What drives the cross-country differences in Asset Price Responses to Capital Flows? The Case of Emerging Markets ♣

Joe C. Y. Ng, City University of Hong Kong

Charles Ka Yui Leung, City University of Hong Kong

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Abstract

Large swings in capital flows of emerging markets, which may trigger booms and busts in stock and housing markets, are a common concern of researchers and policymakers. Our multi-stage empirical framework enables us to decompose different capital flows and show that (1) except for China, the transitionary components are the major drivers in foreign direct investment, portfolio investment, and loan inflows in 22 emerging markets, (2) stock prices responses to hot money shocks vary across countries, and (3) such differential responses can be explained by the "fundamentals." Emerging markets with lower institutional quality and lower levels of quality-adjusted human capital tend to have more significant peak responses of stock prices. Our results survive several robustness checks. We also show that it is crucial to include all advanced economies in empirical analysis and that private capital flows behave differently from the aggregate counterpart.

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I. Introduction

The volatility of international capital flows (CFs) is a common concern of researchers and policymakers.[1] CFs trigger booms and busts in asset markets and even threaten macroeconomic and financial instability (e.g., 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). Figure 1 illustrates these "stylized facts": global capital inflows increased from 2.42% of the world's GDP in 1991 to its historical peak of 25.56% in 2007, followed by the lowest record of 2.38% in 2009. Figure 1 also shows that remarkable drops in CFs are often associated with "crises," as asset prices have typically experienced sharp drops during those episodes, including the Asian financial crisis in the late 1990s, the bursting of the dot-com bubble in the early 2000s, the global financial crisis in the late 2000s, and the European sovereign debt crisis in the early 2010s.

(Figure 1 about here)

Therefore, this paper sheds light on the following questions. First, what explains the international movements of CFs? Second, which components of CF cause large swings in asset prices? Third, do asset prices across countries react to an HM shock differently? If so, why? Previous research attempts tend to focus on the first question. For instance, a typical undergraduate textbook would suggest that capital moves from the north (or advanced economies, AEs) to the south (or emerging markets, EMs). The intuition is simple. When production technologies are identical across countries, AEs, which have more capital, have a lower marginal product of capital. Differences in the marginal product of capital would drive the capital to move from AEs to Ems. Unfortunately, this neoclassical prediction is at odds with the data, as highlighted by Lucas (1990) and many subsequent studies.[2] As an alternative,

[1] We discuss the academic literature on CFs in greater detail in a later section. On the policy side, among many speeches and documents, Grenville (1998), who served as Deputy Governor of the Reserve Bank of Australia, stated, "…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." (Italics added.)

[2] Cole et al. (2016) show that, due to contractual frictions, AEs, and EMs may not have the same technology.

the "two-way capital flows" hypothesis suggests that the flows of foreign direct investment (FDI) are in line with the neoclassical growth model, while financial investment (FI) flows from poor to rich countries, which have more developed financial markets. Thus, cross-country differences in financial development explain the international movement of CFs.

This paper attempts to achieve the following goals. First, we re-examine the current theories on CFs by studying the components of FI using net CF data.[3] According to the definition of the IMF, FI is the sum of portfolio investment (PI), other investment (OI), financial derivatives, and reserves minus gold. We focus on the flows of PI and foreign loans in OI (henceforth loans), for several reasons. The "reserves minus gold" are dictated by the central banks, which are known to behave differently from the private sector.[4] Financial derivatives often involve hedging and speculation, which may have very different objectives from PI and loans.[5] In contrast to reserves minus gold and the financial derivatives, PI includes debt and equity securities that are *directly traded* in the market, and the loan flows we extract from OI include the *non-securitized* international flows of loans. For future reference, we label PI and loans as "private flows" or "non-central bank flows" to highlight the exclusion of reserves minus gold and derivative trading from the analysis.[6] Interestingly, we find that PI and loans *do not* exhibit the same pattern as FI. In line with the earlier discussion, we also find that PI and loans, in addition to FDI, are associated with fluctuations in asset prices, that is, stock and housing prices in EMs. We explain this in more detail later.

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[3] It seems to us that colleagues in policy circles are more concerned about the *gross* inflows of capital, while colleagues from academia tend to concentrate on the *net* inflows of capital. We examine both. Due to space limitations, we focus on net inflows. Supplementary results from gross inflows are available upon request.

[4] It is beyond the scope of this paper to review the literature on the central banks' objectives and behaviors. See Aizenman et al. (2015), Bank of International Settlements (2011), and the reference therein, among others.

