t \epsilon_t.$$

The mean equation for $\boldsymbol{r}_t$ is

$$r_t = \mu_t + a_t.$$

The variance equation for $\boldsymbol{r}_t$ is

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i a_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2,$$

where ϵ_t is a sequence of iid random variables with zero mean and unit variance, $\alpha_0 > 0$, $\alpha_i \geq 0$, $\beta_j \geq 0$, and $\sum_{i=1}^{\max(p,q)}(\alpha_i + \beta_i) < 1$.

Step 2: Multivariate GARCH Model

In the multivariate analysis, the vector of the return series $\{\boldsymbol{r}_t\}$ becomes

$$\boldsymbol{r}_t = \boldsymbol{\mu}_t + \boldsymbol{a}_{t,}$$

where $\boldsymbol{\mu}_t = E(\boldsymbol{r}_t | \boldsymbol{F}_{t-1})$ is the conditional expectation of given past information that $\boldsymbol{F}_{t-1}\boldsymbol{\alpha}_t = (\alpha_{1t}, \alpha_{2t,\dots}, \alpha_{kt})'$ is a shock or innovation of the series at time t.

$\boldsymbol{r}_t$ follows the multivariate time series model.

The mean equation for $\boldsymbol{r}_t$ is

$$\boldsymbol{\mu}_t = \boldsymbol{v}\boldsymbol{x}_t + \sum_{i=1}^{p} \boldsymbol{\phi}_i \boldsymbol{r}_{t-i} - \sum_{i=1}^{q} \boldsymbol{\theta}_i \boldsymbol{a}_{t-i}.$$

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[13] The daily return of the stock index is the continuously compounded return or log return of the index at time t.

$\boldsymbol{x}_t$ denotes an m-dimensional vector of exogenous variables with $\boldsymbol{x}_{1t} = 1$.

$\boldsymbol{v}$ is a $k \times m$ matrix. p and q are non-negative integers.

The conditional covariance matrix of $\boldsymbol{\alpha}_t$ given $\boldsymbol{F}_{t-1}$ is a $k \times k$ positive definite matrix $\sum_t$ defined by $\sum_t = cov(\boldsymbol{\alpha}_t | \boldsymbol{F}_{t-1})$. The time evolution of the $\{\sum_t\}$ process is a volatility model for the return series $\boldsymbol{r}_t$, using the conditional correlation coefficient and variance of $\boldsymbol{\alpha}_t$ to reparametrize $\sum_t$.

The DCC GARCH model can be presented briefly as follows:

$$\textstyle\sum_t \equiv [\boldsymbol{\sigma}_{ij,t}] = \boldsymbol{D}_t \boldsymbol{\rho}_t \boldsymbol{D}_t,$$

where $\boldsymbol{D}_t = diag\{\sqrt{\sigma_{11,t}}, \ldots, \sigma_{kk,t}$, which is a $k \times k$ diagonal matrix consisting of the standard deviation of elements of $\boldsymbol{\alpha}_t$. The $\sqrt{\sigma_{ii,t}}$ is the ith element of the standard deviations implied by the estimation of univariate GARCH models, which are computed separately.

In addition, $\boldsymbol{\rho}_t$ is a conditional correlation matrix of $\boldsymbol{\alpha}_t$, as can be seen directly from rewriting this equation as:

$$\boldsymbol{\rho}_t = \boldsymbol{D}_t^{-1} \textstyle\sum_t \boldsymbol{D}_t^{-1}.$$

A special property of dynamic conditional correlation models is that $\boldsymbol{\rho}_t$ is allowed to be time varying. $\boldsymbol{\rho}_t$ is symmetric with a unit diagonal element. The time evolution of $\sum_t$ is governed by that of conditional variance $\sigma_{ii,t}$ and the elements ρ_{tij} of $\boldsymbol{\rho}_t$, where $j < i$ and $1 \leq i \leq k$.

Engle (2002) proposed that $\sum_t$ is a positive definite matrix and satisfies

$$\textstyle\sum_t = (1 - \theta_1 - \theta_2)\overline{\sum} + \theta_1 \epsilon_{t-1} \epsilon'_{t-1} + \theta_2 \sum_{t-1},$$

where $\boldsymbol{\epsilon}_t$ is the standardized innovation vector with elements $\epsilon_{it} = a_{it} / \sqrt{\sigma_{ii,t}}$. $\overline{\sum}$ is an unconditional covariance matrix of $\boldsymbol{\epsilon}_t$, and θ_1 and θ_2 are non-negative scalar parameters satisfying $0 < \theta_1 + \theta_2 < 1$. The $\boldsymbol{D}_t^{-1}$ matrix is the normalization matrix to guarantee that $\boldsymbol{\rho}_t$ is a correlation matrix. The caveat of the model is that θ_1 and θ_2 are scalar, so that all the unconditional correlations have the same dynamics. This may be hard to justify in real applications, especially when dimension k is large (Tsay 2010).[14]

The advantage of the DCC GARCH specification is that it takes into account the possible structural breaks in the unconditional correlations among EAEs' equity markets during the sample period. The model allows the joint analysis of the volatility of two countries' equity markets and the assessment of the pairwise relationship.

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[14] In the literature the alternative measure of conditional correlation is the BEKK-GARCH model. However, this model is subject to problems as well. First, the parameters in the equation for $\sum_t$ do not have a direct interpretation concerning the lagged values of volatility or shocks. Second, the number of parameters employed increases rapidly with the number of variables.

4. THE ANALYSIS OF THE DEGREE AND EVOLUTION OF THE INTERCONNECTEDNESS OF VOLATILE CAPITAL FLOWS

The time series plots of the daily behavior of gross foreign equity flows and daily returns[15] on the equity index in Appendix Figure 1 suggest that the degree of financial instability among EAEs has increased in the current period of volatile capital flows.[16] Questions arise from this observation: was there an increasing degree of financial interdependence in Asian financial markets during calm periods, and is there significant evidence of financial contagion among EAEs during the financial crisis? If contagion exists, did the impact of the crisis generated outside the region outweigh that of Asia's own financial crisis?

These questions can be addressed by examining the linkages between markets in EAEs through the co-movements in stock market volatility, in other words the coincidence of periods of increased/decreased stock market volatility across countries. Such linkages can be examined through the time-varying conditional correlation coefficient derived from the DCC GARCH estimation.

The analysis includes stable periods (the pre-Asian crisis and pre-global financial crisis periods) and crisis periods (the Asian crisis, Lehman Brothers crisis, and euro crisis). Any evidence of a strong contemporaneous relationship across stock markets during calm periods defines the interdependence of the equity markets among countries. This can be assessed by checking the statistical significance of the calculated conditional correlation coefficients. The possibility of contagion is further defined as a significant shift in these cross-country linkages during crises.

4.1 The International Volatility Linkages during Calm Periods

Financial interdependence can be examined from the international volatility linkages during calm periods. The stronger co-movements in the financial variables could relate to the greater developments and international integration in normal events. The resulting pairwise conditional correlation coefficients of the equity returns during the pre-Asian crisis period (September 1992 to December 1996) and the pre-US crisis period (January 1998 to December 2006) are illustrated in the third and fifth panels of Appendix Table 3.

The estimation results in the table and the time series plots suggest stronger inter- and intra-regional financial integration, as reflected in the higher correlation coefficients of the equity returns among Asian countries as well as in Asian in relation to US stock markets. In fact, the pairwise correlation coefficients within the region are greater than their correlations with the US market. For instance, the correlation of the Thai stock market and the Indonesian stock market increased from 0.28 (t=1.93*) in the pre-Asian crisis period to 0.32 (t=10.63***) in the pre-US crisis period. The correlation of the Malaysian stock market and the Republic of Korea's stock market was 0.05 (t=1.57) in

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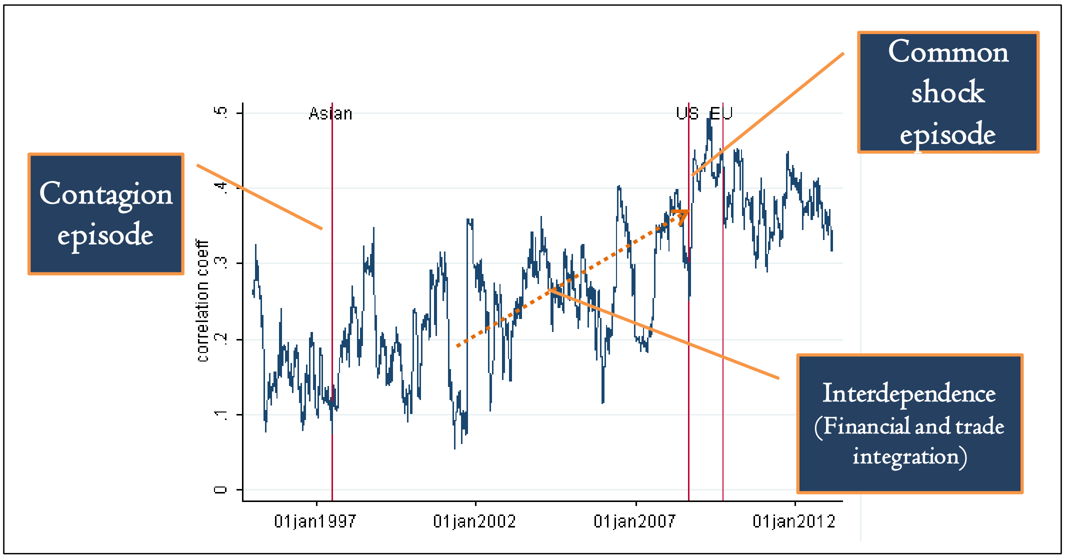
[15] Visual inspection of the time series plots of the stock index shows that all the series are non-stationary, and the unit root test confirms this notion. Therefore, the daily stock index returns are taken so that they can be applied to the DCC-GARCH estimation. Not surprisingly, the return of the series (in Appendix Figure 1) exhibits volatility clustering, which we can fit into the GARCH (1,1) model. The volatility of the return was also quite large during the Asian and US crises.

[16] The time series plots of the daily returns on equity index reveal that the volatility of the stock index in all the countries rose rapidly during the Asian and US financial crises.

the pre-Asian crisis period and became statistically significant, with a coefficient level of 0.26 (t=6.62***), in the pre-US crisis period.

The time series plots of the pairwise conditional correlation coefficients of each country's stock index return versus the Thai stock index return (Appendix Figure 2) also indicate strong evidence of volatility co-movements across countries during the pre-1997 crisis and pre-US crisis periods, except in the case of the PRC. This suggests the interdependence and linkages of the stock markets in the region. The finding of a minor relationship with the PRC is unsurprising, since the country only recently opened its equity market to foreign trading. The correlation between the PRC equity market and the other Asian countries remains low. The correlation coefficients of the PRC with Taipei,China and Thailand are weakly significant. The correlations of the Chinese stock market with the US stock market and the rest of the Asian countries are insignificant. Hong Kong, China is the only exception, for which the correlation coefficient with the PRC is strongly significant, since Hong Kong, China is the de facto financial center for the PRC. This implies the low level of international integration of the Chinese stock market.

Figure 1: Correlation Coefficients of the Indian and Thai Stock Markets



Source: Author's calculation.

The degree of fundamental linkages, such as increasing trade and financial integration, between the EAEs and the US is also increasing. In the pre-1997 crisis period, the correlation coefficients between the US stock returns and those of EAEs remained low and insignificant (Appendix Figure 3). There were insignificant inter-linkages between the stock market in the US and the EAEs in general; thus, the change in volatility tends to be determined mainly by own-country factors. However, since 1998 the inter-linkages of the US stock returns and the EAEs' stock returns have increased significantly. As illustrated in the correlation table in Appendix Table 3, the degree of integration has increased substantially and become significant during the pre-US crisis period in all the Asian countries except Malaysia, Indonesia, and the PRC. During the pre-US crisis period, there were strongly significant correlation coefficients for Singapore; Hong Kong, China; the Republic of Korea; and Taipei,China. Singapore is the most vulnerable to shocks generated by the US, as the conditional correlation coefficients of the stock returns between the two countries were 0.97 (t=373.7***) prior to the US crisis. The conditional correlation coefficients of the US with Hong Kong, China; the Republic of Korea; and Taipei,China were 0.14 (t=4.3***), 0.12 (t=3.55***), and 0.10 (t=2.84***), respectively.

4.2 Evidence of Crisis Contagion

The common movement of the equity markets among EAEs can be used further to trace the contagion and spillovers during crisis periods. If the equity markets of each country move independently, then it is likely that the financial risk is driven by country-specific factors. In contrast, if the correlation coefficients rise dramatically, reflecting that the volatility moves together, all the equity markets in EAEs would be perceived by investors as being subject to common risks. This could imply that foreign investors make their investment decision based on the global risk sentiment factor or the regional factors rather than the country-specific factors.

The existence of contagion during crises could be justified on theoretical grounds. The reason for the increases in cross-market linkages after the occurrence of shocks was explained by Masson (1998) as the ability of a crisis in one country to coordinate investor expectations. A co-movement in price would exist because of the correlation in memories rather than fundamentals. The DCC GARCH estimation confirms the existence of contagion. The sub-period examination shows that the correlations of the Asian equity markets picked up significantly, especially during the global financial crisis.

Statistically, contagion has been defined as a significant increase in asset prices' co-movements, which can be checked from the comparison of the correlation coefficients when dividing the data into pre- and post-crisis sub-periods.[17] The results are presented in Appendix Table 3, in which panels 3 and 4 compare[18] the resulting changes in the conditional correlation coefficients during the pre- and post- Asian financial crisis periods. The correlation coefficients of several country pairs became statistically significant during the Asian financial crisis. For instance, there was a significant increase in volatility spillover or crisis contagion between Thailand and India, as the correlation coefficients increased from 0.04 (t=0.71) to 0.10 (t=1.79*) during the Asian financial crisis. The correlation coefficients between Singapore and Hong Kong, China also increased from -0.10 (t=-0.29) to 0.14 (2.05**) during the Asian financial crisis. The volatility spillover became significant during the Asian financial crisis when comparing Indonesia with other countries, such as Malaysia, the Philippines, and Taipei,China and when comparing the Republic of Korea with other countries, such as Singapore, India, and Taipei,China. In addition, for those that already had a significant correlation coefficient prior to the Asian financial crisis, the correlation coefficients increased even further after the crisis; for instance, the correlation coefficients rose from 0.11 (t=3.22***) to 0.20 (t=3.10***) for Thailand versus the Republic of Korea, from

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[17] Another measure suggested in the previous part is to add the crisis dummy variable in the conditional variance equation of the DCC GARCH to examine whether there is any significant increase in the conditional correlation and conditional variance of equity markets during a crisis. However, the estimation results are omitted here due to the computational difficulties.

[18] The existence of contagion can also be assessed by the statistical significance of the crisis dummy variables in the conditional variance equation of the DCC GARCH model. The crisis dummy variables take the value of 1 during a crisis and 0 otherwise. The statistically significant positive relationship of the crisis dummy variables in the conditional variance equation implies a significant increase in the conditional correlation and conditional variance of equity markets during a crisis. The method allows us to control for the factors determining the conditional variance and conditional mean of equity. The alternative measure in the literature is the regression-based contagion test, which can be performed by regressing the correlation coefficients with the crisis dummy variable to observe the structural changes.

