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Multilateral aspects of the CFMs measures

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Abstract

In face of the capital flow surge, the volatile asset price and the risk of large sudden flow reversal are among the main issues that raise concerns for policy makers. This paper examines transmission of volatility in asset returns and flows into asset markets using the DCC-GARCH model. The main interest of this paper is to answer question whether unilateral movements creates side effects to neighboring countries, or may be against one another. The results show that the spillover effects of the CFMs measure exist. The study select the equity market since the portfolio inflows generally believed to be riskier, more volatile and less desirable than the long term investment.

Introduction

This paper examines cross market linkages within EAEs, which can be measured by the correlation of volatility or shocks in assets returns and in net foreign portfolio flows. The surge in inflows is harmful for the recipient countries in several ways such as creating asset price surge as well as the risk of capital pull out. This could affect a whole region, which have higher degree of financial inter-linkages. The policy makers worry that a negative shock to one country can transmit to other countries in the region easily, even if there are few real linkages between the two countries and the economic fundamental of the second country is strong. Policy makers in several countries in the region react to the capital flow surges differently, mainly depending on the institutional set up, the policy constraint, the resiliency to shocks of the real sectors.

This paper aims to analyze the multilateral impacts of the capital flow measures (CFMs) of each country in the region, since it is interesting to observe whether the policy measure in one country impose externalities on other countries. It is widely agreed in the literature that capital controls have no significant effects on the aggregate volume of capital inflows. The measure can only shift the composition and lengthen maturity of capital flows to reduce the country vulnerability. With this, economists and policy makers, including IMF, have recently become more supportive of the capital controls. However, there was little concern in the literature about the spillover effects of capital controls. It is possible that the control on capital inflows can significantly reduce the volume of certain types of capital flows into a country, but simply shift the challenges of large inflows such as asset price bubble and currency appreciation into other countries. Evidence of the multilateral impacts of the measure can be useful in further evaluating the role and potential benefit of the regional cooperation.

What this paper does not prove whether the coordinate action is superior to unilateral capital flow measures, nor does assessing effectiveness of capital flow measures vis-à-vis its objective. Instead, this paper identifies the mechanism of the spread of turmoil across countries in the region and assesses whether the CFMs measure affects these relationship and create any possibility of externality. If the spread of turmoil and externality exists, it could suggest that the multilateral arrangement could be justified[1] for instance, the

[1] This is the same spirit as the argument of Forbes and Rigobon (2002), which suggest that evidence of contagion could justify multilateral (IMF) intervention, as the aid could prevent the second economy from experiencing financial crisis. On the other hand, if the two countries link to each

coordinated restriction on capital flows to avoid discriminate actions that would simply redirect flows to other countries and to avoid circumvention of capital controls.

This paper uses a Dynamic Conditional Correlation GARCH model by Engle (2002) to examine volatility spillovers between countries in Asia. The model allows tracking correlation evolutions of assets prices between countries and net private capital flows into equity markets

The organization of the paper starts with the background of the challenge of the emerging Asia in coping with the volatile capital flows. The following section is an analysis of how connect are the volatile capital flows in emerging Asia, and its mechanism for the connection. Next, the paper discusses the multilateral impacts of the capital flows measure (CFMs) and conclude the finding.

Part 1: Challenge of emerging economies from volatile capital flows

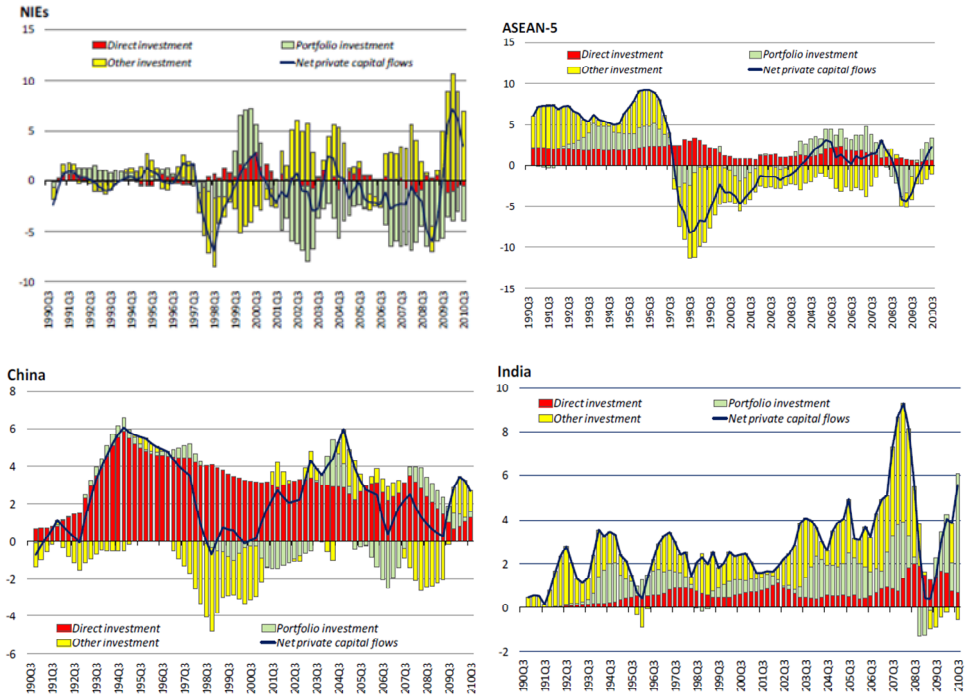
Policy makers in many Emerging Asian Economies (EAEs) have had to cope with the **increasingly volatile capital flows**. In the aftermath of the global financial crisis, capital flows in to emerging economies, especially Asia have bounced back speedily from their slump in 2008. Investors from exceptionally low interest rates in developed countries and even investors in EAEs themselves regain their appetite for risk, and, in particular, by 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 capital flows in the region. The push factors include factor 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 climates and the expectation of the currency appreciation in the EAEs. Some researches argue 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 give more importance to the pull factors, as the better economic prospect is a key driver for the surges. Recently, Brockmeijer and Husain (2011) conclude that global push factors play a significant role in explaining incidence of a surge, while the pull conditions determine the magnitude of a surge. This

other through the economic fundamental, the transmission of shocks would not constitute contagion. The second economy should adjust to this shock itself. The multilateral arrangement such as bail-out fund would just prolong the adjustment and would be sub-optimal solution. Multilateral arrangement would thus be less effective and harder to justify in this case.

analysis seems to be consistent with the data that the capital flows tends to be more volatile in the financial center, for example, Hong Kong.

Natures of capital flows to emerging Asia have been changing especially their composition and behaviors. ***The composition*** changes towards portfolio and banking flow raising concern among policy makers in the region as these are more volatile and short-lived. For instance, China has seen a shift from foreign direct investment to banking flows, while India experienced a change in composition of inflows from banking flows to portfolio flows (see figure 1). In NIEs except Korea, the recent surge is dominated by extraordinary banking related flows. The portfolio flows have dominated during the current surge in case of Korea and ASEAN5. 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*** have change in such a way that the pace of inflow surges have risen strikingly. In addition, the shifted in attitudes towards risk leads to large swing in global portfolio investment flows, and increase volatility in global equity and bond markets.

Figure 1 Emerging Asia Net Private Capital Flows (in % of GDP, 4 quarters moving average)

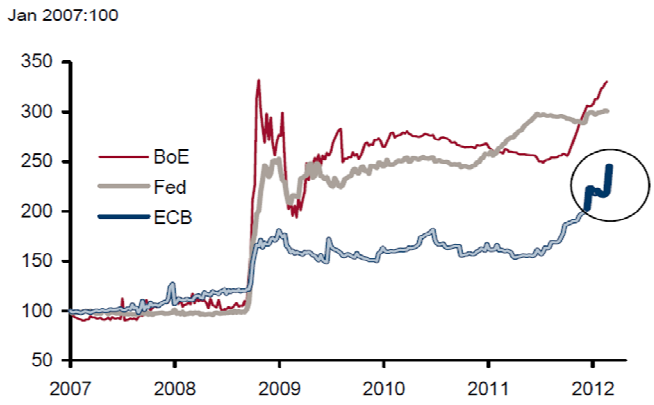


Source: Pradhan et. Al. (2011), Note: NIEs of Asia includes Hong Kong, Korea, Singapore, and Taiwan

Going forward, there is still trend of sustained large capital inflows from renewed demand for emerging Asia assets from the sovereign debt problems in Europe and slow

growth in the United States which resulted in the low interest rates, asset purchases and enhanced access to funding (see figure 2).

Figure 2 Central bank balance sheets (% of GDP)



3Source: Credit Suisse (29 February 2012)

Unfortunately, financial markets in EAEs have limited absorptive capacity (see table 1). This raise concerns on the upward pressure of asset prices in EMEs in face of higher liquidity from G3 countries.

Table 1 EMEs have financial markets with limited absorptive capacity.

Billions USD	Stock market size	Bond market size	FX market size
Thailand	218	180	7.4
Malaysia	90	183	7.3
Indonesia	130	98	3.4
Philippines	27	55	5.0
Singapore	282	115	265.9
Korea	1,627	1,085	43.8
Japan	4,280	11,521	312.3
USA	30,455	25,064	904.4

1Source: WDI and BIS
Note: Stock market, total value at end-2010; Domestic debt securities, amount outstanding at end-2009; FX, average daily turnover in April 2010

With the uncertainty in the global growth prospect and the sovereign debt crisis in Euro area, the major concerns for policy makers in EAEs are the impacts on the banks and financial

markets[2] from these uncertainties. The main channels for contagion are capital flows from portfolio investment, bank funding, and the provision of trade finance. This study aims to analyze the contagion through the portfolio investment.

The surge in foreign capital has led to a renowned focus on capital controls, which is a policy option to manage large inflows additional to exchange rate policy and monetary policy.

Part 2: How connected are these volatile capital flows in Emerging Asia and by which mechanism?

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

Earlier literatures examine the volatility spillovers in the stock market in case of developed countries (Karolyi, 1995; and Harris and Pisedtasalasai, 2006), Asia (Joshi, 2011; and Chou et al 1999), and other EMs (Scheicher, 2011). These researches found significant volatility spillovers between developed countries to EM, and spillovers among EMs. Shamiri and Isa (2009) examined volatility spillover from the US to South East Asia using the stock return data and bivariate GARCH model. The results show that Singapore, Korea and Hong Kong are among the South East Asia markets that are vulnerable to shocks generated from US investors due to the large proportion of US investors participating in the stock markets. There remain limited studies in the intra-regional financial spillovers. My work adds to the previous literatures by examining financial inter-linkages through co-movements of financial

[2] Sustained large capital inflows have posed c**hallenge to the conduct of monetary policy and management of capital flows** in several ways. First of all, it has placed the considerable pressure on the exchange rate. The combination of persistent current account surpluses, rising capital inflows, and accumulation of foreign exchange reserves in EAEs with persistent US deficits exerted upward pressure on exchange rates. As the pressure could be either one or two way, it could hamper the international trade and investment activities. Second, it creates the fiscal burden from the management of sustained large capital inflows, such as sterilized intervention. Third, it could hamper the monetary transmission mechanism. Fourth, it poses risk on financial stability such as pressure in asset markets, bank lending boom, volatile foreign exchange markets and risk of capital flow reversal. The capital inflows could result in credit booms and create economic overheating through pushing up inflation expectation, while the risk of capital flow sudden stop or reversal within a short period could result in sharp currency depreciation or reserves depletion.

variables for countries in the region and understands **whether the recent financial distress has become systemic**, and compares event study of Asian financial crisis and the global financial crisis.

