Are Asset price movements driven by international capital flows? The case of emerging markets♣

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Abstract

Large swings in developing countries' asset price movements are often associated with volatile capital flows. This paper develops a multi-step empirical procedure to investigate the mechanism behind. We are able to extract and separate unobserved permanent and transitory components ("hot money") of the international capital flows. Transitory components are important, even for the Foreign Direct Investment (FDI). Taking that into account, the prediction of neoclassical growth model actually holds for the FDI but not the Portfolio Investment (PI) and Other Investment (OI) in our cross-country sample. We also confirm that real net FDI, PI and OI inflows are correlated with the real stock market prices. Statistically speaking, the magnitude of the impulse response of real stock prices to a real hot money shock is significantly related to the per capita real GDP and human capital index of the receipient countries.

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I. Introduction

International capital flows (CF) is well-known for its volatility. For instance, as the Deputy Governor of the Reserve Bank of Australia then, Grenville (1998) pointed out in a speech that "…The central point here is that some types of capital flows, for all their benefits, are very volatile. Policy-makers are not just interested in the *growth* of GDP, but its *variance*. Large volatile influences are a policy nightmare." Such volatility of CF is well-demonstrated by Figure 1: Global capital inflows increase from 2.42% of world's GDP in 1991 to the historical peak of 25.56% in 2007, followed by the lowest record of 2.38% in 2009.[1] With such a scale, it is not surprising that CF, especially when it quickly enters and leaves an economy as "hot money" (HM), would triggers booms and busts in asset markets, even threatening the macroeconomic and financial instability (Chari and Kehoe, 2003; Forbes and Warnock, 2012; Kaminsky, 1999; Kaminsky and Reinhart 1998; Martin and Morrison, 2008; Milesi-Ferretti and Tille, 2011; Reinhart and Rogoff, 2011; Tong and Wei, 2011; among others). In fact, Figure 1 clearly shows that between the periods from 1991 to 2016, four remarkable drops in CF are all associated with some form of "crisis", including the Asian Financial Crisis (AFC) in the late 1990s, the bursting of dot-com bubble in early 2000s, the Global Financial Crisis (GFC) in late 2000s and the European sovereign debt crisis in early 2010s.

(Figure 1 about here)

In light of that, several questions naturally arise. First, what are the factors that drive the CF? Second, what are HM and how is the HM component of CF differ from the "non-HM" component? Third, what is the relationship between CF and asset price movements? Clearly, this paper is *not* the first attempt to address these questions. For instance, a typical undergraduate textbook would respond to the first question by suggesting CF moves from the North (or Advanced Economies, or ADV) to the South (or

[1] Source: World Economic Outlook (world's GDP), Balance of Payments and International Investment Position Statistics (capital inflows) and author's calculation.

Emerging Markets, or EM). The intuition is simple. If the production technologies across countries are more or less the same, ADV, who have more capital, would have a lower marginal product of capital (MPK). EM, on the other hand, have a lower level of capital and hence should have a high MPK. Arbitrage would lead to capital moving from ADV to EM. Unfortunately, this neoclassical prediction is at odd with the data, as highlighted by Lucas (1990) and many subsequent studies.[2]

This paper attempts to contribute to the literature in the following ways. First, using *net capital flow data*, we document that the prediction of Neoclassical growth model holds for the Foreign Direct Investment (FDI) but not the Portfolio Investment (PI) and Other Investment (OI).[3] This "stylized fact" seems to be consistent with the "composition hypothesis" that different kinds of CF affect the economy differently, but it may not be consistent with the "two-way capital flows hypothesis" which suggests the FDI flow is consistent with the neoclassical growth model, while financial capital flows from poor to rich countries.[4] Instead, we find no clear relationship between net PI and OI outflows and the income level of the countries. This leads us to a basic question about what is associated with PI and OI. Using *gross capital flow data*, we find that PI and OI inflows are instead significantly associated with stock market prices.[5]

Second, we study how the HM interact with the asset prices in EM. The justifications are clear. EM seem to suffer more with the volatile HM than ADV. ADV has a larger stock of capital and hence the marginal impact tends to be smaller. Since HM may not be directly observable, we need to take a stand

[2] On top of the so-called Lucas puzzle on why capital does not flow from ADV to EM, Gourinchas and Jeanne (2013) raise the allocation puzzle: capital flows to emerging markets are not only low by size but are allocated to countries that grow less than other emerging markets.

[3] Our informal discussion with others seem to suggest that colleagues in policy circles have more concerns on the inflows of capital, while colleagues from academia tend to push us to study the net flow of capital. We examine both. Due to the space limit, however, we are more focused on the net flow in the text. Supplementary results from inflows are available upon request.

[4] The literature is too large to be reviewed here. Among others, see Bekaert et al. (2005), Wei (2006) and the literature review in a later section.

[5] If the word "net" is absent, capital inflows refer to gross inflows.

on how we construct the time series of HM. Among others, Claessens et al. (1995) show the unreliability of categorizing capital flows into "short-term" and "long-term" by using accounting labels. Following Harvey (1981, 1989) and Sarno and Taylor (1999a) we take into consideration the temporariness and reversibility properties of hot money and suggest identifying HM through an unobserved-component approach. Sarno and Taylor (1999b) and Fuertes et al. (2014) apply a similar approach to identify HM flows in different developing countries.

We follow that literature and separate the permanent component from the temporary components (HM) of the international capital flows. Moreover, we make some additional adjustments. For instance, we observe that large surges and flight in CF may be infrequent events and may be driven by non-economic reasons (such as natural disasters, personnel changes of political leaders, etc.), and hence become potential outliers and breaks in the data, we include interventions to the unobserved components model. Clearly, HM is a fast-moving component of capital flows and it is associated with short-run fluctuations of macro-variables. Therefore, we also extract temporary components from macro-variables of EM and ADV for our VAR and impulse responses analysis. We envision the world where the macro-factors of ADV affect the macro-factors and HM of EM, but not vice versa. In practice, however, there are too many macro-variables for ADV, given a short sample size of each EM. It is therefore natural to employ a two-step factor-augmented VAR (FAVAR) model. First, principal component analysis is conducted to extract the "common factors" among the macro-variables of ADV. In the second step, three FAVAR models, with respectively FDI, PI and OI hot money inflows as the dependent variable, are estimated for each of the 24 EM in our sample. Thus, we have 71 FAVAR models in total. Following Ouliaris and Pagan (2016) sign restriction approach, we estimate the stock market prices response to shocks in HM components of FDI, PI and OI inflows, with the economic fundamentals being naturally controlled for.

The rest of the paper is organized as follows. Section II provides a review of related capital flows literature. Section III provides a discussion on the pattern of net FDI, PI and OI inflows. Section IV shows the relationship between real capital inflows and real assets prices. Section V, VI and VII are methods, data, and results, respectively. The last section concludes.

II. Literature review

Before we go into the formal analysis, it is instructive to review the related strands of literature and relate this paper to them.

a. The Lucas puzzle

Based on the standard textbook production function in the neoclassical growth model and data from Summers and Hestion (1988), Lucas (1990) conclude that the MPK in India should be about 58 times the MPK in the United States. Under the assumption of free and complete international capital market, investment goods from the United States and other ADV would flow rapidly to India and other EM and expect no investment from EM to ADV under such degree of return differentials. However, a massive amount of capital flows from ADV to EM are not observed in practice. African countries are the typical examples of the "Lucas puzzle." During the two major capital-inflow episodes in the period of 1974-81 and 1988-97, the labor- and resource-abundant African countries were not the major capital flows recipients (Montiel, 2006).

To address the "Lucas puzzle" of why capital flow does not flow from rich to poor countries, many efforts have been devoted. For instance, Alfaro et al. (2003) examine empirically the role of heterogeneous fundamentals across countries and capital market imperfections in explaining the Lucas puzzle. They find that low institutional quality is the leading explanation during 1970-2000. In the Federal Reserve Board Speech, Bernanke (2005) argue that the rate of return in EM is, in fact, lower in EM due to a savings glut. Hence, capital flows from EM to ADV. Laibson and Mollerstrom (2010), however, find that global savings rates did not show a robust upward trend during the relevant period. They suggest national asset bubbles result in international imbalances. Caballero et al. (2008) show that EM cannot generate enough savings instruments, resulting in a reverse capital flows from EM to ADV after financial liberalization. Mendoza et al. (2009) ascribe global imbalances to the differences in financial development between EM and ADV. Buera and Shin (2013) present a model with underdeveloped financial markets and conclude that under the domestic financial frictions, saving rates increase but investment rates respond with a lag, leading to capital outflows. Sandri (2010) blames insurable idiosyncratic investment risk in EM causing entrepreneurs rely on saving for self-financing. For the precautionary reason, the increase in saving needs to be larger than the increase in investment. This net increase in saving can sustain current account surpluses. Similarly, Angeletos and Panousi (2011) indicate uninsurable idiosyncratic entrepreneurial risk introduces a precautionary motive for saving and a wedge causing lower interest rates EM and hence, capital flows out from EM.

Some authors argue that the key to the Lucas puzzle is that poor countries have the inferior technology and hence capitals do not have higher marginal products in those countries. Cole et al. (2016) therefore rephrase the Lucas puzzle by asking why technology does not flow from rich to poor countries since with lower factor prices in EM, a technology that is profitable in ADV should be even more profitable in EM. They show that the inefficiency of financial markets may explain why certain types of technologies cannot be implemented in EM. Similarly, a recent study Buera and Shin (2016) argue that total factor productivity (TFP) matters. When the pre-existing idiosyncratic distortions are removed by a large-scale economic reform, the TFP of a small open economy increases. In the meantime, due to the domestic financial frictions, saving rates go up but investment rates respond with a lag, causing capital outflows.