[5] Besides, data availability prevents us from conducting a more systematic investigation of financial derivatives.

[6] Some EMs, such as China, have a significant amount of state-owned enterprises (SOEs), whose investments are also included in the PI and loans. Our dataset does not allow us to separate the SOE investment from the others. Our label only aims to highlight that the central banks, which control the reserve and often participate in hedging, are excluded from our analysis. We later show that "private flows" do behave very differently from the other components of CF.

Second, we study which components of CF drive the asset price movements, controlling for the fluctuations of the macroeconomic variables. Several technical issues arise. First, the composition of capital flows is not directly observed. Therefore, we must take a stand on how we decompose the time series of CF. In the main text, we follow the literature to adopt an unobserved-component approach to separate HM from the other components of CFs.[7] In the robustness check, we directly use a band-pass filter to extract the HM component and then repeat the whole exercise. The results are very similar.

The second technical issue is to determine which macro variables to include in the analysis. While it seems reasonable to include the macro variables in both AEs and EMs, there are too many to include. Macro variables are also correlated, and hence it is unnecessary to include all of them. We, therefore, use a two-step factor-augmented vector autoregression (FAVAR) model.[8] First, we conduct principal component analysis to extract "common factors" from the transitionary components of macro variables in AEs. Second, for *each* country and *each* asset price, we estimate three FAVAR models, *each with a different type of capital flows* (net FDI, PI, and loan inflows) as the endogenous variable. One of our identification assumptions is that while the macro factors of AEs affect the macro factors and HM of EMs, the reverse is not true. Subject to data availability of the macro variables in EMs, we can study only the stock prices from 22 EMs and house prices from 8 EMs.[9] Thus, we have around 90 FAVAR models. Following the sign restriction approach proposed by Ouliaris and Pagan (2016), we estimate (in real terms) the responses of stock and housing prices to FDI, PI, and loan HM shocks. We find essential cross-country differences in the stock price responses and associate them with individual country characteristics. We provide some interpretations and possible directions for future research.

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[7] We present more discussion on this point later.

[8] For a review of the literature on FAVAR and related topics, see Stock and Watson (2016).

[9] To identify HM shocks, our VAR models must include the long-term interest rate, which is relatively scarce in EMs. We present more discussion on this point later.

The rest of the paper is organized as follows. Section II provides a review of the related literature on CF. Section III clarifies the pattern of net FDI, PI, and loan inflows. It shows a bidirectional relationship between CFs and asset prices. The subsequent sections present the statistical models, data and results, robustness check, and diagnostic check, respectively. The last section concludes the paper.

II. Literature review

Before we present our formal analysis, it would be instructive to review and relate our paper to the relevant strands of literature.

a. International movement of capital flows and their determinants

In response to the empirical findings of Lucas (1990), or the "Lucas puzzle," many efforts have been devoted to understanding the direction of CFs (e.g., Gourinchas and Jeanne, 2013, and the references therein). Bernanke (2005) argues that the rate of return in EMs is, in fact, lower due to a savings glut. Hence, capital flows from EMs to AEs. Laibson and Mollerstrom (2010), however, find that global savings rates did not show a robust upward trend during the relevant period. They suggest that national asset bubbles result in international imbalances. Caballero et al. (2008) argue that EMs cannot generate enough savings instruments, resulting in reverse CFs from EMs to AEs after financial liberalization. Mendoza et al. (2009) ascribe global imbalances to the differences in financial development between EMs and AEs. Sandri (2014) and Angeletos and Panousi (2011) point out that the uninsurable idiosyncratic risk in EMs introduces a precautionary motive for saving. David et al. (2014) argue that while the return of capital in the Ems may be higher, they are riskier. Cole et al. (2016) articulate a model where the inefficiency of financial markets hinders the most advanced technologies to be adopted in EMs. Hence, capital in EMs may not have a higher MPK, which explains the Lucas puzzle.

Some studies distinguish FDI from FI in their response to the Lucas puzzle. For instance, Prasad et al. (2006) find that FI has been flowing from EMs to AEs, while FDI flows move in the opposite direction. Ju and Wei (2010) propose a model where savings flow out of EMs in the form of financial capital under inefficient financial systems, while FI takes place in EMs in the way of FDI. Wang et al. (2016) develop a model where both firms and households in EMs are borrowing constrained, and domestic savings cannot be effectively channeled to firms. Savings are abundant, and yet fixed capital is scarce. High MPK and low-interest rates for financial assets in EMs lead to two way capital flows.

