Winner of the *Journal of Investment Consulting*'s 2014 Academic Paper Competition

Foreign Investors in Emerging Equity Markets: Currency Effect Perspective

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Abstract
This paper takes a perspective from foreign exchange (FX) to investigate the daily trading behavior and price impact of foreign investors in six Asian emerging equity markets over the past two decades. It exploits the unsolved interrelationship between capital flows and equity returns, and it also explores a possible role of FX and provides several new findings. First, flows chase domestic equity returns but not currency returns. Second, flows have an impact on FX returns as well as equity returns, and both impacts are more than temporary. When currency effects are washed out, the equity effects either become insignificant or are substantially reduced in magnitude. Finally, both past returns and volatility in the global equity/FX market affect flows. Our findings challenge the literature, which neglects FX on this topic, and provide new insights on the dynamics of flows, FX, and equity market.

Introduction

"… there are important, yet not well understood, dynamic relationships between international equity and currency markets and these are driven by information spillover via the mechanism of currency order flow." (Francis et al. 2006, p219)

The seminal works by Brennan and Cao (1997) and Griffin et al. (2004) have established the theoretical frameworks to study the interrelationship between foreign investment flows and local equity returns. These frameworks have since been used as a foundation for empirical research concerning the effects of foreign capital inflows on equity returns in emerging markets (Froot et al. 2001; Bekaert et al. 2002; Richards 2005). These papers differ in many ways, but they share a common element: All treat foreign investment like domestic investment and ignore the role of currency risk by measuring all returns in U.S. dollars (Bohn and Tesar 1996; Froot et al. 2001; Bekaert et al. 2002) or pay little attention to the role of exchange rate during the process (Brennan and Cao 1997; Griffin et al. 2004; Richards 2005). As pointed out by Hau and Rey (2006), home and foreign investors in these frameworks are separated by information asymmetries (Brennan and Cao 1997) or by exogenous differences in return expectations (Griffin et al. 2004) instead of an exchange rate (FX). Neglecting FX may appear to be innocuous, but such inattention may result in missing the role of FX when capital flows enter/leave local markets; this process is under research and gathering attention (e.g., Francis et al. 2006). For instance, to the extent that exchange rate changes are contemporaneously correlated with equity market increases, a positive relationship between local equity returns and inflows could simply be a proxy for a currency effect (Griffin et al. 2004). Inspired by Hau and Rey (2004, 2006), we assume that foreign investors are separated from the local market by an exchange rate and we check whether/how FX plays a role in the interaction between capital flows and equity returns. The goal of this paper is to explore the dynamics of capital inflows, currency returns,[1] and equity returns by introducing currency returns to the existing framework and investigating its relationship with other economic variables separately.

The vital structural assumption of this paper is incomplete FX risk hedging. In a completely symmetric two-country model with equal market capitalizations, foreign investors can simply swap and eliminate FX risk by trading it with domestic investors holding the reciprocal risk, which may cause domestic and international investment problems alike (Hau and Rey 2006). But market completeness represents a highly counterfactual benchmark and is at odds with current evidence on extremely low hedge ratios for foreign equity investment. Surveys of investors suggest that although international bond positions may be hedged, international equity positions typically are unhedged (e.g., Levich et al. 1999 report that only 8 percent of international equity positions are hedged), possibly because a bond's periodic coupon payments and final payment are much better defined than equity. This is true in national statistics but also at the level of individual equities (Curcuru et al. 2014). The typical foreign equity investor holds currency return and local equity return risk as a bundle.

This paper contributes to the study of foreign flows to emerging markets (EMs) in two ways. First, we use a high-frequency, long-span, broad-covered dataset with precise actual trading dates to tackle the traditional but still open questions in this area. For instance, the question of whether foreigners pursue a return-chasing or a portfolio-rebalancing strategy with regard to domestic equity returns is still under debate (e.g., Curcuru et al. 2011). Furthermore, there is limited evidence as to whether foreign investors have an impact on the domestic equity returns, and if there is an impact, whether the impact is temporary or permanent (e.g., Froot and Ramadorai 2008). Finally, since it has been argued that foreign equity flows into emerging markets are substantially affected by stock returns in mature markets (Griffin et al. 2004; Richards 2005), it is natural to question whether foreign flows also are affected by volatility in the mature stock market and whether returns or volatility is a better explanatory variable.

The paper's second, and more important, contribution is to answer questions regarding the role of FX in the process in which foreign investment affects local equity markets, which are rarely mentioned in the existing literature. First, since it is suggested that in practice foreign investors hedge only a minor proportion of their FX exposure (e.g. Hau and Rey 2006), it is natural to conjecture that fluctuations in FX also may impact foreign equity flows. If so, do foreign equity flows pursue a portfolio-rebalancing strategy regarding currency returns (Hau and Rey 2004, 2006) or a return-chasing strategy? Second, given the growing literature showing over-short horizons' exchange rates, changes could be explained by order flows (Evans and Lyons 2002a,b,c). Might foreign equity flows also cause FX fluctuations when they enter/leave local equity markets, affecting the decisions of both investors and policy-makers? If so, we want to know whether the impact is temporary or permanent, and we also want to quantify the magnitude of the impact of foreign investors on local equity returns and currency returns, respectively. Furthermore, since it has been argued that foreign equity flows into emerging markets are substantially affected by external stock markets (Griffin et al. 2004; Richards 2005), it is natural to question whether foreign flows also are affected by external FX markets and whether equity or FX is a better explanatory variable.

To the best of our knowledge, two comprehensive studies have been completed on the interrelationship between foreign flows and local stock markets using daily data.

Froot et al. (2001) use proprietary data from State Street Bank and Trust over the period August 1, 1994–December 31, 1998, for forty-four countries. Froot et al. (2001) find that foreign investors follow a positive trading strategy and that daily equity inflows have a positive forecasting power for future equity returns in emerging markets. This research has many strengths, but its data are only a partial measure of the flows of foreign investors as related to the trades of only one particular custodian; in addition, the trade dates are inferred from contractual settlement dates according to settlement conventions in each country instead of actual trade dates (Richards 2005). Like many other papers, because the equity returns are measured in U.S. dollars in this paper, Froot et al. (2001) may overestimate the magnitude of the effects of foreign flows on local equity markets by partially or entirely mistaking the effects of flows on foreign exchanges (currency effects) as the effects of flows on equity returns (equity effects).

Richards (2005) analyzes precise daily data for the actual trades of all foreign investors from January 1999 to September 2002 in six Asian equity markets. Richards (2005) finds a stronger positive correlation between the net purchases of foreigners in a market and the same-day returns in that market. Nevertheless, these and other findings from a shorter period a decade ago need updating because the interrelationship between flows and equity returns may have changed since then. More importantly, most of the existing literature has dealt only with equity markets, leaving unexplored the dynamics of FX changes and its interaction with equity markets as well as net equity inflows.

This paper fills the gap by providing fresh evidence on the relationship between daily net equity inflows and FX markets as well as on the relationship between inflows and local equity markets, conditional or unconditional on equity inflows. To our knowledge, this is the first paper to explore the role of FX in studying the relationship between foreign equity investment and local equity markets. Also, the data presented here are relatively high-frequency and cover a long sample period including crisis and non-crisis periods.

Despite widespread strongly held views, surprisingly little information or empirical evidence exists regarding these questions. Indeed, the existing literature arises from either aggregate low-frequency (quarterly/monthly) bilateral equity flow data over roughly one decade (e.g., Bohn and Tesar 1996; Brennan and Cao 1997; Bekaert et al. 2002), or high-frequency (daily/weekly) data over a short sample period of two or three years (e.g., Choe et al. 1999, 2005; Froot et al. 2001; Griffin et al. 2004; Richards 2005; Dvorak 2005; Wang 2007; Froot and Ramadorai 2008). The low-frequency property introduces poor statistical estimate precision and makes it nearly impossible to explore the short-term interactions between flows and returns. For instance, Bekaert et al. (2002) find barely significant predictive relationships between monthly flows and returns in country-specific analyses. However, the short-sample property may impair the research no less than low frequency, because it may miss long-term patterns and reversals. As clearly pointed out in Froot et al. (2001, 157), "If prices shoot up in response to flows, such effects are difficult to discern in short time series samples of short duration, such as the one used in this paper." Similarly, Richards (2005, 26) explicitly noted: "One possible caveat about these results is that they might be specific to the particular sample period employed, namely the sharp rise and subsequent collapse of global equity markets over 1999–2002. Unfortunately, it is not yet possible to test for this using out-of-sample data."

Following Richards (2005), we employ the precise daily data on aggregated foreign net flows into six representative Asian equity markets. The datasets span from various starting dates in the 1990s to the end of 2013 and are about three–six times the size of daily datasets used in other literature such as Froot et al. (2001) or Richards (2005); this provides an opportunity to avoid the short-sample caveats of those earlier studies. To offset the wealth growth effects in such a long time period, flows were scaled by the equity market capitalization of each respective market. Because the data include all the recorded trades of foreign investors from the stock exchanges, it has broader coverage than data covering only one group of investors—for example, U.S. investors in studies using U.S. Treasury data (e.g., Brennan and Cao 1997; Bekaert et al. 2002), or mutual funds (e.g., Borensztein and Gelos 2003) or customers of a particular custodian (Froot et al. 2001, Froot and Ramadorai 2008). The combination of advantages of previous data provides us an ideal opportunity to revisit previous literature and ask new questions.

The main tool of analysis in this paper is a vector-autoregressive (VAR) framework as in Froot et al. (2001), but with a number of differences. On the one hand, we use equity local returns (ELR, or equity in local currency) instead of equity dollar returns to measure the exact effects of daily equity flows on local equity returns (Griffin et al. 2004; Richards 2005). On the other hand, we add FX returns as another variable in the traditional bivariate framework, which assists us in separating the currency effects and the equity effects of flows. Additionally, if past capital flows have a permanent (temporary) effect on the equity/FX returns, which can be seen from the impulse response analysis upon the VAR results, it means that the information (price pressure) hypothesis works. Causality tests can be implemented easily upon the VAR results. Additionally, we extend global factors from global stock return in Richards (2005) to global stock volatility and global FX volatility to compare their explanatory power, respectively.

We put our data to work in a number of ways. First, we characterize our data by their persistence. We find that autocorrelations in flows, and to some smaller extent in equity returns, are greater than in currency returns. We also find significant same-day correlations between flows and FX returns, indicating the interrelationship between flows and FX returns may be similar to the one between flows and equity returns.

In equity markets, we find that foreigners pursue a return-chasing rather than a portfolio-rebalancing strategy with regard to domestic equity returns. Furthermore, we find that foreign investors have a permanent impact on domestic equity returns. Additionally, foreign flows also are affected by volatility in the mature stock market although returns are still better explanatory variables than volatility.

In currency markets, FX returns have surprisingly little impact on foreign equity flows. That is to say, flows pursue neither a return-chasing strategy nor a portfolio-rebalancing strategy regarding FX returns. Moreover, we find that flows also have caused permanent FX fluctuations, ranging from one-third to one-half of the magnitude of their equity effects. Finally, flows are affected by external FX markets as capital inflows decrease when global FX volatility goes up.

Literature Review

Flows and Equity Returns

This paper mainly relates to two strands of literature, namely studies examining the interrelationship between international capital flows and local equity returns, and studies concerning flows (mainly currency order flows) and currency returns. Historically, many studies have examined the interrelationship between international flows and equity prices using short-span and low-frequency data from emerging markets. For instance, over quarterly intervals, Brennan and Cao (1997) find a positive correlation between flows and contemporaneous (or lagged) returns. Using monthly data, Bohn and Tesar (1996) find evidence that flows are positively correlated with lagged flows, and with contemporaneous and lagged expected returns. Froot et al. (2001) were the first to verify causality by extending the analysis into daily data from 1994 to 1998 with a bivariate VAR method. On the one hand, Froot et al. (2001) find that flows are strongly influenced by past returns, a finding consistent with positive feedback trading or the return-chasing hypothesis. On the other hand, Froot et al. (2001) find small contemporaneous price impacts from flows, followed by substantial impact in weeks and months thereafter. Bekaert et al. (2002) add the world interest rate and local dividend yields to the bivariate set-up in Froot et al. (2001) and find that positive shocks to flows generate short-term price increases that partially persist over longer horizons. Analyzing actual daily trades of all foreign investors in six Asian emerging equity markets from 1999 to 2002, Richards (2005) confirms the positive feedback trading phenomenon but finds a much larger contemporaneous price impact of flows, though most of this is complete within several days. Using weekly data from 1994 to 1998, Froot and Ramadorai (2008) find strong forecasting power of performance in local equity markets from past institutional cross-border portfolio flows but not from closed-end fund flows. Using monthly portfolio holding data of U.S. investors, Curcuru et al. (2011) confirm a positive relationship between portfolio reallocations and future returns but find contradictory evidence regarding the impacts of returns on flows: U.S. investors sell past winners to partially rebalance their portfolios rather than chasing returns in emerging markets. These papers differ in many ways, but they share a common element: All treat foreign investment like domestic investment and ignore the role of currency risk by measuring all of the returns in U.S. dollars (Bohn and Tesar 1996; Froot et al. 2001; Bekaert et al. 2002; Froot and Ramadorai 2008; Curcuru et al. 2011) or pay little attention to the role of exchange rate during the process (Brennan and Cao 1997; Griffin et al. 2004; Richards 2005).

Flows and Currency Returns

A smaller strand of literature concerns flows (mainly currency flows) and FX returns. Traditional models based on macroeconomic fundamentals lead to poor forecasting of exchange rates (Meese and Rogoff 1983; Frankel and Rose 1995; Rapach and Wohar 2002, 2004; Faust et al. 2003; Cheung et al. 2005). Wei and Kim (1997) and Cai et al. (2001) find that currency volatility is better explained by large trader positions than news announcements or fundamentals. Studies on microstructure suggest that exchange rate changes could be well explained by currency order flows (Rime 2001; Evans and Lyons 2002a,b,c; Hau et al. 2002;

Killeen et al. 2006). Using daily proprietary data, Froot and Ramadorai (2005) find that currency flows are related to short-term currency returns but that fundamentals better explain long-term returns.

Net capital flows and order flows are similar in nature, although they are not the same thing. Net capital flows capture the net of foreigners' net purchases from residents and residents' net purchases from foreigners, and order flows are the "net of buyer-initiated and seller-initiated orders" (Evans and Lyons, 2002a). It has been suggested that the transactions of foreigners represent demand shocks and that domestic (individual) investors provide liquidity (Richards 2005), so we conjecture that the capital flows we use in this paper also may have significant impacts upon exchange rates. To the best of our knowledge, the evidence about interrelationship between equity flows and FX returns is very preliminary and mainly about developed markets. For instance, the appreciation of the dollar that coincided with the rise in the U.S. stock market during the early days of the euro suggested that exchange rates would be driven partly by the flow of funds to the stock market (Bailey et al, 2001). Brooks et al. (2004) find a statistically significant association between equity portfolio capital flows and exchange-rate movements in the euro against the U.S. dollar. Within the portfolio-rebalancing framework and conditional on any exogenous equity return and FX shocks, it is plausible that net capital flows and order flows are closely aligned (Hau and Rey 2004). For example, conditional on an exogenous appreciation of her local investment, a foreign investor is likely to initiate the selling of local assets as well as the selling of local currency balances. Hau and Rey (2006) find that net foreign equity flows are positively correlated with a local currency appreciation. However, at least two questions are still unclear: First, to what extent are the equity flows able to move exchange rates with comparison of the magnitude of their impacts on equity returns, and is the movement temporary or permanent? Second, do FX returns have an impact on equity flows or not? Our paper fills these gaps.

Data and Preliminary Data Analysis

Data

Our data consist of net equity inflows, exchange-rate returns, domestic equity returns in local currency in daily frequency for six Asian Emerging Markets (EMs), as well as various global equity returns, global equity volatility, and global FX volatilities.

Following Richards (2005), we obtain daily net purchases of foreigners in six East Asian markets from the exchanges via the exchanges, Bloomberg, and CEIC databases from various starting dates in the 1990s to the end of 2013. The six East Asian equity markets are Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of Thailand (SET), Taiwan Stock Exchange (TWSE), and Kosdaq Stock

Market. The sample size of the six markets is large enough to provide results that are potentially fairly general, yet it is small enough to allow us to present country-by-country results in a way that might not be possible in datasets with a larger number of markets. The first five markets are “main boards”; the sixth, which focuses on Korean start-up and technology-related companies, is a “second board.” We also obtain the daily market capitalization of each local market from Bloomberg and scale the daily net purchases of foreigners by local market capitalization so that the scaled flows we actually use are in percentages. Foreign investors in these markets must register with the local exchange or regulator, and brokers must report the nationality of the buyer and seller in each transaction that occurs. As a result, our data capture the trading of all registered foreign investors. Given the reasons for exclusions in Froot et al. (2001) and Richards (2005), we do not include net purchases by foreigners of American depositary receipts (ADRs) or country funds in foreign markets, or equity futures and other derivatives in the domestic markets. The final samples begin September 9, 1996, for Indonesia (JSX); June 30, 1997, for KSE (Kospi); March 15, 1999, for Korea (Kosdaq) and the Philippines (PSE); January 1, 2001, for Taiwan (TWSE); and January 12, 1997, for Thailand (SET). The ending date for daily analysis is December 30, 2013, for all markets.

Daily exchange rate returns (in percent) are constructed as the “negative log returns” of the daily exchange spot-rate data taken from Bloomberg. The conventional market quotation is the number of local currency per U.S. dollar.

Local equity returns (in percent) are constructed as “log returns” of the main capitalization-weighted index of stocks traded on these markets in local currency. We use the Jakarta Composite, Kospi, Philippine Stock Exchange PSE Composite, Bangkok SET, TWSE/TAIEX, and Kosdaq indexes for the Jakarta Stock Exchange (JSX), Korea Stock Exchange (KSE), Philippine Stock Exchange (PSE), Stock Exchange of Thailand (SET), Taiwan Stock Exchange (TWSE), and Kosdaq Stock Market, respectively. Unlike some of other indexes provided by international providers such as MSCI and S&P/IFC, these indexes are actually the headline indexes used in newswire stories reporting the performance of each market, and they are available to investors on a real-time basis.

Various global equity returns and volatility, together with global FX volatilities in both global FX and equity markets, also have been taken into account. Like Richards (2005), we obtain global equity returns such as the S&P 500, Nasdaq Composite, Philadelphia Semiconductor, MSCI World, and MSCI Emerging Markets Free indexes from DataStream and Bloomberg. Other data from Datastream and Bloomberg used in the study include global equity volatility (VIX) and global implied FX volatility (JPMXVYG7). The VIX is the Chicago Board Options Exchange Market Volatility Index, which is the measure of the implied volatility of

S&P 500 Index options. The JPMXVYG7 is JP Morgan's implied volatility in global currencies through a turnover-weighted index of G7 countries, based on three-month at-the-money forward options, which are designed to measure aggregate risk premiums in global currency markets, to calibrate trading strategies, and to express views on volatility as an asset class. For robustness, we also obtain realized global FX volatility ($fxvol_{it}$) stemming from Menkhoff et al. (2012a,b). More specifically, we calculate the absolute hourly log return for each currency on each hour in our sample, and then average over all currencies available on any given hour and average hourly values up to the daily. The hourly FX data are from the beginning of 2001 to the end of 2013 via www.fxhistoricaldata.com and cover the currencies from the European Union, the United Kingdom, Japan, Switzerland, Canada, Australia, and New Zealand.