As mentioned in the first part, many countries in EAEs are affected by the highly volatile capital flows. This causes dramatic movement in asset prices, especially the stock market. The research questions are 1) how much connections/linkages 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. 2) Do these periods of highly correlated stock market movements provide possibility/evidence of **contagion** among countries in the region?

2.1 Definition of interdependence versus contagion and the measurement

In order to answer above questions, the definition of contagion should be discussed. Contagion is mostly defined as the spread of markets' turmoil from one country to other financial markets (Naoui et al., 2010; Allen and Gale, 2000; Kyle and Xiong 2001; Kiyotaki and Moore, 2002; Kaminsky, Reinhart and Vedh, 2003; Brunnermeier and Pederen, 2005, 2009 and Masson, 1998, 1999). According to Masson (1998, 1999), there are three non-exclusive characteristics which explain the contagions[3]. The first is **"monsoonal"**; crises may be the result of a common factor or common shocks which affect all countries simultaneously. For instance, during the Black September of 1982, the economic policy from developed economy created macroeconomic effects in emerging market. The second refers to **"spillovers"**, resulting from interdependency between countries. Once the crisis hit a country, it affects the fundamental of the neighbouring countries through trade or financial linkages, such as exchange rate devaluation or a liquidity crisis. Previous literatures examining fundamental-based contagion are Calvo and Reinhart (1996); Kaminsky and Reinhart (1999, 2000); and Forbes and Rigobon (2000, 2002). They found that the trade and financial links are the main crisis-transferring mechanism and these links are expected to remain constant before, during and after crisis. The last one refers to the **"pure contagion"**; the crisis was triggered and spread by investor's psychological behaviour or panic movements rather than being induced by economic fundamentals/links. For instance, liquidity shocks, which agents divest their assets in countries as a function of the crisis in another countries (Forbes and

[3] See Naoui et al. (2010) ;and Marcal et.al. () for review of literatures in details

Rigobon, 2002). More specifically, Goldstein and Hawkins (1998) considered signalling as one of the cause of the Asian financial crisis in 1997. Taking financial problem in Thailand into account, investors re-evaluated their investment in similar countries and re-allocated their resources. Masson (1999) found that changing in investors' expectations is important in transferring crisis from one country to others, as monsoonal and spillover effects do not seem sufficient to understand the spread of contagion in Latin America and East Asia. Forbes and Rigobon (2002) and Pesaran and Pick (2003) interpreted monsoon and spillover as **interdependence**.

Dornbush, 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. Definition of their contagion is similar to some other papers that argue that if there is transmission of shocks from one country to another, contagion occurs, even if there is no significant change in cross –market relationships. Pritsker (2001) use the term contagion and spillovers interchangeably and define contagion as the spread of shocks from one country to others. The transmission of shocks is through market participants who follow portfolio strategies. Pericoli and Sbracia (2001) define increase in co-movements in prices and quantities between markets given the crises in one or more markets as contagion.

We can conclude from the review of related literatures above that there is no consensus on the precise definition of contagion and it remains an open question even in the modern literatures. **This paper follows Forbes and Rigobon (2002) which was in line with Masson (1998, 1999) and defines contagion as a significant increase in cross-market linkages after a shock to one country** (or a group of countries). With this definition, **interdependence or linkages** refers to a situation when two markets show a high degree of comovement during period of stability. The examination in this paper is simply to show that the market volatility is transmitted across countries in EAEs. **Contagion** occurs if 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/interdependences between the two countries. The examination simply tests if this volatility transmission changes significantly after the shocks/crisis.

With this definition, the analysis in this section is simply to compare linkages between markets in EAEs (through the cross market correlation coefficients) during the stable period (pre-Asian crisis and pre-US crisis periods) and the crisis period. Any evidence of strong contemporaneous relationship across stock markets defines the interdependences between markets. The possibility of contagion is further defined as a significant shift in these cross-country linkages during crisis.

The caveats of the tests for contagion based on cross market correlation coefficients is the biasness and inaccuracy due to heteroskedasticity as suggested in Forbes and Rigobon (2002)[4]. In other words, cross-market conditional correlation coefficients are conditional on market volatility. During crisis, markets are more volatiles, the estimates of the conditional correlation coefficients tend to increase and can be biased upward. Their works specifies magnitude of the bias and correct for it.

The ARCH GARCH class frameworks have advantages, as it incorporates heteroskedasticity in their models (Forbes and Rigobon, 2002). The modern literatures also emphasize the need to consider the dynamic/ time varying aspects of correlations (Engle, 2002). Thus, the DCC GARCH model is useful in measuring contagion among Asian financial markets. Earlier literature that examine contagion in Asian financial market using DCC GAGRCH model are Chiang et al., 2005 and Cho and Parhizgari (2008). The former examine whether there is any significant increase in DCC during Asian financial crisis by employing the regression method with dummy variables of crisis. The latter employs the mean difference t-test and median difference z-tests for identifying the contagion by investigating whether there are significant differences in the estimated time varying correlation coefficients between the stable and turmoil periods. Cho and Parhizgari (2008) found that the DCC-GARCH model is superior to the volatility adjusted cross-market correlations employed in Forbes and Rigobon (2002). The main reason is that the DCC GARCH model continuously adjusts the correlation for the time varying volatility.

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4 Earlier literatures analyze correlation by using co-movements, causality, error correction models, co-integration and vector autoregression methodology (Pascual, 2003; Darbar and Deb, 1997; Karolyi and Stulz 1996; and Parhizgari et al., 1994; Ahmad et.al. 2005; Bhattacharya and Samanta, 2001; Chelley-Steeley, 2005; Chung and Ng 1992; Eun and Shim, 1989; and others4). However, modern literatures recognize the bias in the simple correlation coefficient that arises from the increased volatility during the crisis (Forbes and Rigobon, 2002)

2.2 How to test for existence of contagion/spill over?

The time series plots of the daily behavior of stock market returns against the net capital flows (in appendix figure 1) suggests that the degree of financial instability among EAEs has increased associating with the current period of volatile capital flows. After the global financial crisis, the stock prices and the net foreign equity flows into EAEs become more volatile. A question arises from this observation; is there significant evidence of the financial contagion among EAEs during the US crisis, if so, is the impact stronger than the crisis originated within the region (1997 financial crisis)? This can be done by examining the co-movements in stock market volatility across countries. The existence of statistically significant co-movement in volatility, in other words, the coincident of periods of increased stock market volatility can be evidence of the presence of contagion. The multivariate GARCH model will be employed. Previous literatures using the GARCH framework interpret the contagion from a simultaneous increase in the conditional variance of stock returns (Edwards and Susmel, 2001; and Forbes and Rigobon, 1999). The former finds evidence of coincidence in periods of high volatility in the Asian and Russian stock market during the crisis in 1990s using the SWARCH methodology. The latter detects breakpoints in simple return correlations across countries in case of Latin American countries and found similar results.

I examine the volatility spillovers among the EAEs stock markets in terms of both price and quantity. **First**, the study of spillover in asset prices and be done by employing the daily return of the stock index (closing price) for S&P500 index for US (SPX), Hang Seng of Hong Kong (HIS), Shanghai Stock Exchange (SSE) of China, Jakarta Composite Index (JKSE) of Indonesia, and Korean Stock Exchange (KOSPI) for Korea, Thailand Stock Exchange (SET) for Thailand, Bombay stock exchange (BEX) for India, Kuala Lumpur stock exchange (FBMKLCI) for Malaysia, Philippines stock exchange, and Taiwan stock exchange. The daily returns are identified as the first difference in the natural logarithm of the closing index value for the two consecutive trading days. The period of analysis for stock price is from November 1992, where all data are available, through March, 2012. The starting date of November 1992 is considered as the stable period. The sample period include the Asian financial crisis[5] (1997-

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

1998), the pre-global financial crisis (1999-the collapse of Lehman on 22 August 2008), and the eruption of the US crisis (22 August 2008 to present) [6].

Second, to study the transmission of volatility in terms of quantity, the daily net flows by foreign institutional investors into the local equity markets in US dollar terms are also analyzed. The data are available daily for India, South Korea, Philippines, Taiwan, Indonesia, Thailand and Viet Nam since 2006 onwards. The data is already stationary, so there is no need to take the first difference in the GARCH calculation. The data for the stock prices and the net flows into stock markets data are both obtained from Bloomberg LP.

From visual inspection of the time series plots of the stock price, all the series are non-stationary and the unit root test confirms this notion. Therefore, the daily stock price 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 GARCH (1,1) model. The volatility of the return is also quite large during the Asian and US crisis.

To address the stock market linkages between countries within Asia, a multivariate GARCH model is estimated in order to examine the co-movement of the volatility in the stock market of countries in EAEs. The Dynamic Conditional Correlation (DCC) GARCH model by Engle (2002) and Engle and Sheppard (2001) is employed to examine the time varying correlation coefficients, since it has flexibility of univariate GARCH models coupled with parsimonious parametric model for correlations. In addition, it takes time varying volatility into account and address possible feedback effects. It also helps avoiding the biased in examining volatility spill over and contagion that would occur with the standard correlations as stated in Forbes and Rigobon (2002). 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 estimation is simple and consists of two steps. The first is a series of univariate GARCH estimates, and the second the correlation estimate. The DCC GARCH model can be briefly presented as follows:

$$H_t = D_t R_t D_t, \qquad \text{where} \qquad D_t = diag\left\{\sqrt{h_{i,t}}\right\} \tag{1}$$

6 Prior to the current capital inflow surges, there have been two waves of large inflows into Emerging Asian economies: 1. Early 1990s to Asian Financial crisis in 1997 and 2. early 2000s to global financial crisis in 2008.

and R_t is a correlation matrix containing the conditional correlations as can directly be seen from rewriting this equation as:

$$E_{t-1}\left(\varepsilon_t\varepsilon_t^{'}\right)=D_t^{-1}H_tD_t^{-1}=\mathrm{R}_t, \qquad \text{since} \qquad \varepsilon_t=D_t^{-1}r_t \qquad (2),$$

A special property of dynamic conditional correlation models is that R_t is allowed to be time varying. D_t is a diagonal matrix comprised of the standard deviations implied by the estimation of univariate GARCH models, which are computed separately. $\sqrt{h_{it}}$ is the i^{th} element of the standard deviation from the GARCH model. The DCC model can be formulated as the following statistical specification[7]:

$$r_t\left|\zeta_{t-1}\right. \sim N(0,D_tR_tD_t) \quad \text{where} \quad D_t=diag\left\{\sqrt{h_{it}}\right\} \qquad (3)$$

$$D_t^2=diag\left\{\omega_i\right\}+diag\left\{\kappa_i\right\}\circ r_{t-1}r_{t-1}^{'}+diag\left\{\lambda_i\right\}\circ D_{t-1}^2 \qquad (4)$$

$$\varepsilon_t=D_t^{-1}r_t \qquad (5)$$

$$Q_t=S\circ(\mu'-A-B)+\varepsilon_{t-1}\varepsilon_{t-1}^{'} \qquad (6)$$

$$R_t=diag\left\{Q_t\right\}^{-1}Q_tdiag\left\{Q_t\right\}^{-1} \qquad (7)$$

$$S=E\left[\varepsilon_t\varepsilon_t^{'}\right] \qquad (8)$$

Let r_t denotes an *n×1* vector of stock returns[8], exhibiting a mean of zero. Each series of the assets returns follows a univariate GARCH process, as presented in Equation (4).