While these theories focus on the *direction* of CFs, a related issue to resolve is the *volatility* of the CFs. In the interest of space, we highlight only a few contributions here. Mercado and Park (2011) find that per capita income growth, trade openness, and changes in stock market capitalization are essential determinants for CFs to develop Asia. Forbes and Warnock (2012) identify the episodes of extreme CF movements and show that global factors, especially global risk, in addition to contagion through trade, banking, or geography, are significantly related to those extreme CF episodes.

b. Capital flows and asset prices

This paper is also related to the emerging literature on the nexus between CFs and asset prices. For instance, Sá et al. (2011) estimate panel VAR models for a set of OECD countries. They apply sign restrictions to identify monetary policy and capital inflow shocks and find that capital inflow shocks have a significant effect on the appreciation of housing prices. Tillmann (2013) finds that capital inflow shocks lead to positive responses of stock and housing prices in a set of Asian emerging economies. However, some authors worry that a decreasing degree of co-movement in GDP among countries may create hedging and hence have important implications for both CFs and asset prices (Cerutti et al., 2017; Doyle and Faust, 2005; Kalemi-Ozcan et al., 2013; Kose et al., 2012). While these papers are related to the current project, the econometric framework and research focus are very different.

The current paper differs from the literature in several ways. Although some authors focus on the capital flows between the U.S. and other countries or capital flows to a small number of emerging markets, this paper includes 22 EMs. We consider not only internal factors (or "pull factors," i.e., influence from domestic economies) but also external factors (or "push factors," i.e., the impact from AEs) in studying the responses of asset prices to different kinds of HM shocks.[10] While many studies conduct cross-sectional analysis, this paper builds a multi-stage dynamic estimation framework to address some potential endogeneity concerns. Furthermore, while some studies adopt a panel data approach which effectively assumes that all countries share the same relationship between the capital flows and economic fundamentals, this paper estimates the relationship between each type of CF and the asset prices in each country, uncovering significant heterogeneity in asset price responses across countries. We then show that some country characteristics can explain those differences in asset price responses.[11]

III. The Pattern of capital flows

We begin by clarifying the pattern of net CFs and establishing some potentially new "stylized facts." Table 1 is constructed in the spirit of Ju and Wei (2010) and Wang et al. (2016).[12] We focus on the "net outflows," and our negative values represent "net inflows." In Panel A, the average net

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[10] According to the International Monetary Fund (2014), push factors include, for example, economic growth, liquidity, and level of bond yields in AEs. Pull factors refer to the factors of recipient countries (RCs) that attract CFs, such as "economic prospects" of the RCs. Throughout this paper, we use "push and pull factors" and "external and internal factors" interchangeably.
Other studies also distinguish pull factors from push factors. For instance, Fratzscher (2012) focuses on the importance of pull and push factors around the 2008 financial crisis. In contrast, this paper studies a more extended period and focuses on the impact of CFs on the asset prices in EMs.

[11] Some conference participants helped us to become aware of Cesa-Bianchi et al. (2015). Their paper and ours are related but different in many respects. In addition to the sampling period, they adopt an unbalanced panel approach. They also use interpolation and extrapolation to extend their dataset. Therefore, their dataset contains more countries. They estimate a fully identified system. In contrast, as we want to differentiate different shocks, we need long-term interest rate data. We adopt a balanced panel approach, and we do not interpolate any data series. We also effectively estimate a partially identified system, which we explain in more detail later.

[12] The Appendix provides the definitions of the different kinds of capital flows.

FDI outflows are 0.98% and -2.09% of the GDP for AEs and EMs, respectively.[13] On average, the EM group is a *net importer,* while the AE group is a *net exporter* of FDI. The pattern reverses for the average net FI outflows. All of these findings are consistent with the Two Way Capital Flow hypothesis.

(Table 1 about here)

We wonder if the "non-central bank" components of FI, which are the PI and loan flow, display the same pattern as the reserves minus gold and the financial derivatives. The apparent answer is negative. Table 1 Panel B shows that the average net PI outflows are -1.13% and -0.37% of the GDP for AEs and EMs, respectively. These findings are *not in line with* the Two Way Capital Flow hypothesis. In the case of loans, there is no clear direction either. Therefore, we seek to establish new stylized facts regarding capital flows.

Given that significant CFs are often associated with substantial asset price movements, we conjecture that PI and loan flows are related to asset price movements. As a first pass of the data, we run some basic time-series regressions to examine whether CFs indeed interact with stock and housing prices in EMs. We concentrate on EMs because they seem to suffer more with the volatile HM than AEs. Due to data availability, we restrict our attention to a subgroup of EMs (see Appendix).