Data used in previous literature are neither too short nor in low frequency. Table 1 shows the details of the data in a representative set of literature.

Table 1: Datasets of the Relevant Previous Literature

Table 1 reports the sample markets, sample period, frequency, nature, and source of the data sets used in several previous representative research papers in this area.

Title	Markets	Sample Period	Frequency	Nature	Source
Tesar and Werner (1994)	U.S. Vis-à-vis Canada, Germany, Japan, U.K.	1978:01−1991:03	Quarterly	Bilateral equity flows	Statistics Canada and U.S. Treasury
Tesar and Werner (1995)	U.S. vis-à-vis 4 industrial markets and 15 EMs	1978:01−1991:03	Quarterly	Bilateral equity flows	U.S. Treasury
Bohn and Tesar (1996)	U.S. vis-à-vis 22 industrial and emerging markets	1980−1994	Monthly	Bilateral equity flows	Not specified
Brennan and Cao (1997)	U.S. vis-à-vis 4 industrial markets and 16 EMs	1982:02(1989:01)−1994:04	Quarterly	Bilateral equity flows	U.S. Treasury
Choe et al. (1999)	KSE of South Korea	December 1996 to the end of 1997	Daily	All foreign investors	KSE stock exchange
Froot et al. (2001)	U.S. vis-à-vis 44 industrial and emerging markets	Mid-1994 to 1998	Daily	Customers of a particular custodian	State Street Bank & Trust
Bekaert et al. (2002)	U.S. vis-à-vis 20 emerging markets	In the 1980s and 1990s	Monthly	Bilateral equity flows	U.S. Treasury
Choe et al. (2005)	KSE of South Korea	December 1996 to November 1998	Daily	All foreign investors	KSE stock exchange

Griffin et al.(2004)	9 EMs	1996(1997,1998,1999) to February 23(January 31), 2001	Daily	All foreign investors	Stock exchanges and regulating agencies
Richards (2005)	6 EMs	January(March)1999 to September 2002	Daily	All foreign investors	Stock exchanges and Bloomberg and CEIC
Dvorak (2005)	Indonesia	January 1998 to 2001	Daily	All foreign investors	JSX stock exchange
Wang (2007)	Indonesia and Thailand	January 1996 to May (June)1999	Daily	All foreign investors	JSX stock exchanges
Froot and Ramadorai (2008)	U.S. vis-à-vis 25 industrial and emerging markets	August 12, 1994 to December 24, 1998	Weekly	Customers of a particular custodian	State Street Bank and Trust

Preliminary Data Analysis

Data on properties of the four variables that are the main object of our analysis—foreign net purchase flows (nf_{it}), equity dollar returns (edr_{it}), foreign-exchange returns (fxr_{it}), and equity returns in local currency (elr_{it})—are shown in table 2 for the periods from the various starting dates to the end of 2013.

Table 2: Descriptive Statistics

This table provides descriptive statistics of the four main economic variables—foreign net flows (nf_{it}), equity dollar returns (edr_{it}), FX returns (fxr_{it}), and equity local returns (elr_{it}) in daily frequency—for six equity markets from various starting dates to the end of 2013. Net flows are expressed as percentages of the previous day's market capitalization and all return variables are expressed as the log returns of the closing price from respective indexes. (A) shows the first-order autocorrelations. (B) shows the correlations between net flows and various same-day returns, and correlations between FX returns and equity local returns. (C) shows the cross-correlations between the net purchases of foreigners across different markets. * indicates that the correlation coefficient is significant at the 5-percent level or better.

(A) First-order autocorrelations in foreign net purchase flows (nf), equity dollar returns (edr), foreign-exchange returns (fxr),equity returns in local currency (elr).

	nf	edr	fxr	elr
Indonesia (JSX)	0.1889	0.0784	−0.0210	0.1443
Korea (KSE)	0.4821	0.0777	0.0162	0.0651
Korea (Kosdaq)	0.4206	0.1220	−0.0206	0.1437
Philippines (PSE)	0.1792	0.1436	−0.0294	0.1256
Taiwan (TWSE)	0.5151	0.0706	0.0343	0.0573

Thailand (SET)	0.5637	0.1186	0.1211	0.0753

(B) Correlations among net purchases and same-day returns within each market.

	nf&edr	nf&fxr	nf&elr	edr&fxr	edr&elr	fxr&elr
Indonesia (JSX)	0.2288*	0.0594*	0.2971*	0.7791*	0.7707*	0.2010*
Korea (KSE)	0.2943*	0.1185*	0.3115*	0.6677*	0.9147*	0.3099*
Korea (Kosdaq)	0.1976*	0.0887*	0.1966*	0.5574*	0.9571*	0.2930*
Philippines (PSE)	0.1773*	0.0636*	0.1787*	0.5055*	0.9605*	0.2455*
Taiwan (TWSE)	0.5376*	0.3253*	0.5160*	0.4647*	0.9861*	0.3113*
Thailand (SET)	0.3722*	0.1319*	0.3714*	0.4752*	0.9590*	0.2063*

(C) Correlations between flows into different markets.

	Indonesia (JSX)	Korea (KSE)	Korea (Kosdaq)	Philippines (PSE)	Taiwan (TWSE)	Thailand (SET)
Indonesia (JSX)	1					
Korea (KSE)	0.1813*	1				
Korea (Kosdaq)	0.0483*	0.3767*	1			
Philippines (PSE)	0.1138*	0.0944*	0.0071	1		
Taiwan (TWSE)	0.1771*	0.5028*	0.2980*	0.1130*	1	
Thailand (SET)	0.1581*	0.3390*	0.1622*	0.1745*	0.3767*	1

The data in table 2(A) show substantial positive autocorrelation in daily net inflows (nf_{it}), consistent with Froot et al. (2001) and Richards (2005), with a median autocorrelation of 0.451. Daily returns in these markets are far less autocorrelated, with a median autocorrelation of 0.098, −0.002, and 0.100 for equity dollar returns (edr_{it}), foreign-exchange returns (fxr_{it}), and equity returns in local currency (elr_{it}), respectively. This positive autocorrelation in flows could be due to particular investors establishing positions slowly (perhaps to reduce market impact) or to investors of similar types responding in the same direction—but with different speeds—to new information (Richards 2005).

Each market shows a strong positive same-day correlation between daily net inflows and equity returns, with a median correlation coefficient of 0.261 and 0.304 for nf_{it} and edr_{it} in the first column and for nf_{it} and elr_{it} in the third column, respectively. However, we also find a statistically significant positive same-day correlation between daily net inflows and foreign-exchange returns in every case in the second column, although it is not as strong as the correlations between net inflows and equity returns, with a median correlation coefficient of 0.103. This suggests that there are some unrevealed relationships between capital inflows and exchange rate dynamics, and we will confirm this in the empirical results below. Not surprisingly, we find quite high correlations for edr_{it} and fxr_{it} and for edr_{it} and elr_{it} in the fourth column and the fifth column, as edr_{it} incorporated information from both elr_{it} and fxr_{it}. Astonishingly, the final column shows that for every country there is also a statistically significant positive correlation for fxr_{it} and elr_{it}, with a median correlation coefficient of 0.269, which suggests that common factors may be influencing the dynamics of foreign-exchange returns and equity returns in local currency. Overall, we find strong positive correlation between net inflows and equity returns, like previous literature, but we also find strong correlation between net inflows and foreign-exchange returns, as well as strong correlation between foreign-exchange returns and equity returns in local currency, paving a solid foundation for the further trivariate VAR system that will be used in later sections of this paper.

Econometric Framework

Based on the preliminary evidence about autocorrelations and correlations described above, we employ a VAR system for daily net inflows, foreign-exchange returns, and local equity returns. VARs have been used by Froot et al. (2001), Bekaert et al. (2002), Richards (2005), and others to examine the relationship between inflows and returns in other contexts. Our analysis goes beyond all the existing VARs: We use local currency equity returns and add another exchange-rate return into the system after daily equity inflows but before local currency equity returns.

Inspired by previous literature, we estimate an unrestricted tri-equation system where we cast the joint dynamics of equity inflows (nf_{it}), foreign exchange-rate returns (fxr_{it}), and equity returns in local currency (elr_{it}) for each country as a p^{th}-order Gaussian vector autoregression:

$$\begin{pmatrix} nf_{it} \\ edr_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{edr} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ edr_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{edr} \end{pmatrix} \quad (1)$$

$$\begin{pmatrix} nf_{it} \\ elr_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{elr} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ elr_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{elr} \end{pmatrix} \quad (2)$$

$$\begin{pmatrix} nf_{it} \\ fxr_{it} \\ elr_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{fxr} \\ \alpha_{elr} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) & \phi_{13}(L) \\ \phi_{21}(L) & \phi_{22}(L) & \phi_{23}(L) \\ \phi_{31}(L) & \phi_{32}(L) & \phi_{33}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ fxr_{it-1} \\ elr_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{fxr} \\ \varepsilon_{it}^{elr} \end{pmatrix} \quad (3)$$

The ordering of the variables is as defined above, with net capital inflows always in the first place. Similar to the traditional literature on this issue, such as Froot et al. (2001), Bekaert et al. (2002), Griffin et al. (2004), and Richards (2005), we order return variables after capital flows. We hold no priors about the order of FX returns and equity returns. We report the results of FX returns before equity returns, but we also assure the robustness of our results by ordering FX returns after equity returns and find similar results. Currency returns and equity returns are contemporaneously positively correlated, as seen in previous contents; but we assume that when a foreigner purchases a domestic equity from a resident, he initiates the purchase of foreign exchange first, so it is natural to order currency returns before equity returns. Actually, our net currency flow coincides with the conventional definition of the order flow (net of buyer- over seller-initiated trades). Conversely, if a foreigner sells a domestic equity that he owns to a resident, the sale is also settled in domestic currency and the foreigner then immediately converts the money into his own currency to avoid foreign-exchange risk. In the aggregate, this implies a straightforward correspondence between positive capital inflows into the domestic economy with net domestic currency/equity purchases on the one hand and negative capital inflows and net domestic currency/equity sales on the other hand.

We are mainly interested in the following:

1. the impact of net capital inflows on equity returns to test the price pressure versus permanent impact hypotheses;
2. the effects of past currency returns and past equity returns on flows to test whether capital flows are driven by return-chasing strategy or portfolio-rebalancing strategy, and if capital flows are chasing returns, whether capital flows are chasing equity returns or currency returns or both;
3. the effects of net capital inflows on currency returns to explore a possible role of exchange rate in the process during which foreign equity investment affects local equity markets;
4. and whether external volatilities in mature equity/FX markets affect inflows or not.

Empirical Results

Next we present the empirical results from our multi-variable VAR systems, with all eigenvalues having moduli less than one so that the VARs are stationary. Based on preliminary regressions and tests using the final full VAR systems, the lag length is set at five as in Griffin et al. (2004) and Richards (2005); this makes sense because five trading days form one week and we using daily data to examine weekly effects. We also re-examine all our VAR results with systems containing forty lags as in Froot et al. (2001) and find that our results are essentially unchanged.

Inflows and Local Stock Returns in U.S. dollars

Here we discuss our findings based on using the bivariate VAR system from Froot et al. (2001) with our data. The VAR results are presented in table 3.

Table 3: Vector Autoregression of Flows and Equity Dollar Returns by Country

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows* (nf_{it}) are the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous-day's market capitalization; *EquityDollarReturns* (edr_{it}) are the daily continuously compounded returns on the country stock market index in U.S. dollars; *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator L; and ε_{it}^{nf} and ε_{it}^{edr} are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report *t*-statistics computed using the OLS variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent levels, respectively. For each country the *p*-values of two Granger causality tests are reported. Granger 1: Returns do not Granger-cause flows. Granger 2: Flows do not Granger-cause returns. The results of the VAR equations are as follows:

	Flow equations					
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.135***	0.333***	0.331***	0.105***	0.358***	0.396***
	(8.580)	(20.377)	(19.757)	(6.228)	(16.537)	(23.212)
L2.Flows	0.068***	0.112***	0.075***	0.083***	0.073**	0.090***
	(4.295)	(6.499)	(4.251)	(4.898)	(3.226)	(4.963)
L3.Flows	0.051**	0.064***	0.068***	0.056***	0.057*	0.066***
	(3.193)	(3.732)	(3.866)	(3.350)	(2.505)	(3.645)
L4.Flows	0.067***	0.061***	0.075***	0.054**	0.057*	0.084***
	(4.231)	(3.546)	(4.263)	(3.190)	(2.549)	(4.639)
L5.Flows	0.033*	0.076***	0.072***	0.043**	0.052*	0.041**
	(2.130)	(4.880)	(4.383)	(2.602)	(2.574)	(2.618)
L.EquityDollarReturns	0.001***	0.003***	0.002***	0.001***	0.003***	0.004***
	(7.057)	(16.148)	(9.422)	(8.720)	(7.168)	(18.152)
L2.EquityDollarReturns	0.000	-0.001***	-0.001***	0.000**	0.001	-0.001***
	(0.895)	(-4.207)	(-6.198)	(2.853)	(1.072)	(-3.638)
L3.EquityDollarReturns	0.000	-0.000*	-0.001**	0.000**	0.000	-0.001**
	(-0.059)	(-1.980)	(-2.696)	(2.968)	(0.296)	(-2.690)

L4.EquityDollarReturns	-0.000**	-0.000*	0.000	0.000	0.000	-0.001***
	(-2.938)	(-2.064)	(-0.458)	(1.226)	(-0.779)	(-3.639)
L5.EquityDollarReturns	0.000	0.000	0.000	0.000	-0.001	-0.001***
	(-0.583)	(-1.584)	(-1.089)	(0.05)	(-1.282)	(-3.540)
Intercept	0.004***	0.001**	0.001**	0.001**	0.002***	0.000
	(9.009)	(2.827)	(2.673)	(2.904)	(3.999)	(0.760)
Adj. R-sq	0.064	0.309	0.233	0.082	0.292	0.389
Granger 1	0.000	0.000	0.000	0.000	0.000	0.000
			EquityDollarReturn equations			
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.944	2.691*	4.359**	-0.652	4.163***	8.932***
	(0.573)	(2.176)	(2.846)	(-0.307)	(4.331)	(6.816)
L2.Flows	1.054	2.739*	1.385	2.327	-0.810	-1.173
	(0.635)	(2.111)	(0.862)	(1.091)	(-0.808)	(-0.841)
L3.Flows	4.243*	1.752	1.693	2.040	1.095	-1.733
	(2.553)	(1.346)	(1.053)	(0.957)	(1.090)	(-1.240)
L4.Flows	-1.746	0.854	-0.624	4.475*	-1.695	-0.430
	(-1.051)	(0.658)	(-0.390)	(2.109)	(-1.698)	(-0.309)
L5.Flows	1.575	0.873	-0.559	2.989	0.549	0.651
	(0.962)	(0.746)	(-0.373)	(1.430)	(0.610)	(0.538)
L.EquityDollarReturns	0.069***	0.057***	0.105***	0.147***	0.015	0.071***
	(4.366)	(3.483)	(6.268)	(8.755)	(0.687)	(4.159)
L2.EquityDollarReturns	0.058***	-0.067***	0.031	-0.038*	-0.005	-0.010
	(3.672)	(-3.957)	(1.807)	(-2.232)	(-0.238)	(-0.582)
L3.EquityDollarReturns	-0.013	-0.048**	0.007	-0.031	-0.013	-0.016
	(-0.838)	(-2.825)	(0.404)	(-1.784)	(-0.585)	(-0.893)
L4.EquityDollarReturns	-0.064***	-0.082***	0.013	-0.009	-0.005	0.004
	(-4.062)	(-4.845)	(0.770)	(-0.502)	(-0.224)	(0.241)
L5.EquityDollarReturns	-0.049**	-0.073***	-0.029	-0.052**	-0.014	-0.001
	(-3.069)	(-4.368)	(-1.712)	(-3.029)	(-0.691)	(-0.071)
Intercept	-0.027	-0.014	-0.026	0.014	-0.002	0.029
	(-0.606)	(-0.363)	(-0.655)	(0.558)	(-0.060)	(1.011)
Adj. R-sq	0.018	0.024	0.023	0.028	0.013	0.028
Granger 2	0.074	0.000	0.006	0.036	0.000	0.000

From the flow equations, we can see that net inflows are very persistent; flows of the previous trading day have extremely strong positive explanatory power on current flows, with t-statistics between 6.228 (Philippines) and 23.212 (Thailand). Other than that, the past equity returns in U.S. dollars of the previous trading day also have a small (from 0.001 to 0.004) but quite significant (t-statistic from 7.057 to 18.152) positive influence on flows. Together with Granger-causality tests, the results from the flow equations indicate that foreign investors remain positive feedback traders until the end of 2013; in general they have been chasing the equity dollar returns of the previous day in the domestic market rather than rebalancing their portfolios with regard to the change of domestic equity dollar returns.

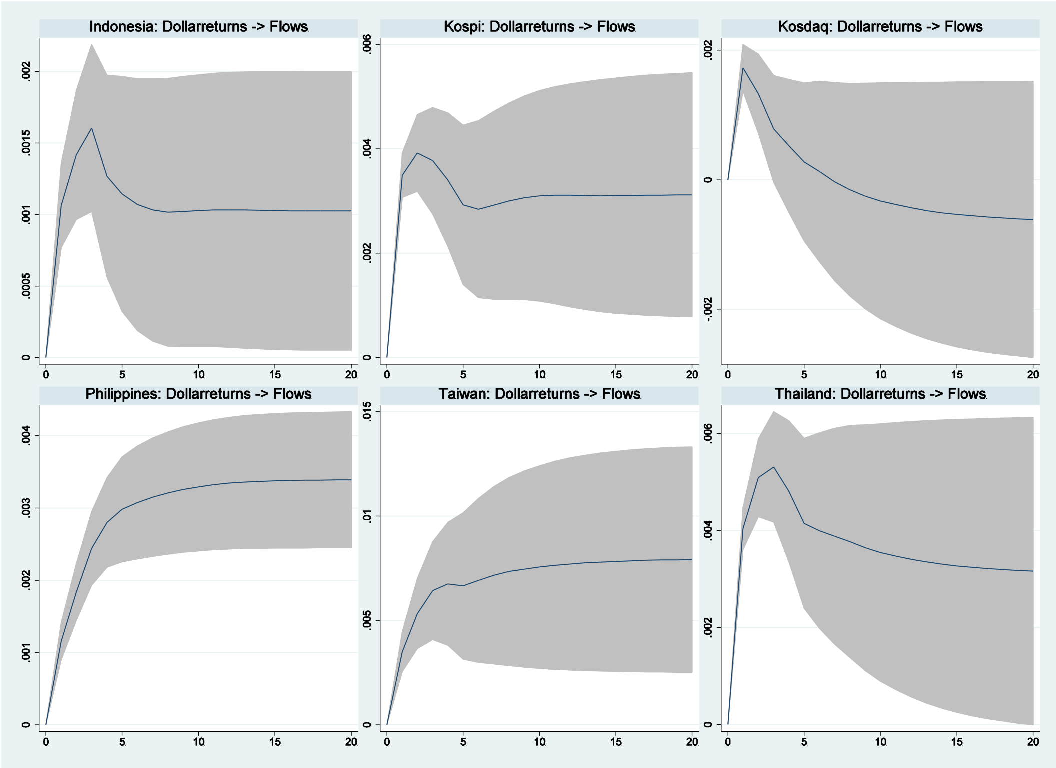
From the equity dollar return equations, we can see that dollar returns, like flows, are also very persistent in most of our sample countries except Taiwan. More importantly, flows in the previous five trading days also help to explain the current equity dollar returns with coefficients ranging from 2.691 (Korea) to 8.932 (Thailand) and t-statistics ranging from 2.109 (Philippines) to 6.816 (Thailand). All the coefficients of flows are positive when significant, and most of the coefficients of the flows are significant on the previous day (for Indonesia, it is the flows three days ago that are significant, and for the Philippines it is the flows four days ago that are significant). The Granger-causality tests reject the null hypothesis that past flows have no impact on current equity dollar returns at the conventional significance level (5 percent) for five of six sample countries and marginally reject the same null hypothesis for Indonesia (the *p*-value is 0.074).