Backus et al. (2014), on the other hand, suggest demographic changes matter. There are two important demographic changes: (1) change in life expectancy would affect the household saving decision and

(2) change in the age distribution would affect the aggregation of those decisions. Thus demographic trends play an important role in driving international capital flows. Other related works include Carroll and Jeanne (2009); Durdu et al. (2009); Chien and Naknoi (2011); Wen (2009, 2011); Andolfatto (2012); Chari et al. (2012); among others.

b. Two-way capital flows hypothesis

In contrast to the abovementioned literature, some studies turn the focus to two-way capital flows to explain the Lucas puzzle. The two-way capital flows hypothesis argues that the international movement of FDI flows are consistent with the neoclassical growth model; it is rather the financial flows that lead to the Lucas puzzle. Prasad et al. (2006) characterize the patterns of capital flows between EM and ADV and find that capital has been flowing from EM to ADV while FDI flows are more in line with neoclassical growth model. Ju and Wei (2010) propose a model to explain two-way capital flows in which savings flow out of EM in the form of financial capital under inefficient financial system while foreign investment takes place in EM in the form of FDI. Wang et al. (2015) distinguish financial capital from fixed capital flows in their model and introduce two wedges: a saving wedge and an investment wedge. In their model, since both firms and households in EM are borrowing constrained, domestic savings cannot be effectively channeled to firms. Hence, savings are abundant and fixed capital is scarce in EM. High MPK and low-interest rates for financial assets causing two-way capital flows.

c. The determinants of capital flows

What causes extreme capital flow movements? Many answers have been proposed and it is beyond the scope of this paper to review that literature. Nonetheless, it may be instructive to highlight a few contributions in the literature that may enlighten the subsequent discussion. Raddatz and Schmukler (2012) show that investors and fund managers adjust their investments in response to changes in the country returns substantially, creating large international capital flows reallocations during the crisis period, exposing countries in their portfolios to foreign shocks. Mercado and Park (2011) study the determinants of capital inflows and find that there are three important determinants of capital inflows to developing Asia, namely per capita income growth, trade openness, and change in stock market capitalization. In particular, trade openness increases the volatility while the change in stock market capitalization, global liquidity growth, and institutional quality lowers the volatility. For emerging Europe and emerging Latin America, a regional factor plays an important role in determining the size and volatility of capital inflows. Forbes and Warnock (2012) introduce a methodology for identifying episodes of extreme capital flow movements in order to study what causes the episodes. These episodes are, namely capital surges, stop, flight and retrenchment. Different from other related literature, the authors employ gross flows instead of net flows for analysis. They show that global factors, especially global risk, are significantly related to extreme capital flow episodes. Contagion, whether through trade, banking, or geography, is also associated with stop and retrenchment episodes. Surprisingly, there is little association between capital controls and the probability of having foreign capital surges or stops.

Capital surges, stop, flight and retrenchment are directly linked to the term “hot money”. Hot money is commonly referred to the capital flows aiming at a short-term profit, interest rate differentials, anticipated exchange rate shifts or equity premium (Guo and Huang, 2010a, b; Fuertes et al., 2014). Informational friction is also a potential cause of hot money. In the model of Brennan and Aranda (1999), foreign investors are less informed about the domestic investors. This informational friction results in a more volatile debt capital flows compared to equity capital flows. It is shown to be consistent with the pattern of international capital flows during the Asian crisis. Similarly, Chari and Kehoe (2003) build a model to show how informational frictions in international financial markets and standard debt default problems produce hot money.

d. Capital controls

Obviously, hot money is an important policy concern. Korinek (2011) argue that hot money is a cause of serial financial crises. In his model, there is a group of borrowing countries access finance from international investors and these countries are subject to borrowing constraints that depend on their value of asset holdings. When one of the borrowing countries is hit by an adverse shock, the borrowing constraints will bind and agents have to cut back consumption. This will then lead to a fall in asset prices, further tightening borrowing constraints and declining consumption. International investors lose investment opportunities and the interest rate is bided below the steady-state level. Other unconstrained countries may raise their debt and expose themselves to the risk of future financial constraints.

Therefore, policy-makers have been trying to manage inflows through macro policy and capital controls. Edison and Reinhart (2001) examine three cases of capital controls: Brazil 1999, Malaysia 1998, and Thailand 1997. The aims of capital controls are stabilizing the exchange rate and interest rate and achieving more policy autonomy. They find that capital controls did not achieve much of the intended results in Brazil and Thailand. By contrast, in Malaysia, capital controls were effective in achieving the intended outcomes. Using a data set covers 69 emerging market and developing economies over 1975-2004, Glick and Hutchison (2011) also find that capital controls did not effectively protect economies from currency crises during the sample period.

Thus, there is no single way to deal with the negative impact of short-term capital inflows. Ostry et al. (2010) summarize some conditions for capital controls to be justified: (1) the economy is operating near potential, (2) level of reserves is adequate, (3) exchange rate is not undervalued and (4) capital flows are likely to be transitory. The use of macro policy is another way to deal with short-term capital inflows. However, in some circumstances macro policy alone may not be appropriate, for instance, if the inflation rate is high or currency is already too strong, lowering policy rates will be ill-advised. Therefore, policymakers need to use a mixture of macro policy and capital controls in different circumstances. Ostry et al. (2012) suggest prudential policies and capital controls in place during the booms would help to enhance financial stability and economic resilience during surges of capital.

e. Measuring hot money

Notice that while hot money (HM) appear frequently in the media, it is a “conceptual construction” and it is not directly observed. Hence, a strand of empirical literature is developed to measure HM and investigate its properties and the effects on asset prices. Some authors directly construct the HM series using items in the balance of payment account while some identify hot money through unobserved-component approaches. Zhang and Fung (2006) calculate the amount of hot money inflow as (change in foreign exchange reserves) minus (trade and service balance) minus (foreign direct investment). Their empirical work shows stock composite index is important in explaining housing price movements, which are also affected by the inflation rate and hot money inflows. Following the same definition, Guo and Huang (2010a) investigate the extent of the impact from hot money inflow on the fluctuations of the real estate and stock markets of China. Their results indicate that hot money has driven up property prices as well as contributed to the accelerating volatilities in both markets. In particular, they find that hot money is an important determinant of the fluctuations of China's property prices. Other studies employing the same definition include Martin and Morrison (2008); Guo and Huang (2010b). Bouvatier (2010), however, defines hot money as (portfolio investment) plus (other investment) plus (errors and omissions) and concludes hot money inflows in China were particularly strong in 2003 and 2004.

On the other hand, Claessens et al. (1995) show the unreliability of categorizing capital flows into “short-term” and “long-term” by using accounting labels. Following Harvey (1981, 1989), Sarno and Taylor (1999a) take into consideration the temporariness and reversibility properties of hot money and suggest identifying hot money through an unobserved-component approach. They employ maximum likelihood Kalman filtering techniques and non-parametric variance ratio statistics to study the relative importance of permanent and temporary components of capital flows to Latin American and Asian developing countries over the period 1988–1997. They find relatively low permanent components in equity flows, bond flows and official flows, while commercial bank credit flows appear to contain quite large permanent components and FDI flows are almost entirely permanent. Applying the same technique, Sarno and Taylor (1999b) find relatively high reversible components in portfolio flows to East Asian economies. Fuertes et al. (2014) deploy state-space models à la Kalman filter and control for the influence of push and pull factors in the unobserved components to investigate the relative importance of hot money in bank credit and portfolio flows from the US to 18 emerging markets over the period 1988- 2012. Their analysis reveals that hot money in bank credit flows has increased during the 2000s relative to the 1990s.

f. Capital flows and asset prices

Last but not the least, we would stress that there is an emerging literature on the nexus between capital flows and asset prices. Kim and Yang (2011) employ a panel VAR model for five Asian countries. They suggest that capital inflows contribute to asset price appreciation, although capital inflow shocks explain a relatively small part of asset price fluctuations. Also, capital flow shocks increase stock prices immediately and land prices with some delay. Sá et al. (2011) and Tillmann (2013) estimate panel VAR models for different sets of countries. They apply sign restrictions to identify monetary policy and capital inflows shocks and find capital inflow shocks have a significant effect on the appreciation of asset prices. Helbling et al. (2011) use sign restrictions to identify a credit shock and find credit market shocks drive activity during the latest global recession. Credit shocks originating in the United States have a significant impact on the evolution of world growth during global recessions. Agnello and Schuknecht (2011) also find that international liquidity triggers the housing booms and busts.