0.08 (t=2.32***) to 0.17 (2.76***) for Malaysia versus Taipei,China, and from 0.07 (t=2.24**) to 0.17 (t=2.74**) for the Philippines versus Taipei,China. Nevertheless, the correlation coefficients of some country pairs remained weak and insignificant, even during the Asian crisis period; for instance, there was no significant relationship between Singapore and other Asian countries. There was also an insignificant relationship between India and other Asian countries except the Republic of Korea and Thailand.

The resulting increase in the conditional correlation coefficients, during the pre-, during-, and post-US crisis periods, is more dramatic, as presented in panels 5, 6, and 7 of Appendix Table 3. The correlations of equity markets among Asian countries increased markedly during the pre-US crisis period. This was partly due to the stronger intra-regional financial integration prior to the US crisis; the dependence of each country's market thus progressively intensified. The correlation coefficients of the majority of the country pairs were statistically significant during the pre-US crisis period, except the pair of the PRC and Singapore. During the US crisis period, the correlation coefficients of all the pairs rose rapidly and became strongly statistically significant. Note that the correlation coefficients among the Asian countries are generally higher than the correlations between the US and each Asian country. This suggests a strong linkage of the stock indexes within the region. Hence, a common shock could create a volatility spillover from one country to another. In addition, the global liquidity surge during the US quantitative easing directly flooded into the equity and bond markets in Asia, as stated in panel 7 (the crisis recovery period) of the table. This is considered as a common shock to Asian countries that could create greater systemic risk in the region. The spread of the news that determines the global risk sentiment also plays an important role. In the risk-on period, the stock return rose sharply with an improvement in the sentiment towards the global economic recovery. However, it fell when there was bad news about the slower pace of the global economic recovery, such as the uncertainty about the US economic recovery plan, the intensification of the euro sovereign debt crisis, and the possibility of a hard landing in the PRC. This results in the global aspects of changes in stock return volatility, possibly leading to contagion. The global factors thus influence the stock markets in Asia. This suggests that the instability arising outside the region could aggravate the volatility spillover of the financial markets within the region.

Lastly, the time series plots of the estimated dynamic correlation coefficient illustrate the development of the correlation during each episode. The correlation coefficients of the Thai stock returns against each of the other Asian stock returns are shown in Appendix Figure 2. Thailand was chosen as the crisis originator in 1997 and can illustrate the case for intra-regional spillover. The correlation coefficients of the individual Asian countries' stock returns against the US stock returns are presented in Appendix Figure 3 to illustrate its impact as the crisis originator in 2008. The resulting implied correlation coefficients increased sharply, confirming the role of the Thai financial market as the crisis originator in 1997. However, the pairwise correlation coefficients incurred a more dramatic rise in response to the shock originating outside the region, that is, the global financial crisis in 2008. The correlation increased even further after the euro sovereign debt crisis in some cases. The results reflect that the US crisis was perceived by investors as a major event and contributed to the integration of the equity markets among the EAEs. The intensification of the euro crisis further contributed to the uncertainty in the global financial market. This confirms the existence of the monsoonal effects of the crisis.

5. THE ANALYSIS OF THE FACTORS DETERMINING THE INTERCONNECTEDNESS OF VOLATILE CAPITAL FLOWS

The previous section illustrated the evolution of the interconnectedness of the Asian financial markets. This section further analyzes the factors determining their relationship. The explanatory variables are introduced into the DCC GARCH estimation. The dependent variable is the equity returns of each Asian country.

The set of explanatory variables in the conditional mean is lagged by one period. The explanatory variables include

1) The liquidity shock: measured by the spread between the three-month London interbank rate and the fixed interest rate offered in the overnight swap index (OIS) over the three-month maturity. The spread between the two rates is considered to be a measure of the health of the banking system, risk, and liquidity in the money market. A lower spread indicates higher liquidity in the market and vice versa.
2) The domestic-specific factor: this refers to a pull factor, such as the domestic economic growth prospect, the exchange rate return, the introduction of capital controls, and so on. In this analysis the return of the local currency versus the US dollar is the representative of the domestic-specific factor. A stronger local currency with respect to the US dollar results in a negative sign of the currency return, implying that foreigners receive a currency gain from investing in the local stock market.

The set of explanatory variables in the conditional variance equation includes

1) The global confidence shock: the VIX index[19] or the Chicago Board Options Exchange Market Volatility Index, which measures the implied volatility of S&P 500 index options. It reflects the stock market uncertainty through the market's expectation of stock market volatility over the next 30-day period. A higher VIX index reflects larger global confidence shocks through higher levels of risk aversion and uncertainty.
2) The confidence shocks from crisis originator economies (US factors and EU factors): the US economic surprise index and the EU economic surprise index are employed to gauge the shock from these two economies.
3) The EME regional factor: the economic surprise index for the Asia and Pacific region gauges the regional risk sentiment factors.

Appendix Table 4 presents the DCC GARCH estimation by controlling for these factors. The DCC GARCH calculation consists of two steps. The first step is the univariate GARCH calculation, which controls for the domestic-specific factor and the liquidity shock in the conditional mean equation. The conditional variance equation examines two models: the first controls for the global risk sentiments, proxied by the VIX index; the second controls for the US and EU shocks and the shock within the Asia and Pacific region, which are proxied by the economic surprise index. The results are presented in Table 4A. The results in the first step show that the equity returns in all

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[19] The VIX index is a theoretical measure of the amount of volatility that investors have priced into options to buy or sell on Standard & Poor's 500-stock index. It is commonly called the "fear index." It tends to rise in price whenever the stock market is turbulent, which makes the VIX appear to be the perfect insurance against a volatile market.

the economies followed the volatility clustering process. The domestic factor, that is, the domestic currency return, appears to be significant with a negative sign in the conditional mean equation of the GARCH, except for the PRC; Hong Kong, China; the Republic of Korea; and India. The strong negative sign of the coefficient suggests that the currency gain in an earlier period is significantly associated with a higher stock return. In addition, the shock in the domestic-specific factor significantly explains the conditional variance of the equity return. The local currency is pegged with the US dollar in the case of the PRC and Hong Kong, China; it is thus unsurprising to find that the currency return has no significant impact on the stock market volatility in these two countries. In the case of the Republic of Korea, the flows into the country occurred mainly through the debt flows into the banking sector rather than the portfolio flows. In the Indian stock market, the stock return rose significantly with respect to the currency loss. Although the Indian rupee moderately appreciated against the US dollar between late 2009 and 2011, it exhibited sharp currency depreciation against the US dollar in most of the periods observed after the US crisis. This was mainly due to the capital outflows from the country. The impact of the US liquidity factors shows the mixed results. It has a statistically significant positive relationship with the equity returns in both models in the cases of the US, Singapore, Thailand, the Philippines, Indonesia, and the Republic of Korea.

In the conditional variance equation, the global risk sentiment index, as reflected by the VIX, significantly determines the volatility in all the sample countries. The higher the VIX index is, the more volatile the spillover effect. This confirms the role of the global risk sentiment in determining the asset price volatility. In addition, the economic surprise shock from the crisis originators (the US and the EU) and the regional shock play an important role in the stock return volatility for the majority of the sample countries. The exceptions are as follows. The US economic surprise and the Asia and Pacific economic surprise index are not statistically significant in the cases of the Philippines; Indonesia; and Hong Kong, China. The EU economic surprise index is not significant for Thailand, Malaysia, and India.

The second step is the multivariate GARCH calculation for the conditional correlation of each country's equity returns after specifying the model with respect to the first step. The correlation coefficients are presented in Table 4B. All the pairwise correlation coefficients are statistically significant in both models. The results are quite similar; thus, the use of models 1 and 2 can serve as a robustness check of the results. The results confirm that, after controlling for both push and pull factors, there is still a significant correlation coefficient across the equity markets within Asia and between Asia and the US.

6. THE ANALYSIS OF THE BEHAVIOR OF EQUITY FLOWS AND VOLATILITY SPILLOVERS AFTER THE CMF MEASURES

The findings in the previous parts suggest that equity markets are more linked internationally through financial integration during calm periods. The link is stronger through volatility contagion during crisis periods. During periods of market turbulence, CFM is introduced to safeguard the financial stability in the domestic market. The introduction of the control is expected to reduce the spillover/contagion of the shock. The following section explores the impacts of CFM on the linkages of the stock markets among the emerging Asian countries.

The analysis can be divided into two parts. The first part concerns the examination of the change in the international correlations of the equity prices after the introduction of CFM through the DCC GARCH framework. The second part contains an event study of the impact of CFM on gross foreign purchases and sales in the local equity market. It is useful to note here that the two parts explore the impacts of CFM from different angles. The first part analyzes the significance of a CFM dummy in the GARCH model. The examination of the dummy of control in the DCC GARCH investigates the structural change in the conditional correlation coefficient and the conditional variance. It is an assessment of the medium- to long-term impact of CFM measures. The second part is an event study of the gross equity flow, which is an assessment of the temporary and extreme capital movement around the introduction of the control.

6.1 The Examination of the Correlation of the Stock Prices after the Measure

This section examines the effect of control on the volatility spillover of the equity index. This part consists of two steps. The first step analyzes the significance of the CFM dummy in the GARCH model. It is an analysis of structural change in the conditional variance, which aims to assess the medium- to long-term impact of CFM. The second step is an examination of the changes in the international correlations of stock index returns after the introduction of CFM through the DCC-GARCH framework. Considering that it is difficult to distinguish the true cause of volatility, which can be from the crisis itself or from the capital control, this study does not aim to assess the effectiveness of the control itself. Instead, it aims to examine the possibility of a negative externality of CFM from one country to the others. The externality in this context refers to an increase in neighboring country volatility or international risk sharing after the CFM measures. Several questions arise in this section. For instance, does CFM curb/raise the volatility of asset prices in each country? Does the measure enhance the volatility contagion among the EAEs?

Following a priori Edison and Reinhart (2001), one should expect a lower degree of co-movement for a country that has imposed controls during the period in which CFM is in place. This implies that the introduction of the measure dampens the volatility interdependence between the countries instituting controls and their neighboring countries. If the measure results in lower volatility across the board or if it only changes the volatility in the country where the measure was instituted without creating side effects for others, there is no negative externality. Another possible contrast scenario is that the control originating in a country could (or could not) not only successfully reduce uncertainty in its own equity market but also raise volatility in its neighbors' markets. A negative externality would result from such a measure.

The capital control episodes analyzed in this paper are listed in Appendix Table 1. These are examples of emerging Asian countries resorting to capital controls during periods of market stress. The resulting univariate GARCH calculation of each country's equity return after controlling for CFM is presented in Appendix Table 5A. The dummy for CFM is introduced in the conditional variance equation of the GARCH calculation. The term $dummy_c$ is a dummy variable that takes the value of one during the control period and zero otherwise. The announcement date is selected instead of the official active date to address the issue of some capital control measures having been anticipated by financial markets.

The model is similar to model 1 in the previous section; the additional explanatory variable is the CFM dummy.[20] The conditional mean equation consists of the US three-month Libor–OIS spread (bicloiss) and the return on the exchange rate (in terms of the local currency versus the US dollar). The US three-month Libor–OIS spread helps to control for the liquidity condition in the US. The change in the local currency in relation to the US dollar is the proxy for the change in the domestic-specific factors. The conditional variance equation consists of the dummy variable of the control and the VIX index. Since CFM is introduced in periods of turbulence, the study attempts to separate the impacts of the measures from those owing to the financial crisis per se. The risk sentiment index, as reflected in the VIX index, helps to control for the risk sentiment in the global financial market.

The results show that the dummies of all the CFM measures have a significant negative relationship with the variance of the stock return, implying that the introduction of the control is associated with the lower volatility of the stock return. The conditional volatility of stock returns is found to have declined in all the countries every time CFM was introduced. This happened to the country instituting the control itself and its neighboring countries. The results suggest that the equity market is calmer every time the measures are introduced, within both the home country and its neighbor. The introduction of the capital controls tends to be associated with smaller international volatility spillovers among EAEs. This suggests that there is no negative externality from CFM in the medium to long term. In fact the measure helps to calm the equity market in the region in the medium to long term.

In addition, including the dummy for CFM does not alter the relationship between the VIX index and the Libor–OIS spread. The coefficients are similar to those of the first model in the previous section. The VIX index significantly determines the variance of the stock returns in all the countries, while the Libor–OIS spread is significant for the majority of the sample countries. This partly reflects that the introduction of CFM does not alter the contemporaneous movement of the equity return with international variables. There is no clear evidence of a weaker influence from foreign variables on domestic ones around the introduction of the measure.

The second step of the GARCH calculation yields pairwise conditional correlation coefficients of the equity returns in Asia. The results are presented in Appendix Table 5B. The pairwise correlation coefficients reduce drastically after including the measure dummy in all the cases. The control is thus associated with smaller international correlations of stock returns among EAEs. This suggests that CFM tends to reduce international risk sharing in the medium to long term.

The caveat for this study is that several CFM measures were introduced in Asia, some weeks after others. It is difficult to separate fully the impact of each of the CFM measures. The dummy for the control is included separately in each calculation.

6.2 The Event Studies of the Foreign Equity Flows after the Measures

This section analyzes the impact of a CFM announcement on the foreign equity flows in each Asian country. It investigates the daily flows (in US dollar terms) of sales and purchases made by foreign institutional investors in the local equity markets. The data are available for India; the Republic of Korea; the Philippines; Taipei,China; Indonesia;

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[20] Not all the measures in Appendix Table 1 are analyzed for two main reasons. First, some measures are introduced consecutively after others. Second, adding the dummy variable of some measures resulted in flat log likelihood in the GARCH calculation.

and Thailand since 1999. The examination of the gross flows can be performed by identifying the "extreme[21] capital flow movement" around the period of the introduction of CFM. This helps in isolating the small change or fluctuation of capital flows from the analysis.

Given that we want to find the impact of the CFM measures on the gross flows, a daily analysis is required to investigate the market response. There are two main criteria for counting events as extreme movements. First, in the episode the change in gross sales and purchases must be more than one standard deviation above the rolling mean. Episodes end when the movement falls within the one standard deviation band. Second, for the episode to qualify as an "extreme event," there must be at least one day when the change in the gross flow is at least two standard deviations above its mean.

Appendix Table 6 exhibits the behavior of the foreign institutional investors involved in purchases (column 4) and sales (column 5) in EAEs' equity markets. The star sign in the table indicates the country that introduced the measure. The extreme movements of foreign purchases are defined as the dark red area, while the extreme foreign sales are represented by the dark grey area. The pale red and pale grey areas represent the near extreme event episodes, in which the change in capital flow is above the one standard deviation band but below the two standard deviation band.

The results from the event studies show that the extreme movements lasted for only a few days to a week. There are also some interesting findings from the event studies; the explanations are the following:

First, a country's measures temporarily reduce the flow of foreign purchases in its own equity market. In addition, they are associated with irregular foreign purchases of equity in other countries. Examples are the Republic of Korea's measures to limit private foreign exchange exposure (on 19 November 2009 and 19 May 2011), the Republic of Korea's withholding tax (on 18 November 2010), the Republic of Korea's restriction on external borrowing (on 19 December 2010), and Indonesia's minimum holding period (on 13 April 2011). The reduction of foreign purchases in the equity markets of these countries is above one standard deviation, as represented by the shaded light grey area. In addition, around the period of the control in these markets, there is evidence of irregular foreign purchases in other markets. Most of the measures above are associated with a surge in equity inflows into Thailand, such as the Republic of Korea's measures to limit private foreign exchange exposure (on 19 November 2009 and 19 May 2011), Indonesia's increasing minimum holding period on Bank Indonesia's certificates from one month to six months (on 13 April 2011), and the Republic of Korea's withholding tax on government bond and central bank securities (on 18 November 2010). The Republic of Korea's restriction on external borrowing (on 19 December 2010) is associated with a surge in equity inflows into Indonesia. There was either no change or reduction in the daily flow of foreign sales in the equity market of the countries that initiated the measure. It seems that investors tended to reduce their transaction in these countries to wait and see the clarity of the impacts of its measures. Although these measures are not the direct cost to investors in the equity market, they tend to signal that the government is less supportive of foreign portfolio flows. Hence, investors tend to divert the flow into other countries in the short term.