Because we are interested in whether past net flows impact equity returns as well as whether the impact is temporary or permanent (to test the price pressure versus permanent impact hypotheses), we further implement impulse response analysis (figure 1). The cumulative impacts of 1-percent innovations in domestic equity dollar returns on flows over a twenty-day period are shown in figure 1B.[2] Impulse response analyses show that the impact is permanent rather than temporary, which means that the price pressure effect is not the only reason that past flows drive away current equity prices. After twenty days, the median impulse response suggests that innovations to net inflows equivalent to 1 percent of market capitalization would be associated on average with a cumulative boost to equity prices of about 18.20 percent.

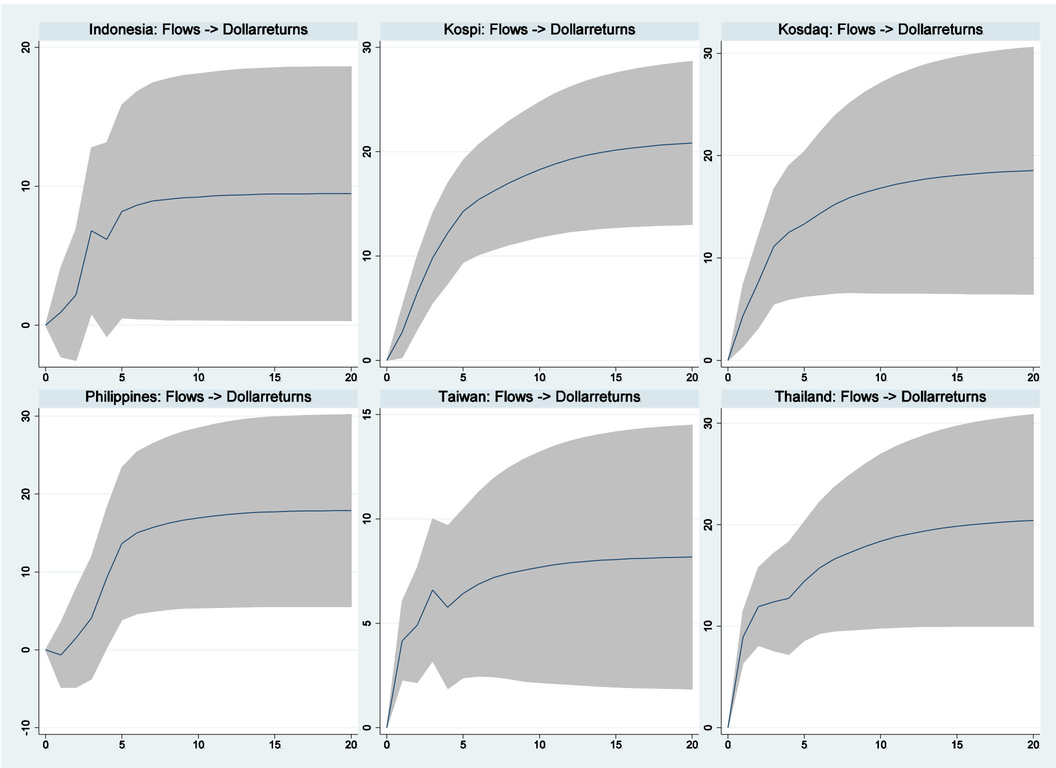
Figure 1: Impulse Response Analyses between Flows and Dollar Equity Returns

This figure shows (A) the cumulative responses of net inflows to a 1-percent innovation in dollar equity returns and (B) the cumulative responses of dollar equity returns to a 1-percent innovation in scaled flows. The estimates are obtained from the bivariate vector autoregression system described above in "Econometric Framework," with data from various starting dates to the end of 2013. The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

(A)


Indonesia: Dollarreturns -> Flows
Kospi: Dollarreturns -> Flows
Kosdaq: Dollarreturns -> Flows
Philippines: Dollarreturns -> Flows
Taiwan: Dollarreturns -> Flows
Thailand: Dollarreturns -> Flows

(B)


Indonesia: Flows -> Dollarreturns
Kospi: Flows -> Dollarreturns
Kosdaq: Flows -> Dollarreturns
Philippines: Flows -> Dollarreturns
Taiwan: Flows -> Dollarreturns
Thailand: Flows -> Dollarreturns

Inflows and Local Equity Returns in Local Currency

Now we use local equity returns in local currency instead of equity dollar returns and replicate the VAR model from the previous section. The results are reported in table 4, which is based on a bivariate vector auto-regression system of net equity inflows and equity returns in local currency.

Table 4: Vector Auto-Regression of Flows and Equity Returns in Local Currency

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows* (nf_{it}) are the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous-day's market capitalization; *EquityLocalReturns* (elr_{it}) are the daily percentage of continuously compounded returns on the country stock market index in local currency; *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator L; and ε_{it}^{nf} and ε_{it}^{elr} are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report *t*-statistics computed using the OLS variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent levels, respectively. For each country the *p*-values of two Granger causality tests are reported. Granger 1: Returns do not Granger-cause flows. Granger 2: Flows do not Granger-cause returns. The VAR equations are as follows:

$$\begin{pmatrix} nf_{it} \\ elr_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{elr} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ elr_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{elr} \end{pmatrix}.$$

	Flow equations					
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.106***	0.323***	0.330***	0.103***	0.364***	0.390***
	(6.628)	(19.556)	(19.740)	(6.143)	(17.097)	(22.613)
L2.Flows	0.064***	0.120***	0.076***	0.081***	0.072**	0.096***
	(3.960)	(6.936)	(4.302)	(4.828)	(3.241)	(5.257)
L3.Flows	0.054***	0.062***	0.067***	0.057***	0.052*	0.071***
	(3.357)	(3.556)	(3.817)	(3.372)	(2.335)	(3.861)
L4.Flows	0.074***	0.065***	0.076***	0.053**	0.060**	0.082***
	(4.613)	(3.748)	(4.363)	(3.186)	(2.697)	(4.481)
L5.Flows	0.031	0.080***	0.070***	0.044**	0.053**	0.040*
	(1.959)	(5.172)	(4.291)	(2.640)	(2.655)	(2.558)
L.EquityLocalReturns	0.003***	0.005***	0.002***	0.001***	0.004***	0.005***
	(10.553)	(17.997)	(9.686)	(8.791)	(7.020)	(18.245)
L2.EquityLocalReturns	0.001*	-0.001***	-0.001***	0.000**	0.001	-0.001**
	(2.128)	(-5.186)	(-6.201)	(3.257)	(0.993)	(-3.156)
L3.EquityLocalReturns	0.000	-0.000	-0.001**	0.000**	0.000	-0.001**
	(0.584)	(-1.546)	(-2.765)	(2.724)	(0.734)	(-3.006)

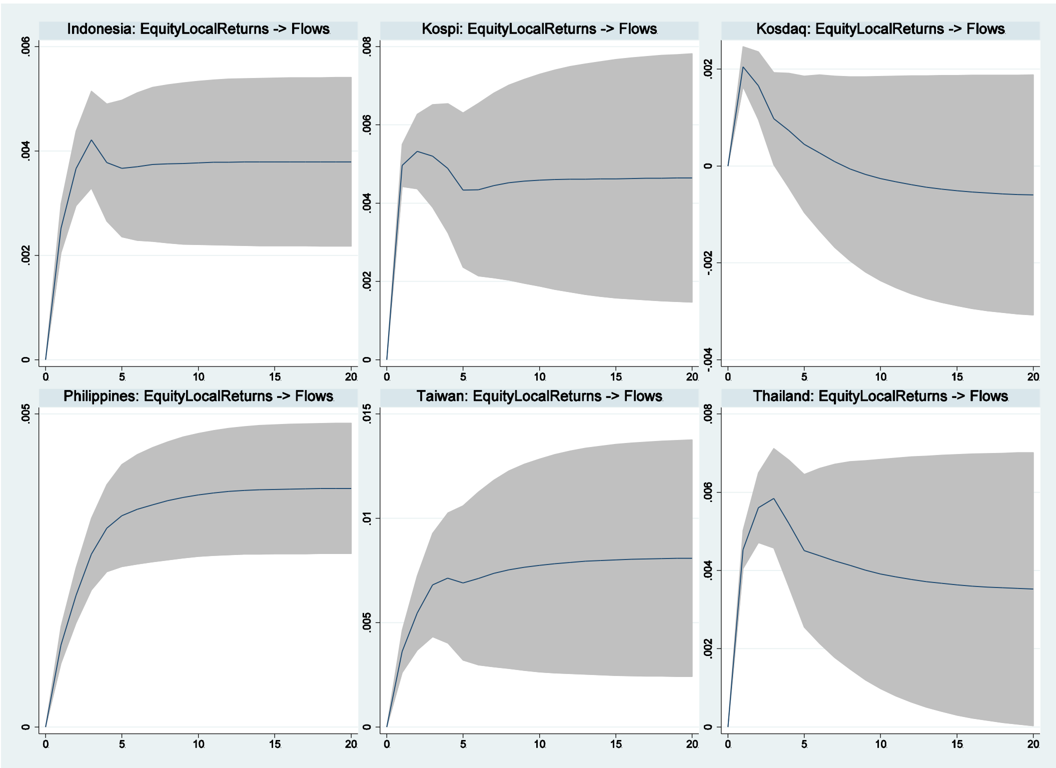
L4.EquityLocalReturns	-0.001**	-0.001	-0.000	0.000	-0.000	-0.001***
	(-2.717)	(-1.913)	(-0.270)	(1.459)	(-0.909)	(-4.134)
L5.EquityLocalReturns	-0.000	-0.001*	-0.000	0.000	-0.001	-0.001**
	(-0.695)	(-2.282)	(-1.256)	(0.072)	(-1.510)	(-3.112)
Intercept	0.004***	0.001**	0.001**	0.001**	0.002***	0.000
	(9.193)	(2.792)	(2.675)	(2.826)	(3.969)	(0.760)
Adj. R-sq	0.080	0.321	0.234	0.083	0.292	0.390
Granger 1	0.000	0.000	0.000	0.000	0.000	0.000
EquityLocalReturn equations						
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	-0.701	2.606**	3.639**	-0.012	3.943***	7.846***
	(-0.650)	(2.631)	(2.741)	(-0.006)	(4.471)	(6.548)
L2.Flows	0.848	1.984	1.352	1.822	-1.089	-1.538
	(0.783)	(1.917)	(0.970)	(0.957)	(-1.180)	(-1.211)
L3.Flows	1.676	0.662	0.440	1.867	0.931	-0.809
	(1.547)	(0.637)	(0.316)	(0.981)	(1.007)	(-0.635)
L4.Flows	1.114	-0.554	-0.022	3.961*	-1.383	-0.611
	(1.030)	(-0.537)	(-0.016)	(2.092)	(-1.506)	(-0.480)
L5.Flows	0.585	0.787	-0.610	2.090	0.434	0.224
	(0.551)	(0.850)	(-0.469)	(1.120)	(0.523)	(0.204)
L.EquityLocalReturns	0.146***	0.047**	0.130***	0.125***	0.003	0.027
	(9.092)	(2.863)	(7.760)	(7.460)	(0.147)	(1.553)
L2.EquityLocalReturns	0.001	-0.078***	0.006	-0.019	-0.005	0.005
	(0.051)	(-4.537)	(0.339)	(-1.118)	(-0.245)	(0.274)
L3.EquityLocalReturns	-0.035*	-0.034*	0.020	-0.048**	-0.009	-0.011
	(-2.157)	(-1.969)	(1.152)	(-2.789)	(-0.432)	(-0.633)
L4.EquityLocalReturns	-0.023	-0.043*	0.018	-0.009	-0.011	-0.012
	(-1.410)	(-2.526)	(1.036)	(-0.506)	(-0.512)	(-0.648)
L5.EquityLocalReturns	-0.022	-0.048**	-0.027	-0.055**	-0.020	0.001
	(-1.344)	(-2.794)	(-1.575)	(-3.254)	(-0.986)	(0.056)
Intercept	0.024	0.004	-0.025	0.020	-0.001	0.025
	(0.870)	(0.137)	(-0.725)	(0.879)	(-0.055)	(0.971)
Adj. R-sq	0.023	0.015	0.026	0.023	0.011	0.020
Granger 2	0.324	0.000	0.018	0.061	0.000	0.000

At first glance, everything in table 4 is similar to table 3. However, when you zoom in on the equity local returns, you find that the coefficients of past flows have become either insignificant (for Indonesia) or reduced in magnitude (for the other five countries). Correspondingly, the power of the Granger-causality tests has decreased: In table 4 these tests reject the null hypothesis that past flows have no impact on current equity dollar returns in Indonesia (the *p*-value is 0.324) and only marginally reject this hypothesis for Philippines (the *p*-value is 0.061). Turning to impulse response analyses (figure 2), the respective cumulative responses of equity local returns on the innovation of flows become insignificant, and the median impulse response suggests that the cumulative impact of innovations to net inflows equivalent to 1 percent of market capitalization on equity prices decreased by 17.43 percent to 14.04 percent.

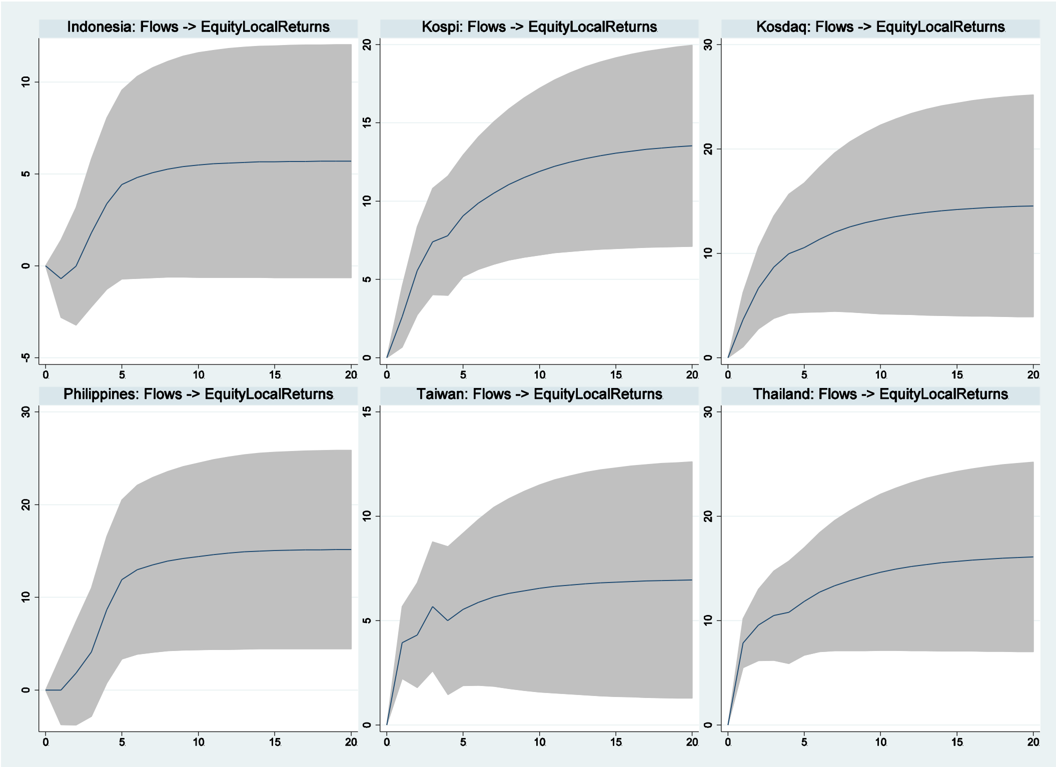
Figure 2: Impulse Response Analyses between Flows and Equity Local Returns

This figure shows (A) the cumulative responses of net inflows to a 1-percent innovation in equity local returns and (B) the cumulative responses of equity local returns to a 1-percent innovation in scaled flows. The estimates are obtained from the bi-variable vector autoregression system described above in "The Econometric Framework," with data from various starting dates to the end of 2013. The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

(A)



(B)



Inflows and Foreign Exchange Returns

Here we investigate the bivariate behavior of flows and foreign-exchange returns. Because we already know that flows also are positively correlated, although to a less extent, with foreign-exchange returns in preliminary data analyses, we are wondering whether flows forecast foreign-exchange returns or vice versa. Compared with how much we know about flows and equity returns, we know little about the interrelationship between flows and foreign-exchange returns. Specifically, we ask two questions. First, do foreign-exchange returns have an impact on net equity inflows? If so, do foreign equity flows pursue a return-chasing strategy or a portfolio-rebalancing strategy regarding currency returns? Second, do net inflows have an influence on foreign-exchange returns? If so, we also are concerned whether the impact is temporary or permanent.

Analogously, we first employ a bivariate VAR model to investigate these questions, as we did above, but we use foreign-exchange returns instead of equity returns. Table 5 presents the results from the bivariate VAR model of net equity inflows and foreign-exchange returns.