2.3 Estimation results

The analysis starts with the examination of impacts of the Asian and the US crisis on the volatilities of the equity price and of net foreign investment flows into equity market (appendix figure 1). The plots of volatilities of these series reveals that volatility of stock prices in all countries shoot up during the Asian and US financial crisis. The conditional volatility of the net equity flows also rose significantly during the US crisis. The next analysis is an assessment of how the market correlations vary in time and especially to point at their amplification during the crisis. The correlation between each stock return series was estimated with the DCC integrated method. Then the contagion was defined as the significant increase of asset prices co-movements, after applying the correlation based

7 See Engle (2002) for details of the model.

8 The weekly return of the stock index is the continuously compounded return or log return of the index at time t.

contagion test. Since the data of the equity flows are unavailable during the Asian crisis, the following sub-section is the discussion of the results from the equity price.

The estimation results for the dynamic correlation of the stock price from the DCC-GARCH model are presented in appendix figure 2 and 3. Appendix figure 2 exhibits the calculated conditional correlation coefficients of individual country stock returns against the US stock returns. The US is chosen for each country pair-wise relationship as a crisis originator in 2008. In the same spirits, appendix figure 3 illustrates the conditional correlation coefficients of Thai stock returns against each country stock returns, to observe impact of the crisis contagion originated from Thailand. The discussion of how the correlations evolved during the calm period and the crisis period are discussed as follows;

Comparing the two episodes of calm periods, the results suggest that degree of financial interdependence has increased from the pre-Asian crisis (1992-1996) to the pre-US crisis period.

The correlation coefficients of each country equity return versus Thai's equity return in appendix figure 3 generally indicate strong evidence of volatility co-movements across countries during the pre-1997 crisis, except in case of China. This suggests the interdependence and linkage of stock markets in the region. The finding of low relationship with China is unsurprising since the country just recently opened the equity market for foreign trading, up until now, foreign access remains limited. In the pre-1997 crisis, correlation coefficients between US stock prices and those of countries in EAEs are low and insignificant in almost all countries except Singapore and Hong Kong (see appendix figure 3). This is partly because the inter-linkages between stock market in the US and the EAEs in general remain low, the change in volatility are mainly determined by own country and regional factors.

During the pre-US crisis, the calculated correlation coefficients increase significantly in comparison with both the US and Thailand as the crisis originators. This suggests the higher degree of fundamental linkages such as an increasing trade and financial integration both inside and outside the region. One could relate the greater developments and international integration to the stronger co-movements in the financial variables, in normal events.

During the crisis period, the main findings suggest that implied correlation between the return of the stock prices in Asian markets increase sharply in both the Asian financial crisis in 1997 and the global financial crisis in 2008, however, the latter event incurs a more dramatic rise. The regression based test for the structural shift indicates an existence of crisis contagion from Thailand to the rest of the countries in Asia during 1997 and a more severe crisis spill-over from the US to countries in Asia during 2008. The existence of contagion during crisis could be justified by theoretical ground. The reason for increase in cross market linkages after occurrence of shocks was explained in Masson (1998) that a crisis in one country could coordinate investor expectations. The co-movement in price would exist because of correlation in memories rather than fundamental.

During the subprime crisis, the correlations between the different markets considerably increased mainly because the dependence of each country's market has progressively intensified. This is partly attributable to the spread of the news that determines the global risk sentiment. This results in the global aspects of changes in stock price volatility, leading possibly into contagion.

More strikingly, there is a significant increase in the pair-wise conditional correlation among Asian countries itself. The coefficients are even stronger than in comparison with the US. This suggests that if there is a shock to a country in the EAEs, the impact can be even larger than the shock originated from the US. One could link this phenomenon to the increased financial integration, which has intensified contagion effects across markets. Although inter-regional relationship is substantiate comparing to intra-regional, however, the latter is gaining importance. Going forward, it is likely that the significance of intra-regional integration outweigh the intra-regional relationship.

Part 3: How does the regulation of countries in EAEs affect each other?

3.1 What are the regulations of each country and how are they related?

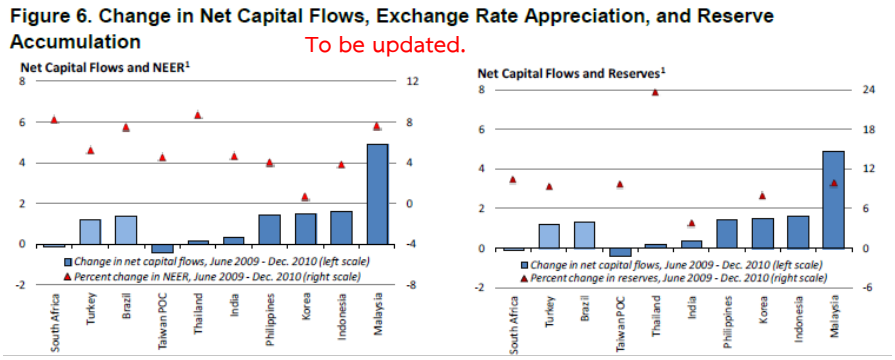
The challenge to emerging economies regarding the capital flows is the ability to absorb these flows effectively and avoid the buildup of vulnerabilities (Strass-Kahn, 2010). Capital flows are generally believed to have positive effects on promoting economic growth and capital allocation efficiency and the development of the financial market. However, one should beware of the negative effects such as exchange rate overshooting, financial

instability such as assets bubbles and credit booms, pushing up inflation expectations and the risk of sudden reversal and economic slowdown (Choi, 2010).

It has been widely agreed that EMs share a common concern about the surge and the volatile capital flows, however, their **policies response** of each country varied widely with respect to the difference each country's economic fundamentals and policy limitation[9]. The limitation can be political economy issues (such as opposition to nominal appreciation) and institutional concerns (such as cost of sterilization). Details will be discussed below.

Emerging Asia tend to **accumulate reserve** rather than allowing **currency appreciation**, except in case of Indian rupee (where reserve remain below pre-Lehman level). The recent exchange market pressure[10] in EAEs, except for Hong Kong and Korea, has found to be less than the peaks of the pre-global crisis period. In addition, the real effective exchange rates remain significantly below the levels of early 2000s except in case of China (see figure 4).

Figure 4: Change in Net Capital Flows, Exchange Rate Appreciation, and Reserve Accumulation



As inflows have been large and persistent, foreign exchange intervention seems to be arduous task. For instance, Thailand and Indonesia allowed significant exchange rate appreciation, though reserve increases rapidly and are currently 60 percent above their pre-crisis levels. Pradan et. al. (2011) argued that as long as expectation of currency appreciation is maintained and inflows are persistent; inflows may be even stronger with the reserves accumulation and resisting exchange rate appreciation.

Recipient countries have used macroeconomic policies to deal with the recent surges in inflows; a more direct measure i.e. the capital flow management measures (CFMs) have also gain more popularity and the IMF have also recognize them as a legitimate part of toolkits

9 (See page 6 Pradan et. al.—size and composition of flows)

10 The exchange market pressure (EMP) is … It is calculated by… Pradhan et. al. (2011) calculated the EMP index during surge episodes in figure 3.

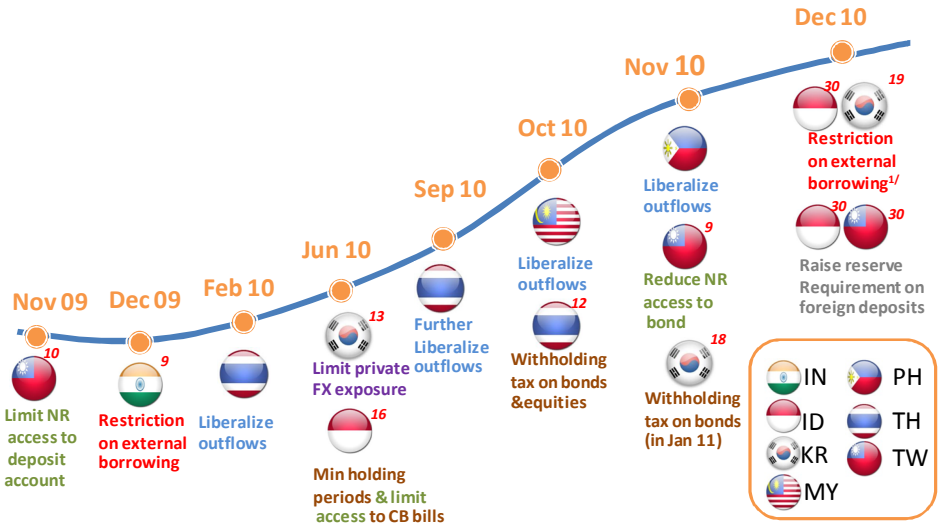
to manage large capital inflows. It has been motivated under the concerns about overheating, external competitiveness, financial stability and sterilization costs of reserve accumulation (Pradan et. al., 2011). Many agreed that the measures have been effective in altering composition of inflows and in limiting credit growth and asset price inflation, while aggregate capital flows was not affected. However, one should aware that these capital control measures have limitations as it can be regard as the temporary measures, which should be employed under specific circumstances such that the economy should be running near its potential and the exchange rate should not be undervalued (Ostry et al., 2010).

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 market could find way to circumvent it, so the measure is ideal only temporarily. The type of capital control is also important. Many have agreed that capital control is more effective in changing composition of inflows and its maturity structure, rather than reducing volume. Unfortunately, nobody could suggest the ideal tools. There are only a few guidelines. For instance, the measure should be designed such that it could last long enough to counter the capital flows surge and can be withdrawn quickly when they are no longer needed. The measure should be flexible enough to adapt to sudden changes in investor sentiment.

The argument for the next section is that in a more globalized world with stronger trade and financial connections, decision taken at individual country level may have impacts on the rest of the countries. Thus, before deciding to impose capital controls, it is crucial to aware that it could prompt other countries to follow suit. This could exacerbate the problem as the flows are likely to move from more restricted country to those without restriction. If the recipient country of the flows saw the pressure, it might decide to raise the restriction. In the end, a whole region may be in the suboptimal level of the capital inflows, as the measure could also deter good flows.

Figure 5 presents series of the CFMs and chronology of events. Table 2 illustrates details of each CFMs, classifying by choice of policy tools.