III. Pattern of capital flows

We begin with clarifying the pattern of net capital outflows and establish some potentially new "stylized facts."[6] Table 1 is constructed in the spirit of Ju and Wei (2010) and Wang et al. (2015). In Panel A, the average net FDI outflows are 0.91% and -2.28% of GDP for ADV and EM, respectively. Clearly, on average EM is a *net importer* while ADV is a *net exporter* of FDI. The pattern reverses for

[6] It is well known that even international "stylized facts" can change over time. For instance, see Cheung et al. (2005).

the average net financial investment outflows. This is, unsurprisingly, consistent with the two-way capital flow hypothesis (TWCFH). Nevertheless, given that financial investment consists of four types of capital flows, namely portfolio investment (PI), other investment (OI), financial derivatives and reserve minus gold, a natural question to ask is "do the elements of the financial investment follow the same pattern?". We pay particular attention to PI and OI for several reasons. PI and OI flows mainly reflect the private market decisions, while "reserve minus gold" may be related to central banks behaviors, which may involve some non-economic considerations. Financial derivatives might involve hedging and speculation, which may have very different objectives from PI and OI. In addition, data availability issue also prevents us from conducting a more systematic investigation on the financial derivatives component of the CF. We view PI as a direct way to access financial markets, providing liquidity and flexibility, while OI is a large residual category that mainly consists of debt instruments. Moreover, many studies treat the entire PI and OI inflows as a part of the hot money,[7] as some authors find that PI mainly consists of temporary components.[8]

(Table 1 about here)

According to the TWCFH, EM should be a net exporter of PI and OI. In Table 1 Panel B, when the top two Asian financial centers, Hong Kong and Singapore, are removed from the EM group, net PI outflows change from 0.33% to -0.55% of GDP. Statistically speaking, these countries are clear outliers are hence removing them from the sample seems to be justified.[9] For the case of OI (panel C), there is no clear direction either. Thus, our stylized facts show that PI and OI are not only inconsistent with the TWCFH but also neoclassical model prediction and Lucas puzzle. There is still much to explain.

[7] Examples are Zhang and Fung (2006); Bouvatier (2010) and Guo and Huang (2010).

[8] Examples are Sarno and Taylor (1999) and Fuertes et al. (2014).

[9] Hong Kong and Singapore are outliers with net PI outflows of 13.2% and 13.8% of GDP, respectively.

VI. Capital flows and asset prices

In the light of that, we return to the basic question: what factors drive PI and OI? Given the definitions of PI and OI, it is natural to conjecture that they are linked to asset prices, for example, stock market prices. In the following analysis, we will focus on the case of EM and hence it is connected to the recent attention on the relationship between capital flows and asset prices in EM.

As a first pass of the data, we run some basic regressions. We ask whether capital flows indeed drive stock prices. Table 2 Panel A shows that real FDI inflows do not seem to affect the real stock price, while real PI and real OI inflows do. However, this approach, while seems intuitive and popular, may overlook some subtle econometric issues. For instance, these regressions have assumed that CF is an exogenous variable while the real stock prices is an endogenous variable. In fact, CF might also be affected by the previous period real stock price movements. The idea is simple. For instance, an expected improvement in productivity, whether due to technological improvement or due to a political reform, would stimulate the real stock price. At the same time, foreign capital would be attracted by a "high return environment." Hence, a conventional regression may not be sufficient to capture such dynamic interactions. Therefore, some supplementary regressions are run and the results are reported in Panel B. It clearly shows that real stock prices in current and/or lagged period significantly affect different components of real capital flows. Hence, we need a framework which allows for the dynamic interactions between real capital flows and real stock prices. This is also consistent with the previous literature which emphasizes on both the "push" and "pull" factors of capital flows.[10]

(Table 2 about here)

V. Method

[10] According to International Monetary Fund (2014), "push factors include weak economic growth, excess liquidity, and low bond yields in advanced economies." "Pull factors," on the other hand, refers to the factors of the recipient countries (RC) which attract capital flows, such as "better economic prospects" of the RC. Throughout this paper, we will use "push and pull factors" or "external and internal factors" interchangeably.

In the previous section, we have established the "stylized fact" that CF and the stock prices in EM exhibit two-way-dynamic-interactions. Therefore, to complement some previous studies which focus on cross-sectional regressions, this section explicitly models the dynamic interactions among the hot money inflows, asset prices and macroeconomic variables in EM.

Our procedures are as follows. First, we extract and separate unobserved permanent and temporary components (i.e. HM) for both real FDI, PI and OI inflows for EM. Since large surges and flight during the financial crisis may be infrequent events and hence are potential outliers and breaks in the data, interventions are incorporated into the unobserved-component model. Also, EM may experience some idiosyncratic shocks during transitions and reforms. Without controlling for breaks and outliers, the estimation of the unobserved components may be affected.

Notice also that the current framework captures the idea that capital flows or hot money can be induced by external as well as internal factors. For instance, if ADV receive favorable shocks, they might want to invest in EM to diversify their investment. Similarly, an improvement of the macroeconomic conditions in EM could also attract investment from ADV. Therefore, we extract temporary components from macro-variables of EM and ADV to form the VAR system. Figure 2 provides a visualization of our econometric framework.

(Figure 2 about here)

To extract hot money from CF and short-run components from macro-variables, we employ the unobserved-component approach, which emphasize the temporariness and reversibility properties of hot money (Sarno and Taylor, 1999a). A general state space model may be written as:

$$y_t = \mu_t + \upsilon_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t \qquad \varepsilon_t \sim NID(0, \sigma_\varepsilon^2) \qquad (1)$$

where

$$\begin{aligned} \mu_t &= \mu_{t-1} + c + \eta_t, & \eta_t &\sim NID(0, \sigma_\eta^2) \\ \beta_t &= \beta_{t-1} + \xi_t, & \xi_t &\sim NID(0, \sigma_\xi^2) \\ v_t &= \rho_1 v_{t-1} + \rho_2 v_{t-2} + \zeta_t, & \zeta_t &\sim NID(0, \sigma_\zeta^2) \end{aligned}$$

and $\rho_1 + \rho_2 < 1$, $\rho_2 - \rho_1 < 1$ and $|\rho_2| < 1$. In this formulation, ε_t is the irregular component, μ_t is the trend (level) component, c is the slope of the trend and v_t is the cycle component represented by an AR(2) process. The intervention variables are represented by $w_{j,t}$ which take the forms of:

$$w_t = \begin{cases} 0 & for \;\; t \neq \tau \\ 1 & for \;\; t = \tau \end{cases} \qquad \text{for outliers,}$$

$$w_t = \begin{cases} 0 & for \;\; t < \tau \\ 1 & for \;\; t \geq \tau \end{cases} \qquad \text{for level breaks}$$

and

$$w_t = \begin{cases} 0 & for \;\; t < \tau \\ 1 + t - \tau & for \;\; t \geq \tau \end{cases} \qquad \text{for slope breaks}$$

For detecting level breaks and outliers, *t*-test for auxiliary residuals will be carried out. Figure 3 illustrates the point that ignoring structural breaks and outliers would lead to biased estimation. The effective exchange rate of Russia has a clear structural break, as reflected visually as well as formal *t*-statistics. After correcting for the structural break, it is clear that the accuracy of the estimation is significantly improved. That said, we also need to guard against the possibility of "over-fitting." Therefore, we do not add interventions for every outlier and level break detected. Instead, it must be based on theories or facts that concerning the possible causes of the breaks, for example financial crisis (Commandeur and Koopman, 2007).

(Figure 3 about here)

While equation (1) provides the general state space model, there are several variations that we can estimate, as reported in Table 3. To choose the "optimal model" among them, we adopt AIC as the selection criteria:

$$AIC = log(PEV) + 2 \times \frac{n+d}{T}$$

where PEV is the prediction error variance at steady state, d is the number of non-stationary elements in the state equations and n is the number of hyperparameters.

(Table 3 about here)

To study the impact the hot money, or the transitory components of net real capital inflows, we adopt the following definition:

$$\mathrm{HM_t} = V_t + \varepsilon_t + coefficients\ of\ outliers\ and\ level\ breaks\ at\ the\ break\ dates$$

It is clear that V_t, ε_t and outliers are transitory components. A level break, by definition, causes a permanent shift in the stochastic level. However, taking away level breaks from the transitory components would lead to a loss of information of the sudden drops or increases in level at the dates when the level breaks occur. We, therefore, include the coefficients of level breaks *at the break dates* as transitory components. We treat the slope interventions as a part of the stochastic level and hence, a part of the permanent components[11].

To assess the persistence of the capital inflows, Q-ratio will be employed:

$$Q(\mu_t) = \frac{\sigma_\eta^2}{\max(\sigma_\eta^2, \sigma_\zeta^2, \sigma_\varepsilon^2)}$$

The Q-ratios are scaled measures of the importance of the unobserved permanent and transitory components of the flows. If most of the dynamics in the flows is due to the permanent component, then we expect the Q-ratio for the stochastic level to be one; this means that a large part of the capital flows will remain in the country concerned for an indeterminate period of time. Instead, if most of the variation in capital flows is explained by the dynamics of the transitory component then the Q-ratio of

[11] Empolying a local linear trend model where the slope of the level is allowed to be time-varying may substitute some of the slope interventions. However, such model implies an I(2) process and it is suitable for our marco variables. See Harvey (1989) for a discussion of local linear trend model.

the AR component or the irregular component is equal to 1. In other words, the capital flows under consideration are dominated by hot money.

Clearly, we deviate from the usual approach of employing first difference filter to induce stationarity. A potential problem of using first difference filter is that only high frequency component remains, however, correlations between different variables may exist in lower frequency bands (for example, see Baxter, 1994). To validate our approach, we will provide a more formal comparison in a later section.