Table 5: Vector Auto-Regression of Flows and FX Returns by Country

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows* (nf_{it}) are the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous-day's market capitalization; *ForeignExchangeReturns* (fxr_{it}) are the daily percentage of continuously compounded returns on the local currency against U.S. dollars; *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator *L*; and ε_{it}^{nf} and ε_{it}^{fxr} are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report *t*-statistics computed using the ordinary least squares (OLS) variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent levels, respectively. For each country the *p*-values of two Granger causality tests are reported. Granger 1: Returns do not Granger-cause flows. Granger 2: Flows do not Granger-cause returns. The VAR results are as follows:

Flow equations						
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.162***	0.391***	0.347***	0.136***	0.436***	0.490***
	(10.482)	(24.846)	(20.953)	(8.204)	(23.394)	(30.682)
L2.Flows	0.070***	0.075***	0.058***	0.094***	0.062**	0.054**
	(4.508)	(4.470)	(3.308)	(5.622)	(3.077)	(3.008)
L3.Flows	0.046**	0.058***	0.065***	0.062***	0.058**	0.034
	(2.948)	(3.458)	(3.745)	(3.700)	(2.855)	(1.887)
L4.Flows	0.060***	0.052**	0.072***	0.053**	0.036	0.054**
	(3.861)	(3.059)	(4.116)	(3.188)	(1.806)	(3.031)
L5.Flows	0.029	0.070***	0.069***	0.043**	0.030	0.036*
	(1.862)	(4.496)	(4.166)	(2.588)	(1.650)	(2.274)
L.FXReturns	0.000	0.002***	0.002**	0.002***	0.006*	0.004***
	(0.527)	(4.765)	(3.112)	(3.348)	(2.432)	(4.991)
L2.FXReturns	-0.000	0.000	-0.002**	0.001	0.002	-0.001
	(-1.245)	(0.105)	(-2.728)	(1.302)	(0.804)	(-0.702)
L3.FXReturns	-0.000	-0.001	-0.000	0.001	-0.005*	-0.001
	(-0.239)	(-1.602)	(-0.390)	(1.934)	(-2.079)	(-1.481)
L4.FXReturns	-0.000	-0.001	-0.001	0.000	0.001	0.000
	(-1.478)	(-1.953)	(-1.048)	(0.241)	(0.528)	(0.096)
L5.FXReturns	-0.000	-0.000	-0.000	0.000	0.002	-0.002*
	(-0.556)	(-0.826)	(-0.373)	(0.148)	(0.815)	(-2.082)
Intercept	0.004***	0.001**	0.001**	0.001**	0.002***	0.000
	(8.772)	(2.784)	(2.714)	(2.962)	(3.822)	(0.827)
Adj. R-sq	0.052	0.264	0.210	0.061	0.283	0.336
Granger 1	0.454	0.000	0.002	0.008	0.035	0.000
FXReturn equations						
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	1.236	0.909	0.967*	0.044	0.513***	1.903***
	(1.184)	(1.869)	(2.122)	(0.073)	(3.565)	(5.659)

L2.Flows	1.395	0.864	0.268	0.276	0.214	-0.095
	(1.321)	(1.658)	(0.557)	(0.456)	(1.372)	(-0.254)
L3.Flows	2.546*	0.282	1.119*	0.459	0.087	-0.710
	(2.409)	(0.541)	(2.326)	(0.755)	(0.559)	(-1.895)
L4.Flows	-3.908***	0.707	-0.560	0.660	-0.236	0.227
	(-3.700)	(1.357)	(-1.164)	(1.089)	(-1.519)	(0.607)
L5.Flows	0.028	0.147	-0.068	0.992	-0.002	0.037
	(0.027)	(0.304)	(-0.151)	(1.653)	(-0.017)	(0.112)
L.FXReturns	-0.021	0.000	-0.022	-0.030	0.006	0.119***
	(-1.348)	(0.026)	(-1.323)	(-1.831)	(0.349)	(7.478)
L2.FXReturns	0.084***	-0.125***	0.026	-0.054**	-0.007	-0.042**
	(5.467)	(-8.029)	(1.552)	(-3.232)	(-0.361)	(-2.640)
L3.FXReturns	-0.007	-0.023	-0.039*	0.020	-0.026	-0.052**
	(-0.443)	(-1.488)	(-2.319)	(1.170)	(-1.374)	(-3.287)
L4.FXReturns	-0.039*	-0.093***	0.016	-0.051**	0.022	0.024
	(-2.528)	(-5.961)	(0.964)	(-3.079)	(1.157)	(1.489)
L5.FXReturns	-0.028	-0.117***	-0.026	-0.017	0.063***	0.106***
	(-1.792)	(-7.475)	(-1.536)	(-1.039)	(3.390)	(6.693)
Intercept	-0.047	-0.018	-0.001	-0.007	-0.001	0.004
	(-1.659)	(-1.107)	(-0.077)	(-0.891)	(-0.177)	(0.502)
Adj. R-sq	0.015	0.037	0.008	0.008	0.014	0.044
Granger 2	0.001	0.000	0.006	0.229	0.000	0.000

From the flow equations, we can clearly see that past foreign-exchange returns of the previous trading day have a small (from 0.002 to 0.006) but quite significant (*t*-statistics from 2.432 to 4.991) positive influence on the flows in five of the six countries (that is, except Indonesia). The Granger-causality tests confirm that foreign investors chase foreign-exchange returns of the previous day rather than rebalancing their portfolios with regard to the change of foreign-exchange returns.

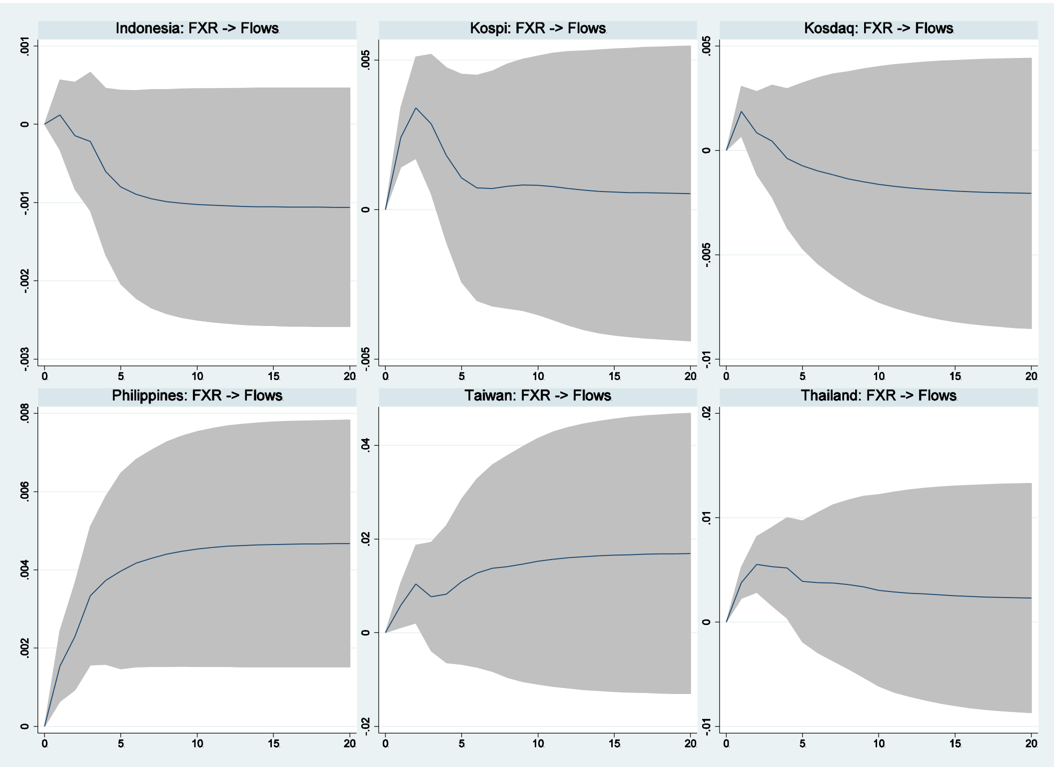
From the foreign-exchange return equations, we can see that the foreign-exchange returns are not as persistent as flows and equity returns. Moreover, in four of six countries we find that past flows have significant positive impact on the current foreign-exchange returns (most of the coefficients of the flows are significant on the previous day's flows, but for Indonesia it is the flows three days ago that are significant). The coefficients range from 0.514 (Philippines) to 2.546 (Indonesia) and *t*-statistics range from 2.122 (Kosdaq) to 5.659 (Thailand). The Granger-causality tests reject the null hypothesis that past flows have no impact on current foreign-exchange returns at the conventional significance level (5 percent) for five of six sample countries (that is, except the Philippines).

However, the impulse response analyses in Figure 3A indicate that after two−five days the cumulative impacts of past currency returns on flows are significantly different from zero only for the Philippines, which means that the impacts of past currency returns on flows are very temporary. The cumulative impacts of 1-percent innovations in domestic equity dollar returns on flows over a twenty-day period are shown in Figure 3B. On the other hand, the significant positive impact of flows on foreign-exchange returns is permanent rather than temporary, suggesting that flows have a similar impact on foreign-exchange returns as on equity returns. The median impulse response suggests that innovations to net inflows equivalent to 1 percent of market capitalization would be associated on average with a cumulative boost to foreign-exchange returns of about 3.86 percent.

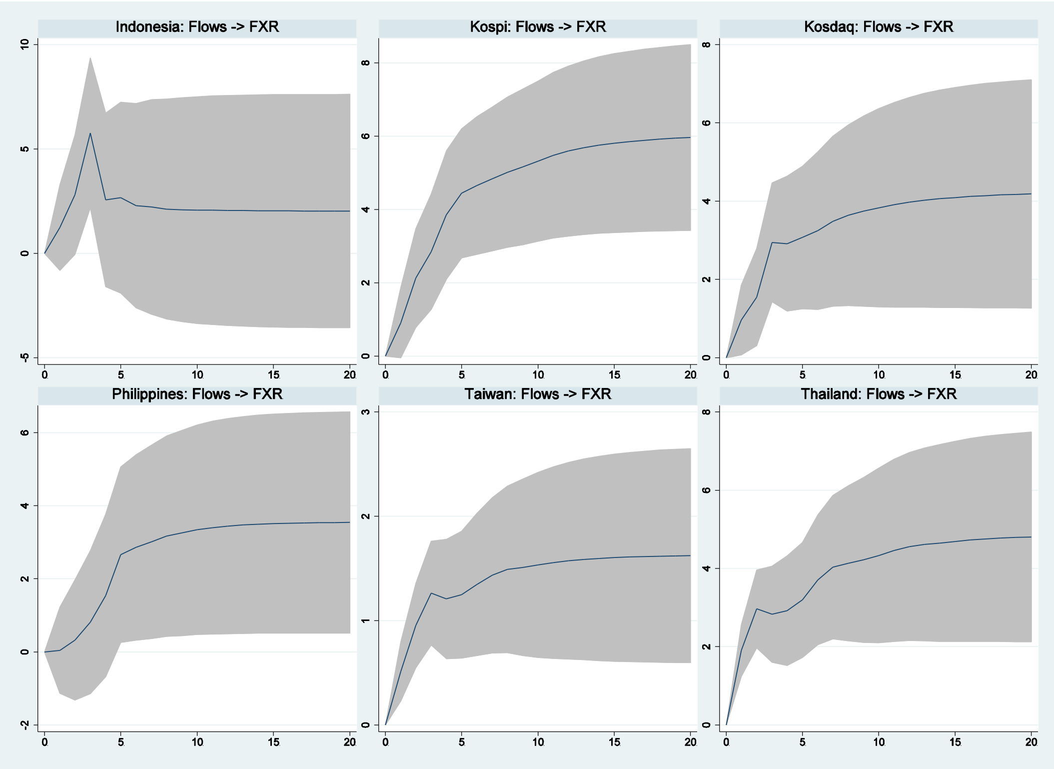
Figure 3: Impulse Response Analyses between Flows and FX Returns

This figure shows (A) the cumulative responses of net inflows to a 1-percent innovation in FX returns and (B) the cumulative responses of FX returns to a 1-percent innovation of scaled flows. The estimates are obtained from the bi-variable vector autoregression system described above in "Econometric Framework," with data from various starting dates to the end of 2013.The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

(A)



(B)



What is the Role of Currency?

Because we find the interrelationship between flows and equity returns is similar to the one between flows and foreign-exchange returns, we conjecture that literature such as Froot et al. (2001) may mix the dynamics of foreign exchange into equity returns by using equity dollar returns and overestimate both the impacts of past flows on current equity returns and the impacts of past equity returns on current flows. Ignoring foreign-exchange returns, literature such as Griffin et al. (2004) and Richards (2005), which uses the bivariate VAR system of flows and equity returns in local currency equity, may suffer from a serious omitted-variable problem; in the extreme, they may take the interrelationship between the flows and foreign-exchange returns as the interrelationship between the flows and equity returns, because equity returns are just a proxy of foreign-exchange returns. Similarly, it is also plausible that the interrelationship between flows and foreign-exchange returns from a bivariate VAR system of flows and foreign-exchange returns such as the one described above is just the interrelationship between flows and equity returns because foreign-exchange returns are just a proxy of equity returns. Hence, our strategy here will be to confront these possible problems with a trivariate VAR system of flows, foreign-exchange returns, and equity returns in local currency. In other words, we separate equity dollar returns into foreign-exchange returns and equity local returns.

Table 6: Vector Auto-Regression of Flows and FX Returns and Equity Local Returns

This table presents results from the trivariate VAR specified in equation (3) within five lags. Notations follow the previous tables. For each country the *p*-values of six Granger-causality tests are reported. Granger 1 (2): Foreign-exchange returns (equity local returns) do not Granger-cause flows. Granger 3 (4): Flows (equity local returns) do not Granger-cause foreign-exchange returns. Granger 5 (6): Flows (foreign-exchange returns) do not Granger-cause equity local returns.

	Flow equations					
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.105***	0.323***	0.331***	0.103***	0.359***	0.390***
	(6.554)	(19.544)	(19.735)	(6.111)	(16.505)	(22.607)
L2.Flows	0.063***	0.119***	0.076***	0.082***	0.072**	0.094***
	(3.910)	(6.867)	(4.317)	(4.853)	(3.164)	(5.164)
L3.Flows	0.054***	0.062***	0.067***	0.056***	0.061**	0.071***
	(3.352)	(3.597)	(3.835)	(3.334)	(2.698)	(3.896)
L4.Flows	0.075***	0.065***	0.076***	0.054**	0.057*	0.084***
	(4.694)	(3.789)	(4.355)	(3.194)	(2.518)	(4.584)
L5.Flows	0.031	0.081***	0.072***	0.044**	0.050*	0.040*
	(1.953)	(5.239)	(4.361)	(2.639)	(2.476)	(2.561)
L.FXReturns	-0.000	-0.000	0.000	0.001	0.003	0.002*
	(-1.744)	(-0.712)	(0.243)	(1.293)	(1.419)	(2.330)
L2.FXReturns	-0.000	0.000	-0.001	-0.001	0.001	-0.000
	(-1.731)	(0.182)	(-1.884)	(-1.125)	(0.424)	(-0.524)
L3.FXReturns	-0.000	-0.001*	0.000	0.000	-0.006*	-0.000
	(-0.059)	(-1.976)	(0.387)	(0.630)	(-2.315)	(-0.186)
L4.FXReturns	-0.000	-0.000	-0.000	-0.000	0.001	0.000
	(-1.082)	(-0.456)	(-0.725)	(-0.707)	(0.413)	(0.249)
L5.FXReturns	-0.000	-0.000	0.000	-0.000	0.003	-0.001*
	(-0.507)	(-0.505)	(0.155)	(-0.391)	(1.059)	(-1.985)
L.EquityLocalReturns	0.003***	0.005***	0.002***	0.001***	0.003***	0.004***
	(10.690)	(17.346)	(9.233)	(8.313)	(6.684)	(17.602)
L2.EquityLocalReturns	0.001*	-0.001***	-0.001***	0.001***	0.001	-0.001**
	(2.482)	(-4.831)	(-5.366)	(3.301)	(1.033)	(-3.116)
L3.EquityLocalReturns	0.000	-0.000	-0.001**	0.000*	0.001	-0.001**
	(0.688)	(-0.826)	(-2.884)	(2.553)	(1.089)	(-2.997)
L4.EquityLocalReturns	-0.001*	-0.001	0.000	0.000	-0.001	-0.001***
	(-2.364)	(-1.722)	(0.026)	(1.633)	(-1.052)	(-4.000)
L5.EquityLocalReturns	-0.000	-0.001*	-0.000	0.000	-0.001	-0.001**
	(-0.655)	(-2.079)	(-1.340)	(0.146)	(-1.684)	(-2.798)
Intercept	0.004***	0.001**	0.001**	0.001**	0.002***	0.000
	(9.058)	(2.750)	(2.676)	(2.817)	(3.984)	(0.762)
Adj. R-sq	0.081	0.322	0.235	0.084	0.294	0.392
Granger 1	0.187	0.494	0.481	0.508	0.109	0.101
Granger 2	0.000	0.000	0.000	0.000	0.000	0.000

FXReturn equations

	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	-0.329	0.777	0.953*	0.130	0.548**	1.412***
	(-0.301)	(1.464)	(2.039)	(0.211)	(3.239)	(3.734)
L2.Flows	1.212	0.509	0.074	0.413	0.273	-0.125
	(1.102)	(0.918)	(0.151)	(0.668)	(1.544)	(-0.312)
L3.Flows	3.365**	1.007	1.195*	0.482	0.132	-0.737
	(3.059)	(1.808)	(2.436)	(0.779)	(0.745)	(-1.832)
L4.Flows	-2.112	0.898	-0.330	0.678	-0.247	0.467
	(-1.923)	(1.622)	(-0.675)	(1.101)	(-1.404)	(1.162)
L5.Flows	0.403	-0.234	0.040	1.046	0.011	0.244
	(0.373)	(-0.471)	(0.086)	(1.724)	(0.070)	(0.702)
L.FXReturns	-0.036*	0.007	-0.015	-0.032	0.007	0.110***
	(-2.301)	(0.406)	(-0.850)	(-1.844)	(0.355)	(6.858)
L2.FXReturns	0.081***	-0.130***	0.022	-0.050**	-0.005	-0.045**
	(5.202)	(-7.925)	(1.269)	(-2.888)	(-0.286)	(-2.780)
L3.FXReturns	-0.003	-0.028	-0.040*	0.025	-0.023	-0.052**
	(-0.174)	(-1.671)	(-2.333)	(1.411)	(-1.208)	(-3.201)
L4.FXReturns	-0.023	-0.077***	0.022	-0.051**	0.022	0.023
	(-1.496)	(-4.699)	(1.253)	(-2.947)	(1.181)	(1.430)
L5.FXReturns	-0.022	-0.119***	-0.015	-0.015	0.066***	0.109***
	(-1.415)	(-7.263)	(-0.867)	(-0.864)	(3.494)	(6.826)
L.EquityLocalReturns	0.065***	-0.007	-0.009	0.001	-0.001	0.017**
	(3.910)	(-0.740)	(-1.490)	(0.230)	(-0.292)	(3.067)
L2.EquityLocalReturns	0.024	0.016	0.009	-0.006	-0.003	0.004
	(1.426)	(1.644)	(1.386)	(-1.063)	(-0.652)	(0.616)
L3.EquityLocalReturns	0.011	0.000	0.002	-0.002	-0.003	0.002
	(0.631)	(0.008)	(0.260)	(-0.407)	(-0.830)	(0.402)
L4.EquityLocalReturns	-0.080***	-0.036***	-0.010	0.002	-0.001	0.001
	(-4.734)	(-3.717)	(-1.632)	(0.272)	(-0.164)	(0.151)
L5.EquityLocalReturns	-0.033*	0.016	-0.011	-0.005	-0.003	-0.011
	(-1.962)	(1.719)	(-1.833)	(-0.808)	(-0.697)	(-1.919)
Intercept	-0.054	-0.018	-0.002	-0.007	-0.002	0.004
	(-1.884)	(-1.103)	(-0.159)	(-0.887)	(-0.330)	(0.473)
Adj. R-sq	0.026	0.042	0.011	0.009	0.015	0.047
Granger 3	0.016	0.001	0.008	0.184	0.001	0.001
Granger 4	0.000	0.001	0.058	0.852	0.901	0.021