Figure 5: Capital Flow Management Measures (CFMs) with announcement date



6 Source: Author's compilcation

Note: 1/Bank levy in 2011H2 for Korea; Limit bank ST borrowing in Mar 11 and raise RR on FCD in Mar & Jun 11 for Indonesia

Table 2 Capital flow Management Measures in Asian Economies

Policy tool	Country example (announcement date)	Objective
1. Limits private FX exposure	**Korea (13 Jun 10)**- capped bank's FX forward positions. Reduce firms' hedging limit from 125% to 100% of export receipts.	Reduce private external borrowing
2. Raise restriction on external borrowing	**India (9 Dec 09)-** reinstate interest rates cap on private external borrowing; **Korea (19 Dec 10)** –banks' levy on non-deposit FC liabilities (in 1 Aug 11) , (<1yr=0.2%,1-3 yrs=0.1%, >3yrs=0.05%); **Indonesia (30 Dec 10**) –re-impose limit on bank's ST foreign borrowing to 30% of capital (in Mar 11)	Limit access to foreign credit and prevent high cost borrowing
3. Minimum holding period	**Indonesia (16 Jun 10)-** 1 month on central bank bills in 7 Jul 10	Limit volatility of flows
4. Limit foreign access	**Indonesia (Jun 10)**- issue 9&12M SBIs to replace 1&3M, expand supply of non-tradable term deposit up to 6 months tenor for local banks; **Taiwan (10 Nov 09)-** barred NR access to time deposit accounts ;and **Taiwan (9 Nov 10)-** restricted off shore funds from investing more than 30% of their portfolio into money market products and government debt with maturity less than a year	Stop vehicle for carry trade to reduce flows volatility Plus reduce NR access to government bond in case of TW
5. Encourage outbound investment	**Malaysia (Oct 10), Philippines (Nov 10), Thailand (Feb &23 Sep 10) ; Thailand (Jun 10)** -raised limits on FA accumulation by residents, including FDI	
6. Reserve requirements on FC and NRs account	**Taiwan (30 Dec 10)** –raise RR on NR local currency account **Indo. (30 Dec 10)**-raise RR on FC account (Mar=1-5%, Jun 11=8%)	Reduce bank's incentive to intermediate ST inflows (ID)
7. Withholding tax on foreign holdings of gov't bonds	**Thailand (12 Oct 10)**- reinstate 15% on bond; **Korea (18 Nov 10)-** 14% on gov't bonds and central banks securities in 1 Jan 11	Slow inflow into bond markets

3 Source: Pradhan et. Al. (2011), Moghadam (2011), Brockmeijer and Husan (2011), BBVA Research (2011)

From figures and table above, one may notice that Singapore, Malaysia and Philippines do not introduce any of the capital flows measures. This partly reflects that economies (especially the real sectors) in these countries are resilient to the pressure on the FX

appreciation. The foreign exchange policy in Malaysia and Philippines is more liberalized than their neighbor.

The next section is an assessment of changes in cross border volatility link in the equity market (both price and quantity of flows) after an introduction of these CFMs measure.

3.2 Do the responses/regulations improve or hurt overall volatilities of the region?

This section studies the multilateral impacts of CFMs in the context of Emerging Asia. The effect of the announcement of recent CFMs is one country on volatility of equity returns and equity funds flows of other countries in the same region can be tested using event studies. The DCC-GARCH model in the previous section was used to test for the effect of control on volatility of both stock price (stock index return) and quantity (net flows into equity markets). We further assess changes in cross border volatility link, by examining the structural change in the persistency of the capital flows in the region after the CFMs measure in particular country was introduced.

The flows into stock markets and the stock prices are employed in this study due to the availability of cross country data, and because of their importance. The volatile flows, especially portfolio flows into bond and equity market are frequently viewed as a destabilizing force in asset markets and financial system. Hence, the aim to reduce volatility in asset prices is among the main reasons for introduction of control.

Considering that it is difficult to separate 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 control itself**. Instead, this study is **rather to examine the possibility of the negative externality of the CFMs measure in one country to another.** The externality in this context refers to the increase in overall/neighbor country volatility after the CFMs measures. There are several questions arise in this section. For instance, does the CFMs curbs/raise the volatility of the portfolio flows and volatility of asset prices in each country? Does the measure help delink its own volatility with the global market sentiment? Does the measure enhance volatility contagion among EAEs?

According to Edison and Reinhart (2001), equity markets continue to be internationally linked, despite the introduction or escalation of capital controls during the Asian financial crisis. In addition, following the introduction of the capital controls, one should expect the

following phenomena in the financial variables 1) a decline in volatility spillover; 2) an 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 variable to domestic ones. This section gives attention to the first two phenomena, as the objective of this section is to examine effects of controls on changes in cross border volatility links.

To assess whether the degree of co-movement across countries in several financial variables is influenced by the introduction of capital control, we examine the structural break in the conditional correlation coefficient derived from DCC GARCH model in previous section[11]. **Following a priori in Edison and Reinhart (2001), one should expect a lower degree of co-movement for the country that has imposed controls during the period in which CFMs are in place.** We are interested in the multilateral aspects of the CFMS, more specifically, the spillover effects of the CFMs from one country to another. One would observe that the analysis pay attention to the results of the CFMs on 1) conditional volatility of country that introduced measures as well as its neighboring countries; and 2) conditional correlation of the country that imposed controls and its neighbor. Analyzing impacts of these two aspects allow us to draw some conclusion. Given that $\rho_0 \neq 0$ is a pair-wise conditional correlation of the stock price/net flows derived from DCC-GARCH model and $\rho_{t|m_i}$ is a conditional correlation after measure i was introduced. Three scenarios should be analyzed.

1) If $0 < \rho_0 < \rho_{t|m_i}$, there is evidence of spillover, volatility contagion after the measure is introduced
2) If $0 < \rho_0 = \rho_{t|m_i}$, two countries are said to be interdependence though the fundamental factors. The introduction of the CFMs does not significantly change the relationships.

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11 Previous studies by Chensavasdijai et.al. (2011) assume linear relationships between equity returns/equity funds flows and measures in the region by employing the case of selected Latin American and Asian countries and evaluate the impact of CFMs in one country on the level of equity returns and equity funds flows of other countries by linear regression and find mixed results. Edison and Reinhart (2001) studied the impacts of capital controls in Brazil (1999), Malaysia (1998), and Thailand (1997) on financial variables using GARCH test with dummy variables of capital controls and found that only in case of Malaysia that achieve greater interest rates and exchange rate stability after an introduction of capital controls.

3) If $0 < \rho_{t|m_i} < \rho_0$, the introduction of measure dampen the volatility interdependence between two countries.

The first scenario suggests the negative externality arise after a country introduced the CFMs measure. The second suggest that the CFMs do not alter the relationship. The last scenario suggest that the extent of contemporaneous co-movement of asset price returns/net equity flow drops significantly following the introduction of controls. However, one would need to cross check with the conditional volatility for both countries which adopt the measure and the neighboring countries. If control in country A successfully reduces uncertainty in the equity market in own country but instead raise volatility in its neighbors. One would see negative externality from such measure. On the other hand, if the measure raises the volatility in country A, but has no impact on the rest, there is no negative externality and no benefit.

Case	Volatility increase in country instituting the controls	Increase volatility of neighbor countries (Negative Externality)	Co-movement	Benefit to country instituting controls
1	√	√	Increase	×
2	√	×	Decline	×
3	×	√	Decline	√
4	×	×	Inconclusive	√

In addition, one can assess whether the CFMs result in the less contemporaneous movement of the home country equity price/flow with international variables, especially the global investor sentiment (VIX) index[12] . This can be done through calculating the conditional correlation of the equity price/flows with the VIX index, and assess whether there is significant structural shift after the CFMs measure.

The capital control episodes analyzed in this paper are listed in table 3 (which is a summary of table 2). These are recent examples of Emerging Asian countries resorting to capital controls during periods of market stress. Provisionally, possible usefulness of capital controls

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

is a means to buy time during crisis periods. The frequency of the financial indicators we analyzed is daily.

Table 3 Summary of CFMs measure

Date	Country
10 Nov 09	**Taiwan -** barred NR access to time deposit accounts
09 Dec 09	**India -** reinstate interest rates cap on external borrowing
13 Jun 10	**Korea** - capped bank's FX forward positions.
16 Jun 10	**Indonesia -** Minimum holding period
12 Oct 10	**Thailand** - withholding tax
9 Nov 10	**Taiwan-** restrict NR investment in portfolio markets
18 Nov 10	**Korea** -- withholding tax
19 Dec 10	**Korea** –banks' levy on non-deposit FC liabilities
30 Dec 10	**Taiwan**–raise RR on NR local currency account **Indonesia -**raise RR on FC account and limit on bank's ST foreign borrowing

The test for structural break is the regression based test using dummy variable for capital controls. The term $dummy_c$ is a dummy variable that takes on the value of 1 during the control period and 0 otherwise. The announcement date was selected instead of the official active date to address that some capital control measures have been anticipated by financial markets. x_i are the domestic and global market conditions (control variables[13]). Global market conditions include global risk aversion, which is proxied by the volatility in the S&P 500 index (VIX index). Domestic conditions include domestic policy rates and sovereign risks.

3.3 Estimation results

The impact of CFMs announcements on neighbouring countries can be summarised as follows. **First**, the results generally suggest that the introduction of the capital controls associate with a decline in the volatility spillover of the stock price. However, the results are mixed in case of the net foreign equity flows. In most cases, the results suggest that capital controls fail to reduce international interdependence among equity markets[14].

13 To partly separate impacts of the intensification or introduction of capital controls and of the financial crisis events we use the control variables (read p 535 stopping hot money)

14 The result is similar to Edison and Reinhart (2001), which found the capital controls fail to reduce international interdependence among currencies, equity markets and interest rates for Brazil and Thailand during the Asian Financial Crisis in 1997.

Second, there are evidences of structural breaks in both the conditional volatility and conditional correlation around the introduction of controls. In most cases, the measure results in greater co-movement in the net equity flow into countries in the region.

Lastly, there is less contemporaneous movement of the flows with international variables, especially the VIX index suggesting a weaker influence from foreign variable to domestic ones.

Capital controls and policy interventions in foreign exchange market can be used only in short term (regarding as the first line of defense). This also supports the argument that if the drivers of capital flows are mainly found at home (i.e. the pull factor is stronger), such policies may be misguided (Fratzscher[15] 2011). In addition, think about the case of negative externalities. Even though many countries in the region could tightly control their capital account, but some other countries liberalized it. The crisis could still create contagion among countries in the region through the worsening sentiment. The following analysis presents impacts of each CFMs measures on the equity markets.

Stock price

Conditional correlation increases significantly in all pairs of countries after an introduction of all CFMs measures in this study. This suggests that the volatility of equity prices in each country in EAEs is more connected after CFMs measures. We next examine behavior of conditional volatility of both the country that introduce measure and its neighboring countries. The results show that the volatility of stock return decline significantly in all countries, except Singapore, every time the CFMs was introduced. This reflects that equity market is calmer every time after the measures are introduced, both within home country and its neighbor. In case of Singapore, the volatility of stock returns is not sensitive to all the CFMs measured introduced by its neighbor. This is partly because the size of market is large and more group of participants.

Net foreign flows

As majority of the CFMs introduced aims to slow down the volatility of the short term flows, it is also useful to examine their impacts on the second moments of the equity flows. The

15 "Push factors versus pull factors as drivers of global capital flows", Marcel Fratzscher 23 August 2011

resulting conditional correlations vary case by case and are presented sequentially as follows;

India: **reinstating interest rates cap on external borrowing, 9th December 2009**

The objective of the measure is to limit private access to foreign credit and prevent high cost of borrowing. The plots of conditional variance of the equity flows into India are presented in appendix figure 4A, the red vertical line on the left hand side of the figure illustrates the time around the first measure was introduced. This measure does not change conditional variance of the flows into India's equity markets (appendix figure 4A), nor does significantly alter the correlation coefficients with other countries (appendix figure 5A-5F). It is likely that foreign investors regard it as prudential measures. In the analysis below, one would find that some other measure could have impacts on the flows such as Taiwan's measure on the restriction of non-resident investment in portfolio markets, which signals government's less supportive of foreign portfolio flows.