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[21] Forbes and Warnock (2012) identified the extreme capital flow movement by observing quarterly gross capital flow data in the balance of payments. A positive value is interpreted as inflows from foreign investors. Episodes of extreme capital flow movement can be divided into four types: a "surge" is a sharp increase in gross capital inflows; a "stop" is a sharp drop in capital inflows; a "flight" is a sharp increase in gross capital outflows; and "retrenchment" is a sharp decrease in gross capital outflows. The flight and retrenchment episodes are defined as activities driven by domestic investors.

Second, some measures have no impact on the flow of foreign purchases in local equity markets but are associated with a surge in an inflow into other markets. Examples are India's restriction on external borrowing (on 9 December 2009), Indonesia's minimum holding period on bonds (on 16 June 2010), Taipei,China's limit on non-residents' access to central bank instruments (on 9 November 2010), Taipei,China's and Indonesia's raising of the reserve requirement (on 30 December 2010), and measures to limit private foreign exchange exposure in the Republic of Korea (on 13 June 2010 and 26 November 2012) and in the Philippines (on 5 November 2010, 28 October 2011, and 26 December 2012). Thailand seems to be the major recipient of the flows, followed by the Republic of Korea, Taipei,China, Indonesia, and the Philippines. A country's measure also results in foreign sales in its own equity market. In column 5 of Appendix Table 6, the foreign sales in equity markets soared by more than two standard deviations in the case of Indonesia's minimum holding period on bonds (on 16 June 2010) and by more than a standard deviation in the case of the Philippines's limit on non-residents' access to central bank instruments on 17 July 2012. This happened even when the market was experiencing the risk-on sentiment, as represented by the low VIX index. Hence, it confirms that the flow was diverted away from countries that introduced CFM to other countries. There is no data on foreign purchases and sales of equity in the PRC. However, we find that the introduction of the PRC's restriction on external borrowing on 31 March 2010 is associated with a surge in inflows into many countries, such as Indonesia, Thailand, the Republic of Korea, and Taipei,China.

Lastly, measures targeting fixed-income investment are associated with a surge in inflows into the country's own equity market in some cases. The Philippines's limit on non-residents' access to the central bank's special deposit account (SDA) facility on 17 July 2012 is an example. The measure aimed to reduce the volatility of the speculative flows, as the time deposit account is the vehicle for carry trade. It is likely that the controls in the deposit account could instead have diverted the funds away from the original vehicle for carry trade into the equity market. The measure could not stop the volatility of the flows. The measure is also associated with an outflow (i.e. foreign sales in the equity market), even though there is a risk-on sentiment in the market.

7. CONCLUSION

This paper attempts to identify the relationship of the equity markets in Asia. Over the past two decades, the degree of volatility interdependence of the equity markets among the Asian economies has been increasing during calm periods, reflecting stronger fundamental linkages. The increased financial integration has intensified the contagion effects across markets. During the global financial crisis period, the equity markets among the EAEs exhibited stronger correlations, confirming the existence of contagion and the intensification of systemic risk. However, correlation is not always bad, as integration brings undoubted benefits in terms of growth and market development (Kose, Prasad, and Terrones 2009). In addition, a higher correlation may be a sign of risk sharing at work.

The paper also tested the effects of CFM on changes in cross-border volatility links in the context of equity markets. The introduction of CFM measures is associated with a reduction in the conditional variance of the equity markets in the country instituting the controls as well as in its neighboring countries. In all the cases, the measure is associated with a reduction in the volatility dependence of the stock index within the region. This implies that CFM could calm the markets in the medium to long term. In the short run, the event of flow diversion into other markets seems to appear with the introduction of the measure.

For the discussion of multilateralism, the degree of externality of CFM is not clear in this study. In addition, all policies entail spillovers in general, such as interest rates, exchange rate intervention, and reserve accumulation. International policy coordination may not be limited to the case of CFM. However, Asia remains a very diverse region. Differing objectives and priorities complicate policy coordination (Truman 2011). Given the difficulties, policy coordination has focused on building the regional resilience to shocks and multilateral crisis management facilities. Lastly, the major externalities remain external to Asia; hence, a cohesive Asia increases the regional bargaining power.

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APPENDIX

Appendix Table 1: Capital Flow Management Measures in Asian Economies

Policy Tool (*Objective*)	Country Example (Announcement Date)
1. **Limit private FX exposure** (*to dampen speculation in FX markets*)	**Rep. of Korea (19 Nov 2009)** – capped the FX forward position for exporters to up to 125% of the underlying position and required banks to raise their long-term foreign currency borrowing from 80% to 90% of long-term lending. **Rep. of Korea (13 Jun 2010)** – capped banks' FX forward positions at 50% of regulatory capital for domestic banks and 250% for foreign banks. Reduced firms' hedging limit from 125% to 100% of export receipts. **Rep. of Korea (19 May 2011)** – cut the ceiling on FX derivative contracts owned by domestic banks from 50% to 40% of equity and by foreign bank branches from 250% to 200%, effective in Jul 2011. **Rep. of Korea (26 Nov 2012)** – cut the ceiling on FX derivative contracts owned by domestic banks from 40% to 30% of equity and by foreign bank branches from 200% to 150%, effective in Nov 2012. **Rep. of Korea (21 Feb 2013)** – declared the plan for new measures that could tighten KRW NDF trading rules and an additional levy on banks' FX debt or tax for FX and bond transactions. **Philippines (5 Nov 2010)** – starved the market of USD by "rolling-off" the FX forward book to stem peso appreciation. **Philippines (28 Oct 2011)** – increased capital adequacy or the capital charge on NDF positions from 10% to 15%, effective on 1 Jan 2012. **Philippines (26 Dec 2012**) – pre-termination of NDFs no longer allowed. Banks' NDF exposure cannot exceed 20% of qualified capital for local banks and 100% for foreign banks.
2. **Raise the restriction on external borrowing** (*to limit access to foreign credit and prevent high-cost borrowing*)	**India (9 Dec 2009)** – reinstated the interest rate cap on private external borrowing. **Rep. of Korea (19 Dec 2010**) – banks' levy on non-deposit FC liabilities, effective on 1 Aug 2011 (<1yr=0.2%, 1–3 yrs=0.1%, >3yrs=0.05%). **Indonesia (30 Dec 2010)** – re-imposed a limit on banks' ST foreign borrowing to 30% of capital, effective in Mar 2011. **PRC (31 Mar 2010)** – SAFE cut the short-term debt quota by 1.5% to USD32.4 to prevent abnormal capital inflows, effective in April 2010. **Rep. of Korea (29 Jul 2011**) – the government imposed a levy of 0.02–0.2% on foreign debt, less FCD held by banks, effective in Aug 2011.
3. **Minimum holding period** (*to limit the volatility of flows*)	**Indonesia (16 Jun 2010)** – from 7 Jul 2010, all SBI buyers are subjected to a one-month holding period. **Indonesia (13 Apr 2011)** – increased the holding period to six months, effective on 13 May. **Philippines (7 Dec 2012)** – possible announcement of a new measure, i.e. a minimum holding period of 90 days for domestic fixed-income instruments. It is possible that there is a further reduction in the NDF exposure limit or a further increase in risk weighting for NDFs, effective in Q1 2013.
4. **Limit foreign access to central bank instruments** (*stop the vehicle for carry trade to reduce flows' volatility*)	**Indonesia (16 Jun 2010)** – issued 9 and 12M SBIs to replace 1 and 3M and expanded the supply of non-tradable term deposits up to 6 months' tenor for local banks; effective on 7 Jul 2010. **Taipei,China (10 Nov 2009)** – barred NR access to time deposit accounts. **Taipei,China (9 Nov 2010)** – restricted offshore funds from investing more than 30% of their portfolio in money market products and government debt with maturity of less than a year. **Philippines (17 July 2012)** – banned foreigners from investing in the central bank's special deposit account (SDA) facility.
5. **Reserve requirements on FC and NRs' account**	**Taipei,China (30 Dec 2010)** – raised the reserve requirement on the local currency account held by non-residents. **Indonesia (30 Dec 2010)** – raised the reserve requirement on foreign currency accounts from 1 to 5% in Mar and to 8% in Jun 2011 (*to reduce banks' incentive to intermediate ST inflows*).

continued on next page

Appendix Table 2 *continued*

Policy Tool (*Objective*)	**Country Example (Announcement Date)**
6. **Withholding tax on foreign holdings of gov't bonds**	**Thailand (12 Oct 2010)** – reinstated 15% interest income and capital gains tax on non-resident purchases of government bonds (*to slow the inflow into bond markets*) **Rep. of Korea (18 Nov 2010)** – reinstated 14% on government bonds and central banks' securities, effective on 1 Jan 2011.
7. **Other FX control measures**	**PRC (15 Nov 2010)** – introduced 7 FX controls, including placing a floor on banks' long FX spot risk and clamping down on exporters' over-invoicing. **Indonesia (30 Sep 2011)** – required banks to submit complete, accurate, and timely data on foreign exchange flows to BI. **Philippines (15 Dec 2011)** – all applications for FDI registration must be filed with the BSP within 5 years of the date of inward remittance/actual transfer of assets to the Philippines.
8. **Measures on property**	**Hong Kong, China (Jun 2010)** – Raised the minimum down payment for home purchases by 10% for borrowers who receive their main income from abroad. **Singapore (Dec 2011)** – Foreigners and corporate entities need to pay an extra 10% stamp duty when buying residential property. **Hong Kong, China (Oct 2012)** – 15% tax on property purchases by foreigners. **Singapore (Jan 2013)** – sets of measures to cool the heated property market: increased stamp duty for certain home buyers, a tighter loan-to-value limit, and a higher payment requirement for purchasing additional property.
9. **Encourage outbound investment**	**Malaysia (Oct 2010), the Philippines (Nov 2010 and Jan 2011), Thailand (Feb and 23 Sep 2010), and Thailand (Jun 2010)** – raised the limits on FA accumulation by residents, including FDI.

Sources: Brockmeijer and Husan (2011); International Monetary Fund (2011b); Pradhan et al. (2011).

Appendix Table 2: Variables' Description

Variable Name	Description
rSpx	The first difference of the S&P 500 index (SPX), US (% change daily)
rHsi	The first difference of the Hang Seng index (HIS), Hong Kong, China (% change daily)
rShcomp	The first difference of the Shanghai Stock Exchange index (SSE), PRC (% change daily)
rJci	The first difference of the Jakarta Composite index (JKSE), Indonesia (% change daily)
rKospi	The first difference of the Korean Stock Exchange index (KOSPI), Republic of Korea (% change daily)
rSet	The first difference of the Thailand Stock Exchange index (SET), Thailand (% change daily)
rSensex	The first difference of the Bombay Stock Exchange index (BEX), India (% change daily)
rFbmklci	The first difference of the KL Stock Exchange index (FBMKLCI), Malaysia (% change daily)
rPcomp	The first difference of the Philippines Stock Exchange index, Philippines (% change daily)
rTwse	The first difference of the TWSE, Taipei,China (% change daily)
rHKD	The first difference of the Hong Kong, China dollar against the US dollar (% change daily)
rCNY	The first difference of the Chinese yuan against the US dollar (% change daily)
rIDR	The first difference of the Indonesian rupiah against the US dollar (% change daily)
rKRW	The first difference of the Republic of Korea's won against the US dollar (% change daily)
rTHB	The first difference of the Thai baht against the US dollar (% change daily)
rINR	The first difference of the Indian rupee against the US dollar (% change daily)
rMYR	The first difference of the Malaysian ringgit against the US dollar (% change daily)
rPHP	The first difference of the Philippines peso against the US dollar (% change daily)
rTWD	The first difference of the Taipei,China dollar against the US dollar (% change daily)
Bicloiss	The spread between the three-month London interbank rate and the fixed interest rate offered in the overnight swap index (OIS) over the three-month maturity
VIX	The Chicago Board Options Exchange Market Volatility Index, which measures the implied volatility of S&P 500 index options
Cesiusd	The US economic surprise index
Cesieur	The EU economic surprise index
Cesiapac	The Asia and Pacific economic surprise index
rFX	The return of the local currency versus the US dollar
arch	Autoregressive conditional heteroskedasticity models. They assume volatility clustering in the equity return when the variance of the current error term is related to the size of the earlier periods' error terms.
garch	The generalized autoregressive conditional heteroskedasticity (GARCH) process. It assumes that the volatility of the stock return in the current period depends on past squared observations and past variances.

Sources: Author's compilation from Bloomberg LP and the Thai Stock Exchange Commission.

Appendix Table 3: Calculated Correlation Coefficients from the DCC GARCH Estimation of the Stock Returns in Various Periods

(with the t-value in Parentheses)