Now we have separated the hot money component from the original time series of capital flows. Our next step is to investigate how the hot money might affect the asset prices in EM. As we have explained earlier, our "identification assumption" is that the macro-factors of ADV would affect the counterparts in EM, but not vice versa. Furthermore, we allow the macro-factors and HM to interact dynamically. It leads us to adopt a FAVAR framework.[12]

A priori, however, we *do not know which ADV's variables are more decisive* in affecting the EM neither. Our sample of ADV contains 22 countries. Including all of them in the regression may not be practical as the time dimension of our sample is relatively short. Moreover, even if we could include all the macroeconomic variables in our econometric model, macroeconomic variables are known to be correlated, *both across and within countries*. Hence, including all the macroeconomic variables from ADV would not be necessary. We, therefore, follow Stock and Watson (2002a, b), among others, to extract principle components from macroeconomic variables as "common factors," and use those "factors" in the subsequent investigation. More specifically, this paper employs a two-step factor-augmented VAR (FAVAR) model. First, we conduct a principle component (PC) analysis on the macro-variables of 6 selected ADV, namely, Australia, Canada, Euro area, Japan, the United Kingdom and the United States, and we use those PC to represent the impact of the developed world.[13] In the

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[12] Some previous work, such as Fuertes et al. (2014), incorporate macro factors as *exogenous* variables to explain capital inflows in the unobserved component models.

[13] We follow the standard procedure that all the series are normalized to zero mean and unit variance before PC are

second step, three FAVAR models, with respectively FDI, PI and OI hot money inflows as the dependent variable, are estimated separately for each of the 24 EM[14].

Formally, consider the vector $PC_t = \left[PC_{1_t}\ PC_{2_t} \ldots PC_{m_t}\right]'$ where m is the number of principle components extracted from ADV. The FAVAR model is then modeled as:

$$X_t = \varphi_0 + \sum_{j=1}^{p} \varphi_j X_{t-j} + \sum_{i=1}^{q} \theta_i PC_{t-i} + \in_t \qquad (*)$$

where φ_0 and $\in_t \sim i.i.d.N(0, \Sigma_\in)$ are $k \times 1$ vectors, X_t is a $k \times 1$ vectors of endogenous variables. The list of variables are shown in data section. φ_j are $k \times k$ matrices, p and q is the maximum number of lags selected by BIC and θ is a $k \times m$ matrix. It is assumed that the macroeconomic variables of advanced economies are exogenous to the system. However, we do not know a priori how the variables x_t and PC_t interact. The conventional approach is to assume some form of block-recursive structure in the matrices φ_j .[15] However, as explained in Leeper et al. (1996) and others, some of those assumptions might have economic interpretations and hence an assumed block-recursive structure might have precluded certain types of economic dynamics that are of interest.

We therefore follow the sign restriction approach proposed by Ouliaris and Pagan (2016). The structural form of FAVAR model is

$$B_0 X_t = B_1 X_{t-1} + \cdots + B_p X_{t-p} + \alpha_1 PC_{t-1} + \cdots + \alpha_q PC_{t-q} + w_t^x$$

where B_0 has a unit diagonal, and w_t^x is the residual term. As shown in equation (*), $\in_t$ and $\Sigma_\in$ are the innovation of reduced form VAR and variance-covariance matrix, respectively. It can be shown that

$$\Sigma_\in = B_0^{-1} \Sigma_w B_0^{-1\prime}$$

extracted.

[14] Countries included in the VAR analysis are shown in Appendix A.

[15] Among others, see Christiano et al. (1999).

We first draw above-diagonal elements of B_0 such that sign restrictions are satisfied. Then we solve for remaining elements of B_0 and diagonal elements of Σ_w in order to obtain the impulse response. Inspired by Sá et al. (2011) and Tillmann (2013), a set of sign restrictions for a HM inflows shock is shown in Table 4.

(Table 4 about here)

VI. Data

We use the best data accessible to us, which include the series of several variables from 2003Q1 to 2017Q1 in quarterly frequency. The net capital inflows data (FDI, PI, and OI) for EM are collected from Balance of Payments and International Investment Position Statistics (BOPS). Since the net capital inflows are expressed in terms of U.S dollar, we follow the prior studies to deflate the capital flows by U.S. CPI. Inflation rate, current account balance as a percentage of GDP, GDP, short-term and long-term interest rates, M2 (ADV only), unemployment rate (ADV only) and stock market index are collected from International Financial Statistics (IFS) and OECD Statistics. Variables, except inflation rate, current account balance as a percentage of GDP and unemployment rate, are deflated by the CPI of the corresponding countries. The real effective exchange rate is obtained from Darvas (2012). If data are not available from above dataset, we employ data from national sources. All series are seasonally adjusted.

VII. Results

Table 5 shows the summary statistics for the state space decomposition of EM net real FDI, PI and OI inflows and Figure 4 provides a visualization.[16] Several findings are in order. It is obvious from Figure

[16] The statistics for the state space decomposition of macro series are put in the online appendix.

4 that FDI consists of a large proportion of permanent components than that of PI and OI. PI and OI are mainly dominated by the temporary or hot money component. It is also clear that hot money flows are active before and during the recent global financial crisis.

In Table 5, in general, the assumption of no serial correlation of standardized residuals are satisfied except for a few series. The local level model (model 1) is selected to be the best decomposition model for the vast majority of the capital flows series. As it does not contain cyclical components represented by AR(1) or AR(2), "short run persistence" is not observed in general. Moreover, in the case of FDI, the estimated final level of stochastic trend components are significant for most of the countries. This means there is a non-negligible permanent component in FDI in most of the countries, which is consistent with the previous studies.

The Q-ratio indicates net real FDI, PI, and OI inflows are not persistent in general. In contrast, previous studies such as Sarno and Taylor (1999a b) and Fuertes et al. (2014) find that FDI is persistent. One possible explanation is that we use a different dataset. While previous studies focus on the US capital flows to other countries, this paper analyzes capital inflows data of many EM. It may not be too surprising that FDI inflows tend to be persistent in a single-country-to-single-country scenario, especially if a country's policy is consistent and the economy is dominated by a small number of large firms.[17] On the other hand, our paper studies an "aggregate scenario," where we construct "global dynamic factors" variables from many macroeconomic variables of selected ADV, and then estimate a FAVAR for FDI of each EM, hence allow for heterogeneity across countries. We have in mind behind the FDI flows come from international investors, which in turn consist of firms from different nations and industries that are facing different cycles. It is possible that while some investors persistently inject capital, some stop or even retrieve their investment. Therefore, FDI could be "hot" in an aggregate sense.

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[17] For instance, see Gabaix (2016).

It is worth to note that China, whose Q-ratios of the permanent components equal to one in all cases, is the only exception. In the recent decade, China constantly liberalizes her economy and enters a high-growth-era. In the light of that, it is not surprising that China receives relatively persistent net foreign capital inflows compared to other emerging countries.

(Table 5 and Figure 4 about here)

Notice that our procedure differs from the usual approach of detrending with first difference (FD) filter. As a comparison, we separately conduct correlation and principal components analysis for the same macro series of ADV using FD filter and the unobserved-component (UC) model. Table B1 of Appendix B shows that transitory components of obtained from UC are more correlated than the FD series.

Notice that while both FD and UC would produce stationary PC for regression, the capacities of these PC constructed by different methods can differ. Table 6 shows the first 10 components of the two methods. The UC "outperforms" the FD in the sense that the first 5 components of the UC account for 66% of the variations while the FD accounts for only 54%. We also conduct the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy for the two methods. Series with KMO measures lower than 0.5 is not satisfied in general. The KMO statistic indicates the sampling adequacy is higher under the UC method.

(Table 6 about here)

Naturally, one would wonder what these PC represent. While the details are provided in the Appendix, Table 7 highlights the major contributors of the first five PC. It is clear that PC1 captures the common components of the real stock market index, real short-term interest rate, and unemployment rate. PC2 captures the common components of the real effective exchange rate and real money supply in many countries. PC3 captures the common component in real GDP and the unemployment rate in most of the countries. PC4 captures inflation rate, real money supply and current account balance % of GDP in most countries. Finally, PC5 captures the real long-term interest rate in all countries. These results seem to be reasonable and in line with some previous research.

(Table 7 about here)

Finally, we analyze the impulse response of the transitory component of the stock market index to an HM shock. We estimate the impulse responses for each country and would like to compare the magnitude of impulse responses across countries. To facilitate a cross-country comparison, we introduce the notion of peak response (PR). For example, if the stock price of a country increases 2% relative to its steady-state value after a PI hot money shock, and then the response dies out over time, we define the peak response of this country to an HM PI shock to be 2%. Figure 5 provides a visualization of PR.

(Figure 5 about here)

Figure 6 (a), (b) and (c) plot the initial real income against the PR of asset prices to an FDI hot money shock, a PI hot money shock and an OI hot money shock, respectively.

(Figure 6 about here)

Interestingly, in the case of FDI and PI hot money shock, countries with *lower* initial real income per capita tend to have *larger* PR of stock prices. The opposite happens in the case of OI hot money shock. This pattern maybe caused by the different compositions of these capital flows and the degree of financial development among the EM. FDI and PI mainly consist of equity while OI is mainly (external) debt instruments. Clearly, a lower level of per capita GDP itself may reflect not-so-healthy financial system, poorer institutions, lower quality human capital, long-lasting effects of historical events, etc.[18] Table 8 shows regressions of PR of real stock prices to FDI and PI real hot money shocks. The results

[18] The related literature is too large to be reviewed here. Among others, see Acemoglu et al. (2014), Engerman and Sokoloff (2008), Hanushek et al. (2015), Hanushek and Woessmann (2012, 2016), Wei (2006), etc.

suggest that once the quality of human capital, as well as financial development index, are controlled for, the relationship between PR and real GDP per capita becomes insignificant, while the quality of human capital significantly affects the PR in the cases of FDI and PI. Thus, countries with the *higher* quality of human capital, have *lower* PR of real stock prices.