Thailand: **reinstate 15% withholding tax on capital gains for foreign investors into bonds market, 12th October 2010.**

The measure was introduced to slow inflows into bonds market, which could add the appreciation pressure to Thai baht. The conditional variance of net flows into Thailand decline significantly after the measure, as illustrated in appendix figure 4F. The results are in line with Forbes et al. (2011) which found that the tax on bonds could have significant effects on foreign investments in equity. *"..The primary impact of capital controls is not the direct cost to investors, but instead the signaling effect of a government that is less supportive of foreign portfolio flows..."* However, the impact of the measure does not last long, the net foreign equity flows shot up again and reached the peak during early 2011 due to better investors' sentiment. The conditional volatility of the flows increases by about four times.

The announcement of the measure generates negative impacts on its neighbour, as there is negative spill over to Taiwan. Conditional variance of the equity flows into Taiwan shot up after the announcement of Thai's measure (appendix figure 8B). The conditional correlations between the two countries decline due to the divergence in the conditional variance between the two.

The conditional correlation between the net equity flows into Thailand and the VIX index exhibit significant declining relationship (appendix figure 10B). The VIX index increase during the time the measure was introduced, suggesting the worse global investor sentiment. One would observe that the volatility of the flows into Thailand decline regardless of the change in market sentiment, suggesting that the measure reduce the market sensitivity of equity flows into Thailand. On contrary, there was a large equity flows into Taiwan even with the poor market sentiment, suggesting that the hot money temporarily diverted away from Thailand to Taiwan.

Indonesia*: introduced 2 CFMs measures during 2009-2010*

1) Minimum holding period on central bank bill, 16th June 2010
2) Raising reserve requirement on foreign currency account and limit on bank's short term foreign borrowing, 30th December 2010.

The first measure aims to limit volatility of flows into central bank's bill. The red vertical line on the left hand side of appendix figure 4E illustrates the time around the first measure was introduced. The conditional variance of the net equity flows into the country exhibit a significant structural upward shift. It is likely that the hot money diverted from bonds to equity markets. In addition, the conditional variance of net equity flows into Taiwan temporarily increases after the measure suggesting the transmission of shocks from Indonesia to Taiwan (appendix figure 8A). With the negative externalities of Indonesia's (16th Jun 2010) and Thailand's (12th Oct 2010) measures to deter the portfolio flows; Taiwan introduced a measure to restrict non-resident investment in portfolio markets a month later (9th Nov 2010).

The objective of the second measure in Indonesia is to reduce bank's incentive to intermediate the short term inflows. The measure was illustrated by the second vertical line with the label ID in appendix figure 4E. The announcement of the measure was at the same date as Taiwan's measure for raising reserve requirement on non-resident local currency account. The measure is found to have no significant impact on the volatility of net foreign equity flows into the country and its neighbour (appendix figure 5C, 6B, 7A, 8A-8D). In addition, it does not significantly change the conditional correlation coefficients between Indonesia and its entire neighbour (appendix figure 5C, 6B, 7A, 8A-8D), suggesting that there is

no negative externality on its neighbours. The co-movement of flows into Indonesia and the VIX index does not significantly change either (appendix figure 9C).

Taiwan*: introduced 3 CFMs measures during 2009-2010*

1) Barred NR access to time deposit account, 10th November 2009

2) Restrict non-resident investment in portfolio markets, 9th November 2010

3) Raising reserve requirement on NR local currency account, 30th December 2010.

The objective of the first measure is to reduce the volatility of speculative flows, as the time deposit account is the vehicle for carry trade, and to reduce foreign investors' access to government bonds. The red vertical line of the left hand side of appendix figure 4D illustrates the time around the first measure was introduced. After the measure, the volatility of the net non-resident flows into Taiwan stock market remains high, suggesting that the measure could not curb the volatility in Taiwan equity market. In facts, there was a large capital inflow into Taiwan equity markets right after the measure was announced. Thus, the controls on deposit account could instead divert the funds away from the original vehicle for carry trade into the equity market.

In addition, the conditional correlation between the flows into Taiwan and the VIX index decline significantly (appendix figure 8D), due to lower VIX index and higher volatility in Taiwan equity market. The declining VIX index suggests a better global investment sentiment and higher risk appetite. This reflects that the measure could not reduce the influence of external market pressure on the capital flows into the country[16].

Taiwan's second CFMs measure (illustrated by the second vertical line with the label TW in Appendix figure 4D) restricted the offshore funds from investing more than 30 percent of their portfolio into money market products and government debt with maturity less than a year. The last measure (illustrated by the third vertical line with the label TW in Appendix figure 4D) raises reserve requirement on NR local currency account in order to reduce bank's incentive to intermediate short term inflows. From the test of the structural shift, the second and third measures reduce the conditional volatility in the flows. These two measures also reduce the conditional correlations with the VIX index (appendix figure 10B),

16 The magnitude of the correlation coefficient increases. The negative correlation coefficient shows that when the VIX index decline (higher risk appetite), the variance of the net flows into Taiwan increase.

suggesting that the measure successfully curb the volatility of flows into the equity markets as well as reduce influence of external market pressure on the capital flows into the country. However, the impact of the third measure does not last long. The volatility of the flows bounced back around March 2012. One can thus conclude that the CFMs can temporarily reduce the volatility of the flows, overall, the declining trend of the volatility was observed.

The evidence of negative externalities was found in case of Taiwan's measure on the restriction of non-resident investment in portfolio markets. Although the measure curbs the volatility of the flows into Taiwan, the conditional variance in Korea increases significantly after the introduction of Taiwan's measure (see appendix figure 6B). This suggests that the measures benefit to Taiwan but generate side effects to Korea. In addition, the time series plots of the conditional correlations of the equity flows between these two countries exhibits a temporary drop. With the sustained pressure, the measure in one country could prompt other countries to follow suit. A week later, Korea revived a 14% withholding tax on foreign holding of government bonds and securities (see CFMs time line in figure 5). In the environment of volatile capital flows, countries should understand that acting solely in their own self interest is no longer a viable and sustainable solution. The volatility of capital flows into both Taiwan and Korea shot up later on with the volatile global investors' risk appetite.

Up to this point, one would notice that initially, the measures on portfolio flows in Indonesia and Thailand created negative externality to Taiwan. As a result, Taiwan introduces similar measure to curb volatility in the portfolio flows. Even though the measure successfully reduces volatility in Taiwan, one saw evidence of externalities to Korea. So Korea decided to introduce the measure on portfolio.

***Korea**: introduced 3 CFMs measures during 2009-2010*

1) Capped on bank's FX forward positions, 13 June 2010
2) Revived a 14% withholding tax on foreign holding of government bonds, 18th November 2010
3) Bank's levy on non deposit foreign currency liabilities, 19th December 2010

The first measure aims to limit commercial banks' access to foreign credit. It temporarily reduces the variance. The objective of the second measure is to slow inflow into government bond and central bank security markets. The measure was introduced when the

volatility of net equity flows into Korea reached the peak. The conditional volatility declined significantly, suggesting that the measure would deliver the result it intended to.

We saw that these two countries experience similar problems and introduce similar measure at the close times frames. One might imagine what would happen if all countries introduce the same measure. The above results are consistent with the previous literature that assesses the multilateral effects of capital controls in Brazil by analyzing how capital controls affect country allocations and flows in investor portfolios using the dataset from Emerging Portfolio Fund Research (EPFR) (Forbes, et al., 2011). In their work, the **capital control measure imposing on one type of asset could have significant impact on the flows to other types of assets**. For instance, the Brazil's tax measure on bond market could have significant impact on foreign investment in equity market. Their paper suggests that the primary impact of capital controls is the **signalling effect** of a less supportive of foreign portfolio flows, rather than the direct cost to investors. In addition, their paper found spill-over effects of Brazil's capital controls on portfolio allocation of other countries. When Brazil increases its capital control, investors increase their portfolio allocations to other countries in Latin America, especially that have fewer restrictions on capital flows, that are large shares of the benchmark and/or are closely linked to China through commodity dependence and trade. The Brazil's measure also caused investors to reduce their portfolio allocations to countries that have a higher risk of implementing a new control.

In conclusion, this paper found that although capital controls may have reduced the risks of bubbles is asset prices; this could occur at the expenses of other countries. If capital control shifts vulnerability from one country to another, this could have been the spill-over effect. If countries in EAEs simultaneously adopted controls as part of a policy toolkit, the spill-over effect could be substantial. The international coordination for the use of capital controls should be supported to prevent the occurrence of negative externality. **However, the CFMS measure analysed so far in this paper has no multilateral effect as the spill-over are extremely heterogeneous and depend on country characteristic.**

How would coordination help?

In order to prevent the massive surge and withdrawal of capital flows, many countries in Asia introduced the CFMs a tool to handle this. This section argues that country should aware that acting solely for own self interest may not be a viable/sustainable solution.

Prove

1. Saw doing the similar thing with similar pressure
2. One country measure is not sustainable- measure could temporarily curb volatility. (from figures, the volatility decline after measure but bounced back again afterward)
3. Negative externality
   (raise volatility in other countries.)

The above shows policy inconsistency, temporality of the effect and some negative externality, the coordination would help in several ways such as

Many recommend the policy response to the booming capital flows by focusing on making domestic economies more resilient by improving institutions, deepening financial markets and enhancing macroeconomic and prudential policies. However, international cooperation is needed:

1. Insufficiency of individual emerging economies' action (such as Capital controls, Prudential measures, FX intervention-coordination failure)
2. Increasing trade and financial integration within the region (share of with-in Asia final demand is increasing)
3. Fragmentation of production

Part 4 Importance of regional cooperation in mitigating volatile capital flows/Choices of regional co-operations: Pros and Cons

We want intra-regional FX stability and inter-regional FX flexibility *(but we observe an opposite situation at the moment)*

1. Dialogue
   (USD liquidity provider through swap line, Cross border collateral, policy coordination, AMRO, CMIM)
2. Parallel currencies
3. Monetary Union

Part 5 Conclusion

During the calm period, the results generally indicate strong evidence of volatility co-movements across countries, suggest the interdependence and linkage. However, the EAEs were also subjected to the volatility contagion during the crisis upheaval.