	Full Sample	Pre-Asian Crisis	Asian Crisis	Pre-US Crisis	US Crisis	Crisis Recovery
Country Pairs	3 Sep 1992 to 14 Aug 2013	3 Sept 1992 to 30 Dec 1996	2 Jan 1997 to 31 Dec 1997	5 Jan 1998 to 29 Dec 2006	3 Jan 2007 to 30 Dec 2011	4 Jan 2012 to 14 Aug 2013
p_US,TH	–0.03(–0.26)	0.05(1.58)	–0.01(–0.17)	0.07(2.03)**	0.22(6.9)***	0.25(5.36)***
p_US,PH	–0.04(–0.37)	0.03(1.01)	0.07(1.08)	0.06(1.83)*	0.07(1.98)**	0.14(3.12)***
p_US,CN	0.01(0.09)	–0.02(–0.54)	–0.08(–1.01)	–0.01(–0.41)	0.07(1.8)*	0.13(2.88)***
p_US,INDO	–0.03(–0.2)	0.06(1.79)*	–0.06(–0.92)	0.05(1.42)	0.18(5.45)***	0.15(2.79)***
p_US,TW	0.02(0.17)	0.01(0.22)	–0.07(–1.05)	0.1(2.84)***	0.15(4.21)***	0.14(2.77)***
p_US,KR	0.02(0.18)	0.04(1.07)	0.13(1.82)*	0.12(3.55)***	0.2(5.96)***	0.24(4.88)***
p_US,SG	–0.04(–1.43)	0(0.1)	0.99(961.9)***	0.97(373.7)***	0.99(947.3)***	0.99(740.9)***
p_US,HK	0.05(0.46)	0.09(2.86)***	0.15(2.26)**	0.14(4.3)***	0.2(6.04)***	0.27(5.55)***
p_US,INDIA	–0.03(–0.27)	–0.01(–0.41)	0.09(1.18)	0.07(1.78)*	0.27(9.04)***	0.24(4.24)***
p_US,MY	0.02(0.13)	0.09(2.81)***	0.04(0.55)	0.03(0.95)	0.16(4.24)***	0.05(0.86)
p_CN,TH	0.01(0.07)	0.02(0.28)	0.07(0.98)	0.06(1.84)*	0.25(7.25)***	0.29(6.55)***
p_CN,INDO	–0.01(–0.08)	0.02(0.5)	0.06(0.98)	0.03(0.65)	0.31(9.35)***	0.32(7.22)***
p_CN,TW	0.01(0.09)	0.02(0.75)	0.06(0.79)	0.06(1.71)*	0.34(10.46)***	0.38(7.57)***
p_CN,KR	–0.07(–0.73)	0.01(0.44)	0.04(0.46)	0.05(1.45)	0.35(11.27)***	0.33(7.26)***
p_CN,SG	–0.01(–2.92)***	0.02(0.03)	–0.06(–0.84)	–0.02(–0.64)	0.09(2.25)**	0.12(2.55)**
p_CN,HK	0.03(0.38)	0.02(0.25)	0.14(2.27)**	0.1(2.86)***	0.5(19.7)***	0.55(16.38)***
p_CN,INDIA	0.04(0.5)	0.11(2.29)**	0.03(0.53)	0.06(1.46)	0.25(7.97)***	0.25(5.25)***
p_CN,MY	0.02(0.26)	0.04(0.46)	–0.04(–0.62)	0.05(1.47)	0.29(8.36)***	0.28(5.79)***
p_CN,PH	0.00(0.02)	0(–0.04)	0.13(2.01)**	0.03(0.92)	0.21(5.61)***	0.23(4.18)***
p_MY,TH	0.21(1.86)*	0.38(11.32)***	0.18(2.97)***	0.3(9.5)***	0.47(16.36)***	0.31(6.83)***
p_MY,PH	0.04(0.24)	0.26(5.86)***	0.32(4.4)***	0.22(5.59)***	0.48(18.25)***	0.32(5.18)***
p_MY,INDO	0.24(1.67)*	0.29(1.54)	0.37(5.59)***	0.27(7.77)***	0.54(18.79)***	0.39(7.9)***
p_MY,TW	0(0.01)	0.08(2.32)**	0.17(2.76)***	0.24(7.48)***	0.49(17.13)***	0.34(6.76)***
p_MY,KR	0.01(0.12)	0.05(1.57)	0.09(1.23)	0.26(6.62)***	0.51(19.31)***	0.27(4.78)***
p_MY,SG	–0.03(–5.49)***	–0.12(–0.48)	0.03(0.49)	0.01(0.36)	0.17(4.19)***	0.06(1.02)
p_MY,HK	0.23(2.26)**	0.4(12.15)***	0.28(5.02)***	0.31(8.96)***	0.54(16.7)***	0.32(6.66)***
p_MY,INDIA	0.08(0.78)	0.05(0.75)	0.07(1.07)	0.15(3.99)***	0.4(12.01)***	0.19(3.38)***
p_TH,PH	0.10(0.76)	0.24(5.12)***	0.11(1.61)	0.25(6.32)***	0.36(11.73)***	0.40(9.48)***
p_TH,INDO	0.19(1.33)	0.28(1.93)*	0.25(3.99)***	0.32(10.63)***	0.5(15.23)***	0.48(11.72)***
p_TH,TW	–0.03(–0.27)	0.05(1.39)	0.04(0.56)	0.28(7.17)***	0.44(16.35)***	0.40(9.53)***
p_TH,KR	0.06(0.47)	0.11(3.22)***	0.2(3.1)***	0.34(8.42)***	0.47(17.48)***	0.40(9.65)***
p_TH,SG	–0.02(–4.41)***	–0.1(–0.34)	–0.02(–0.25)	0.04(1.3)	0.23(7.33)***	0.23(4.9)***
p_TH,HK	0.17(1.66)*	0.37(10.38)***	0.14(2.15)**	0.37(10.09)***	0.56(21.44)***	0.53(15.09)***
p_TH,INDIA	0.08(0.67)	0.04(0.71)	0.1(1.79)*	0.22(6.8)***	0.46(14.42)***	0.43(10.21)***
p_PH,INDO	0.17(0.99)	0.28(1.33)	0.36(7.03)***	0.25(7)***	0.4(11.53)***	0.35(7.65)***
p_PH,TW	0.00(0)	0.07(2.24)**	0.17(2.74)***	0.21(4.21)***	0.4(11.86)***	0.38(8.2)***
p_PH,KR	0.00(0.02)	0.05(1.35)	0.02(0.34)	0.25(5.87)***	0.43(16)***	0.39(9.23)***
p_PH,SG	0.00(0.14)	–0.15(–0.67)	0.07(1.13)	0.04(1.2)	0.08(2.28)**	0.13(2.85)***
p_PH,HK	0.10(0.98)	0.23(4.93)***	0.32(4.83)***	0.25(6.45)***	0.44(16.33)***	0.39(9.22)***
p_PH,INDIA	0.13(1.21)	0.07(0.98)	–0.02(–0.31)	0.16(4.43)***	0.28(8.03)***	0.20(3.88)***
p_INDO,TW	0.08(0.82)	0.05(1.32)	0.16(2.62)***	0.25(7.38)***	0.5(16.95)***	0.40(7.52)***
p_INDO,KR	0.12(0.92)	0.06(1.79)*	0.05(0.74)	0.29(7.67)***	0.5(15.03)***	0.46(12.15)***
p_INDO,SG	–0.01(–1.98)**	0(0)	–0.07(–0.95)	0.02(0.59)	0.19(5.68)***	0.14(2.56)**
p_INDO,HK	0.15(1.3)	0.25(1.67)*	0.34(5.82)***	0.33(10.59)***	0.6(21.53)***	0.53(15.82)***
p_INDO,INDIA	0.05(0.52)	0.07(0.85)	0.1(1.6)	0.24(6.78)***	0.45(13.96)***	0.39(8.58)***
p_TW,KR	0.05(0.52)	–0.02(–0.47)	0.18(2.24)**	0.43(14.3)***	0.69(36.06)***	0.62(17.52)***
p_TW,SG	0.01(2.68)***	0.01(0.12)	–0.07(–1.08)	0.09(2.43)**	0.16(4.64)***	0.14(2.79)***
p_TW,HK	0.05(0.65)	0.13(3.87)***	0.11(1.45)	0.39(13.59)***	0.61(26.02)***	0.57(13.74)***
p_TW,INDIA	–0.01(–0.08)	0.02(0.59)	–0.05(–0.75)	0.23(7.05)***	0.38(12.73)***	0.35(6.94)***
p_KR,SG	0.01(1.71)*	0(–0.18)	0.12(1.66)*	0.1(2.94)***	0.22(6.57)***	0.24(4.81)***
p_KR,HK	0.07(0.62)	0.07(2.01)**	0.14(2.24)**	0.5(15.68)***	0.66(32.7)***	0.63(22.11)***
p_KR,INDIA	–0.07(–0.67)	0.01(0.14)	0.18(2.1)**	0.3(8.47)***	0.42(13.27)***	0.41(9.64)***
p_SG,HK	0.00(–0.57)	–0.1(–0.29)	0.14(2.05)**	0.12(3.56)***	0.22(6.41)***	0.27(5.42)***
p_SG,INDIA	0.02(3.48)***	–0.05(–0.11)	0.08(1.03)	0.05(1.3)	0.28(9.23)***	0.23(4.08)***
p_HK,INDIA	–0.01(–0.07)	0.01(0.14)	0.09(1.31)	0.31(9)***	0.55(19.94)***	0.50(10.86)***
Alpha	0.01(10.76)	0.03(4.04)	0.01(0.89)	0.01(2.13)	0.01(5.57)	0.03(3.01)
Beta	0.99(10.67)	0.99(10.67)	0.99(10.67)	0.99(10.67)	0.99(10.67)	0.99(10.67)

Source: Author’s calculation.

Appendix Table 4: Factors Determining the Correlations Using the DCC GARCH Model

Appendix Table 4A: Step 1: The Univariate GARCH Calculation with Determinant Factors in the Mean and Variance Equation

	rspx		**rsgx**		**rset**	
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
bicloiss	0(4.72)***	0(2.05)**	0(4.29)***	0(1.79)*	0(3.85)***	0(3.21)***
rFX			–0.03(–2.9)***	–0.03(–2.33)**	–0.16(–2.29)**	–0.18(–2.62)***
arch	0.03(1.72)*	0.13(8.16)***	0.03(2.14)**	0.13(8.56)***	0.19(6.71)***	0.18(7.19)***
garch	–0.06(–1.74)*	0.11(1.98)**	–0.07(–1.93)*	0.1(1.78)*	0.74(21.84)***	0.69(23.99)***
vix	0.09(30.44)***		0.09(29.88)***		0.08(4.96)***	
cesiusd		0(10.37)***		0(9.4)***		0.01(2.24)**
cesieur		0(–18.5)***		0(–18.08)***		0(–0.2)
cesiapac		0(–8.03)***		0(–7.28)***		0(–2.76)***
_cons	–1.88(–20.81)***	2.48(12.82)***	–1.78(–19.91)***	2.45(12.22)***	–4.37(–4.31)***	–3.04(–2.02)**

	rpcomp		**rfbmklci**		**rsensex**	
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
bicloiss	0(3.57)***	0(4.5)***	0(3.39)***	0(1.48)	0(2.44)**	0(1.22)
rFX	–0.37(–6.14)***	–0.37(–6.12)***	–0.08(–2.48)**	–0.09(–2.77)***	0.11(1.94)*	0.13(2.24)**
arch	0.19(6.34)***	0.24(6.85)***	0.13(5.42)***	0.14(5.93)***	0.16(5.36)***	0.17(6.68)***
garch	0.75(20.39)***	0.52(5.87)***	0.43(3.29)***	0.42(3.76)***	0.33(1.7)*	0.63(11.33)***
vix	0.1(4.75)***		0.04(7.34)***		0.05(7.76)***	
cesiusd		0(–1.09)		0(2.7)***		0(2.11)**
cesieur		0(1.92)*		0(1.01)		0(–0.95)
cesiapac		0(–0.41)		0(–3.56)***		0(–2.5)**
_cons	–4.88(–4.27)***	–1.12(–1.51)	–2.38(–6.04)***	–2.2(–3.87)***	–0.94(–1.93)*	–0.95(–1.11)

	rshcomp		**rjci**		**rhsi**	
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
bicloiss	0(–1.08)	0(–0.88)	0(4.5)***	0(3.6)***	0(2.15)**	0(0.57)
rFX	0.04(0.12)	–0.06(–0.18)	–0.06(–1.51)	–0.14(–3.7)***	–0.52(–0.97)	–0.57(–1.03)
arch	0.15(5.75)***	0.1(4.94)***	0.21(6.29)***	0.25(7.45)***	0.09(4.57)***	0.12(7.44)***
garch	0.84(27.05)***	0.82(35.93)***	0.14(1.62)	0.12(1.61)	0.15(1.9)*	0.73(33.87)***
vix	0.1(2.55)**		0.05(12.26)***		0.07(20.12)***	
cesiusd		0.01(3.52)***		0(–0.42)		0(0.3)
cesieur		0.01(4.07)***		0–3.74)***		–0.01(–6.06)***
cesiapac		0(–3.84)***		0(–0.63)		0(0.52)
_cons	–5.53(–2.29)**	–8.64(–4.41)***	–0.8(–4.35)***	1.6(5.23)***	–1.05(–6.56)***	6.23(4.29)***

	rtwse		**rkospi**	
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**
bicloiss	0(0.99)	0(0.69)	0(2.98)***	0(2.37)**
rFX	–0.17(–2.43)**	–0.18(–2.4)**	0.02(0.44)	–0.03(–0.81)
arch	0(–0.12)	0.03(2.00)**	0(0)	0.06(2.46)**
garch	–0.47(–5.71)***	–0.07(–0.69)	–0.15(–1.47)	0.04(0.28)
vix	0.05(16.65)***		0.05(19.26)***	
cesiusd		0(1.83)*		0(–4.14)***
cesieur		0(–6.15)***		0(–7.16)***
cesiapac		0(–3.83)***		0(1.95)*
_cons	–0.24(–2.3)**	1.94(9.42)***	–0.26(–2.18)**	3.25(13.3)***

Source: Author’s calculation.

Appendix Table 4B: Step 2: The Calculation of the Correlation Coefficients

Correlation Coefficients (Z value)				Correlation Coefficients (Z value)			
Model 1		Model 2		Model 1		Model 2	
rset		**rset**		**rjci**		**rjci**	
rfbmklci	0.62(16.59)***	rfbmklci	0.37(20.32)***	rtwse	0.69(22.13)***	rtwse	0.45(25.35)***
rpcomp	0.54(12.61)***	rpcomp	0.25(12.39)***	rkospi	0.72(24.26)***	rkospi	0.47(27.52)***
rshcomp	0.46(8.73)***	rshcomp	0.16(7.94)***	rsgx	0.33(5.91)***	rsgx	0.08(3.82)***
rjci	0.7(23.56)***	rjci	0.44(25.37)***	rhsi	0.77(32.07)***	rhsi	0.53(33.3)***
rtwse	0.57(14.64)***	rtwse	0.36(19.63)***	rsensex	0.66(18.51)***	rsensex	0.39(21.17)***
rkospi	0.6(16.32)***	rkospi	0.39(21.75)***	rspx	0.31(5.65)***	rspx	0.09(4.09)***
rsgx	0.37(6.98)***	rsgx	0.15(7.34)***	**rtwse**		**rtwse**	
rhsi	0.69(24.31)***	rhsi	0.46(27.88)***	rkospi	0.86(52.76)***	rkospi	0.65(50.54)***
rsensex	0.66(18.91)***	rsensex	0.38(20.99)***	rsgx	0.34(5.96)***	rsgx	0.09(4.06)***
rspx	0.36(6.82)***	rspx	0.16(7.55)***	rhsi	0.78(33.88)***	rhsi	0.56(37.16)***
rfbmklci		**rfbmklci**		rsensex	0.62(15.08)***	rsensex	0.32(15.85)***
rpcomp	0.64(17.36)***	rpcomp	0.39(21.36)***	rspx	0.32(5.61)***	rspx	0.08(3.84)***
rshcomp	0.52(9.39)***	rshcomp	0.22(10.65)***	**rkospi**		**rkospi**	
rjci	0.74(24.97)***	rjci	0.45(26.1)***	rsgx	0.37(6.53)***	rsgx	0.15(6.78)***
rtwse	0.7(22.04)***	rtwse	0.44(24.97)***	rhsi	0.8(38.02)***	rhsi	0.63(47.66)***
rkospi	0.69(21.85)***	rkospi	0.44(24.89)***	rsensex	0.65(16.56)***	rsensex	0.39(20.57)***
rsgx	0.26(4.25)***	rsgx	0.05(2.25)**	rspx	0.34(6.08)***	rspx	0.14(6.69)***
rhsi	0.68(22.55)***	rhsi	0.45(26.03)***	**rsgx**		**rsgx**	
rsensex	0.65(15.55)***	rsensex	0.31(15.67)***	rhsi	0.36(6.85)***	rhsi	0.17(7.85)***
rspx	0.25(4.06)***	rspx	0.06(2.6)***	rsensex	0.4(7.07)***	rsensex	0.18(8.22)***
rpcomp		**rpcomp**		rspx	0.99(87.67)***	rspx	0.98(13.66)***
rshcomp	0.41(7.17)***	rshcomp	0.14(6.41)***	**rhsi**		**rhsi**	
rjci	0.61(15.98)***	rjci	0.34(18.2)***	rsensex	0.7(23.34)***	rsensex	0.49(29.36)***
rtwse	0.6(15.41)***	rtwse	0.36(19.32)***	rspx	0.34(6.45)***	rspx	0.16(7.76)***
rkospi	0.6(15.5)***	rkospi	0.37(19.58)***	**rsensex**		**rsensex**	
rsgx	0.21(3.45)***	rsgx	–0.01(–0.26)	rspx	0.39(7.01)***	rspx	0.19(8.8)***
rhsi	0.59(16.07)***	rhsi	0.37(19.71)***	**Adjustment**		**Adjustment**	
rsensex	0.46(9.27)***	rsensex	0.24(11.57)	lambda1	0(3.71)***	lambda1	0(2.05)**
rspx	0.2(3.3)***	rspx	0(–0.04)	lambda2	1(47.14)***	lambda2	0.6(4.09)***
rshcomp		**rshcomp**					
rjci	0.56(11.29)***	rjci	0.2(9.83)***				
rtwse	0.62(13.3)***	rtwse	0.24(11.53)***				
rkospi	0.59(12.25)***	rkospi	0.25(12.41)***				
rsgx	0.27(4.27)***	rsgx	0.04(1.99)**				
rhsi	0.73(20.42)***	rhsi	0.36(18.94)***				
rsensex	0.51(9.21)***	rsensex	0.2(9.47)***				
rspx	0.24(3.89)***	rspx	0.04(1.67)*				

Source: Author’s calculation.