(Table 8 about here)

On the other hand, a well-developed financial system may imply less stringent borrowing constraints in the external channel. Therefore, asset prices in higher income countries are more sensitive to an international debt shock, which is represented by an OI hot money shock in this paper.[19]

VIII. Conclusion

This paper attempts to deepen the understanding of the capital flows and its relationship with asset price movements. We find that the prediction of Neoclassical growth model holds for the Foreign Direct Investment (FDI) but not the Portfolio Investment (PI) and Other Investment (OI): there is no clear relationship between net PI and OI outflows and income level of countries. Instead, the stock market prices are significantly associated with capital inflows. We then construct hot money series for FDI, PI and OI inflows and find that even FDI contains temporary components. We also study the impulse response of stock market prices to a hot money shock. The results indicate that countries with lower initial real GDP per capita tend to have larger peak responses of stock prices in the case of FDI and PI hot money shocks. The opposite happens in the case of OI hot money shock. This may lead to a concern about the capacity of the relatively less developed EM to handle hot money. On the other

[19] Among others, see Aoki et al. (2009) for a related theoretical analysis.

hand, more developed EM with the better financial system may face the threat of international debt shocks. We believe that these findings carry both academic as well as policy implications. For instance, as some dynamic, stochastic general equilibrium (DSGE) models are constructed to match the impulse responses of the model with that in data, our results relating the initial real GDP per capita to peak impulse responses may shed light on the future theoretical modeling. Similarly, countries with different levels of real GDP per capita should expect that their responses to different kinds of capital flows can be very different, and should hence design policy, if any, with that taken into consideration.

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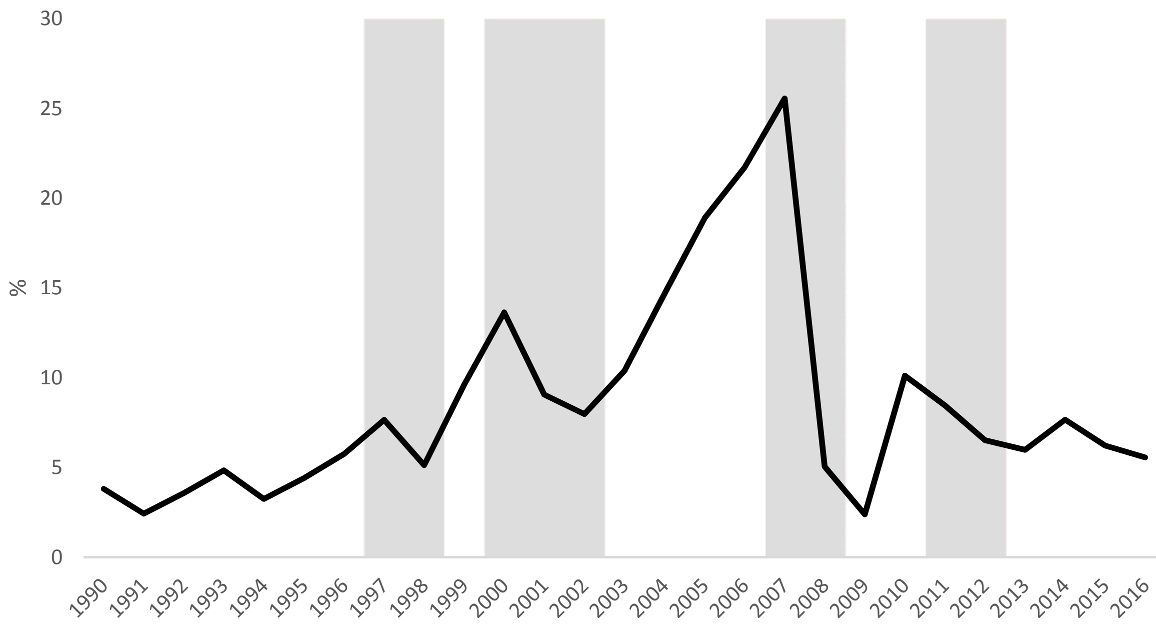
Figure 1 World's capital inflows as a percentage of World GDP



Notes: Shaded areas indicate Asian Financial Crisis in late 1990s, the bursting of dot-com bubble in early 2000s, the Global Financial Crisis (GFC) in late 2000s and the European sovereign debt crisis in early 2010s.

Figure 2 The econometric framework of this paper

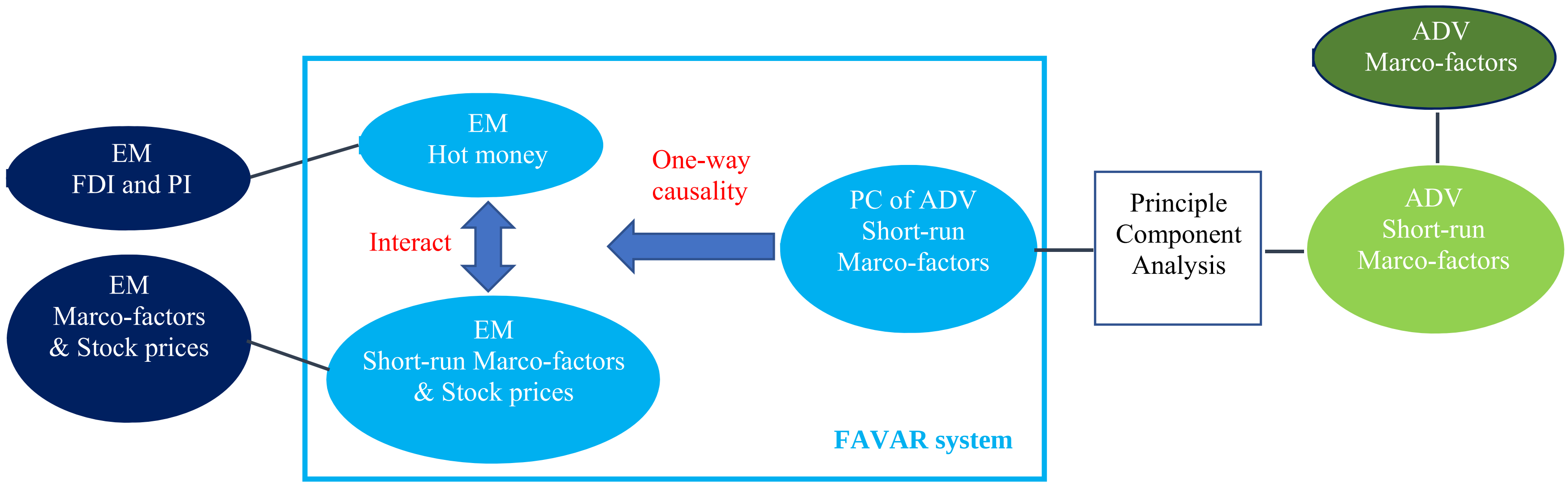
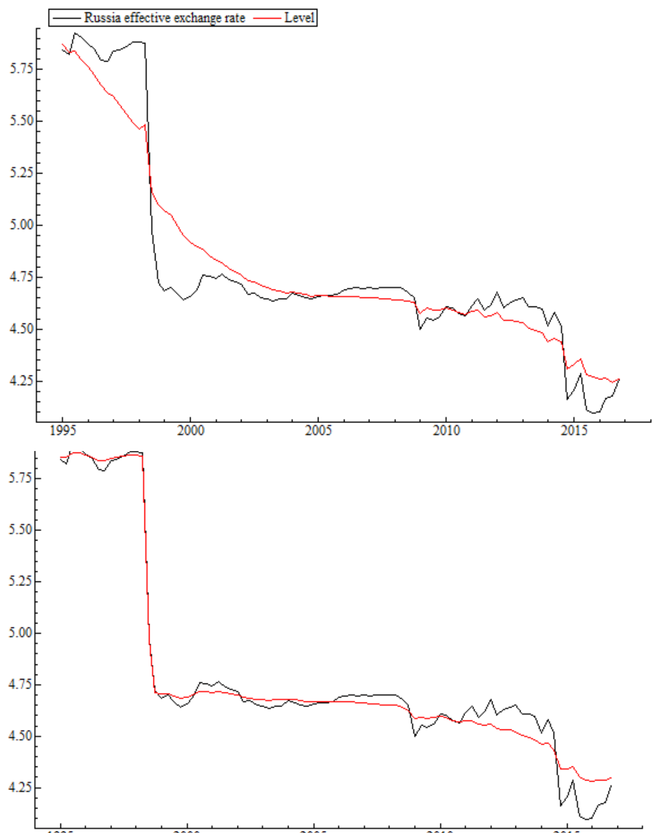