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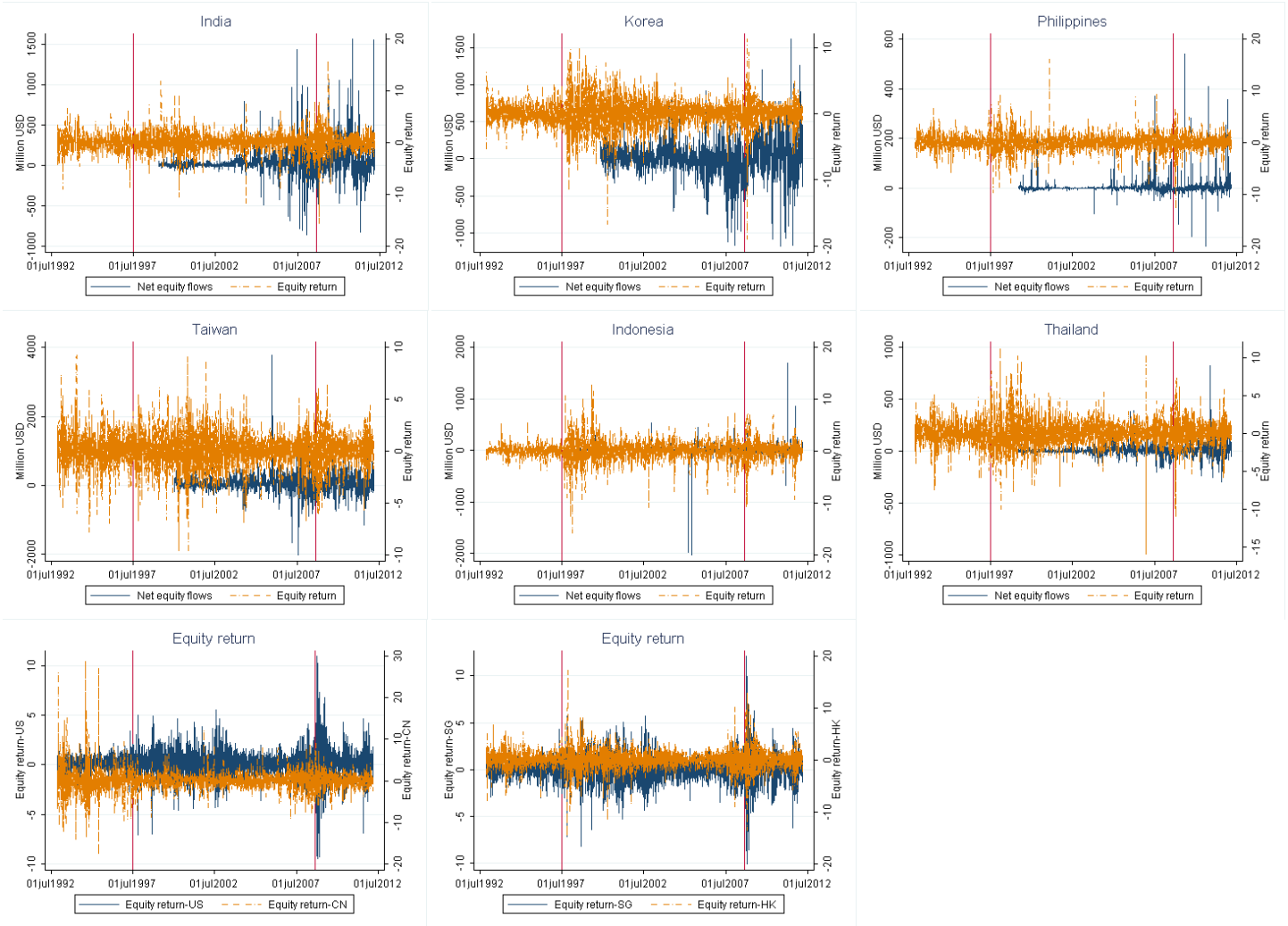
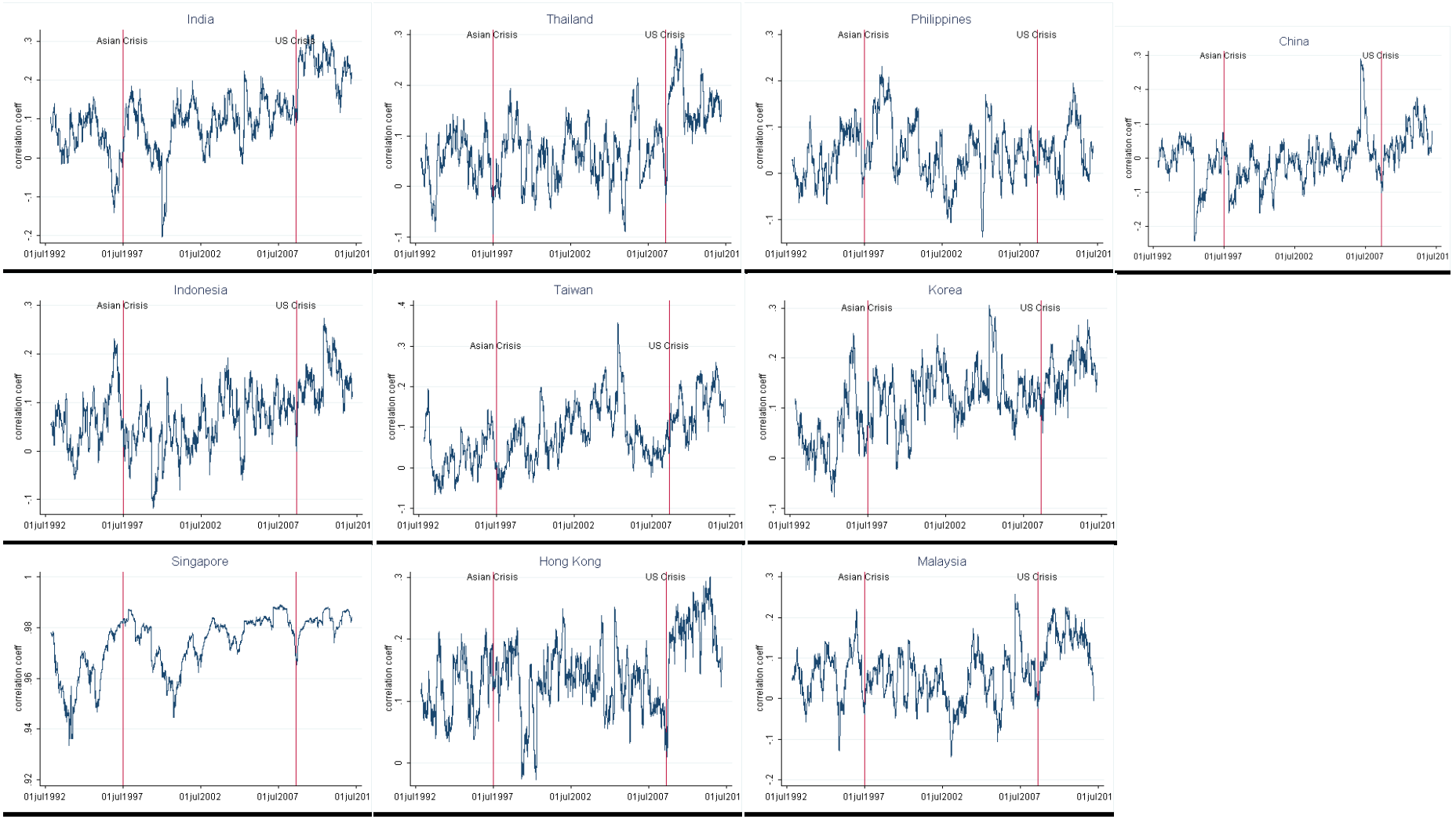
Appendix Figure 1: Time series plots of net foreign equity flows and the daily return on equity index (%).

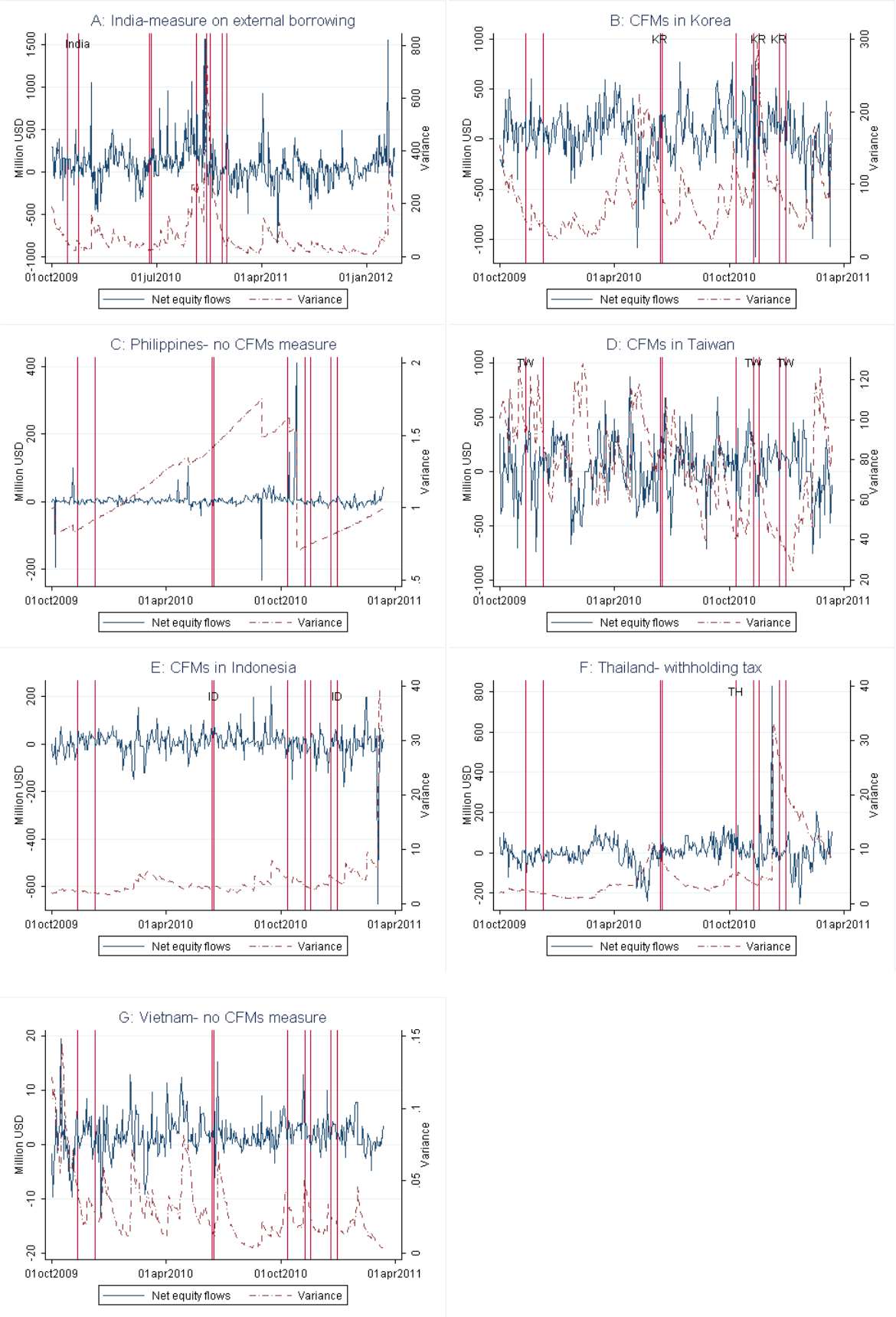


Appendix Figure 2: Correlation coefficients of individual country's stock prices vis-à-vis US stock price (US is crisis originator in 2008).