EquityLocalReturn equations

	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	-0.731	2.569**	3.552**	-0.490	3.446***	7.840***
	(-0.678)	(2.610)	(2.677)	(-0.262)	(3.830)	(6.567)
L2.Flows	0.845	1.748	1.205	1.916	-1.069	-1.801

	(0.781)	(1.699)	(0.865)	(1.022)	(-1.138)	(-1.422)
L3.Flows	1.654	0.707	0.473	1.676	0.896	-0.682
	(1.528)	(0.685)	(0.340)	(0.895)	(0.954)	(-0.536)
L4.Flows	1.172	-0.718	-0.179	3.695*	-1.518	-0.420
	(1.084)	(-0.699)	(-0.129)	(1.982)	(-1.625)	(-0.331)
L5.Flows	0.506	0.777	-0.713	1.854	0.438	0.105
	(0.477)	(0.844)	(-0.549)	(1.009)	(0.520)	(0.095)
L.FXReturns	-0.028	0.153***	0.108*	0.541***	0.298**	0.214***
	(-1.818)	(5.030)	(2.199)	(10.407)	(2.974)	(4.218)
L2.FXReturns	-0.003	0.077*	0.137**	-0.084	0.037	-0.143**
	(-0.196)	(2.550)	(2.794)	(-1.584)	(0.365)	(-2.789)
L3.FXReturns	0.024	-0.087**	-0.009	0.099	-0.003	0.038
	(1.526)	(-2.826)	(-0.192)	(1.862)	(-0.031)	(0.741)
L4.FXReturns	-0.007	-0.008	0.020	0.065	0.081	0.099
	(-0.449)	(-0.270)	(0.404)	(1.223)	(0.809)	(1.941)
L5.FXReturns	-0.036*	-0.097**	0.062	0.044	0.060	-0.126*
	(-2.339)	(-3.176)	(1.267)	(0.825)	(0.595)	(-2.492)
L.EquityLocalReturns	0.151***	0.020	0.117***	0.087***	-0.008	0.017
	(9.274)	(1.131)	(6.701)	(5.033)	(-0.353)	(0.993)
L2.EquityLocalReturns	0.003	-0.085***	-0.005	-0.009	-0.005	0.010
	(0.207)	(-4.740)	(-0.299)	(-0.539)	(-0.223)	(0.551)
L3.EquityLocalReturns	-0.039*	-0.016	0.022	-0.056**	-0.009	-0.014
	(-2.342)	(-0.902)	(1.226)	(-3.177)	(-0.412)	(-0.785)
L4.EquityLocalReturns	-0.022	-0.039*	0.014	-0.015	-0.013	-0.016
	(-1.339)	(-2.192)	(0.773)	(-0.866)	(-0.604)	(-0.869)
L5.EquityLocalReturns	-0.017	-0.024	-0.030	-0.055**	-0.022	0.005
	(-1.038)	(-1.338)	(-1.711)	(-3.224)	(-1.078)	(0.256)
Intercept	0.022	0.006	-0.025	0.025	0.002	0.025
	(0.799)	(0.189)	(-0.734)	(1.106)	(0.059)	(0.969)
Adj. R-sq	0.026	0.028	0.030	0.054	0.014	0.027
Granger 5	0.328	0.001	0.031	0.096	0.003	0.000
Granger 6	0.068	0.000	0.016	0.000	0.076	0.000

Table 6 reports the VAR results for our original trivariate VAR system of flows, foreign-exchange returns, and equity returns in local currency with six Granger-causality tests. Some of the previous results stay valid but others do not. For example, in the flow equations section, the previous day's equity local returns still have a significant positive impact on current flows with strong support from the Granger-causality test, but the forecasting power of the previous day's foreign-exchange returns on current flows, which is implied in table 5, disappears in all the sample markets except Thailand. Furthermore, the hypothesis that past foreign-exchange returns explain current flows is rejected at the conventional level (5 percent) for all six markets including Thailand in the Granger-causality test, invalidating the previous conclusion that foreign investors also chase past foreign-exchange returns in emerging markets, which is a only a proxy for chasing equity local returns due to the correlation between foreign-exchange returns and equity local returns. These results suggest that foreign investors only chase past equity returns rather than foreign-exchange returns, which is further supported by the impulse response analysis in figure 4C and 4E.

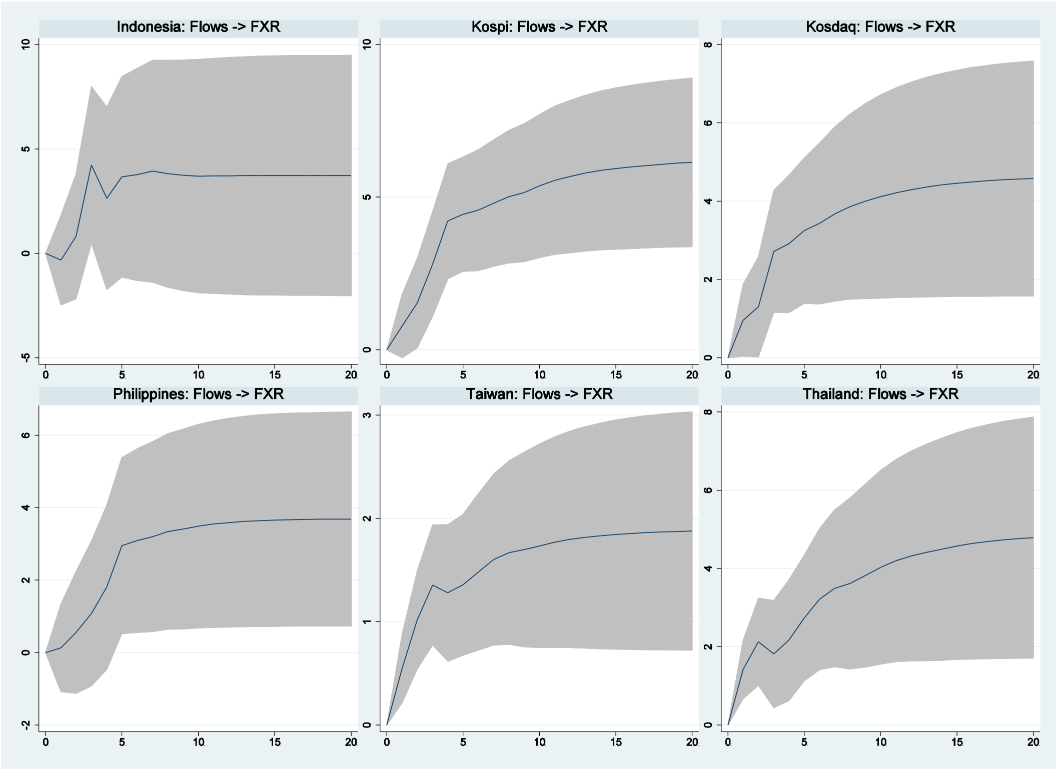
Turning to the foreign-exchange return equations, we find positive significant coefficients on conventional levels of part flows in four markets (Indonesia, Kosdaq, Taiwan, and Thailand), and the hypothesis that past flows have no impact on current foreign-exchange returns is rejected in five markets except the Philippines (the *p*-value is 0.184). This means that past flows do have impact on current foreign-exchange returns. Figure 4A further indicates that in most of the sample markets the impact is permanent instead of temporary. This impact is not a proxy of the impact of past flows on the equity returns and should not be due to the correlation between foreign-exchange returns and equity returns, because we already include the past equity returns in the same equations.

Do past flows explain the current equity returns in local currency, after taking account of foreign-exchange returns? In four out of six markets (KSE, Kosdaq, Taiwan, and Thailand), the answer is still yes, but the magnitudes of all the coefficients are reduced to some extent. Figure 4B shows that now the median impulse response suggests that after twenty days the innovations to net inflows equivalent to 1 percent of market capitalization would be associated on average with a cumulative boost to equity local returns of 13.61 percent and to foreign-exchange returns of 4.16 percent, which means that the effects of capital flows on currency is about one-third of the effects on local equity.

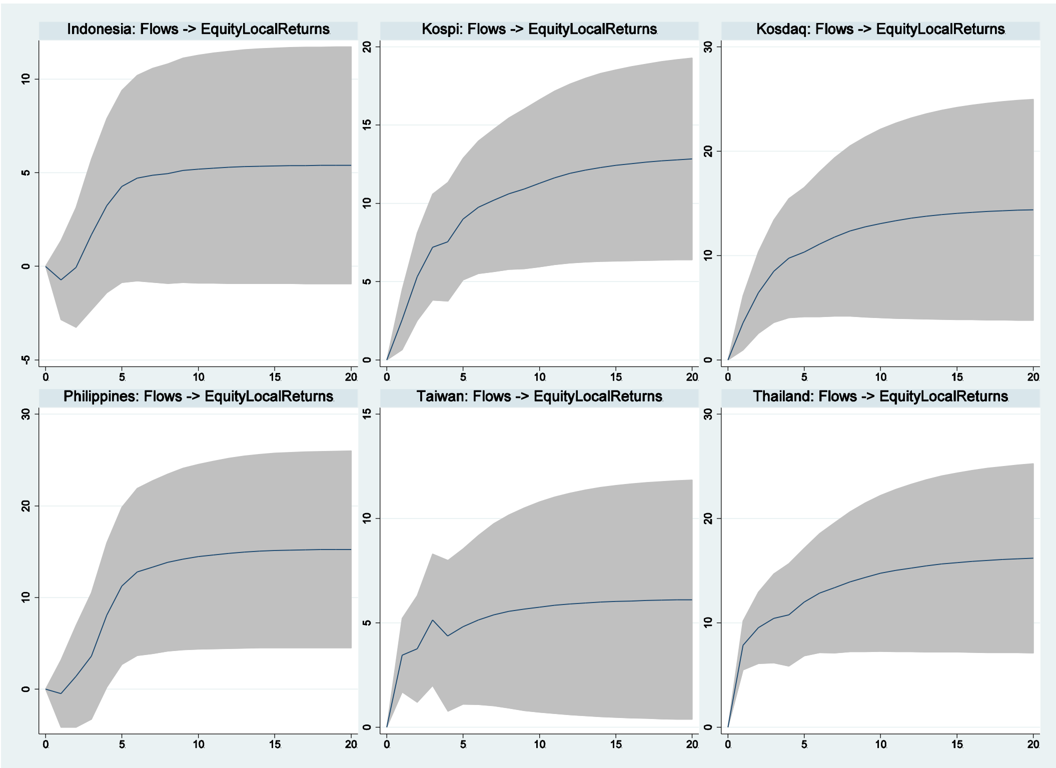
Figure 4: Impulse Response Analyses of a Trivariate VAR System

This figure shows the cumulative responses of (A) FX returns and (B) equity local returns to a 1-percent innovation in scaled flows; the cumulative responses of (C) scaled flows and (D) equity local returns to a 1-percent innovation in FX returns; and the cumulative responses of (E) scaled flows and (F) FX returns to a 1-percent innovation in equity local returns. The estimates are obtained from the trivariate VAR described above in "The Econometric Framework," with data from various starting dates to the end of 2013.The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

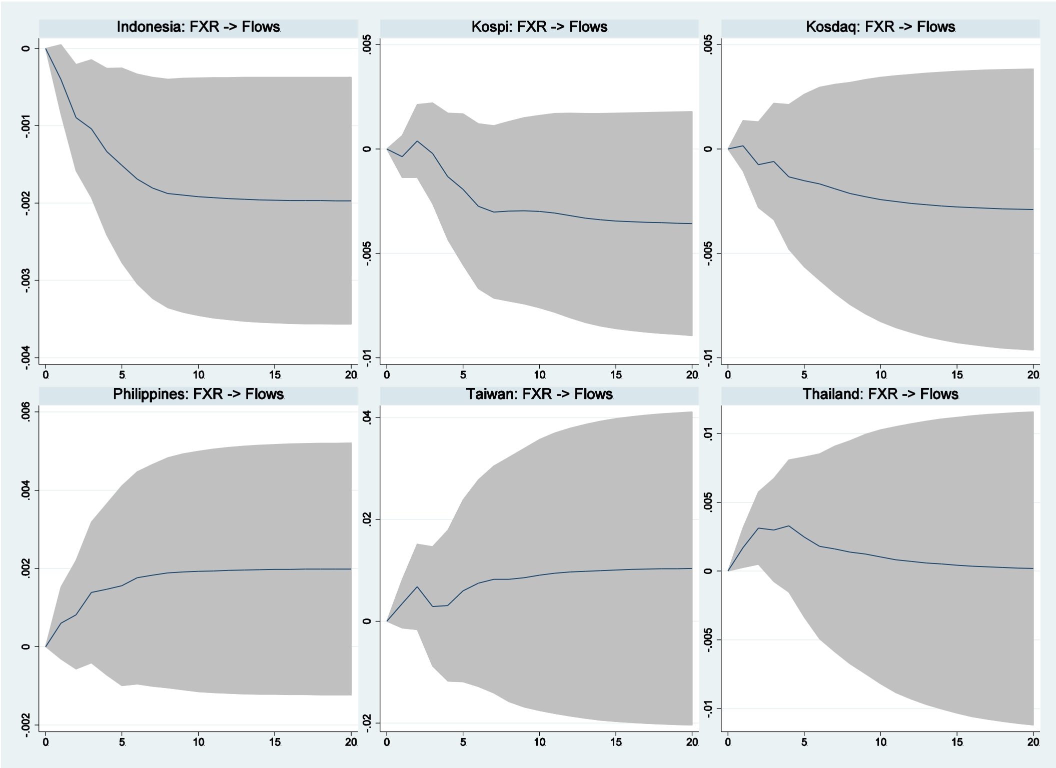
(A)


Indonesia: Flows -> FXR
Kospi: Flows -> FXR
Kosdaq: Flows -> FXR
Philippines: Flows -> FXR
Taiwan: Flows -> FXR
Thailand: Flows -> FXR

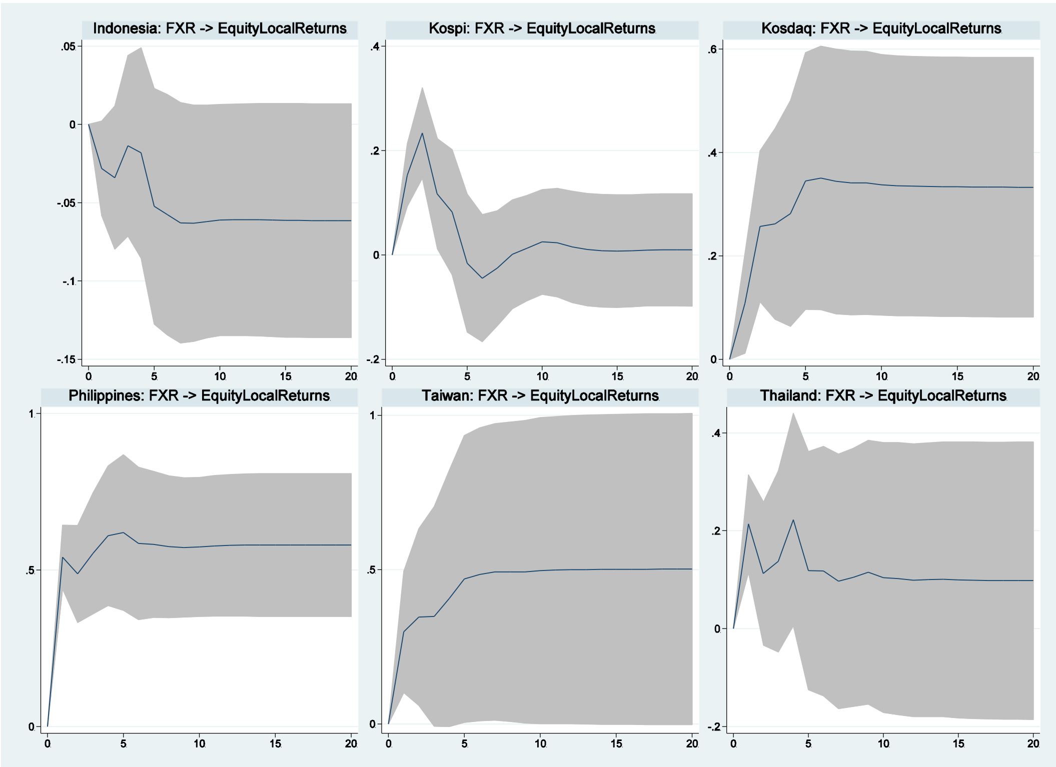
(B)


Indonesia: Flows -> EquityLocalReturns
Kospi: Flows -> EquityLocalReturns
Kosdaq: Flows -> EquityLocalReturns
Philippines: Flows -> EquityLocalReturns
Taiwan: Flows -> EquityLocalReturns
Thailand: Flows -> EquityLocalReturns

(C)


Indonesia: FXR -> Flows
Kospi: FXR -> Flows
Kosdaq: FXR -> Flows
Philippines: FXR -> Flows
Taiwan: FXR -> Flows
Thailand: FXR -> Flows