Figure 3 An example of structural break and estimation

(a) a level component without intervention



(b) *t*-tests for auxiliary residuals

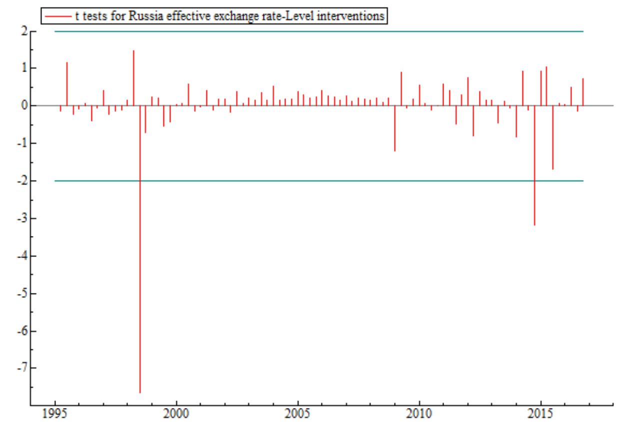
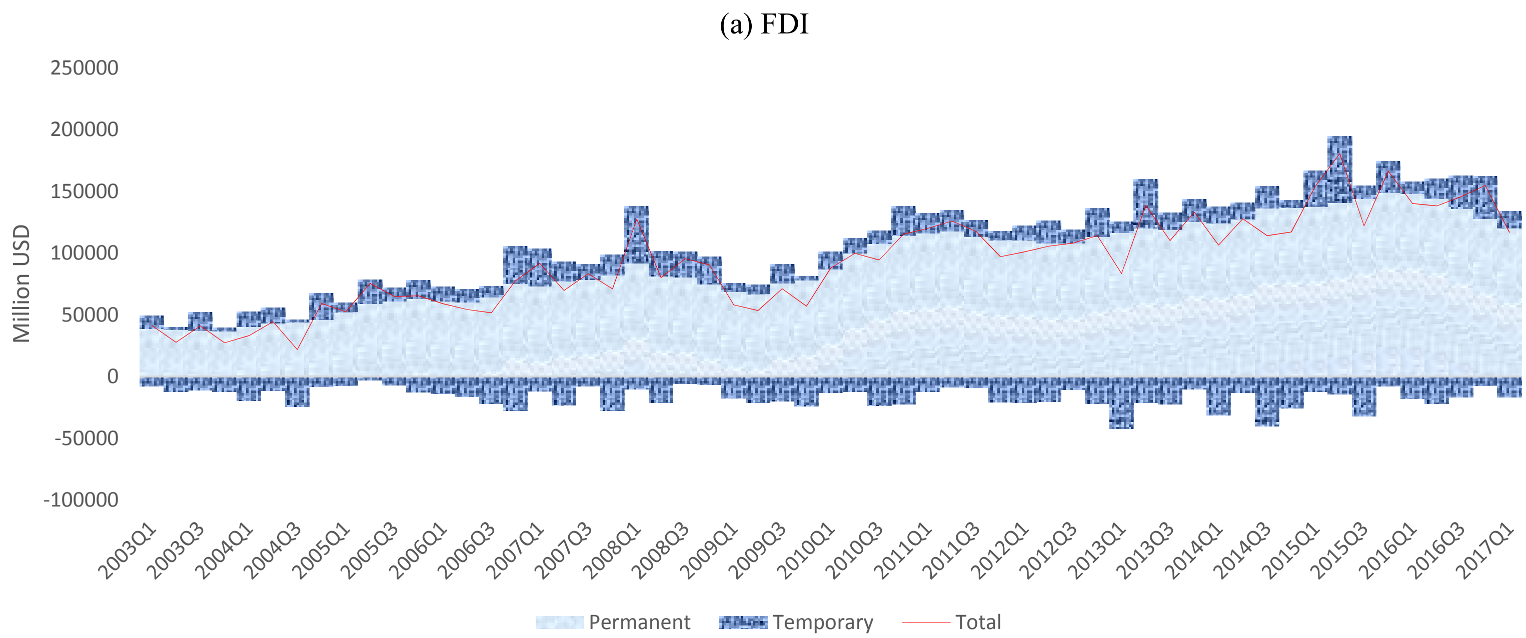
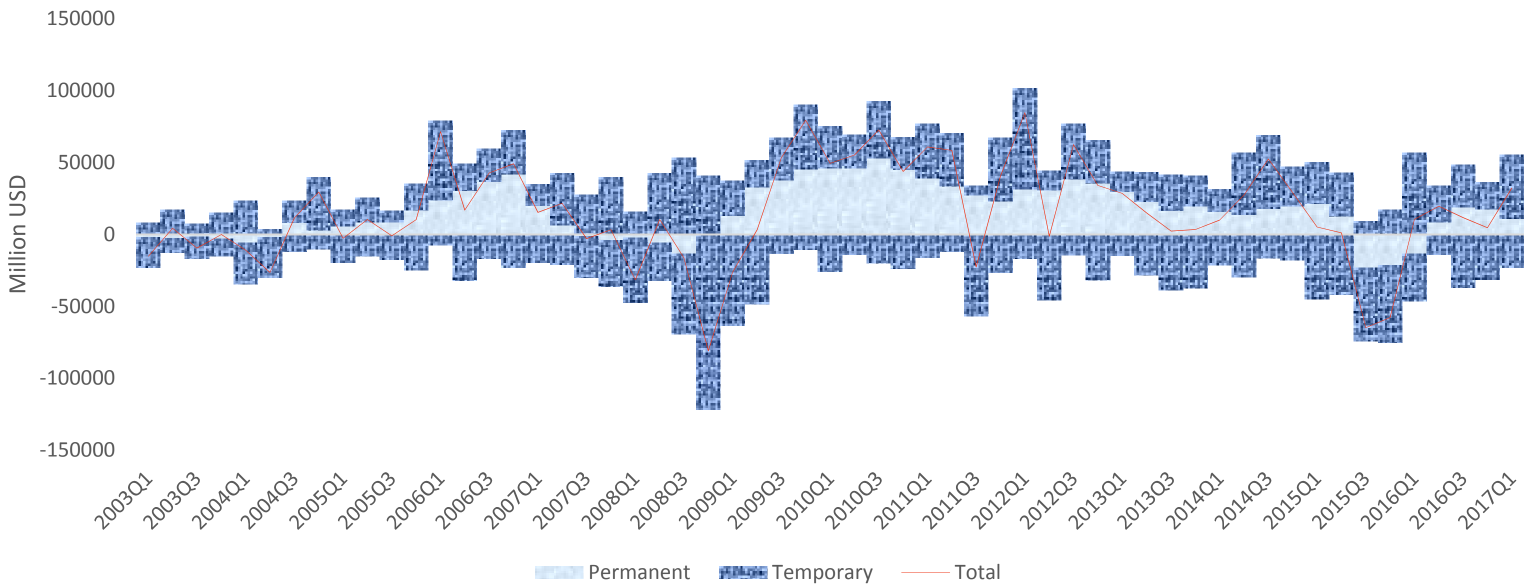


Figure 4 Composition of capital net inflows in EM



(b) Portfolio investment



(c) Other investment

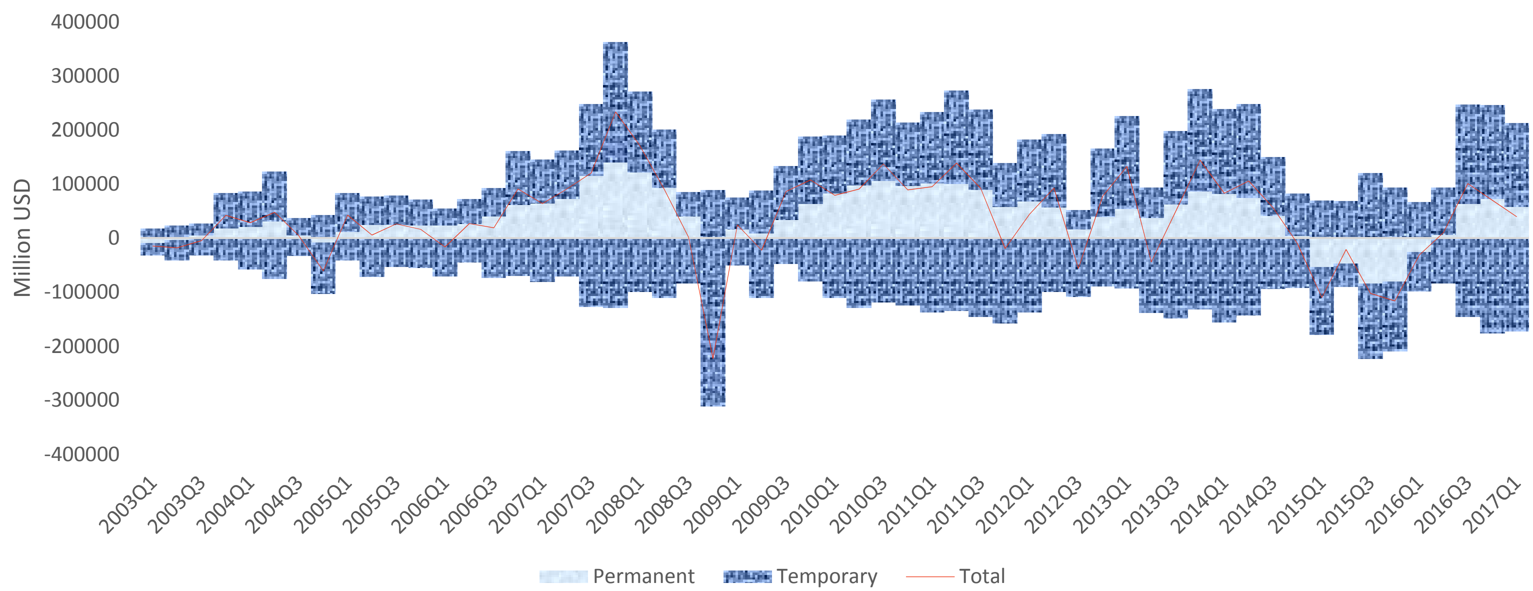


Figure 5 Example of peak response (PR)