Appendix Table 5: The Impact of CFM Measures

Appendix Table 5A: Step 1: The Univariate GARCH Calculation with Determinant Factors in the Mean and Variance Equation

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rset				
bicloiss	0(3.42)***	0(3.44)***	0(3.33)***	0(3.36)***
rthb	–0.19(–2.78)***	–0.19(–2.77)***	–0.19(–2.76)***	–0.19(–2.75)***
arch	0.18(6.3)***	0.17(6.52)***	0.18(6.39)***	0.17(6.43)***
garch	0.61(10.55)***	0.72(14.56)***	0.65(11.71)***	0.67(12.6)***
vix	0.04(5.01)***	0.08(3.07)***	0.05(4.1)***	0.06(3.86)***
dummy(i)	–1.19(–3.24)***	–0.46(–0.76)***	–0.94(–2.42)***	–0.85(–2.08)***
_cons	–1.91(–4.47)***	–3.94(–2.85)***	–2.57(–3.84)***	–2.91(–3.63)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rset				
bicloiss	0(3.43)***	0(3.35)***	0(3.41)***	0(3.33)***
rthb	–0.2(–2.84)***	–0.19(–2.75)***	–0.19(–2.76)***	–0.19(–2.76)***
arch	0.18(6.3)***	0.18(6.41)***	0.17(6.46)***	0.18(6.39)***
garch	0.62(10.84)***	0.66(12.03)***	0.7(13.21)***	0.65(11.72)***
vix	0.04(4.91)***	0.05(3.96)***	0.07(3.26)***	0.05(4.08)***
dummy(i)	–1.13(–3.09)***	–0.9(–2.26)***	–0.64(–1.29)***	–0.94(–2.4)***
_cons	–2.05(–4.42)***	–2.73(–3.72)***	–3.5(–3.04)***	–2.58(–3.82)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rfbmklci				
bicloiss	0(3.22)***	0(3.07)***	0(2.97)***	0(2.98)***
rmyr	–0.08(–2.59)***	–0.08(–2.41)***	–0.09(–2.53)***	–0.08(–2.43)***
arch	0.1(4.63)***	0.12(5.21)***	0.11(5.01)	0.11(5.07)***
garch	0.05(0.69)	0.12(1.24)	0.1(1.09)	0.1(1.15)
vix	0.03(10.76)***	0.04(10.68)***	0.03(10.49)***	0.03(10.53)***
dummy(i)	–0.8(–11.96)***	–0.7(–8.67)***	–0.66(–8.91)***	–0.65(–8.63)***
_cons	–1.43(–10.75)***	–1.64(–9.8)***	–1.56(–9.99)***	–1.58(–9.99)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rfbmklci				
bicloiss	0(3.19)***	0(2.99)***	0(3.08)***	0(2.96)***
rmyr	–0.09(–2.61)***	–0.08(–2.43)***	–0.08(–2.33)***	–0.09(–2.54)***
arch	0.1(4.74)***	0.11(5.05)***	0.12(5.14)***	0.11(5.01)***
garch	0.07(0.91)	0.1(1.11)	0.1(1.11)	0.1(1.08)
vix	0.03(10.79)***	0.03(10.53)***	0.04(10.69)***	0.03(10.48)***
dummy(i)	–0.74(–10.7)***	–0.66(–8.8)***	–0.72(–3.1)***	–0.65(–8.89)***
_cons	–1.5(–10.55)***	–1.57(–10.22)***	–1.62(–3)***	–1.56(–9.89)***

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Appendix Table 5A *continued*

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rpcomp				
bicloiss	0(3.47)***	0(3.51)***	0(3.46)***	0(3.48)***
rphp	–0.36(–5.97)***	–0.36(–5.77)***	–0.37(–5.91)***	–0.36(–5.85)***
arch	0.21(6.53)***	0.22(5.76)***	0.21(5.87)***	0.21(5.9)***
garch	0.39(4.46)***	0.5(3.62)***	0.51(3.81)***	0.5(3.82)***
vix	0.04(7.07)***	0.05(3.91)***	0.04(4.01)***	0.04(4.42)***
dummy(i)	–0.75(–5.5)***	–0.72(–2.5)***	–0.72(–2.51)***	–0.73(–2.69)***
_cons	–1.15(–3.92)***	–1.79(–2.49)***	–1.76(–2.56)***	–1.71(–2.66)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rpcomp				
bicloiss	0(3.56)***	0(3.48)***	0(3.49)***	0(3.47)***
rphp	–0.37(–6.02)***	–0.36(–5.86)***	–0.36(–5.78)***	–0.37(–5.89)***
arch	0.21(6.36)***	0.21(6.00)***	0.22(6.12)***	0.21(5.89)***
garch	0.45(4.32)***	0.49(3.9)***	0.47(3.99)***	0.51(3.85)***
vix	0.04(5.68)***	0.04(4.5)***	0.04(4.87)***	0.04(4.05)***
dummy(i)	–0.82(–3.83)***	–0.73(–2.88)***	–0.72(–3.1)***	–0.73(–2.54)***
_cons	–1.43(–3.34)***	–1.65(–2.79)***	–1.62(–3.0)***	–1.75(–2.59)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rshcomp				
bicloiss	0(–0.9)	0(–0.84)	0(–0.9)	0(–0.82)
rcny	0.08(0.27)	0.08(0.28)	0.13(0.46)	0.11(0.4)
arch	0.08(3.44)***	0.09(3.24)***	0.09(3.55)***	0.08(3.43)***
garch	0.07(0.68)	0.05(0.3)	0.04(0.32)	–0.02(–0.19)
vix	0.02(5.49)***	0.02(5.41)***	0.02(5.28)***	0.02(5.31)***
dummy(i)	–0.82(–11.04)***	–0.82(–9.94)***	–0.83(–10.77)***	–0.87(–11.38)***
_cons	0.49(3.03)***	0.43(1.89)***	0.5(3.06)***	0.57(3.76)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rshcomp				
bicloiss	0(–0.83)	0(–0.83)	0 (–0.9)	0(–0.89)
rcny	0.08(0.29)	0.13(0.47)	0.08(0.29)	0.14(0.49)
arch	0.07(3.33)***	0.08(3.46)***	0.09(3.37)***	0.09(3.55)***
garch	0.04(0.37)	0(–0.03)	0.08(0.5)	0.03(0.29)
vix	0.02(5.65)***	0.02(5.26)***	0.02(5.34)***	0.02(5.28)***
dummy(i)	–0.84(–11.46)***	–0.88(–11.39)***	–0.84(–9.9)***	–0.83(–10.75)***
_cons	0.52(3.61)***	0.55(3.6)***	0.41(1.81)***	0.5(3.03)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rjci				
bicloiss	0(4.21)***	0(4.1)***	0(4.07)***	0(4.08)***
ridr	–0.06(–1.61)	–0.07(–1.92)	–0.07(–1.94)	–0.07(–1.89)
arch	0.17(6.05)***	0.19(6.2)***	0.19(6.22)***	0.19(6.18)***
garch	0.03(0.38)	0.05(0.75)	0.05(0.68)	0.04(0.54)
vix	0.04(12.5)***	0.04(12.6)***	0.04(12.37)***	0.04(12.44)***
dummy(i)	–0.48(–7.19)***	–0.47(–5.95)***	–0.47(–6.26)***	–0.49(–6.51)***
_cons	–0.5(–3.34)***	–0.61(–4.15)***	–0.57(–3.88)***	–0.56(–3.79)***

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Appendix Table 5A *continued*

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rjci				
bicloiss	0(4.22)***	0(4.09)***	0(4.11)***	0(4.07)***
ridr	–0.07(–1.72)	–0.07(–1.9)	–0.07(–1.93)	–0.07(–1.94)
arch	0.19(6.26)***	0.19(6.19)***	0.19(6.15)***	0.19(6.21)***
garch	0.05(0.73)	0.04(0.55)	0.04(0.62)	0.04(0.66)
vix	0.04(12.53)***	0.04(12.43)***	0.04(12.6)***	0.04(12.37)***
dummy(i)	–0.46(–6.58)***	–0.5(–6.66)***	–0.5(–6.41)***	–0.47(–6.27)***
_cons	–0.58(–3.85)***	–0.55(–3.79)***	–0.58(–3.99)***	–0.57(–3.87)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rtwse				
bicloiss	0(0.95)	0(0.86)	0(0.86)	0(0.82)
rtwd	–0.17(–2.34)**	–0.16(–2.19)**	–0.16(–2.26)**	–0.16(–2.27)**
arch	0(–0.21)	0(0)	0(0.1)	0(0.13)
garch	–0.24(–3.09)***	–0.38(–4.26)***	–0.34(–3.78)***	–0.36(–3.99)***
vix	0.05(15.73)***	0.05(15.87)***	0.05(15.7)***	0.05(15.78)***
dummy(i)	–0.52(–8.79)***	–0.31(–5.1)***	–0.37(–5.97)***	–0.33(–5.4)***
_cons	–0.34(–3.01)***	–0.9(–2.48)***	–0.29(–2.53)***	–0.29(–2.47)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rtwse				
bicloiss	0(1)	0(0.83)	0(0.86)	0(0.86)
rtwd	–0.17(–2.36)**	–0.16(–2.26)**	–0.16(–2.22)**	–0.16(–2.26)**
arch	0(–0.01)	0(0.13)	0(0.03)	0(0.1)
garch	–0.25(–3.2)***	–0.35(–3.91)***	–0.38(–4.34)***	–0.34(–3.79)***
vix	0.05(15.65)***	0.05(15.75)***	0.05(15.83)***	0.05(15.71)***
dummy(i)	–0.5(–8.28)***	–0.34(–5.58)***	–0.32(–5.34)***	–0.36(–5.95)***
_cons	–0.33(–2.97)***	–0.29(–2.49)***	–0.28(–2.45)***	–0.29(–2.54)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rkospi				
bicloiss	0(2.85)***	0(2.82)***	0(2.77)***	0(2.74)***
rkrw	0.01(0.39)	0.01(0.41)	0.01(0.39)	0.01(0.33)
arch	0(–0.11)	0(0.08)	0(0.08)	0(0.13)
garch	–0.21(–3.84)***	–0.22(–2.77)***	–0.21(–2.99)***	–0.21(–2.8)***
vix	0.05(18.76)***	0.05(19.14)***	0.05(18.94)***	0.05(18.97)***
dummy(i)	–0.64(–12.57)***	–0.42(–7.26)***	–0.46(–8.56)***	–0.45(–8.14)***
_cons	–0.05(–0.61)	–0.15(–1.49)	–0.2(–1.23)	–0.13(–1.35)

	Coefficient (z value)			
variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rkospi				
bicloiss	0(2.88)***	0(2.75)***	0(2.76)***	0(2.77)***
rkrw	0.01(0.31)	0.01(0.33)	0.01(0.4)	0.01(0.38)
arch	0(0.03)	0(0.13)	0(0.15)	0(0.08)
garch	–0.2(–3.3)***	–0.21(–2.82)***	–0.19(–2.46)***	–0.22(–3)***
vix	0.05(18.86)***	0.05(18.95)***	0.05(19.04)***	0.05(18.92)***
dummy(i)	–0.61(–11.52)***	–0.46(–8.39)***	–0.4(–7.0)***	–0.46(–8.54)***
_cons	–0.09(–1.03)	–0.13(–1.34)	–0.17(–1.61)	–0.12(–1.18)

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Appendix Table 5A *continued*

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rsgx				
bicloiss	0(4.16)***	0(4.02)***	0(4.07)***	0(4.05)***
rsgd	–0.03(–2.79)***	–0.03(–2.68)***	–0.03(–2.69)***	–0.03(–2.69)***
arch	0.02(1.66)*	0.03(1.92)*	0.03(1.86)*	0.03(1.87)*
garch	–0.07(–1.95)*	–0.06(–1.68)*	–0.06(–1.79)*	–0.06(–1.75)*
vix	0.08(29.62)***	0.08(29.52)***	0.08(29.51)***	0.08(29.45)***
dummy(i)	–0.27(–5.69)***	–0.19(–3.42)***	–0.22(–4.4)***	–0.21(–3.98)***
_cons	–1.66(–18.11)***	–1.71(–18.52)***	–1.69(–18.28)***	–1.69(–18.33)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rsgx				
bicloiss	0(4.13)***	0(4.06)***	0(4.04)***	0(4.07)***
rsgd	–0.03(–2.75)***	–0.03(–2.69)***	–0.03(–2.69)***	–0.03(–2.7)***
arch	0.03(1.74)*	0.03(1.86)*	0.03(1.92)*	0.03(1.86)*
garch	–0.07(–1.85)*	–0.06(–1.76)*	–0.06(–1.73)*	–0.06(–1.81)*
vix	0.09(29.69)***	0.08(29.47)***	0.08(29.52)***	0.08(29.49)***
dummy(i)	–0.23(–4.78)***	–0.22(–4.21)***	–0.2(–3.6)***	–0.23(–4.42)***
_cons	–1.68(–18.29***	–1.69(–18.33)***	–1.71(–18.44)***	–1.68(–18.26)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rhsi				
bicloiss	0(1.96)**	0(1.98)**	0(1.93)**	0(1.94)**
rhkd	–0.38(–0.73)	–0.49(–0.93)	–0.45(–0.87)	–0.47(–0.89)
arch	0.08(4.64)***	0.09(4.89)	0.08(4.85)***	0.08(4.82)***
garch	0.05(0.68)	0.08(1.18)	0.08(1.13)	0.07(1.05)
vix	0.06(21.2)***	0.07(21.48)***	0.07(21.31)***	0.07(21.41)***
dummy(i)	–0.36(–6.32)***	–0.2(–3.05)***	–0.25(–3.97)***	–0.25(–3.99)***
_cons	–0.91(–6.61)***	–1.05(–7.42)***	–1.02(–7.26)***	–1.01(–7.27)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rhsi				
bicloiss	0(2.03)**	0(1.95)**	0(1.96)**	0(1.93)**
rhkd	–0.44(–0.84)	–0.46(–0.89)	–0.49(–0.93)	–0.45(–0.86)
arch	0.08(4.68)***	0.08(4.82)***	0.08(4.87)***	0.08(4.85)***
garch	0.05(0.76)	0.07(1.05)	0.08(1.17)	0.08(1.11)
vix	0.06(21.26)***	0.07(21.39)***	0.07(21.45)***	0.07(21.31)***
dummy(i)	–0.38(–6.45)***	–0.26(–4.12)***	–0.22(–3.36)***	–0.25(–3.98)***
_cons	–0.92(–6.73)***	–1.01(–7.26)***	–1.04(–7.41)***	–1.02(–7.25)***