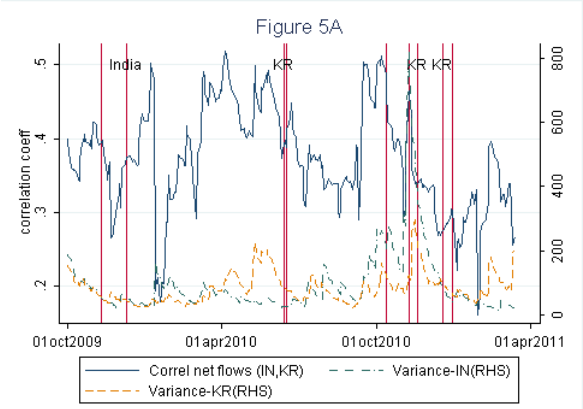


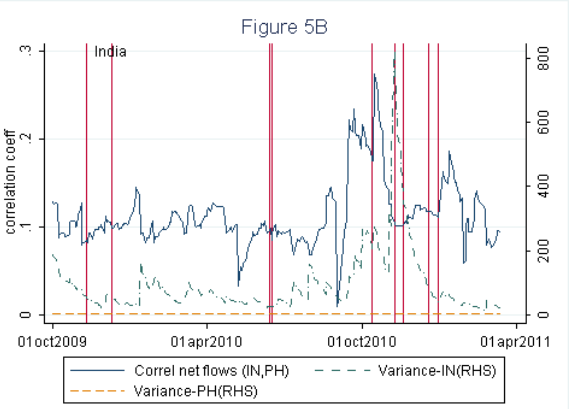
Appendix Figure 3: Correlation coefficients of each country's stock prices vis-à-vis Thai stock price (Thailand is crisis originator in 1997).

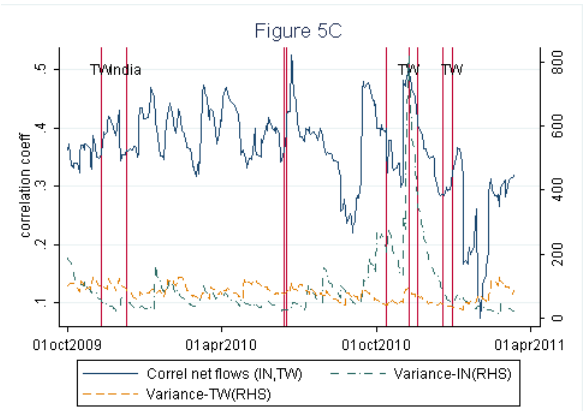
Appendix Figure 4: Plots of net foreign equity flows against its variance

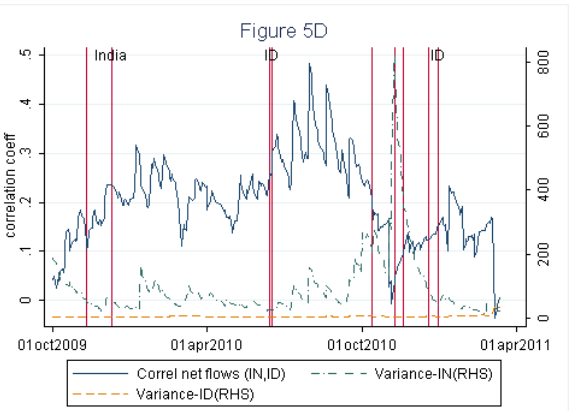


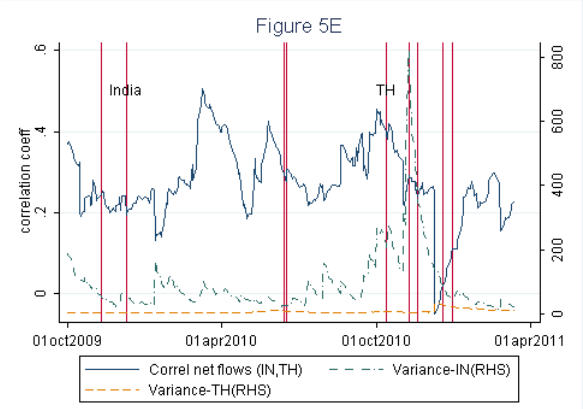
Appendix Figure 5: Conditional correlations of net equity flows-*India* versus others

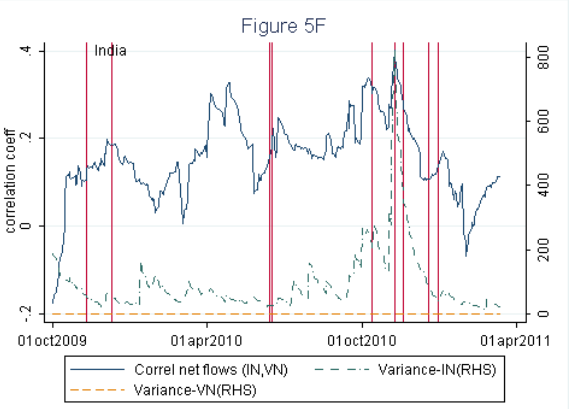


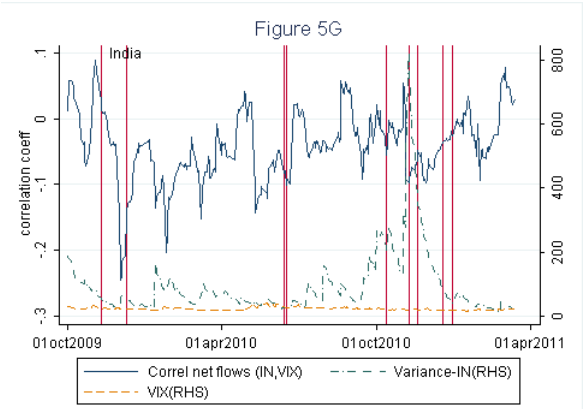




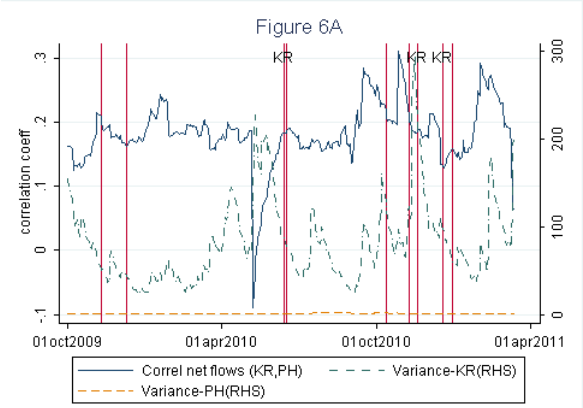


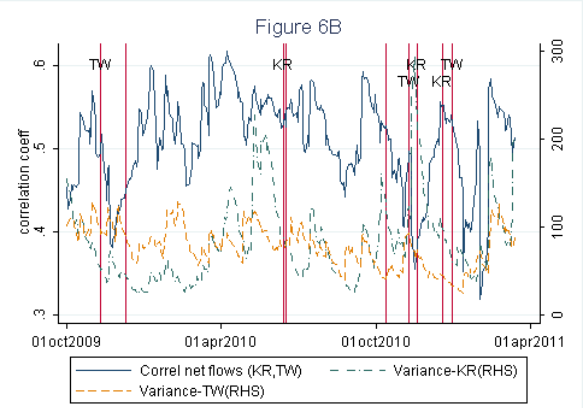


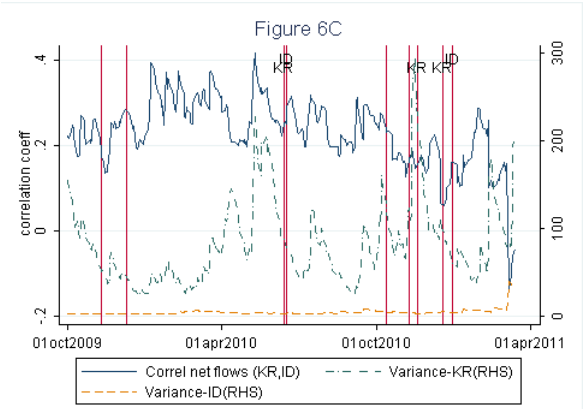


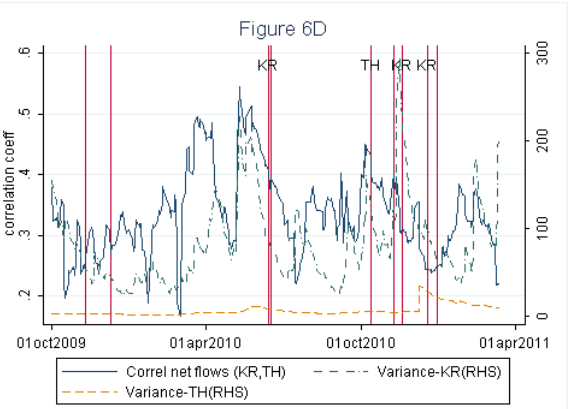


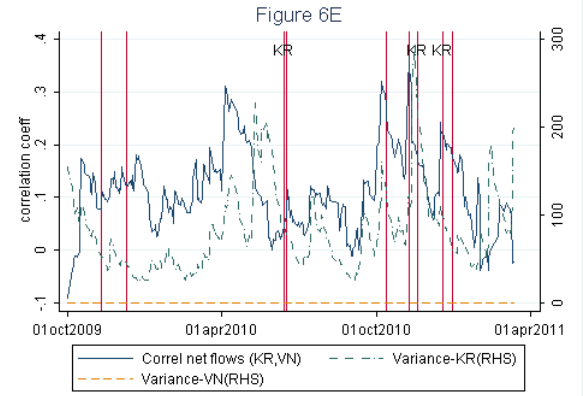
Appendix Figure 6: Conditional correlations of net equity flows-*Korea* versus others