(D)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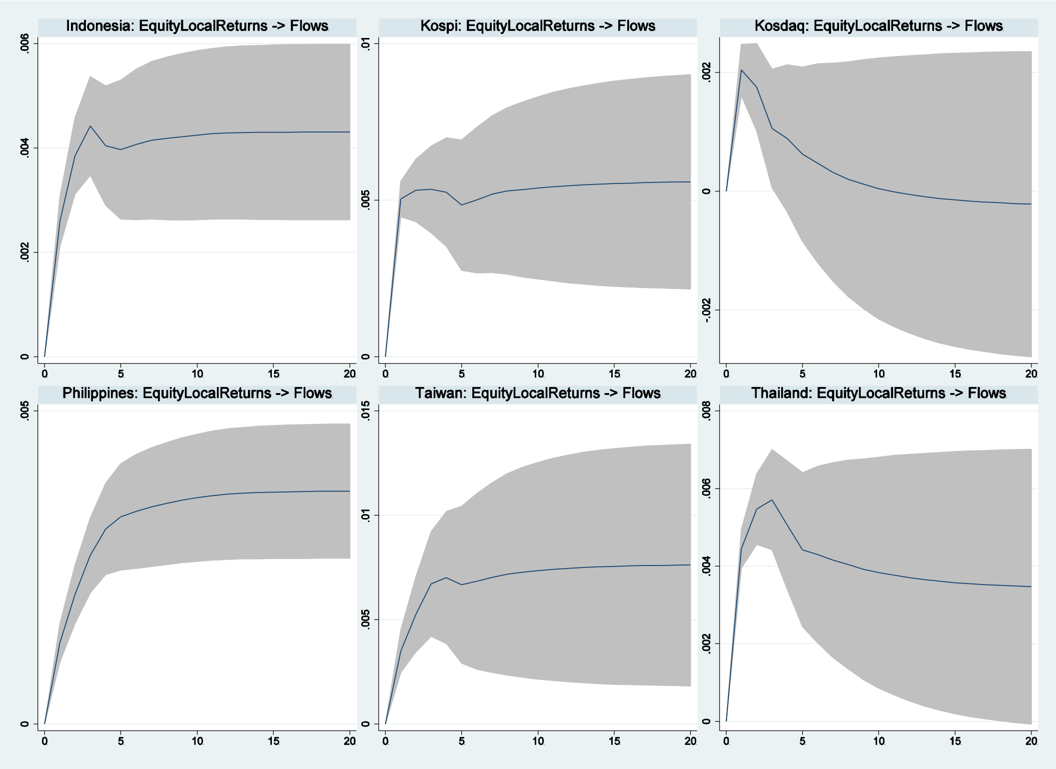
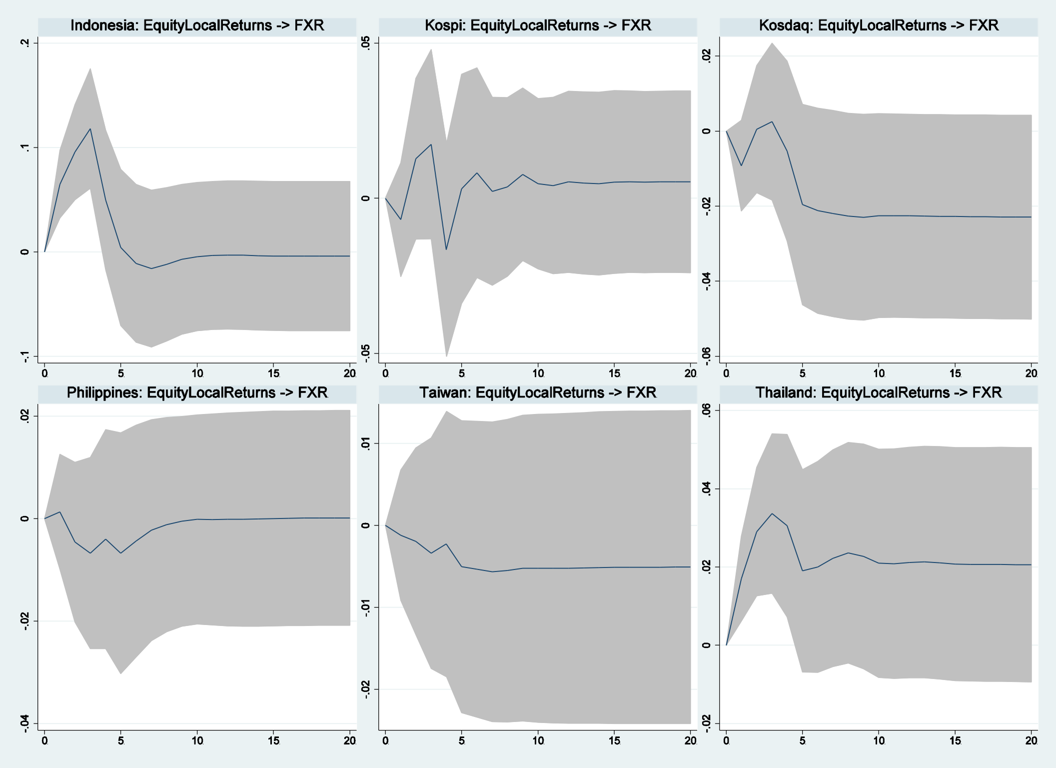
Kospi: FXR -> EquityLocalReturns
Kosdaq: FXR -> EquityLocalReturns
Philippines: FXR -> EquityLocalReturns
Taiwan: FXR -> EquityLocalReturns
Thailand: FXR -> EquityLocalReturns

(E)



Indonesia: EquityLocalReturns -> Flows
Kospi: EquityLocalReturns -> Flows
Kosdaq: EquityLocalReturns -> Flows
Philippines: EquityLocalReturns -> Flows
Taiwan: EquityLocalReturns -> Flows
Thailand: EquityLocalReturns -> Flows

(F)



Indonesia: EquityLocalReturns -> FXR
Kospi: EquityLocalReturns -> FXR
Kosdaq: EquityLocalReturns -> FXR
Philippines: EquityLocalReturns -> FXR
Taiwan: EquityLocalReturns -> FXR
Thailand: EquityLocalReturns -> FXR

Effects of External Equity/FX Market on Inflows

Because it has been argued that foreign equity flows into emerging markets are substantially affected by stock returns in mature markets (Griffin et al. 2004; Richards 2005), it is meaningful to ask whether foreign flows also are affected by the volatilities in mature stock markets and foreign-exchange markets, and whether returns or volatilities are better explanatory variables. Neither of these questions has been answered by existing literature.

Volatility in mature equity markets (the VIX) has not been suggested as an external factor of capital flows until recently; see, for example, Fratzscher (2012), Forbes and Warnock (2012), and Rey (2013). In Fratzscher (2012, table 5, p350), VIX (actually the residual of VIX orthogonalized to the TED spread) is included as a proxy for changes in the levels of risk, and is found to have had a significant negative effect on net equity flows to EMs during the global financial crisis and a positive but insignificant effect in the pre-crisis period. Forbes and Warnock (2012) note that VIX captures changes in both economic uncertainty and risk aversion, and that VIX is positively correlated with stops and retrenchment and negatively correlated with surges and flight (measured by disaggregating extreme flows into gross flows by domestic or foreign investors) but not significantly related to either surges or stops using traditional methodology based on net flows. Miranda-Agrippino and Rey (2012) and Rey (2013) find one single global factor explaining most of the variance in a large cross section of the prices of risky assets around the world, which is strikingly negatively correlated with the VIX. Further, Miranda-Agrippino and Rey (2013) find more bank credit flows into Australia during tranquil periods in international financial markets (reflected in the low value of the VIX). Overall, literature on this issue is very recent and the existing evidence is very preliminary. Remaining questions include whether VIX also matters in non-crisis periods and whether VIX affects net equity flows on a daily basis, etc. Nevertheless, we are interested in the interactions between the VIX and daily flows, and all the previous studies use quarterly, monthly, or at most weekly data.

Table 7: Vector Autoregression of Flows and VIX by Country

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows* (nf_{it}) are the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous-day's market capitalization; *VIX* is the Chicago Board Options Exchange Market Volatility Index, which is the measure of the implied volatility of S&P 500 index options; *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator *L;* and ε_{it}^{nf} and ε_{it}^{VIX} are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report *t*-statistics computed using the OLS variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent level, respectively. For each country the *p*-values of two Granger causality tests are reported. Granger 1: VIX do not Granger-cause flows. Granger 2: Flows do not Granger-cause VIX. The VAR equations are as follows:

$$\begin{pmatrix} nf_{it} \\ VIX_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{VIX} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ VIX_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{VIX} \end{pmatrix}.$$

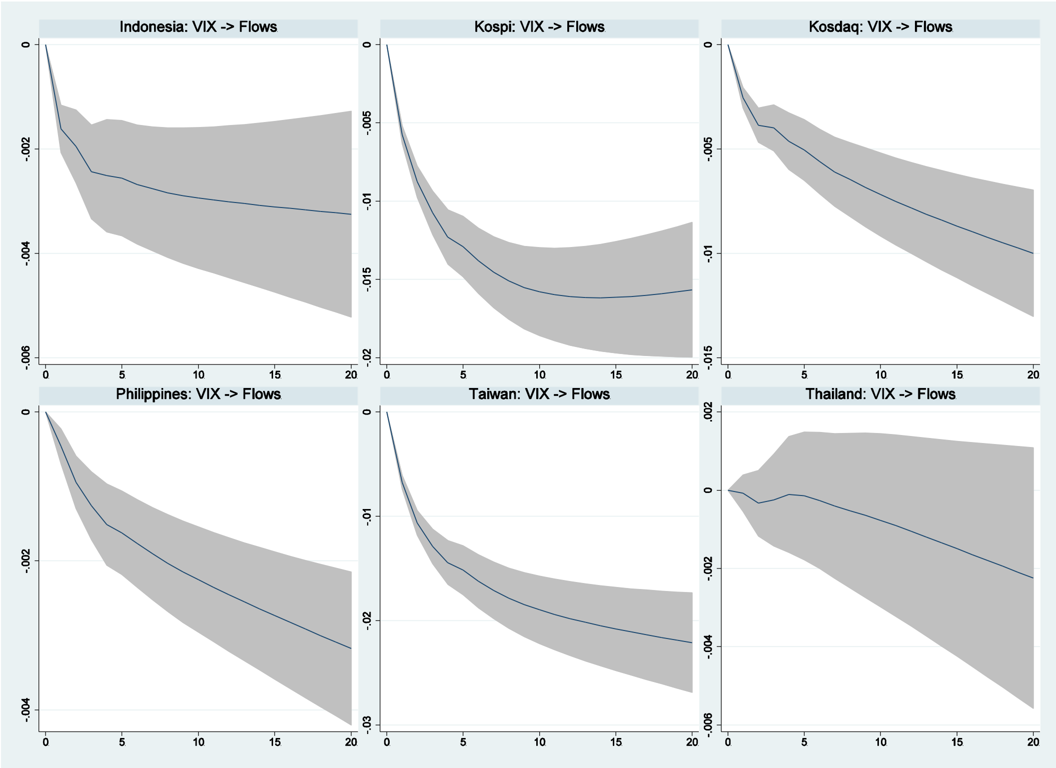
			Flow equations			
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.159***	0.369***	0.337***	0.132***	0.402***	0.496***
	(10.308)	(23.585)	(20.379)	(7.963)	(22.491)	(29.967)
L2.Flows	0.069***	0.073***	0.061***	0.092***	0.073***	0.052**
	(4.402)	(4.362)	(3.488)	(5.520)	(3.794)	(2.816)
L3.Flows	0.046**	0.062***	0.057***	0.060***	0.046*	0.034
	(2.924)	(3.720)	(3.299)	(3.582)	(2.366)	(1.854)
L4.Flows	0.060***	0.062***	0.068***	0.050**	0.039*	0.046*
	(3.873)	(3.797)	(3.920)	(3.023)	(2.102)	(2.510)
L5.Flows	0.027	0.075***	0.059***	0.041*	0.042*	0.032*
	(1.762)	(4.995)	(3.595)	(2.457)	(2.453)	(1.978)
L.VIX	-0.002***	-0.006***	-0.003***	-0.000***	-0.007***	-0.000
	(-6.933)	(-19.508)	(-10.261)	(-3.852)	(-19.832)	(-0.317)
L2.VIX	0.001***	0.004***	0.002***	-0.000	0.005***	-0.000
	(4.250)	(10.256)	(5.191)	(-0.236)	(9.963)	(-0.493)
L3.VIX	-0.000	0.000	0.001**	0.000	0.001**	0.000
	(-0.603)	(0.854)	(2.789)	(1.112)	(2.915)	(1.279)
L4.VIX	0.000	0.000	-0.001	0.000	-0.000	-0.000
	(1.347)	(1.195)	(-1.914)	(0.378)	(-0.032)	(-0.198)
L5.VIX	0.000	0.001**	0.000	0.000	0.001	-0.000
	(0.087)	(2.892)	(1.464)	(1.382)	(1.756)	(-0.813)
Intercept	0.005***	0.001	0.005***	0.003***	0.007***	0.002*
	(4.455)	(0.743)	(4.679)	(4.926)	(4.858)	(2.058)
Adj. R-sq	0.062	0.324	0.232	0.068	0.362	0.330
Granger 1	0.000	0.000	0.000	0.000	0.000	0.346
			VIX equations			
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.320	-0.377	0.073	2.835	-1.064	-4.212***
	(0.315)	(-0.453)	(0.066)	(1.230)	(-1.132)	(-3.678)
L2.Flows	-0.509	1.144	-0.416	-2.813	0.580	0.305
	(-0.495)	(1.295)	(-0.360)	(-1.211)	(0.571)	(0.240)
L3.Flows	0.085	-0.019	-1.359	1.065	-2.245*	0.974

	(0.082)	(-0.021)	(-1.176)	(0.458)	(-2.210)	(0.767)
L4.Flows	0.238	0.251	-1.016	1.257	1.496	1.957
	(0.232)	(0.291)	(-0.886)	(0.541)	(1.520)	(1.542)
L5.Flows	-0.470	-0.120	0.540	-0.629	1.186	0.061
	(-0.464)	(-0.150)	(0.498)	(-0.273)	(1.320)	(0.054)
L.VIX	0.864***	0.860***	0.844***	0.841***	0.853***	0.853***
	(56.216)	(54.922)	(51.139)	(50.685)	(47.815)	(51.629)
L2.VIX	0.040*	0.005	0.024	0.052*	0.067**	0.002
	(1.977)	(0.231)	(1.100)	(2.420)	(2.786)	(0.092)
L3.VIX	0.019	0.064**	0.051*	0.011	-0.022	0.027
	(0.954)	(3.005)	(2.351)	(0.490)	(-0.885)	(1.227)
L4.VIX	-0.008	-0.007	-0.009	0.059**	-0.001	0.040
	(-0.409)	(-0.345)	(-0.401)	(2.705)	(-0.061)	(1.840)
L5.VIX	0.071***	0.065***	0.075***	0.024	0.091***	0.065***
	(4.567)	(3.958)	(4.479)	(1.426)	(4.892)	(3.988)
Intercept	0.316***	0.294***	0.309***	0.279***	0.255**	0.294***
	(4.331)	(4.000)	(3.973)	(3.623)	(3.160)	(3.872)
Adj. R-sq	0.962	0.962	0.964	0.964	0.967	0.963
Granger 2	0.990	0.805	0.511	0.672	0.091	0.003

Figure 5: Impulse Response Analyses between Flows and VIX

This figure shows (A) the cumulative responses of scaled flows to a 1-percent innovation in the VIX and (B) the cumulative responses of VIX to a 1-percent innovation in scaled flows (panel B). The estimates are obtained from the bi-variable vector autoregression system described above in "Econometric Framework," with data from various starting dates to the end of 2013. The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

(A)


Indonesia: VIX -> Flows
Kospi: VIX -> Flows
Kosdaq: VIX -> Flows
Philippines: VIX -> Flows
Taiwan: VIX -> Flows
Thailand: VIX -> Flows

(B)

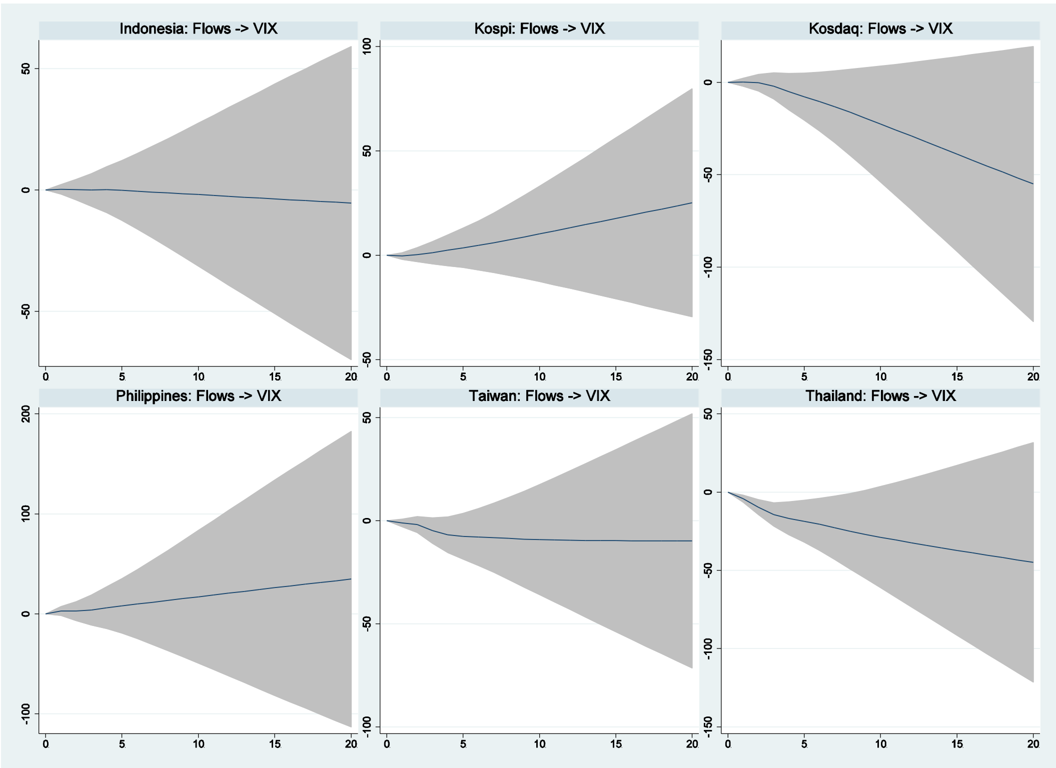
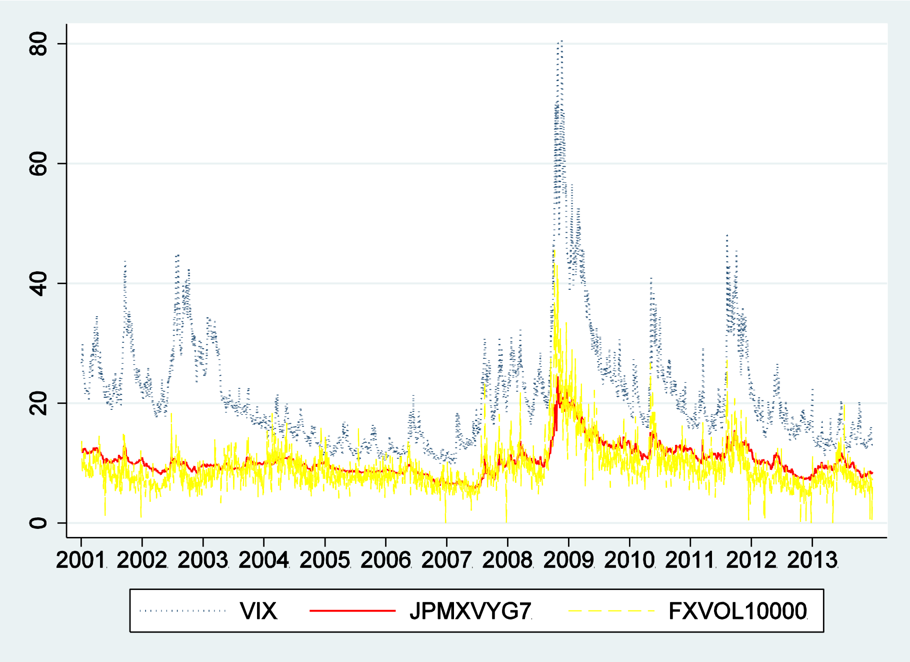

Indonesia: Flows -> VIX
Kospi: Flows -> VIX
Kosdaq: Flows -> VIX
Philippines: Flows -> VIX
Taiwan: Flows -> VIX
Thailand: Flows -> VIX

Table 7 reports the VAR results for our original bivariate VAR system of equity inflows and VIX with bi-directional Granger-causality test results.[3] From the flow equations, we can see in five out of six sample countries, past VIX have a small but strikingly significant (the *t*-statistic is 19.508 and 19.832 for KSE and TWSE, respectively) negative influence on the flows. The only exception is Thailand, which is also negative, though insignificant. These results also are confirmed by the causality test. The adjusted-R2 values are comparable to the previous bivariate VAR system of equity inflows and other variables. From figure 5, panel, the impacts of 1-percent innovations in VIX would be associated on average with a cumulative decrease to standardized net inflows of about −0.006 percent.