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rsensex				
bicloiss	0(2.21)**	0(2.32)**	0(2.21)**	0(2.22)**
rinr	0.08(1.59)	0.08(1.47)	0.08(1.5)	0.09(1.6)
arch	0.12(4.45)***	0.14(4.82)***	0.14(4.88)***	0.14(4.88)***
garch	–0.16(–2.18)**	–0.08(–0.96)**	–0.1(–1.18)**	–0.08(–0.94)**
vix	0.04(12.21)***	0.04(12.73)***	0.04(12.47)***	0.04(12.53)***
dummy(i)	–0.73(–11.59)***	–0.64(–8.44)***	–0.58(–8.27)***	–0.59(–8.12)***
_cons	0.09(0.79)	–0.12(–0.92)	–0.08(–0.6)	–0.11(–0.83)

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Appendix Table 5A *continued*

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rsensex				
bicloiss	0(2.25)**	0(2.23)**	0(2.3)**	0(2.21)**
rinr	0.08(1.52)	0.09(1.6)	0.08(1.51)	0.08(1.49)
arch	0.13(4.67)***	0.14(4.86)***	0.13(4.79)***	0.14(4.89)***
garch	–0.14(–1.91)**	–0.09(–1.02)**	–0.11(–1.29)**	–0.1(–2.22)**
vix	0.04(12.38)***	0.04(12.51)***	0.04(12.67)***	0.04(12.47)***
dummy(i)	–0.7(–10.71)***	–0.6(–8.37)***	–0.66(–8.91)***	–0.58(–8.26)***
_cons	0.03(0.24)	–0.1(–0.73)	–0.08(–0.62)	–0.08(–0.58)

	Coefficient (z value)			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rspx				
bicloiss	0(4.59)***	0(4.46)***	0(4.51)***	0(4.49)***
arch	0.02(1.28)	0.02(1.6)	0.02(1.53)	0.02(1.53)
garch	–0.05(–1.67)*	–0.05(–1.51)*	–0.05(–1.59)*	–0.05(–1.56)*
vix	0.09(30.24)***	0.09(30.09)***	0.09(30.08)***	0.09(30.01)***
dummy(i)	–0.27(–5.84)***	–0.18(–3.19)***	–0.22(–4.28)***	–0.2(–3.8)***
_cons	–1.75(–18.89)***	–1.8(–19.21)***	–1.77(–19.01)***	–1.78(–19.03)***

	Coefficient (z value)			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rspx				
bicloiss	0(4.56)***	0(4.5)***	0(4.48)***	0(4.52)***
arch	0.02(1.41)	0.02(1.52)	0.02(1.58)	0.02(1.53)
garch	–0.05(–1.63)*	–0.05(–1.56)*	–0.05(1.55)*	–0.05(–1.61)*
vix	0.09(30.29)***	0.09(30.03)***	0.09(30.09)***	0.09(30.06)***
dummy(i)	–0.23(–4.84)***	–0.21(–4.01)***	–0.19(–3.42)***	–0.22(–4.32)***
_cons	–1.77(–19.04)***	–1.78(–19.04)***	–1.8(–19.15)***	–1.77(18.98)***

Note:

1. krfxe1 means the Rep. of Korea measure (19 Nov 2009) – capped the FX forward position for exporters to up to 125% of the underlying position and required banks to raise their long-term foreign currency borrowing from 80% to 90% of long-term lending.
2. krfxe3 means the Rep. of Korea measure (26 Nov 2012) – cut the ceiling on FX derivative contracts owned by domestic banks from 40% to 30% of equity and by foreign bank branches from 200% to 150%, effective in Nov 2012.
3. phfxe1 means the Philippines measure (5 Nov 2010) – starved the market of USD by "rolling-off" the FX forward book to stem peso appreciation.
4. indoborrow means the Indonesian measure (30 Dec 2010) – re-imposed the limit on banks' ST foreign borrowing to 30% of capital, effective in Mar 11.
5. cnborrow means the PRC measure (31 Mar 2010) – SAFE cut the short-term debt quota by 1.5% to USD32.4 to prevent abnormal capital inflows, effective in April 2010.
6. krborrow1 means the Rep. of Korea measure (19 Dec 2010) – banks' levy on non-deposit FC liabilities, effective on 1 Aug 2011 (<1yr=0.2%,1–3 yrs=0.1%, >3yrs=0.05%).
7. indomin2 means the Indonesian measure (13 Apr 2011) – increased the holding period to 6 months, effective on 13 May.
8. twlim2 means the Taipei,China measure (9 Nov 2010) – restricted offshore funds from investing more than 30% of their portfolio in money market products and government debt with maturity of less than a year.

Source: Author's calculation.

Appendix Table 5B: Step 2: Calculation of Conditional Correlation Coefficients

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rset				
rfbmklci	0.38(17.56)***	0.39(17.15)***	0.39(17.42)***	0.39(17.22)***
rpcomp	0.25(10.62)***	0.25(10.36)***	0.25(10.54)***	0.25(10.45)***
rshcomp	0.17(6.73)***	0.16(6.44)***	0.17(6.61)***	0.17(6.54)***
rjci	0.45(22.03)***	0.45(21.61)***	0.45(21.82)***	0.45(21.71)***
rtwse	0.37(16.65)***	0.38(16.32)***	0.38(16.45)***	0.38(16.25)***
rkospi	0.4(18.17)***	0.4(17.66)***	0.4(17.96)***	0.4(17.64)***
rsgx	0.14(5.43)***	0.14(5.27)***	0.14(5.35)***	0.14(5.3)***
rhsi	0.48(24.58)***	0.49(24.08)***	0.49(24.31)***	0.49(24.06)***
rsensex	0.39(18.41)***	0.39(17.92)***	0.39(18.02)***	0.39(17.9)***
rspx	0.15(5.64)***	0.15(5.46)***	0.15(5.54)***	0.15(5.49)***

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rset				
rfbmklci	0.39(17.66)***	0.39(17.29)***	0.39(17.19)***	0.39(17.41)***
rpcomp	0.25(10.63)***	0.25(10.49)***	0.25(10.41)***	0.25(10.54)***
rshcomp	0.17(6.66)***	0.17(6.54)***	0.16(6.48)***	0.17(6.6)***
rjci	0.45(22.01)***	0.45(21.77)***	0.45(21.69)***	0.45(21.81)***
rtwse	0.37(16.68)***	0.38(16.3)***	0.38(16.35)***	0.38(16.44)***
rkospi	0.4(18.25)***	0.4(17.72)***	0.4(17.74)***	0.4(17.94)***
rsgx	0.14(5.4)***	0.14(5.31)***	0.14(5.28)***	0.14(5.35)***
rhsi	0.48(24.65)***	0.49(24.13)***	0.49(24.13)***	0.49(24.3)***
rsensex	0.39(18.25)***	0.39(17.94)***	0.40(17.99)***	0.39(18.01)***
rspx	0.15(5.6)***	0.15(5.5)***	0.15(5.48)***	0.15(5.54)***

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rfbmklci				
rpcomp	0.39(17.91)***	0.39(17.42)***	0.39(17.61)***	0.39(17.54)***
rshcomp	0.21(8.54)***	0.22(8.53)***	0.22(8.51)***	0.22(8.44)***
rjci	0.45(21.72)***	0.45(21.4)***	0.45(21.61)***	0.45(21.44)***
rtwse	0.44(20.86)***	0.45(20.8)***	0.45(20.84)***	0.45(20.79)***
rkospi	0.43(20.17)***	0.44(19.77)***	0.44(20.06)***	0.44(19.88)***
rsgx	0.06(2.26)**	0.06(2.14)**	0.06(2.17)**	0.06(2.13)**
rhsi	0.46(22.45)***	0.47(22.12)***	0.47(22.29)***	0.47(22.19)***
rsensex	0.32(13.6)***	0.32(13.23)***	0.32(13.6)***	0.32(13.6)***
rspx	0.07(2.52)**	0.07(2.39)**	0.07(2.41)**	0.07(2.37)**

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Appendix Table 5B *continued*

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rfbmklci				
rpcomp	0.39(17.7)***	0.39(17.57)***	0.39(17.45)***	0.39(17.62)***
rshcomp	0.22(8.46)***	0.22(8.46)***	0.22(8.57)***	0.22(8.51)***
rjci	0.45(21.66)***	0.45(21.48)***	0.45(21.5)***	0.45(21.6)***
rtwse	0.44(20.83)***	0.45(20.81)***	0.45(20.8)***	0.45(20.83)***
rkospi	0.43(20.16)***	0.44(19.93)***	0.44(19.82)***	0.44(20.05)***
rsgx	0.06(2.2)**	0.06(2.13)**	0.06(2.12)**	0.06(2.17)**
rhsi	0.46(22.46)***	0.47(22.25)***	0.47(22.17)***	0.47(22.29)***
rsensex	0.32(13.6)***	0.32(13.6)***	0.32(13.6)***	0.32(13.6)***
rspx	0.07(2.46)**	0.07(2.38)**	0.07(2.36)**	0.07(2.42)**

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rpcomp				
rshcomp	0.13(5.22)***	0.14(5.31)***	0.14(5.38)***	0.14(5.31)***
rjci	0.34(14.78)***	0.34(14.7)***	0.34(14.83)***	0.34(14.79)***
rtwse	0.35(15.59)***	0.36(15.53)***	0.36(15.57)***	0.36(15.53)***
rkospi	0.36(15.81)***	0.36(15.61)***	0.36(15.69)***	0.36(15.66)***
rsgx	0.03(0.96)	0.03(0.97)	0.03(0.97)	0.03(0.95)
rhsi	0.36(16.01)***	0.36(15.83)***	0.36(15.96)***	0.36(15.89)***
rsensex	0.24(10.01)***	0.24(9.81)***	0.24(9.84)***	0.24(9.8)***
rspx	0.03(1.13)	0.03(1.12)	0.03(1.13)	0.03(1.11)

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rpcomp				
rshcomp	0.13(5.11)***	0.14(5.31)***	0.14(5.38)***	0.14(5.38)***
rjci	0.34(14.82)***	0.34(14.8)***	0.34(14.75)***	0.34(14.84)***
rtwse	0.35(15.54)***	0.36(15.56)***	0.36(15.56)***	0.36(15.57)***
rkospi	0.36(15.76)***	0.36(15.68)***	0.36(15.64)***	0.36(15.69)***
rsgx	0.03(0.97)	0.03(0.95)	0.03(0.96)	0.03(0.98)
rhsi	0.36(15.99)***	0.36(15.91)***	0.36(15.87)***	0.36(15.96)***
rsensex	0.24(9.94)***	0.24(9.82)***	0.24(9.84)***	0.24(9.84)***
rspx	0.03(1.13)	0.03(1.11)	0.03(1.12)	0.03(1.14)

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rshcomp				
rjci	0.22(9.14)***	0.23(8.97)***	0.23(9.11)***	0.23(9.03)***
rtwse	0.26(10.73)***	0.27(10.36)***	0.26(10.43)***	0.27(10.45)***
rkospi	0.26(10.74)***	0.27(10.4)***	0.26(10.46)***	0.27(10.52)***
rsgx	0.07(2.56)***	0.07(2.39)***	0.07(2.5)***	0.07(2.39)***
rhsi	0.4(17.96)***	0.39(17.1)***	0.4(17.42)***	0.4(17.32)***
rsensex	0.21(8.38)***	0.21(8.14)***	0.21(8.24)***	0.21(8.11)***
rspx	0.06(2.28)**	0.06(2.14)**	0.06(2.24)**	0.06(2.14)**

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Appendix Table 5B *continued*

Variables	Correlation Coefficient			
	i=cnborrow	i=krborrow1	i=indomin2	i=twlim2
rshcomp				
rjci	0.22(8.99)***	0.23(9.06)***	0.23(9.0)***	0.23(9.11)***
rtwse	0.26(10.56)***	0.27(10.48)***	0.27(10.38)***	0.26(10.44)***
rkospi	0.26(10.55)***	0.27(10.54)***	0.27(10.46)***	0.26(10.46)***
rsgx	0.07(2.54)***	0.07(2.39)***	0.07(2.37)***	0.07(2.5)***
rhsi	0.4(17.67)***	0.4(17.39)***	0.4(17.21)***	0.4(17.42)***
rsensex	0.21(8.25)***	0.21(8.15)***	0.21(8.21)***	0.21(8.24)***
rspx	0.06(2.26)**	0.06(2.14)**	0.06(2.12)**	0.06(2.24)**

Variables	Correlation Coefficient			
	i=krfxe1	i=krfxe3	i=phfxe1	i=indoborow
rjci				
rtwse	0.44(20.63)***	0.44(20.51)***	0.44(20.57)***	0.44(20.45)***
rkospi	0.47(23.31)***	0.48(23.21)***	0.48(23.2)***	0.48(23.15)***
rsgx	0.1(3.86)***	0.11(3.83)***	0.11(3.88)***	0.11(3.85)***
rhsi	0.54(29.51)***	0.55(29.45)***	0.54(29.51)***	0.55(29.47)***
rsensex	0.4(18.78)***	0.41(18.2)***	0.4(18.24)***	0.41(18.22)***
rspx	0.11(4.08)***	0.11(4.04)***	0.11(4.08)***	0.11(4.06)***

Variables	Correlation Coefficient			
	i=cnborrow	i=krborrow1	i=indomin2	i=twlim2
rjci				
rtwse	0.44(20.6)***	0.44(20.5)***	0.44(20.57)***	0.44(20.56)***
rkospi	0.47(23.22)***	0.48(23.22)***	0.48(23.26)***	0.48(23.2)***
rsgx	0.1(3.86)***	0.11(3.86)***	0.11(3.84)***	0.11(3.88)***
rhsi	0.54(29.52)***	0.55(29.54)***	0.55(29.53)***	0.54(29.52)***
rsensex	0.41(18.67)***	0.41(18.29)***	0.41(18.31)***	0.4(18.23)***
rspx	0.11(4.06)***	0.11(4.06)***	0.11(4.05)***	0.11(4.09)***

Variables	Correlation Coefficient			
	i=krfxe1	i=krfxe3	i=phfxe1	i=indoborow
rtwse				
rkospi	0.66(45.76)***	0.67(44.65)***	0.67(44.86)***	0.67(44.85)***
rsgx	0.13(4.59)***	0.13(4.37)***	0.13(4.46)***	0.13(4.4)***
rhsi	0.58(33.2)***	0.58(33.01)***	0.58(33.03)***	0.58(32.97)***
rsensex	0.34(14.41)***	0.34(14.15)***	0.34(14.1)***	0.34(14.09)***
rspx	0.12(4.41)***	0.12(4.2)***	0.12(4.29)***	0.12(4.23)***

Variables	Correlation Coefficient			
	i=cnborrow	i=krborrow1	i=indomin2	i=twlim2
rtwse				
rkospi	0.66(45.31)***	0.67(44.93)***	0.67(44.71)***	0.67(44.87)***
rsgx	0.13(4.55)***	0.13(4.41)***	0.13(4.39)***	0.13(4.46)***
rhsi	0.58(33.13)***	0.58(33.02)***	0.58(33.08)***	0.58(33.04)***
rsensex	0.34(14.3)***	0.34(14.11)***	0.34(14.2)***	0.34(14.1)***
rspx	0.12(4.37)***	0.12(4.24)***	0.12(4.22)***	0.12(4.29)***