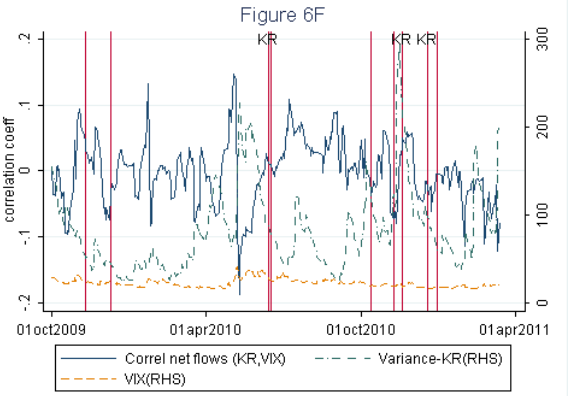




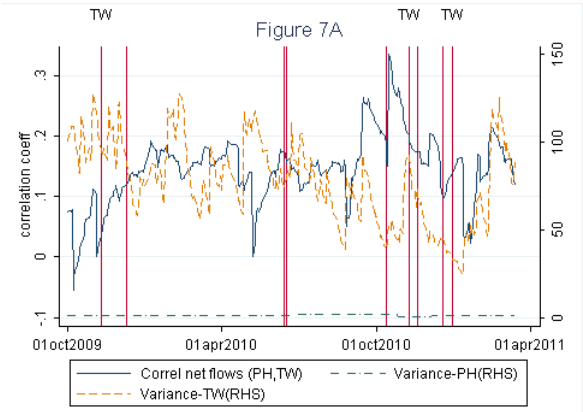


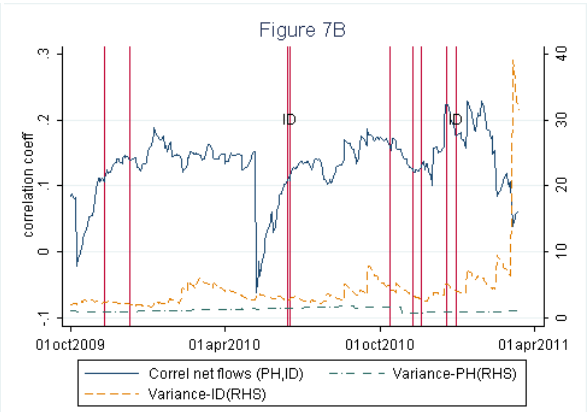


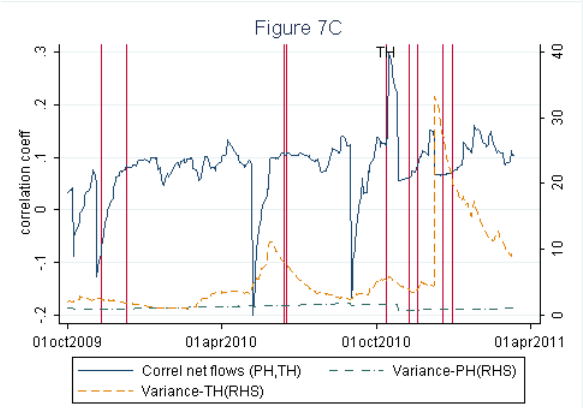


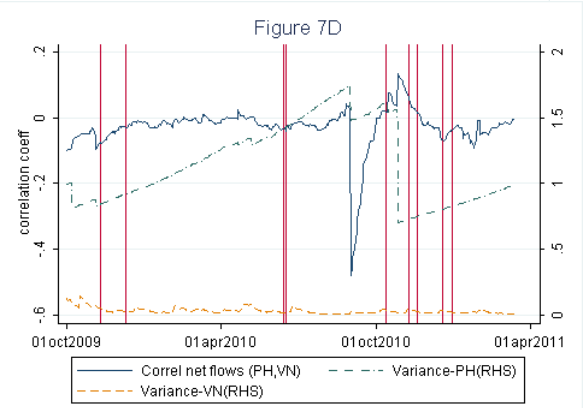


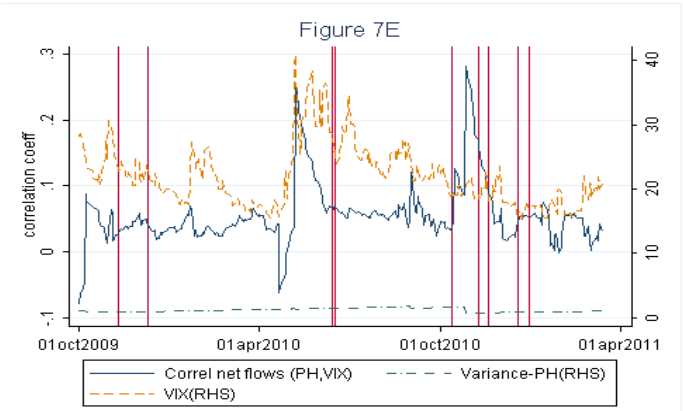
Appendix Figure 7: Conditional correlations of net equity flows- *Philippines* vs others



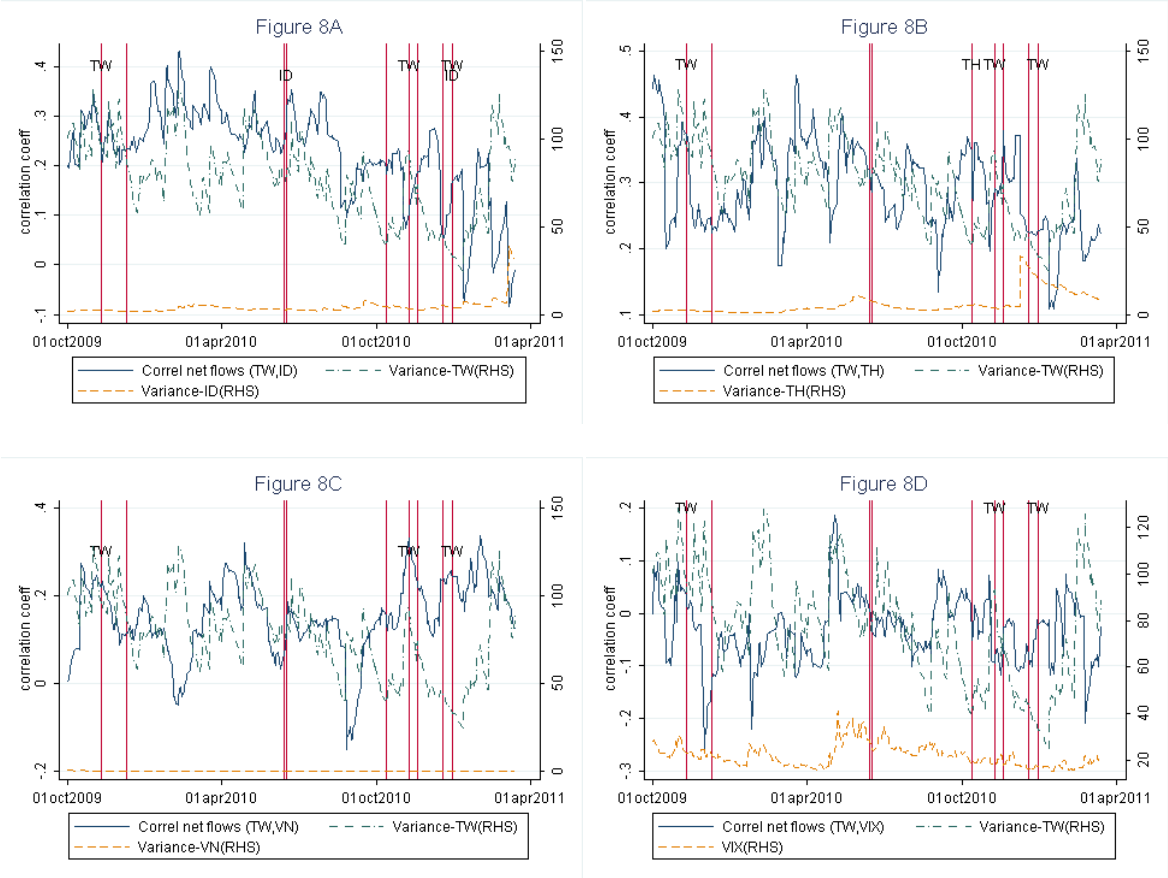




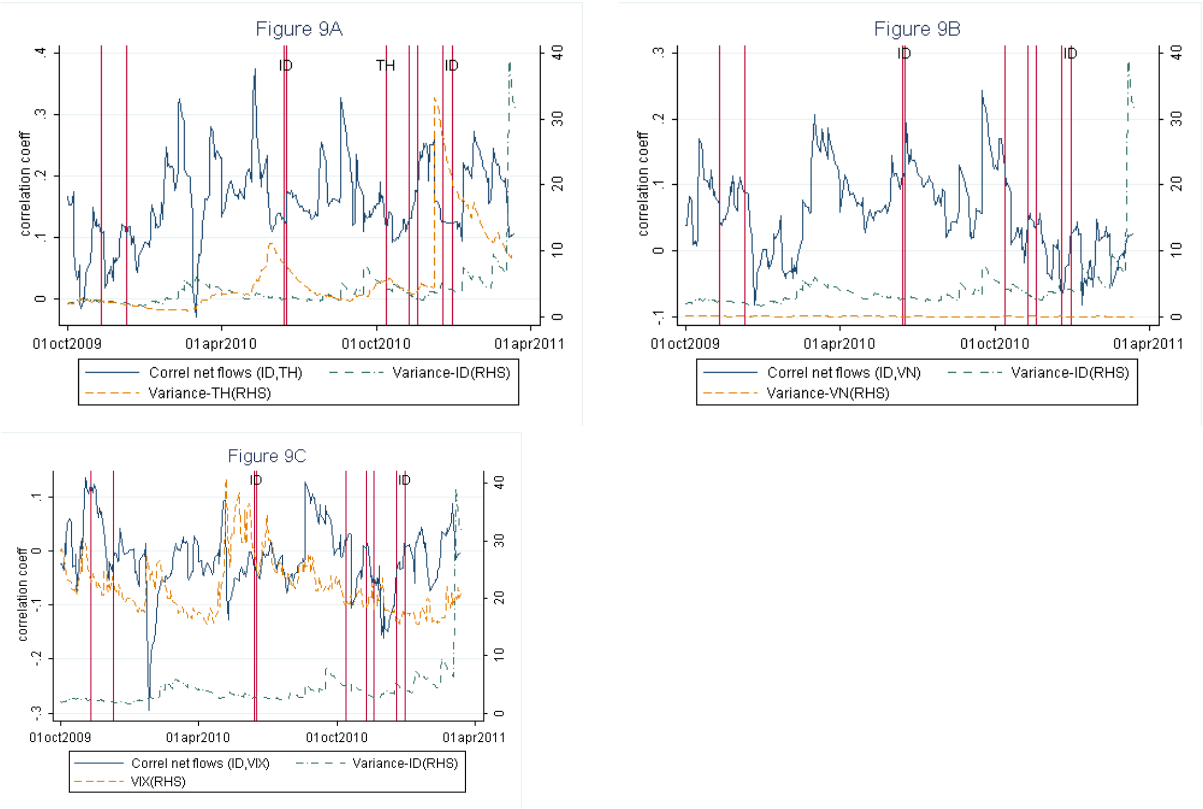




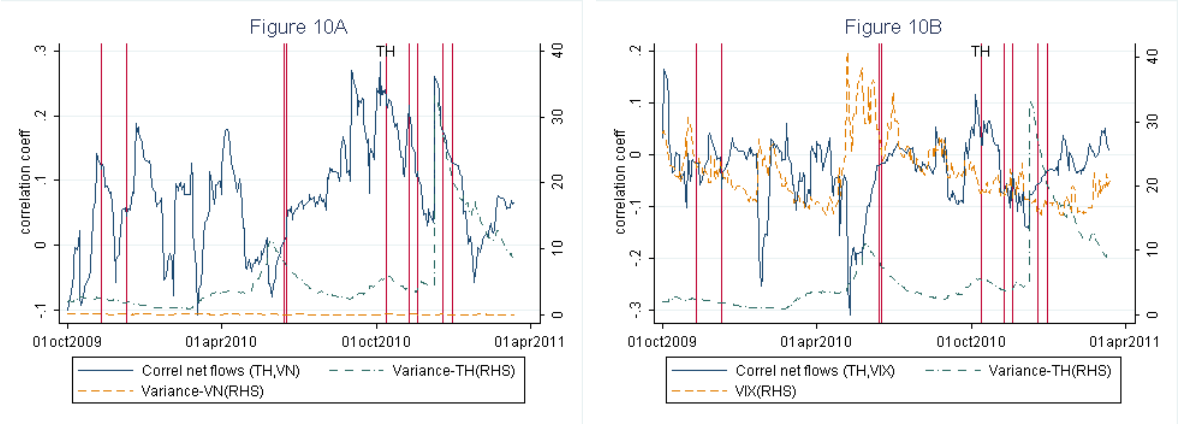
Appendix Figure 8: Conditional correlations-*Taiwan* versus others



Appendix Figure 9: Conditional correlations of net equity flows- *Indonesia* vs others



Appendix Figure 10: Conditional correlations of net equity flows- *Thailand* vs others



Appendix Figure 11: Conditional correlations of net equity flows- *Vietnam* vs VIX