Albeit important, global FX volatility has been raised only by a few very recent literature, such as Menkhoff et al. (2012a,b) and Banti (2013). We employ two measures of FX volatility to investigate the role FX volatility as an external factor of net equity flows via a bivariate VAR system as before. On the one hand, we employ the JPMVXYG7 volatility index that captures the implied volatility from currency options of G7 countries (Banti 2013). On the other hand, we follow Menkhoff et al. (2012a,b) and construct realized daily FX volatility from hourly FX trading data. More specifically, we calculate the absolute hourly log return for each currency on each hour in our sample, and then average over all currencies available on any given hour and average hourly values up to the daily. The hourly FX data is from the beginning of 2001 to the end of 2013 via http://www.fxhistoricaldata.com/ and covers the currencies from the European Union, the United Kingdom, Japan, Switzerland, Canada, Australia, and New Zealand.

Figure 6: VIX, Implied FX Volatility and Realized FX Volatility

Figure 6 plots the time-series of VIX, implied FX volatility (JPMXVYG7) and realized FX volatility (FXVOL1000). The vertical axis measures percentages and the horizontal axis measures days. The sample period is from 2001 to 2013 and the observations are daily.



VIX, implied global FX volatility and global FX volatility are plotted in figure 6. It shows a strong variation through time, but significantly high spikes during the latest financial crisis.

Table 8: Vector Autoregression of Flows and Implied Global FX Volatility by Country

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows (nf_{it})is* the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous day's market capitalization. Here the JPMXVYG7 is JP Morgan's implied volatility in currencies through a turnover-weighted index of G7 countries, based on three-month at-the-money forward options, which are designed to measure aggregate risk premiums in currency markets, to calibrate trading strategies and to express views on volatility as an asset class. *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator L; and ε_{it}^{nf} and $\varepsilon_{it}^{JPMXVYG7}$ are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report t-statistics computed using the OLS variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent level, respectively. For each country the p-values of two Granger causality tests are reported. Granger 1: FX volatility do not Granger-cause flows. Granger 2: Flows do not Granger-cause FX volatility. The VAR equations are as follows:

$$\begin{pmatrix} nf_{it} \\ JPMXVYG7_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{JPMXVYG7} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ JPMXVYG7_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{JPMXVYG7} \end{pmatrix}.$$

	Flow equations					
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.160***	0.395***	0.346***	0.136***	0.441***	0.495***
	(10.345)	(25.192)	(20.901)	(8.215)	(24.515)	(30.965)

L2.Flows	0.067***	0.070***	0.058***	0.093***	0.069***	0.053**
	(4.303)	(4.155)	(3.320)	(5.546)	(3.489)	(2.982)
L3.Flows	0.045**	0.052**	0.059***	0.058***	0.046*	0.033
	(2.871)	(3.082)	(3.387)	(3.493)	(2.330)	(1.835)
L4.Flows	0.062***	0.044**	0.068***	0.050**	0.031	0.045*
	(3.942)	(2.648)	(3.893)	(3.020)	(1.560)	(2.529)
L5.Flows	0.026	0.070***	0.066***	0.040*	0.034	0.034*
	(1.666)	(4.489)	(3.983)	(2.402)	(1.891)	(2.152)
L.JPMXVYG7	-0.004**	-0.016***	-0.007***	-0.002**	-0.021***	-0.012***
	(-3.268)	(-8.773)	(-5.014)	(-3.258)	(-10.297)	(-8.799)
L2.JPMXVYG7	0.005*	0.015***	0.009***	-0.000	0.018***	0.013***
	(2.521)	(6.053)	(4.036)	(-0.041)	(6.059)	(6.863)
L3.JPMXVYG7	-0.004*	-0.001	-0.000	0.001	0.002	-0.003
	(-1.992)	(-0.380)	(-0.087)	(1.192)	(0.834)	(-1.672)
L4.JPMXVYG7	0.005*	-0.001	-0.003	-0.001	-0.000	0.002
	(2.444)	(-0.414)	(-1.609)	(-1.118)	(-0.066)	(0.972)
L5.JPMXVYG7	-0.002	0.003	0.002	0.002**	0.000	-0.001
	(-1.109)	(1.531)	(1.345)	(2.806)	(0.205)	(-0.436)
Intercept	0.005**	-0.005*	0.006**	0.004***	0.009***	0.004*
	(2.907)	(-2.036)	(3.148)	(3.780)	(3.298)	(2.028)
Adj. R-sq	0.054	0.274	0.214	0.067	0.311	0.345
Granger 1	0.004	0.000	0.000	0.000	0.000	0.000

JPMXVYG7 equations

	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	-0.169	-0.163	-0.023	-0.078	0.129	-0.232
	(-0.966)	(-1.173)	(-0.122)	(-0.199)	(0.825)	(-1.203)
L2.Flows	-0.108	0.066	-0.072	-0.203	0.159	-0.050
	(-0.614)	(0.444)	(-0.364)	(-0.515)	(0.924)	(-0.235)
L3.Flows	0.240	-0.377*	-0.259	-0.483	-0.662***	-0.211
	(1.357)	(-2.527)	(-1.320)	(-1.221)	(-3.848)	(-0.982)
L4.Flows	-0.265	0.110	0.175	-0.189	0.098	-0.110
	(-1.507)	(0.742)	(0.893)	(-0.479)	(0.574)	(-0.514)
L5.Flows	-0.171	0.081	-0.132	-0.367	0.319*	0.090
	(-0.981)	(0.586)	(-0.712)	(-0.933)	(2.052)	(0.470)
L.JPMXVYG7	1.037***	1.031***	1.027***	1.035***	1.029***	1.064***
	(67.211)	(65.773)	(61.945)	(62.169)	(57.520)	(66.683)
L2.JPMXVYG7	-0.132***	-0.167***	-0.148***	-0.149***	-0.124***	-0.209***
	(-5.949)	(-7.398)	(-6.237)	(-6.202)	(-4.842)	(-8.941)

L3.JPMXVYG7	0.026	0.113***	0.114***	0.076**	0.105***	0.072**
	(1.171)	(4.957)	(4.776)	(3.153)	(4.094)	(3.021)
L4.JPMXVYG7	0.007	-0.039	-0.037	0.014	-0.101***	0.009
	(0.326)	(-1.699)	(-1.562)	(0.590)	(-3.929)	(0.388)
L5.JPMXVYG7	0.055***	0.056***	0.038*	0.016	0.085***	0.057***
	(3.568)	(3.521)	(2.291)	(0.976)	(4.701)	(3.558)
Intercept	0.072***	0.067**	0.069**	0.073***	0.058*	0.071***
	(3.537)	(3.122)	(3.162)	(3.310)	(2.491)	(3.304)
Adj. R-sq	0.985	0.985	0.986	0.986	0.986	0.985
Granger 2	0.246	0.089	0.616	0.495	0.002	0.184

Table 9: Vector Autoregression of Flows and Realized Global FX Volatility by Country

This table presents results from the bivariate vector autoregression (VAR) specified below with five lags for each endogenous variable. *NetFlows* (nf_{it}) is the daily net capital flow (buy value minus sell value) originated by foreign investors scaled by the previous day's market capitalization. Here $fxvol_{it}$ is a straightforward measure to proxy for global FX volatility stemming from Menkhoff et al. (2012). More specifically, we calculate the absolute hourly log return for each currency on each hour in our sample, and then average over all currencies available on any given hour and average hourly values up to the daily. The hourly FX data is from the beginning of 2001 to the end of 2013 via http://www.fxhistoricaldata.com/ and covers the currencies from the European Union, the United Kingdom, Japan, Switzerland, Canada, Australia, and New Zealand. *Intercept* is the constant intercept term; $ø(L)$ is a polynomial in the lag operator L; and ε_{it}^{nf} and ε_{it}^{fxvol} are zero-mean disturbance terms that are assumed to be intertemporally uncorrelated. The VAR is estimated separately for each country. (A) and (B) report coefficient estimates and adjusted R^2 for the flow and return equations, respectively, from a standard VAR with no contemporaneous variables in either equation. We report *t*-statistics computed using the OLS variance-covariance matrix in parentheses; * and ** indicate statistical significance at the 5-percent and 1-percent level, respectively. For each country the *p*-values of two Granger causality tests are reported. Granger 1: FX volatility does not Granger-cause flows. Granger 2: Flows do not Granger-cause FX volatility. The VAR equations are as follows:

$$\begin{pmatrix} nf_{it} \\ fxvol_{it} \end{pmatrix} = \begin{pmatrix} \alpha_{nf} \\ \alpha_{fxvol} \end{pmatrix} + \begin{pmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{pmatrix} \begin{pmatrix} nf_{it-1} \\ fxvol_{it-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{it}^{nf} \\ \varepsilon_{it}^{fxvol} \end{pmatrix}.$$

	Flow equations					
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	0.141***	0.369***	0.361***	0.090***	0.442***	0.489***
	(7.874)	(20.925)	(20.452)	(5.040)	(24.390)	(27.271)
L2.Flows	0.044*	0.086***	0.055**	0.066***	0.062**	0.068***
	(2.424)	(4.596)	(2.899)	(3.725)	(3.120)	(3.401)
L3.Flows	0.044*	0.038*	0.051**	0.043*	0.030	0.026

	(2.444)	(2.046)	(2.699)	(2.387)	(1.522)	(1.287)
L4.Flows	0.061***	0.062***	0.050**	0.027	0.047*	0.045*
	(3.358)	(3.301)	(2.675)	(1.508)	(2.342)	(2.271)
L5.Flows	0.001	0.071***	0.062***	0.009	0.031	0.024
	(0.031)	(4.021)	(3.510)	(0.510)	(1.684)	(1.340)
L.FXVOL	-5.746**	-5.692*	-2.107	-2.875**	-10.106***	-4.799*
	(-2.826)	(-2.239)	(-1.037)	(-2.963)	(-3.586)	(-2.391)
L2.FXVOL	4.931*	1.160	1.523	-0.175	4.481	1.971
	(2.208)	(0.416)	(0.684)	(-0.165)	(1.443)	(0.905)
L3.FXVOL	-0.634	1.730	0.530	-0.796	-5.166	0.190
	(-0.280)	(0.613)	(0.235)	(-0.741)	(-1.644)	(0.086)
L4.FXVOL	-0.618	-0.428	-3.863	-0.372	3.952	1.997
	(-0.277)	(-0.153)	(-1.733)	(-0.351)	(1.281)	(0.921)
L5.FXVOL	2.187	2.303	-1.126	0.747	1.063	-2.031
	(1.078)	(0.905)	(-0.554)	(0.769)	(0.376)	(-1.011)
Intercept	0.004**	0.002	0.006***	0.004***	0.008***	0.003*
	(3.049)	(1.074)	(4.440)	(6.859)	(4.279)	(2.213)
Adj. R-sq	0.036	0.236	0.215	0.038	0.284	0.333
Granger 1	0.077	0.333	0.003	0.000	0.000	0.067

FXVOL equations

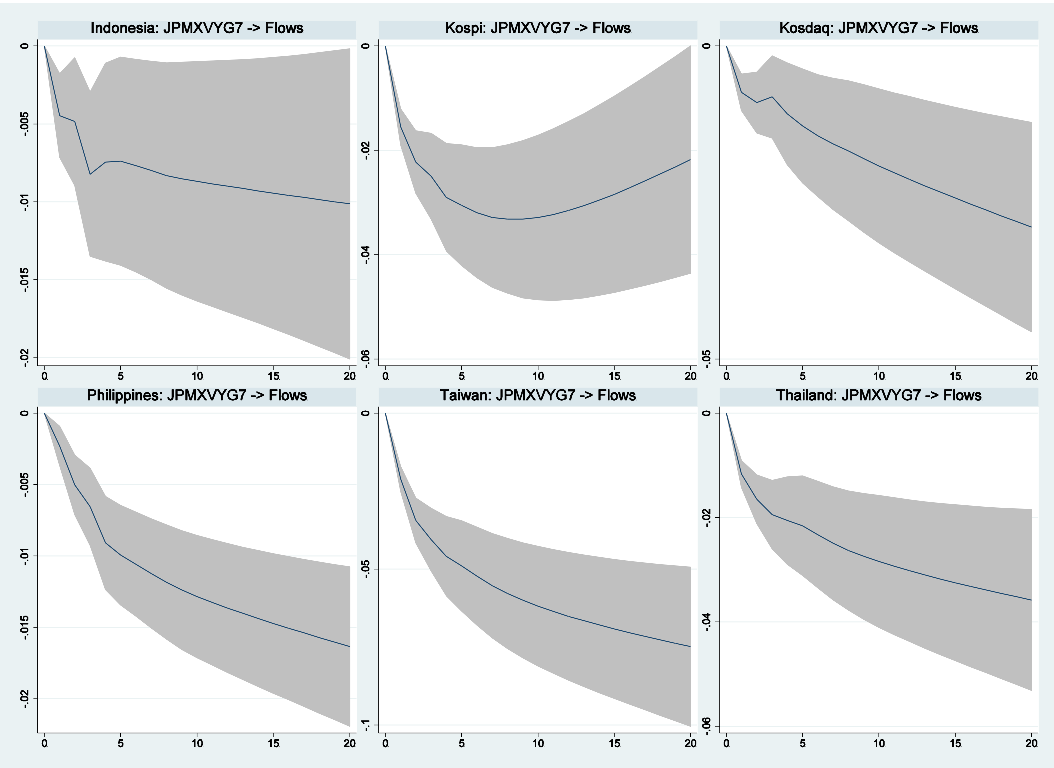
	JSX	KSE	Kosdaq	PSE	TWSE	SET
L.Flows	-0.000**	-0.000	-0.000*	0.000	-0.000	-0.000**
	(-2.918)	(-0.696)	(-1.998)	(0.149)	(-0.406)	(-2.819)
L2.Flows	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
	(-0.073)	(-0.186)	(0.698)	(-1.087)	(-0.992)	(-0.801)
L3.Flows	0.001***	0.000	0.000	-0.000	0.000	0.000
	(3.806)	(0.692)	(0.803)	(-0.238)	(1.549)	(0.764)
L4.Flows	-0.000	0.000	-0.000	0.000	-0.000	-0.000
	(-1.119)	(0.270)	(-0.251)	(0.037)	(-0.351)	(-0.519)
L5.Flows	0.000	0.000	-0.000	-0.000	0.000	0.000*
	(0.670)	(0.003)	(-1.401)	(-0.759)	(0.129)	(1.999)
L.FXVOL	0.459***	0.451***	0.450***	0.442***	0.462***	0.425***
	(25.867)	(25.684)	(25.627)	(25.117)	(25.590)	(23.775)
L2.FXVOL	0.187***	0.186***	0.187***	0.190***	0.195***	0.207***
	(9.587)	(9.646)	(9.719)	(9.873)	(9.813)	(10.653)
L3.FXVOL	0.056**	0.069***	0.069***	0.057**	0.034	0.058**
	(2.821)	(3.542)	(3.564)	(2.912)	(1.710)	(2.939)
L4.FXVOL	0.090***	0.072***	0.071***	0.095***	0.077***	0.090***

	(4.620)	(3.756)	(3.665)	(4.916)	(3.881)	(4.644)
L5.FXVOL	0.125***	0.137***	0.134***	0.134***	0.142***	0.135***
	(7.079)	(7.809)	(7.652)	(7.625)	(7.803)	(7.526)
Intercept	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(6.999)	(7.151)	(7.379)	(6.885)	(6.898)	(7.083)
Adj. R-sq	0.701	0.696	0.697	0.708	0.688	0.701
Granger 2	0.000	0.949	0.192	0.848	0.697	0.006

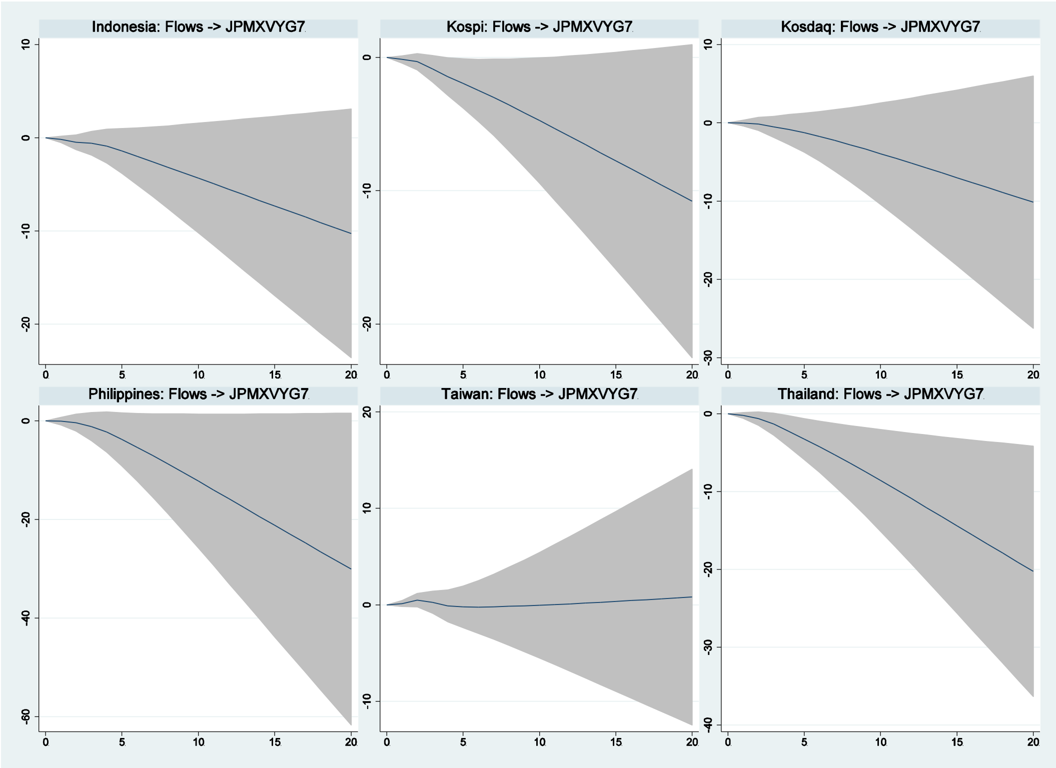
Figure 7: Impulse Response Analyses between Flows and Global FX Volatility

This figure shows the cumulative responses of net inflows to a 1-percent innovation in FX implied volatility (A) and FX realized volatility (panel C), and the cumulative responses of FX implied volatility (B) and FX realized volatility (D) to a 1-percent innovation in scaled flows. The estimates are obtained from the bi-variable vector autoregression system described above in "Econometric Framework," with data from various starting dates to the end of 2013. The gray area represents the 90-percent confidence intervals based on asymptotic standard errors.