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Appendix Table 5B *continued*

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rkospi				
rsgx	0.17(6.08)***	0.16(5.72)***	0.17(5.86)***	0.17(5.77)***
rhsi	0.62(39.76)***	0.63(39.4)***	0.62(39.37)***	0.63(39.35)***
rsensex	0.39(17.55)***	0.4(17.38)***	0.4(17.31)***	0.4(17.24)***
rspx	0.16(6.02)***	0.16(5.69)***	0.16(5.82)***	0.16(5.74)***

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rkospi				
rsgx	0.17(5.98)***	0.16(5.78)***	0.16(5.71)***	0.17(5.86)***
rhsi	0.63(39.5)***	0.63(39.42)***	0.63(39.42)***	0.63(39.37)***
rsensex	0.39(17.49)***	0.4(17.28)***	0.4(17.47)***	0.4(17.29)***
rspx	0.16(5.95)***	0.16(5.75)***	0.16(5.68)***	0.16(5.83)***

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rsgx				
rhsi	0.17(6.29)***	0.17(6.15)***	0.17(6.22)***	0.17(6.18)***
rsensex	0.16(5.95)***	0.16(5.76)***	0.16(5.77)***	0.16(5.72)***
rspx	0.99(119.2)***	0.99(117.6)***	0.99(119.0)***	0.99(118.1)***

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rsgx				
rhsi	0.17(6.24)***	0.17(6.18)***	0.17(6.15)***	0.17(6.22)***
rsensex	0.16(5.88)***	0.16(5.72)***	0.16(5.77)***	0.16(5.77)***
rspx	0.99(119.5)***	0.99(118.3)***	0.99(118.1)***	0.99(119.0)***

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rhsi				
rsensex	0.49(24.31)***	0.49(23.71)***	0.49(23.78)***	0.49(23.64)***
rspx	0.17(6.2)***	0.17(6.06)***	0.17(6.13)***	0.17(6.09)***

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rhsi				
rsensex	0.49(24.16)***	0.49(23.73)***	0.49(23.85)***	0.49(23.78)***
rspx	0.17(6.16)***	0.17(6.09)***	0.17(6.07)***	0.17(6.13)***

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
rsensex				
rspx	0.17(6.36)***	0.17(6.17)***	0.17(6.16)***	0.17(6.12)***

	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
rsensex				
rspx	0.17(6.29)***	0.17(6.12)***	0.17(6.18)***	0.17(6.17)***

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Appendix Table 5B *continued*

	Correlation Coefficient			
Variables	**i=krfxe1**	**i=krfxe3**	**i=phfxe1**	**i=indoborow**
Adjustment				
lambda1	0.01(5.85)***	0.01(5.42)***	0.01(5.8)***	0.01(5.44)***
lambda2	0.95(115.56)***	0.96(93.74)***	0.95(106.34)***	0.96(95.68)***

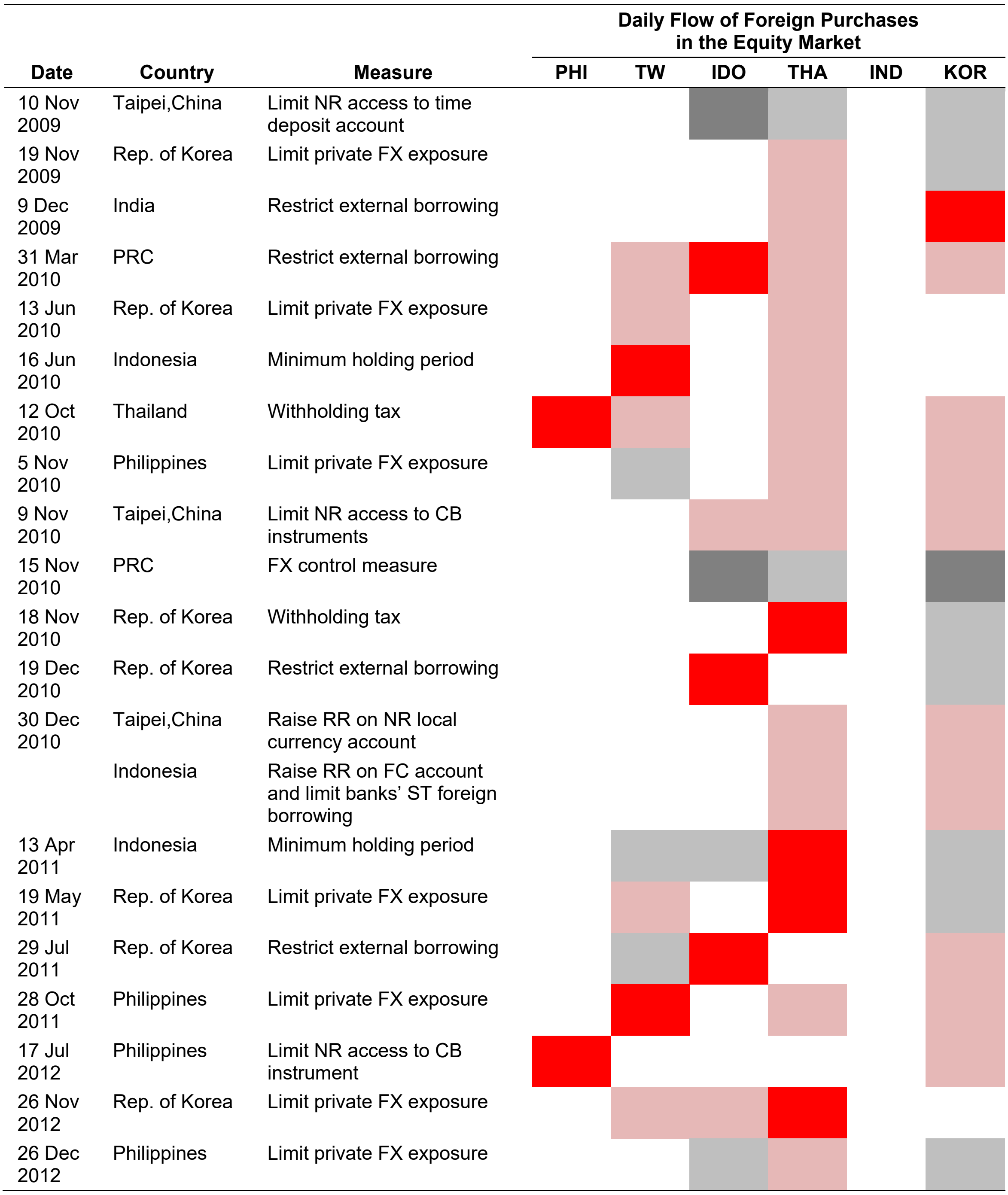
	Correlation Coefficient			
Variables	**i=cnborrow**	**i=krborrow1**	**i=indomin2**	**i=twlim2**
Adjustment				
lambda1	0.01(6.03)***	0.01(5.51)***	0.01(5.48)***	0.01(5.78)***
lambda2	0.95(118.44)***	0.96(98.39)***	0.96(96.5)***	0.95(105.75)***

Note:

1. krfxe1 means the Rep. of Korea measure (19 Nov 2009) – capped the FX forward position for exporters to up to 125% of the underlying position and required banks to raise their long-term foreign currency borrowing from 80% to 90% of long-term lending.
2. krfxe3 means the Rep. of Korea measure (26 Nov 2012) – cut the ceiling on FX derivative contracts owned by domestic banks from 40% to 30% of equity and by foreign bank branches from 200% to 150%, effective in Nov 2012.
3. phfxe1 means the Philippines measure (5 Nov 2010) – starved the market of USD by "rolling-off" the FX forward book to stem peso appreciation.
4. indoborrow means the Indonesian measure (30 Dec 2010) – re-imposed the limit on banks' ST foreign borrowing to 30% of capital, effective in Mar 11.
5. cnborrow means the PRC measure (31 Mar 2010) – SAFE cut the short-term debt quota by 1.5% to USD32.4 to prevent abnormal capital inflows, effective in April 2010.
6. krborrow1 means the Rep. of Korea measure (19 Dec 2010) – banks' levy on non-deposit FC liabilities, effective on 1 Aug 2011 (<1yr=0.2%,1–3 yrs=0.1%, >3yrs=0.05%).
7. indomin2 means the Indonesian measure (13 Apr 2011) – increased the holding period to 6 months, effective on 13 May.
8. twlim2 means the Taipei,China measure (9 Nov 2010) – restricted offshore funds from investing more than 30% of their portfolio in money market products and government debt with maturity of less than a year.

Source: Author's calculation.

Appendix Table 6: Event Studies of Equity Flows and the Associated CFM Measures



			Daily Flow of Foreign Purchases in the Equity Market					
Date	**Country**	**Measure**	**PHI**	**TW**	**IDO**	**THA**	**IND**	**KOR**
10 Nov 2009	Taipei,China	Limit NR access to time deposit account			▓	▒		▒
19 Nov 2009	Rep. of Korea	Limit private FX exposure				░		▒
9 Dec 2009	India	Restrict external borrowing				░		🟥
31 Mar 2010	PRC	Restrict external borrowing		░	🟥	░		░
13 Jun 2010	Rep. of Korea	Limit private FX exposure		░		░		
16 Jun 2010	Indonesia	Minimum holding period		🟥		░		
12 Oct 2010	Thailand	Withholding tax	🟥	░		░		░
5 Nov 2010	Philippines	Limit private FX exposure		▒		░		░
9 Nov 2010	Taipei,China	Limit NR access to CB instruments			░	░		░
15 Nov 2010	PRC	FX control measure			▓	▒		▓
18 Nov 2010	Rep. of Korea	Withholding tax				🟥		▒
19 Dec 2010	Rep. of Korea	Restrict external borrowing			🟥			▒
30 Dec 2010	Taipei,China	Raise RR on NR local currency account				░		░
	Indonesia	Raise RR on FC account and limit banks' ST foreign borrowing				░		░
13 Apr 2011	Indonesia	Minimum holding period		▒	▒	🟥		▒
19 May 2011	Rep. of Korea	Limit private FX exposure		░		🟥		▒
29 Jul 2011	Rep. of Korea	Restrict external borrowing		▒	🟥			░
28 Oct 2011	Philippines	Limit private FX exposure		🟥		░		░
17 Jul 2012	Philippines	Limit NR access to CB instrument	🟥					░
26 Nov 2012	Rep. of Korea	Limit private FX exposure		░	░	🟥		
26 Dec 2012	Philippines	Limit private FX exposure			▒	░		▒

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Appendix Table 6 *continued*

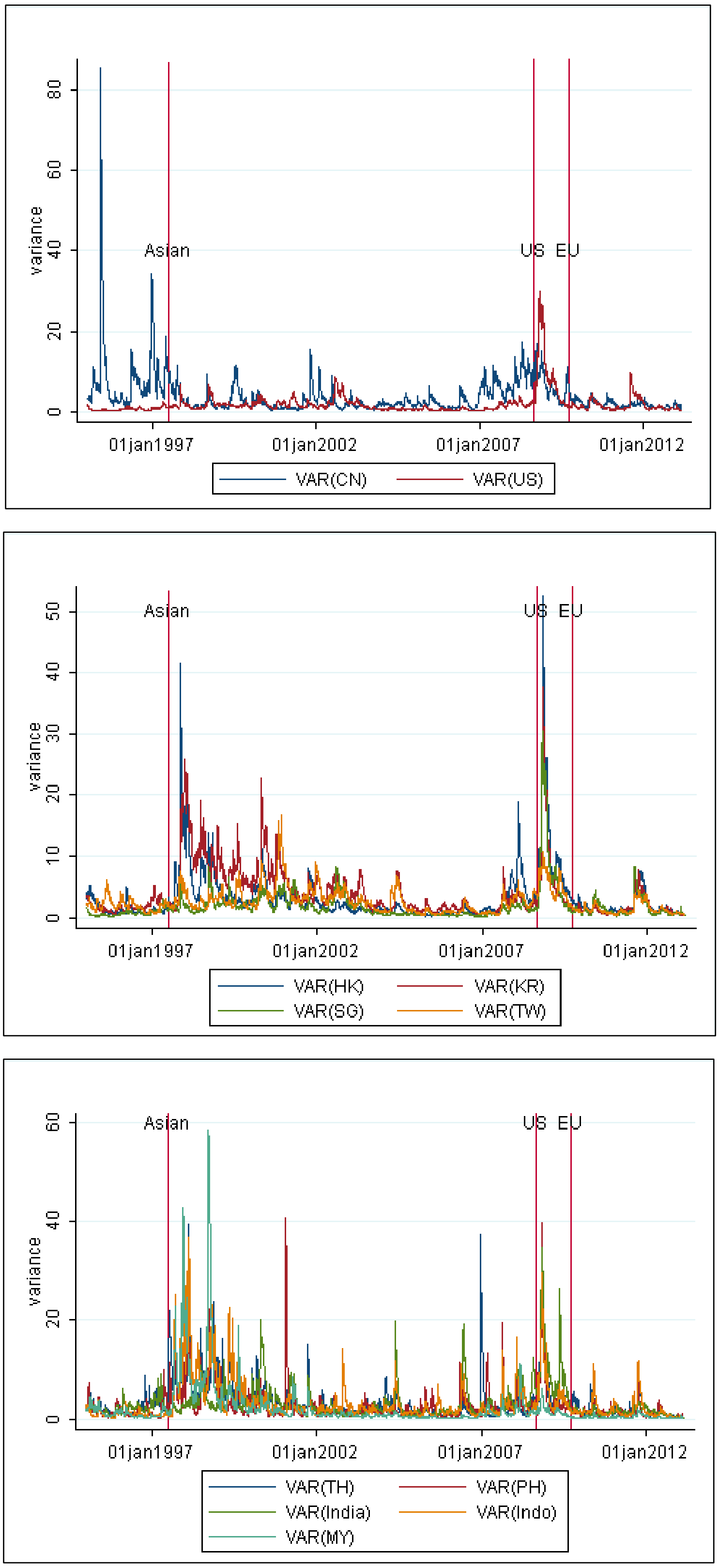
			Daily Flow of Foreign Sales in the Equity Market						VIX
Date	**Country**	**Measure**	**PHI**	**TW**	**IDO**	**THA**	**IND**	**KOR**	**Index**
10 Nov 2009	Taipei,China	Limit NR access to time deposit account			🟥		▒		H
19 Nov 2009	Rep. of Korea	Limit private FX exposure			🟥		▒		L
9 Dec 2009	India	Restrict external borrowing	▧			⬛		⬛	L
31 Mar 2010	PRC	Restrict external borrowing	▧		▧	▒	▧		H
13 Jun 2010	Rep. of Korea	Limit private FX exposure							H
16 Jun 2010	Indonesia	Minimum holding period		▒	🟥				L
12 Oct 2010	Thailand	Withholding tax			🟥		⬛		H
5 Nov 2010	Philippines	Limit private FX exposure			🟥		⬛		H
9 Nov 2010	Taipei,China	Limit NR access to CB instruments		▒					H
15 Nov 2010	PRC	FX control measure		▧	🟥	▒	▒	🟥	L
18 Nov 2010	Rep. of Korea	Withholding tax		▧	⬛	▒		▒	H
19 Dec 2010	Rep. of Korea	Restrict external borrowing		▒		▒	▒	▒	H
30 Dec 2010	Taipei,China	Raise RR on NR local currency account		▧	⬛	▒	▒	⬛	H
	Indonesia	Raise RR on FC account and limit banks' ST foreign borrowing							
13 Apr 2011	Indonesia	Minimum holding period				▧	▒		H
19 May 2011	Rep. of Korea	Limit private FX exposure			▧		▧	▒	L
29 Jul 2011	Rep. of Korea	Restrict external borrowing		▧	🟥		▧		H
28 Oct 2011	Philippines	Limit private FX exposure	▧	🟥	▧	▧		▧	H
17 Jul 2012	Philippines	Limit NR access to CB instrument	▧					▧	L
26 Nov 2012	Rep. of Korea	Limit private FX exposure		⬛	▒	▒	▒	▒	L
26 Dec 2012	Philippines	Limit private FX exposure	▒	⬛	▒	▒		⬛	L

🟥 Increase>2SD ⬛ Decline>2SD
▧ Increase>1SD ▒ Decline>1SD

Note: H stands for a value above its mean over the period from 2009 to 2013; L stands for below the mean.