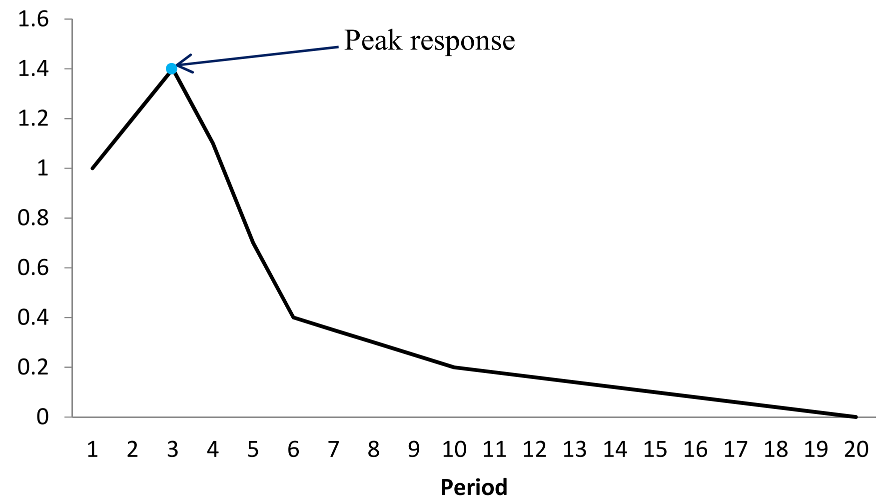


Figure 6 Hot money shock: Peak impulse response (PR) of stock price vs. initial (2003) real GDP per capita

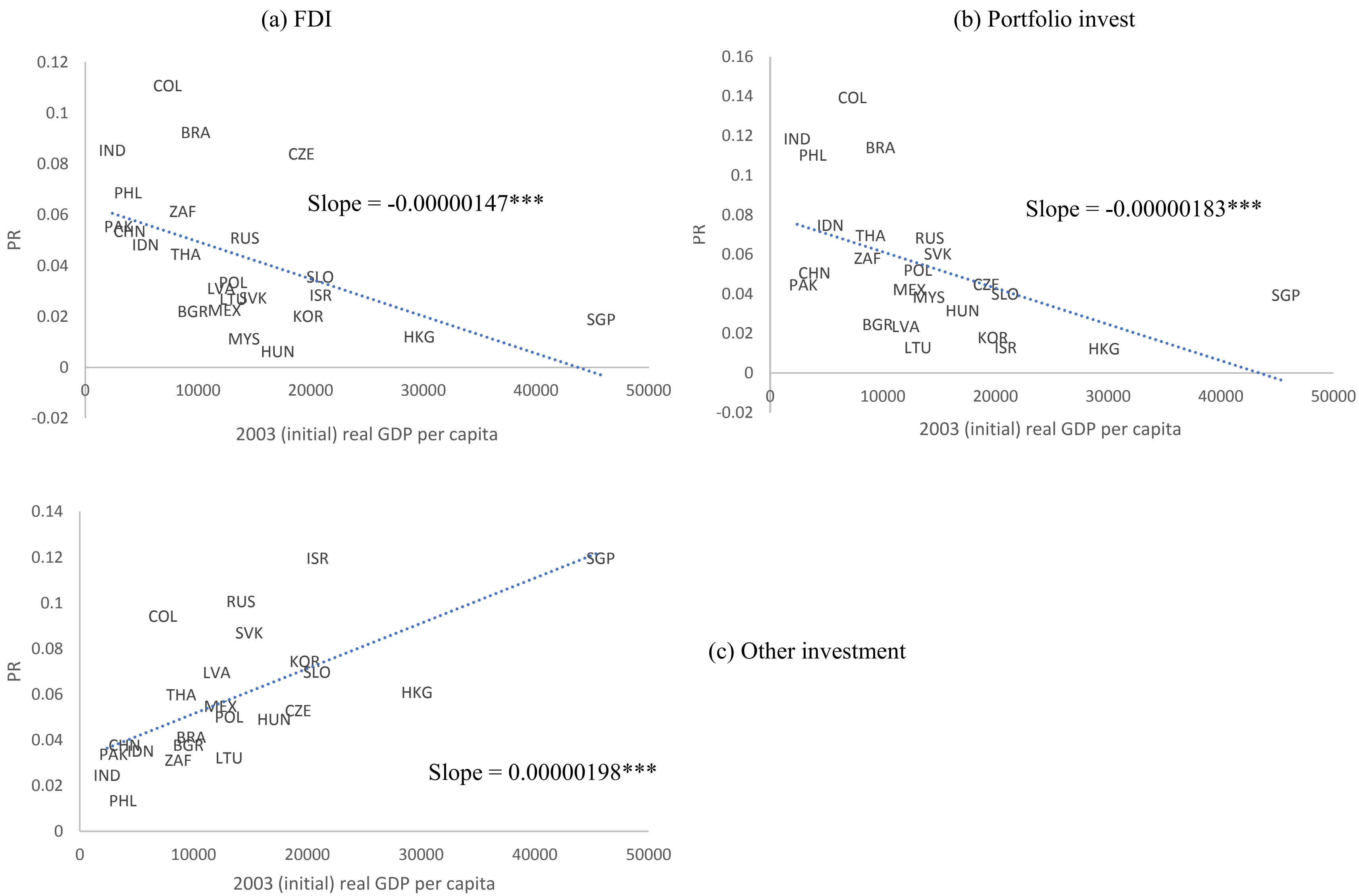


Table 1 Pattern of net capital outflows by country groups

Panel A

Net FDI outflows as a percentage of GDP 2003-2016 (average within the group)		Net financial outflows as a percentage of GDP 2003-2016 (average within the group)	
ADV	EM	ADV	EM
0.98	-2.26	-0.55	2.33

Panel B

Net portfolio investment (PI) outflows as a percentage of GDP 2003-2016 (average within the group)		
ADV	EM	EM excluding Hong Kong and Singapore
-1.13	0.54	-0.37

Panel C

Net other investment (OI) outflows as a percentage of GDP 2003-2016 (average within the group)		
ADV	EM	EM excluding Hong Kong and Singapore
-0.30	-0.30	-0.26

Notes: Countries in different groups are indicated in Appendix A. The pattern of FDI and Financial flows remain unchanged after excluding Hong Kong and Singapore.

Table 2 Relationship between capital flows and asset prices in EM

Independent variable	Panel A			Panel B		
	Dependent variable					
	Real stock price			Real net FDI inflows	Real net PI inflows	Real net OI inflows
Real net FDI inflows	-0.00001					
Real net FDI inflows(t-1)	-0.00001	-	-	-0.14		
Real net FDI inflows(t-2)	-	-	-	0.15		
Real net PI inflows		0.00003***				
Real net PI inflows(t-1)	-	-0.00002**	-		0.28**	
Real net PI inflows(t-2)	-	-	-		0.05	
Real net OI inflows			0.000007**			
Real net OI inflows(t-1)	-	-	-0.000004			0.25*
Real net OI inflows(t-2)	-	-	-			0.002
Real stock price				-1310.89	9232.53***	16534.42***
Real stock price(t-1)	1.30***	1.27***	1.19***	3504.73***	-8577.39***	-8223.52
Real stock price(t-2)	-0.48***	-0.46***	-0.44***			

Notes: Due to data availability and to be consistent with the FAVAR analysis, we employ data 24 EM in the regressions. Note that the level of significance does not change if 32 EM data are used. Variables employed are the cyclical components of real stock prices and net real capital inflows which are extracted by using HP filter, an average of 24 EM. The sampling period is from 2003Q1 to 2017Q1. Constant is included in each regression but not reported. *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively.

Table 3 State space model

Model 1 $y_t = \mu_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = \mu_{t-1} + \eta_t$	Model 6 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = c + \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \rho_2 v_{t-2} + \zeta_t$
Model 2 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \zeta_t$	Model 7 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t}$ $\mu_t = \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \zeta_t$
Model 3 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \zeta_t$	Model 8 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \rho_2 v_{t-2} + \zeta_t$
Model 4 $y_t = \mu_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = c + \mu_{t-1} + \eta_t$	Model 9 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t}$ $\mu_t = c + \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \zeta_t$
Model 5 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t} + \varepsilon_t$ $\mu_t = c + \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \zeta_t$	Model 10 $y_t = \mu_t + v_t + \sum_{j=1}^{h} \lambda_j w_{j,t}$ $\mu_t = c + \mu_{t-1} + \eta_t$ $v_t = \rho_1 v_{t-1} + \rho_2 v_{t-2} + \zeta_t$

Table 4 Sign restrictions

Variables restricted in the first period after the shock	Sign
HM components of net real capital inflows	+
Temporary components of real effective exchange rate	+
Temporary components of real GDP	+
Temporary components of current account balance % of GDP	-
Temporary components of real long-term interest rate	-
Other variables	Unrestricted