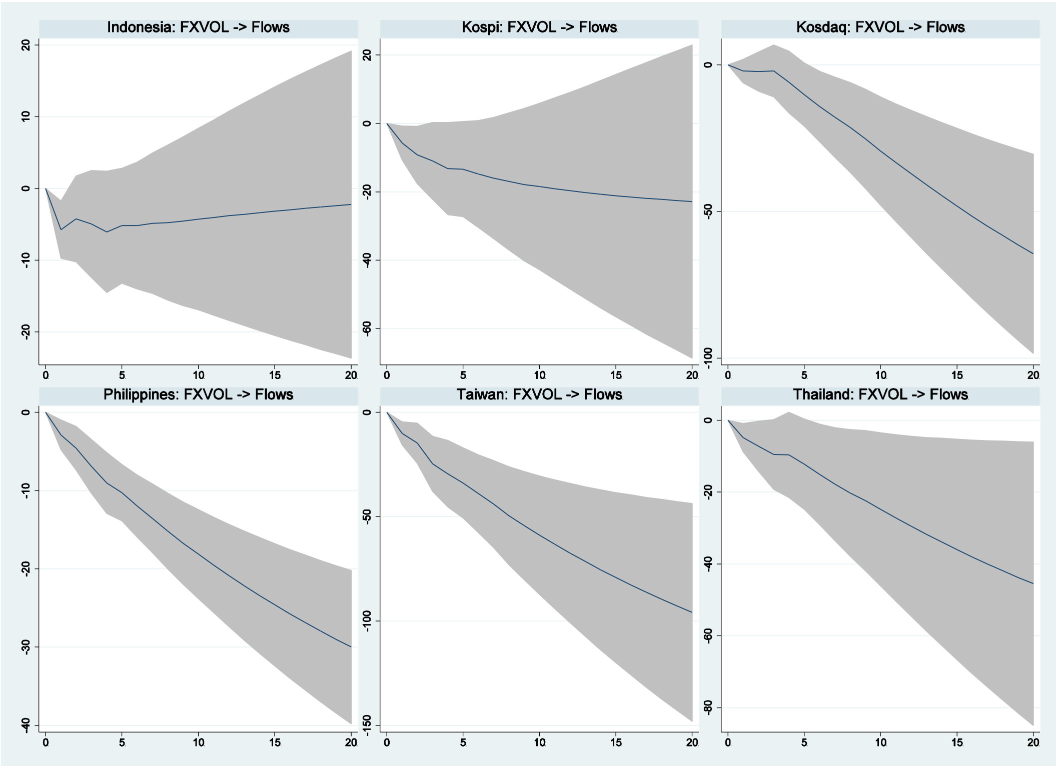
(A)



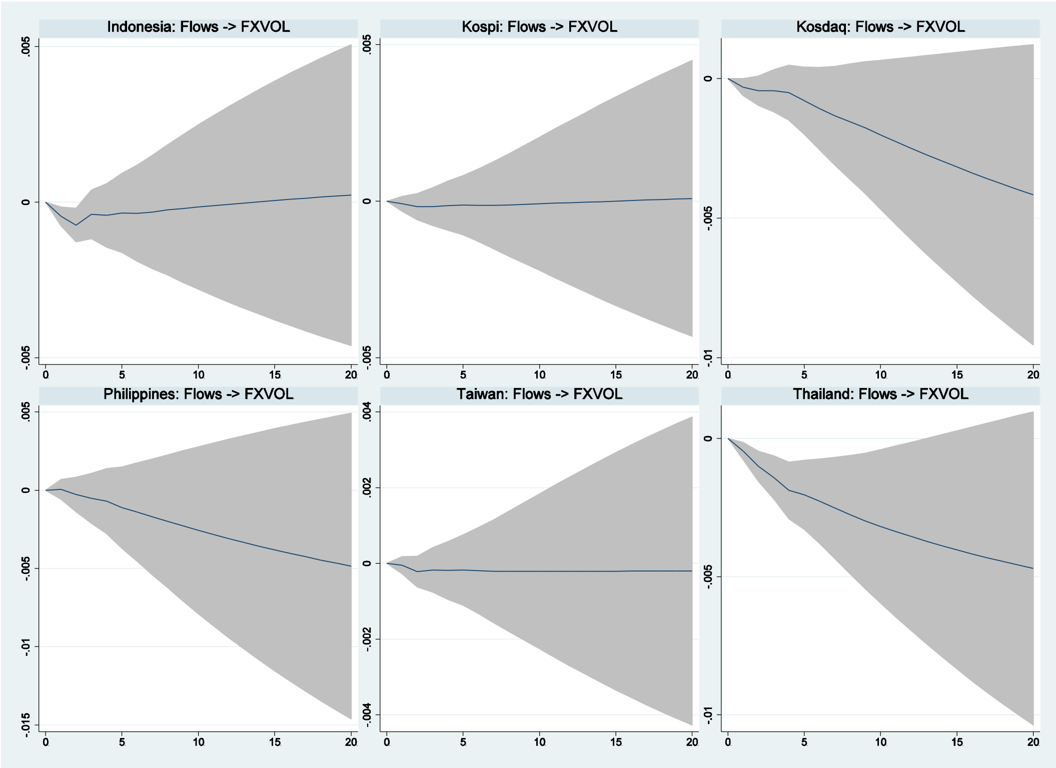
(B)


Indonesia: Flows -> JPMXVYG7
Kospi: Flows -> JPMXVYG7
Kosdaq: Flows -> JPMXVYG7
Philippines: Flows -> JPMXVYG7
Taiwan: Flows -> JPMXVYG7
Thailand: Flows -> JPMXVYG7

(C)


Indonesia: FXVOL -> Flows
Kospi: FXVOL -> Flows
Kosdaq: FXVOL -> Flows
Philippines: FXVOL -> Flows
Taiwan: FXVOL -> Flows
Thailand: FXVOL -> Flows

(D)



The VAR and impulse response analysis results can be found in tables 8 and 9 and figure 7.[4] From table 8A, we can see, in all six sample countries, past implied global FX volatility has a significant (*t*-statistic ranging from 3.258 to 10.297) negative influence on the current flows. The results in table 9A for the realized global FX volatility are similar. In five of six sample countries, past realized global FX volatility has a significant negative influence on current flows. The only exception is Korea (Kosdaq), which is also negative, though insignificant. These results are confirmed by the causality test. The adjusted-R^2 values are also comparable. From figure 7A and C, the cumulative impacts of innovations in both implied and realized FX global volatility to standardized net inflows is significantly negative in more than half the sample countries, and the cumulative impacts of 1-percent innovations in implied and realized FX global volatility would be associated on average with a cumulative decrease to standardized net inflows of about −0.025 percent and −37.739 percent, respectively.[5]

So far it is clear that volatilities both in mature stock markets and foreign-exchange markets have a negative effect on equity flows into the EMs, even in short terms such as on a daily basis. The question turns out to be whether these volatilities are better explanatory variables than the returns variables used in previous literature such as Richards (2005). We assess the explanatory power of these new external variables by putting them to the simple linear model in Richards (2005, 9) and comparing the explanatory power of volatilities to various returns (S&P 500, Nasdaq, Philadelphia Semiconductor, MSCI World, MSCI EM) used in Richards

(2005) in terms of adjusted R^2. To be specific, we regress the net purchases of foreign investors (as a percentage of total market capitalization) in market *i* ($nf_{i,t}$) upon lagged net inflows, contemporaneous own-market (or domestic) returns in local currency ($elr_{i,t}$), and also on various lagged return series ($x_{i,t}$). Like Richards (2005), we also include the contemporaneous returns as a control variable to avoid the possibility of any spurious correlation. For completeness, we include an alternative measure of volatilities, such as the first difference of VIX as the innovation of global equity volatility (Ang et al. 2006), logged VIX and the first difference of logged VIX (Miranda-Agrippino and Rey 2013; Rey 2013), the residual of AR(1) model of global FX volatility (Menkhoff et al. 2012a,b), or the first difference of the logs of global FX volatility (Banti, 2013).

$$nf_{i,t} = \phi_{i0} + \phi_{i1} nf_{i,t-1} + ... + \phi_{i5} nf_{i,t-5} + \phi_{i6} elr_{i,t} + \phi_{i7} x_{i,t-1} + ... + \phi_{i11} x_{i,t-5} + \varepsilon_{i,t} \quad (4)$$

We estimate equation (4) to answer this question, and the results can be found in table 10. For reference, table 10A first provides the adjusted R^2 from equations with only lagged flows, and lagged flows plus contemporaneous domestic returns. Table 10B then presents the adjusted R^2 for the equations that separately include five lags of each of the return variables, and the *p*-values for the hypothesis that the particular return series can be excluded. The results suggest that domestic returns are the best explanatory variables in Indonesia (JSX), Philippines (PSE), and Thailand (SET); Nasdaq is the best explanatory variable in Korea (Kosdaq) and Taiwan (TWSE); and Philadelphia Semiconductor is the best explanatory variable in Korea (KSE). Although in most cases the external equity/FX volatilities significantly improve the explanatory power of equations without lagged returns, they perform no better the past returns.

Table 10: The Explanatory Power of Lagged Domestic and Foreign Factors of Inflows

This table shows the results of regressions to determine the variables that best explain the daily net flows *(nf_{it})* of foreign investors (expressed as percentages of the previous day's market capitalization) in six Asian equity markets over our sample period. (A) shows the adjusted R^2 from a regression with only a constant and five lags of net inflows, and an equation that also includes the contemporaneous return in the market *(elr_{it})*. (B) shows the adjusted R^2 from separately adding five lags of six different returns series *(x_{it})*. *P*-values for the hypothesis that the particular lagged returns series can be excluded are shown in square brackets. Because of the data availability of realized FX volatility and for cross-country comparison reasons, the sample period here for all sample countries is from the beginning of 2001 to the end of 2013. The equation estimated is:

$$nf_{i,t} = \phi_{i0} + \phi_{i1} nf_{i,t-1} + ... + \phi_{i5} nf_{i,t-5} + \phi_{i6} elr_{i,t} + \phi_{i7} x_{i,t-1} + ... + \phi_{i11} x_{i,t-5} + \varepsilon_{i,t} .$$

	JSX	KSE	Kosdaq	PSE	TWSE	SET
Panel A: Adjusted R2 from Equations with No Lagged Returns						
With lagged flows only	0.032	0.234	0.209	0.025	0.279	0.329

With lagged flows and day t returns	0.101	0.340	0.251	0.044	0.506	0.417
Panel B: Adjusted R 2 from Adding Lagged Returns Series (with p-value)						
Domestic returns	***0.127***	0.405	0.271	***0.065***	0.516	***0.477***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
S&P 500 returns	0.106	0.406	0.271	0.048	0.550	0.452
	[0.001]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]
Nasdaq returns	0.111	0.427	***0.274***	0.049	***0.560***	0.452
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Phil. Semiconductor Index returns	0.104	***0.434***	0.273	0.043	0.553	0.441
	[0.016]	[0.000]	[0.000]	[0.635]	[0.000]	[0.000]
MSCI World index returns	0.109	0.425	0.273	0.047	0.549	0.465
	[0.000]	[0.000]	[0.000]	[0.003]	[0.000]	[0.000]
MSCI Emerging Markets returns	0.117	0.411	0.273	0.047	0.533	0.453
	[0.000]	[0.000]	[0.000]	[0.004]	[0.000]	[0.000]
VIX	0.103	0.374	0.267	0.053	0.527	0.417
	[0.028]	[0.000]	[0.000]	[0.000]	[0.000]	[0.139]
First difference of VIX (Ang et al.,2006)	0.103	0.375	0.264	0.048	0.528	0.417
	[0.037]	[0.000]	[0.000]	[0.002]	[0.000]	[0.642]
ln(VIX) (Rey,2013)	0.105	0.383	0.270	0.053	0.546	0.418
	[0.003]	[0.000]	[0.000]	[0.000]	[0.000]	[0.094]
First difference of ln(VIX) (Rey,2013)	0.104	0.383	0.268	0.047	0.547	0.417
	[0.010]	[0.000]	[0.000]	[0.003]	[0.000]	[0.791]
JPMXVYG7	0.102	0.351	0.256	0.051	0.513	0.427
	[0.078]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Residual of AR (1) of JPMXVYG7	0.101	0.350	0.254	0.049	0.513	0.427
	[0.098]	[0.000]	[0.011]	[0.001]	[0.000]	[0.000]
Logdifference of JPMXVYG7 (Banti,2013)	0.100	0.352	0.255	0.048	0.515	0.428
	[0.221]	[0.000]	[0.020]	[0.001]	[0.000]	[0.000]
FXVOL	0.102	0.340	0.255	0.053	0.505	0.418
	[0.195]	[0.242]	[0.000]	[0.000]	[0.005]	[0.000]
Residual of AR (1) of FXVOL (MMMS,2012a,b)	0.102	0.340	0.254	0.054	0.505	0.418
	[0.178]	[0.191]	[0.005]	[0.000]	[0.002]	[0.207]
Log difference of FXVOL	0.100	0.340	0.252	0.046	0.504	0.418
	[0.990]	[0.133]	[0.589]	[0.030]	[0.045]	[0.544]

To sum up, we find that both the past external equity and FX markets have an effect on capital flows into EMs. When the volatility of major external equity/FX markets goes up, there will be less net capital flows into the stock markets in EMs. In most cases, the effect is fairly robust. However, the explanatory power of past external equity/FX volatilities are no better than the explanatory power of past equity returns.

Robustness Tests

To make sure that our key results are robust, we have performed the following robustness tests: scaling flows by volume, scaling flows by the average of absolute flows of previous 25/75 days, using flows without winsorization, adding push factors as in Richards (2005), using one-day lagged flow data, taking alternative number of lags of vector auto-regression like Froot et al. (2001), subsample analyses, using alternative order of variables.

Conclusions

Economists have long studied the behavior and impact of foreign investors in emerging markets. However, the existing literature treats foreign investment like domestic investment and neglects the role of currency risk by measuring all of the returns in U.S. dollars (Froot et al. 2001; Bekaert et al. 2002), or it pays little attention to the role of exchange rate in the process (Brennan and Cao 1997; Griffin et al. 2004; Richards, 2005). Inspired by Hau and Rey (2004, 2006), this research assumes that foreign investors are separated from the home market by an FX rate and investigates the dynamics of equity inflows, exchange markets, and equity markets when foreign investors enter local stock markets in emerging markets. To our knowledge, this paper is the first to explore a possible role of FX in the process during which foreign equity investment affects local equity markets.

We estimate various vector auto-regressions with precise daily equity flows, currency returns, and equity returns in local currency in six Asian markets over a long period from various starting dates to the end of 2013, covering nearly two decades that include both crisis and non-crisis periods. A subsample of our data has been used in Richards (2005), but our sample is three–six times longer. More importantly, the questions from the FX perspective are unique and make this paper and previous papers complementary.

The results of our investigation are at least three-fold. First, using our long-span high-frequency data, we find that foreigners pursue a return-chasing rather than a portfolio-rebalancing strategy with regard to domestic returns in local equity markets, but they pursue neither a return-chasing strategy nor a portfolio-rebalancing strategy regarding currency returns. That is to say, higher equity returns in EMs will attract more foreign investments into the markets in the future rather than induce the global investors to decrease the position of their investments to rebalancing of equity portfolios. However, higher currency returns neither pull more foreign investment into the markets nor initiate selling by foreigners to decrease the exposure of their investments to exchange rate risk. Actually, on a daily basis we find that past currency returns have no significant effect on current net equity inflows as long as the past equity returns are present at the same time.

Second, foreigners' trading has a significant positive impact on foreign-exchange markets as well as on local equity markets, and in both markets the associated impacts are more than temporary. When U.S. dollar returns in the bi-VAR system are replaced with foreign-exchange returns and equity returns in local currency, the impacts on equity returns either become insignificant or are significantly reduced in magnitude. The median impulse response suggests that after twenty days the innovations to net inflows equivalent to 1 percent of market capitalization would be associated on average with a cumulative boost to equity local returns of 13.61 percent and to foreign-exchange returns of 4.16 percent, which means that the effect of capital flows on currency is about one-third of the effect on local equity. These results suggest that researchers and policymakers should be cautious when quantifying the impact of foreign investors on local asset markets. It is better to use equity local returns and take into account the dynamics of FX, in order to avoid mistaking the currency effects of net inflows as equity effects, and not to lose sight of the effects of equity flows on FX market.

Third, like the past returns in external mature equity markets, both the past volatilities of external equity and FX markets have a significant effect on equity flows into EMs. When the volatility of major external equity/FX market goes up, there will be less net capital flows into the stock markets in EMs. In most cases, the effect is fairly robust. The explanatory power of past external equity/FX volatilities are no better than the explanatory power of the past equity.

These results shed a unique perspective on the role of the public currency market in the interrelationship between capital flows and stock markets. In particular, they reveal the extent to which the impacts of capital flows on local economies are indeed on the currency markets instead of equity markets. This research builds on features that are particular to the six Asian countries, and these findings likely have broad implications for understanding the dynamics of capital flows, exchange rates, and stock prices in the post-liberalization era.

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Endnotes

1 We follow the majority of previous literature and define minus [$\ln(e_t) - \ln(e_{t-1})$] as FX returns in this paper; we are aware that a small strand of papers use [$\ln(e_t) - \ln(e_{t-1})$] as FX returns.

2 Because we have no prior information about the ordering between FX returns and equity returns, we must use the generalized impulse response function for equation (3) in "Econometric Framework." In order to make comparison and for robustness of all the other results, we use generalized impulse response function throughout this paper.

3 Similar results are obtained when we use the first order difference of VIX (Ang et al. 2006; Sarno et al. 2013).

4 Similar results are obtained when we use the innovation of global FX volatility, either the residual of the AR(1) model of global FX volatility (Menkhoff et al. 2012a,b) or first difference of the logs of global FX volatility (Banti 2013).

5 The magnitude of realized FX volatility is 10,000 times smaller than the VIX or the JPMVXYG7 volatility index, which means that it is not comparable to the implied volatilities. However, the VIX and the JPMVXYG7 volatility index are in similar magnitude, and we can see that implied FX volatility has a greater impact than the VIX.