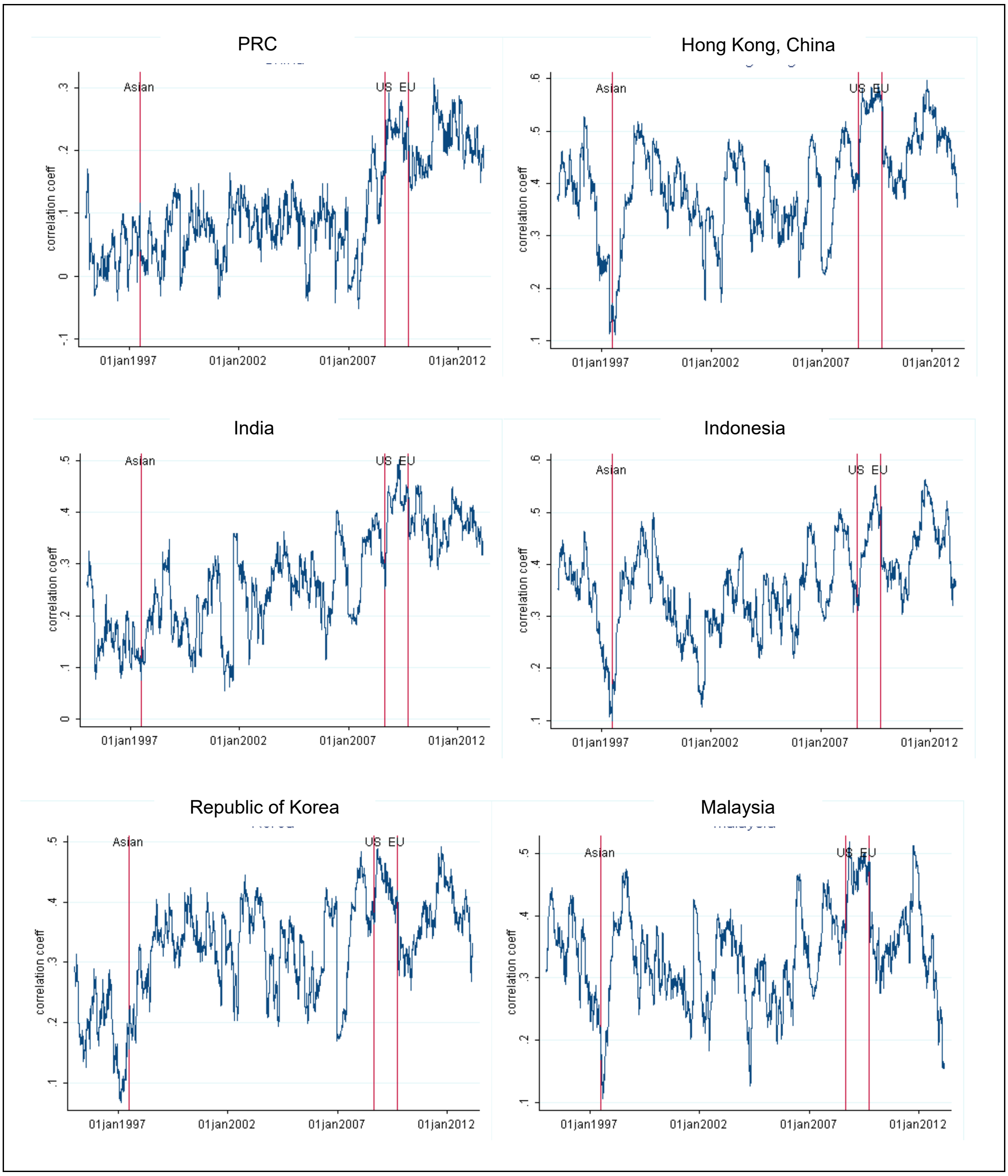
Source: Author's calculation.

Appendix Figure 1: Time Series Plots of the Conditional Variance of the Equity Index
(%)



Source: Author's calculation.

Appendix Figure 2: Correlation Coefficients of Each Country's Stock Return in Relation to the Thai Stock Return (Thailand was the Crisis Originator in 1997)



PRC

Hong Kong, China

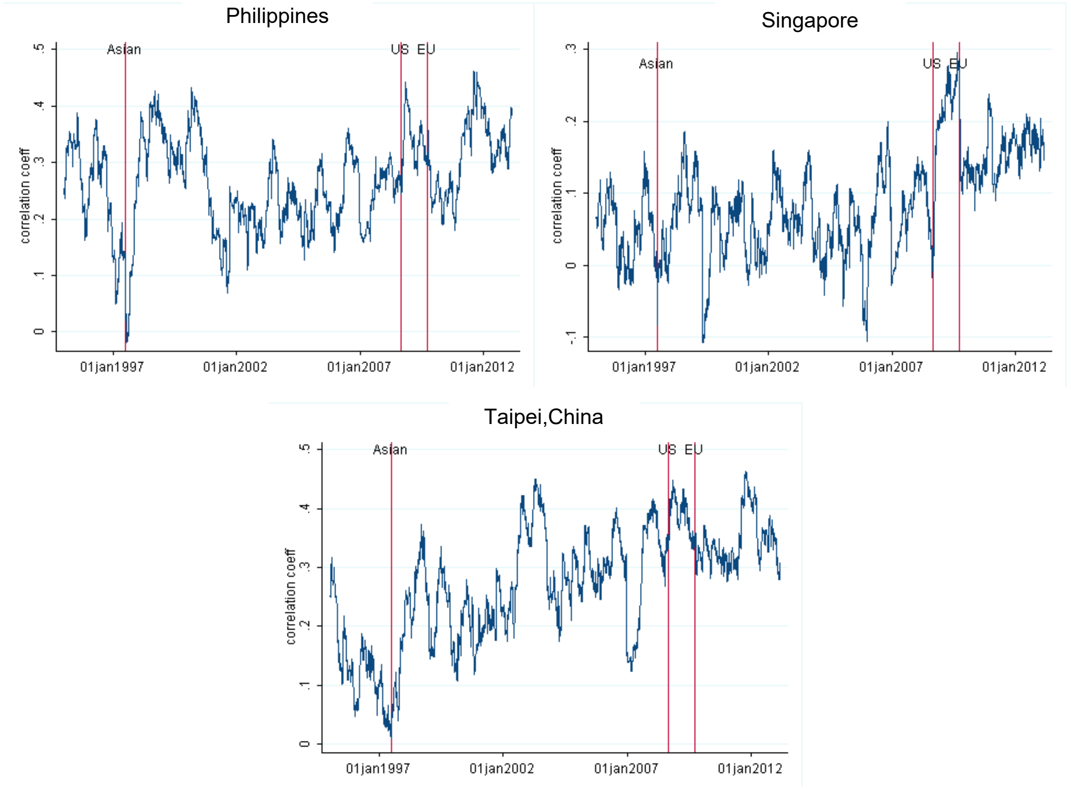
India

Indonesia

Republic of Korea

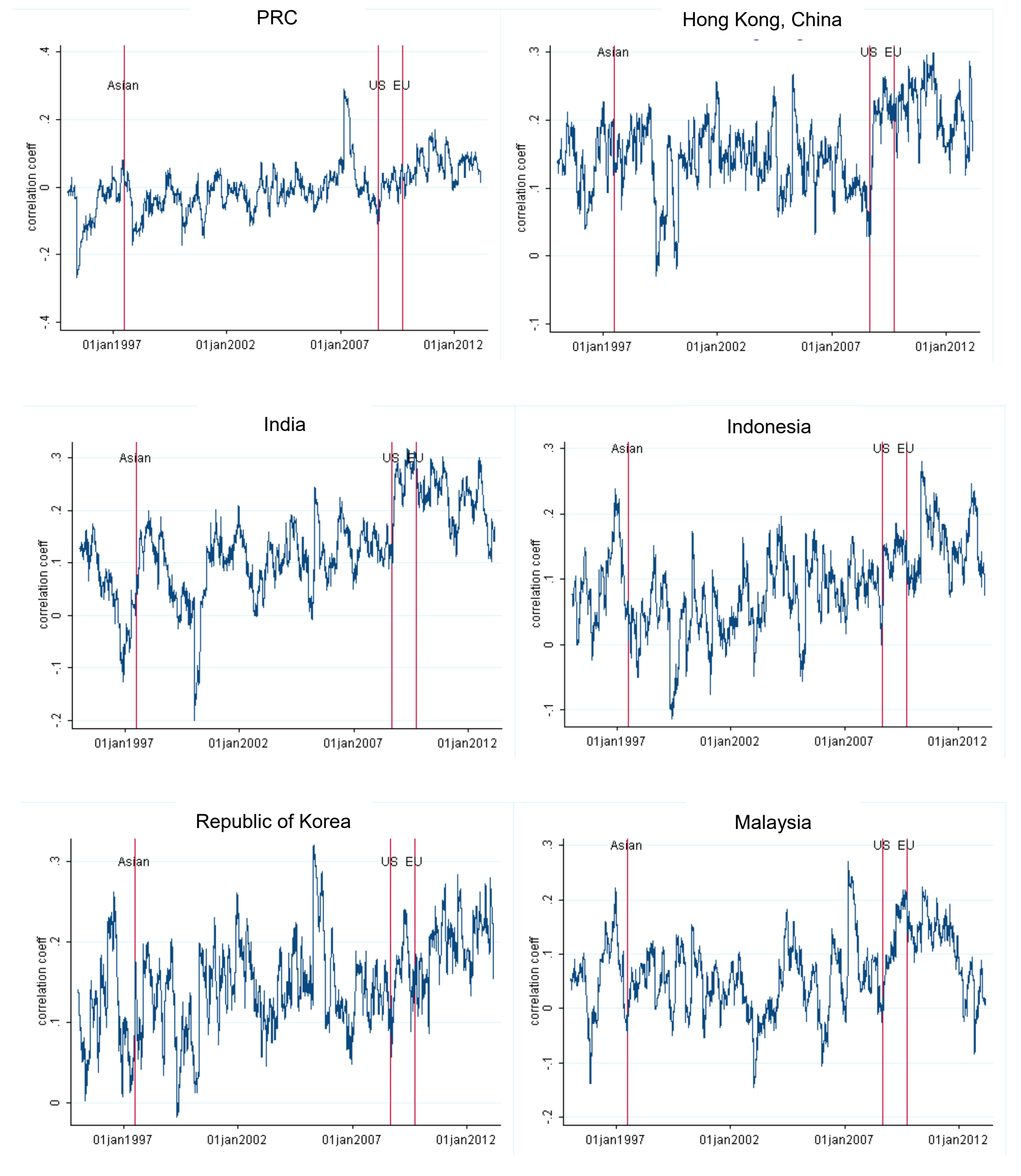
Malaysia

Appendix Figure 2 *continued*



Source: Author’s calculation.

Appendix Figure 3: Correlation Coefficients of Individual Countries' Stock Return in Relation to the US Stock Return (the US was the Crisis Originator in 2008)



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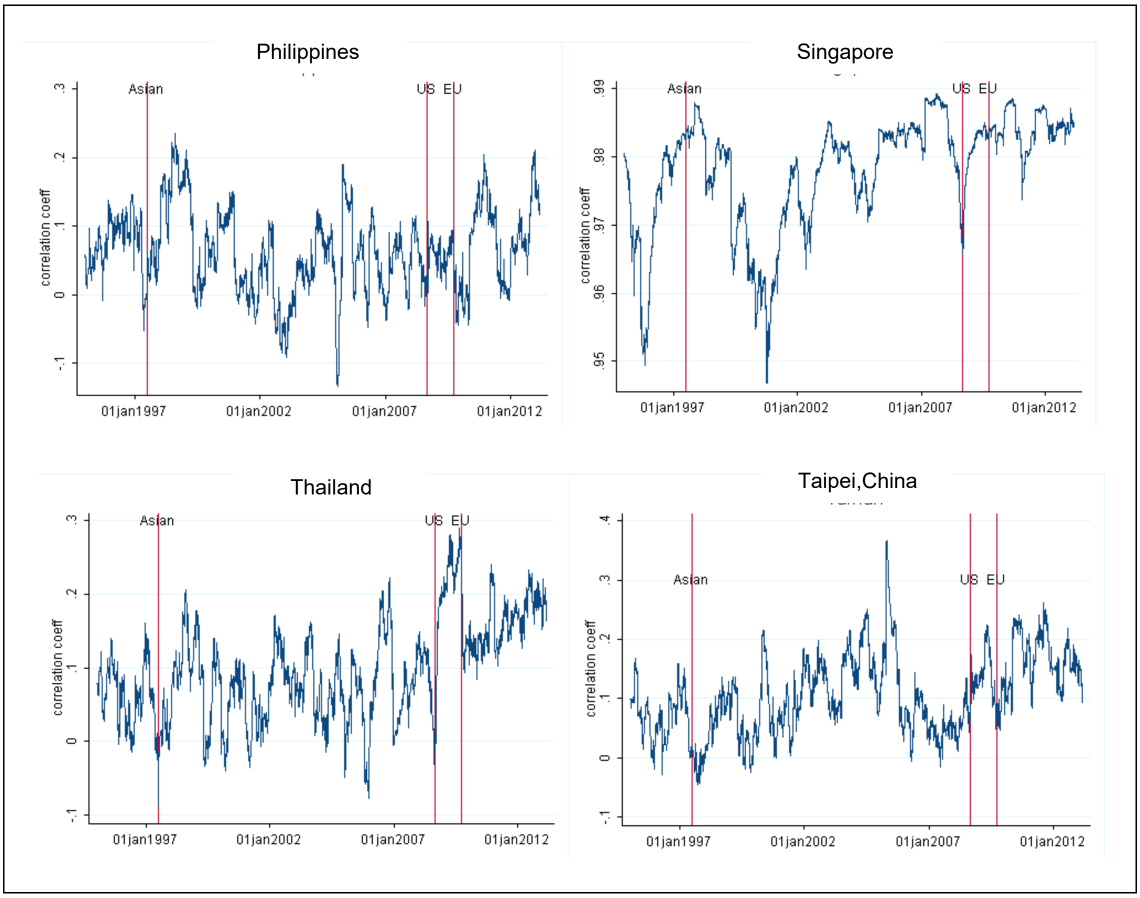
Appendix Figure 3 *continued*



Source: Author's calculation.