Table 5 Summary statistics of the unobserved-component models

(a) FDI

Country	Model	Final level of stochastic trend component	Q-ratio		Ljung-Box	Intervention
			Permanent	Temporary		
			Stochastic trend	Irregular		
Brazil	1	19512.67 ***	0.22	1	5.703	
Bulgaria	1	-2.98	0.60	1	10.202	
China	1	64967.91 ***	1.00	0.92	7.007	
Colombia	1	1499.03 ***	0.27	1	14.499	
Czech	1	873.1 **	0.02	1	13.387	
Hong Kong	1	10811.5 ***	0.02	1	5.865	
Hungary	1	584.49 ***	0.00	1	9.029	
India	1	7921.52 ***	0.07	1	12.596	
Indonesia	1	3387.69 ***	0.31	1	12.123	
Israel	1	378.25 **	0.00	1	11.252	
Korea	1	-5026.94 ***	0.3756	1	14.395	
Latvia	1	62.89	0.72	1	29.825	Outlier: 2007(4)
Lithuania	1	76.49	0.02	1	7.649	
Malaysia	1	564.87	0.04	1	22.035	
Mexico	1	5552.57 ***	0.03	1	10.784	
Pakistan	1	542.99 ***	0.56	1	15.92	
Philippines	1	884.54 ***	0.1451	1	3.395	Outlier: 2007(2)
Poland	1	1619.43 ***	0.01	1	8.393	
Russia	1	-1705.02	0.01	1	16.199	
Singapore	1	8714.82 ***	0.07	1	3.802	
Slovak	1	35.41	0.03	1	5.684	
Slovenia	1	223.66 ***	0.05	1	10.173	
South Africa	1	168.52	0.00	1	4.102	
Thailand	1	-1635.54 ***	0.1002	1	8.553	Outlier: 2011(4)
Australia	1	9791.48 ***	0.02	1	10.274	
Canada	1	-12485.2 ***	0.08	1	4.348	
Euro	1	-30630.6 ***	0.00	1	7.98	
Japan	4	-36005.58 ***	0.07003	1	10.201	Outlier: 2008Q4
United_Kingdom	1	21097.86 *	0.01	1	16.265	
United_States	1	12204.46	0.07	1	10.469	

(b) Portfolio investment

Country	Model	Final level of stochastic trend component	Q-ratio		Ljung-Box	Intervention
			Permanent	Temporary		
			Stochastic trend	Irregular		
Brazil	1	-3718.56	0.1454	1	5.975	Outlier: 2008Q4
Bulgaria	1	-53.33	0.0004755	1	26.352	
China	1	27524.61 ***	1.000	0.484	13.991	
Colombia	1	1183.2 ***	0.04635	1	7.034	
Czech	1	6807.57 ***	0.2203	1	10.632	
Hong_Kong	1	-10520.52 ***	0.01394	1	7.519	
Hungary	1	-1103.02	0.07173	1	18.744	
India	1	3101.77 **	0.005441	1	21.809	
Indonesia	1	4077.67 ***	0.03359	1	6.536	
Israel	4	-1433.34 ***	0.0000	1	9.796	
Korea	1	-10884.84 ***	0.4660	1	2.623	
Latvia	1	-84.95	0.0008416	1	17.24	
Lithuania	1	-679.9 ***	0.07540	1	10.979	
Malaysia	1	-2110.77	0.03222	1	12.004	
Mexico	1	7163.87 ***	0.04782	1	13.891	Outlier: 2009Q1
Pakistan	1	215.63	0.08817	1	10.234	
Philippines	1	-898.92 *	0.06814	1	9.071	
Poland	1	1914.75	0.5735	1	7.403	
Russia	1	25.31	0.1959	1	9.41	
Singapore	1	-8479.68 ***	0.01311	1	15.026	
Slovak	1	-540.75	0.1192	1	13.224	
Slovenia	1	-954.85 **	0.2878	1	20.603	
South_Africa	1	2685.52 ***	0.02963	1	11.135	Outlier: 2008Q4
Thailand	1	-2127.3 ***	0.1484	1	13.459	
Australia	1	5015.7 *	0.005405	1	14.161	
Canada	1	18409.58 ***	0.2097	1	12.898	
Euro	1	-82044.67 **	0.05478	1	8.492	
Japan	1	-13921.96	0.07587	1	12.119	
United_Kingdom	1	53769.1 *	0.1160	1	14.377	
United_States	1	36332.74	0.04259	1	7.995	

(c) Other investment

Country	Model	Final level of stochastic trend component	Q-ratio		Ljung-Box	Intervention
			Permanent	Temporary		
			Stochastic trend	Irregular		
Brazil	1	-7876.9 ***	0.1429	1	7.046	
Bulgaria	1	78.55 ***	0.2940	1	10.83	
China	1	101732.83 ***	1.000	0.813	17.756	
Colombia	1	254.93	0.0006732	1	17.379	
Czech	1	6635.51 ***	0.08818	1	13.716	
Hong_Kong	1	-5050.25	0.07043	1	4.841	
Hungary	1	-1684.15 **	0.05912	1	7.617	Outlier: 2008Q4
India	1	-3303.18	0.2675	1	15.104	
Indonesia	1	-712.96	0.005174	1	5.136	
Israel	1	-311.21	0.05192	1	21.942	Outlier: 2008Q4
Korea	1	-4557.64 *	0.1039	1	6.177	Outlier: 2008Q4
Latvia	1	-163.66	0.4870	1	12.735	
Lithuania	1	766.82 **	0.1247	1	6.518	
Malaysia	-	-	-	-	-	-
Mexico	1	-6078.72 ***	0.02100	1	15.433	Outlier: 2008Q4
Pakistan	1	1275.74 ***	0.3064	1	11.218	
Philippines	1	-211.96	0.07298	1	9.303	
Poland	1	-677.13	0.2260	1	16.188	
Russia	1	-5675.85	0.02131	1	12.258	Outlier: 2008Q4
Singapore	1	-11876.08 ***	0.02089	1	12.74	
Slovak	1	762.2	0.1549	1	13.534	
Slovenia	1	308.23	0.4809	1	14.237	
South_Africa	1	1078.24	0.008633	1	12.686	
Thailand	1	-2769.94 **	0.1937	1	6.608	Outlier: 2011Q4
Australia	1	-1348.41	0.002025	1	7.325	
Canada	1	5223.57	0.03114	1	10.378	
Euro	1	56009.55	0.8066	1	13.987	
Japan	1	10100.3	0.04953	1	5.559	Outlier: 2008Q4
United_Kingdom	1	-50026 **	0.07322	1	11.301	
United_States	4	54351.67 ***	0.0000	1	13.879	

Table 6 Principal component analysis summary statistic

Unobserved-component method					1st difference method				
Component	Eigenvalue	Difference	Proportion	Cumulative	Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	11.102	2.958	0.206	21%	Comp1	10.786	2.977	0.200	20%
Comp2	8.144	1.945	0.151	36%	Comp2	7.809	2.669	0.145	34%
Comp3	6.199	0.809	0.115	47%	Comp3	5.14	2.058	0.095	44%
Comp4	5.391	0.843	0.100	57%	Comp4	3.083	0.506	0.057	50%
Comp5	4.547	0.893	0.084	66%	Comp5	2.577	0.039	0.048	54%
Comp6	3.654	1.111	0.068	72%	Comp6	2.537	0.374	0.047	59%
Comp7	2.543	0.524	0.047	77%	Comp7	2.163	0.127	0.04	63%
Comp8	2.02	0.397	0.037	81%	Comp8	2.036	0.146	0.038	67%
Comp9	1.622	0.476	0.03	84%	Comp9	1.89	0.387	0.035	70%
Comp10	1.147	0.112	0.021	86%	Comp10	1.503	0.211	0.028	73%
KMO measure of sampling adequacy									
0.541					0.492				

Table 7 Major contributors of principal components

Principle component	Major contributors					
	Australia	Canada	Euro Area	Japan	U.K.	U.S.
PC1	RSR	RSP RSR UR	RSP RSR	RSP RSR UR	RSP RSR UR	RSP RSR UR
PC 2	REER RMS RGDP	REER RMS RGDP	REER RMS	RMS	REER RMS	REER RMS
PC 3	UR	UR		RGDP UR	RGDP UR	RGDP UR
PC 4	RMS CA	INF RMS CA	INF RMS CA	INF RMS	INF RMS CA	INF CA
PC 5	RLR	RLR	RLR	RLR	RLR	RLR

Note: CA: current account balance % of GDP; INF: inflation rate; REER: real effective exchange rate; RGDP: real GDP; RMS: real money supply; RSR: real short-term interest rate; RLR: real long-term interest rate; RSP: real stock price; UR: real unemployment rate.

Table 8 Regression of the PR of real stock prices to FDI and PI hot money shocks (in real terms)

Independent variable	Dependent variable											
	PR: case of FDI						PR: case of PI					
RGDP	-0.00000147***			-0.0000007	-0.0000015*	-0.00000059	-0.00000183***			-0.000001	-0.000002	-0.0000001
HCI		-0.026***		-0.019*		-0.019**		-0.036***		-0.026**		-0.027**
FD			-0.058*		-0.008	-0.015			-0.67		0.0007	-0.004

Note: RGDP: initial (2003) real GDP per capita; HCI:: human capital index; FD: initial (2003) financial development index. The constant term is not reported. For the case of OI, PR is only significantly correlated with RGDP. Data source: HCI:" average test score in math and science, primary through end of secondary school, all years" from Hanushek and Woessmann (2009). FD: Svirydzenka(2016)

Appendix

This appendix will be available later.