Table 2 shows the two-way Granger causality between asset prices and different types of CFs. The regressions are estimated in the following form:

$$Asset\ \ prices_t = \ \ c + \sum_{p=1}^{4} \ \beta_p \times Capital\ \ flows_{t-p} + \sum_{q=1}^{4} \alpha_q \times Asset\ \ prices_{t-q} + u_{1t} \qquad (a)$$

[13] We take Ju and Wei (2010) as a reference for the classification of country groups. However, Hong Kong and Singapore are not included in the EM group (or AE group) because (1) they are Asian financial centers (Lane and Milesi-Ferretti, 2017) and (2) they are outliers in the EM group; for example, their average net PI outflows in 2003-2016 are 15.2% and 13.4% of the GDP, respectively.

$$Capital\ \ flows_t = \ \ c + \sum_{p=1}^{4} \beta_p \times Capital\ \ flows_{t-p} + \sum_{q=1}^{4} \alpha_q \times Asset\ \ prices_{t-q} + u_{2t} \qquad (b)$$

where $Asset\ \ prices$ and $Capital\ \ flows$ are cyclical components of real asset prices and real net capital inflows, c is a constant, and u_{1t} and u_{2t} are error terms.

(Table 2 about here)

We test the joint significance of the β and α values in equations (a) and (b), respectively. If the β (α) values are jointly significant, then asset prices (CFs) Granger cause CFs (asset prices). The F test results reported in Table 2 indicate that in most of the EMs, asset prices and CFs *Granger cause each other*. Many previous studies adopt the single equation approach to study the impact of CFs on asset prices. The single equation approach, which seems intuitive and popular, may overlook that CFs may not be strictly exogenous and may be affected by real asset price movements. The results here provide support for a bidirectional causality between CFs and asset prices.

Clearly, both CFs and asset prices may be driven by some "third factor." For instance, an expected improvement in productivity, whether due to technological advancement or political reform, would stimulate real asset prices. At the same time, a "high return environment" would attract foreign capital. Hence, this calls for an empirical model that allows for the *dynamic interactions* between real CFs and real stock prices, which is the focus of the next section.

IV. Econometric Model

The previous section establishes that capital flows and asset prices Granger cause each other. In this section, we study dynamic interactions in more detail. To achieve this goal, we build an empirical framework that enables us to (1) extract the capital flows, asset prices, and macroeconomic variables, and (2) explicitly model the dynamic interactions among those variables. Also, our framework allows for the possibility that asset price responses differ across different CFs, even within the same country, and even more so when we compare across countries.

We proceed as follows. We first extract and separate the permanent and transitionary components for real net FDI, PI, and loan inflows in EMs. As large surges and flight during the financial crisis may be infrequent events and hence are, statistically speaking, potential outliers, we incorporate "intervention terms" into the unobserved-component model. As capital flows may be motivated by both external and internal factors, we extract transitionary components from the macro variables of EMs and AEs. We then estimate a version of the VAR model for different countries. Figure 2 provides a visualization of our econometric framework.

(Figure 2 about here)

To extract the transitionary component from CFs and the short-run components from macro variables, we use the unobserved-component (UC) approach in the main text, which emphasizes the temporariness and reversibility properties of the transitionary components (Sarno and Taylor, 1999a). A general state-space model may be written as:

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

where

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

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 (or 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:

$$w_t = \begin{cases} \begin{cases} 0 & for\ \ t \neq \tau \\ 1 & for\ \ t = \tau \end{cases} & \text{for outliers,} \\ \begin{cases} 0 & for\ \ t < \tau \\ 1 & for\ \ t \geq \tau \end{cases} & \text{for level breaks,} \\ \begin{cases} 0 & for\ \ t < \tau \\ 1 + t - \tau & for\ \ t \geq \tau \end{cases} & \text{for slope breaks.} \end{cases}$$

To detect level breaks and outliers, we conduct *t*-tests for auxiliary residuals. Figure 3 illustrates that ignoring structural breaks and outliers leads to biased estimations. The real effective exchange rate of Russia has a clear structural break, reflected visually and in *t*-statistics. After correcting the structural break, the accuracy of the estimation is significantly improved. To guard against the possibility of "over-fitting," we do not add interventions for every outlier, and level break detected. Instead, interventions must be based on theories or facts related to the possible causes of the breaks, such as financial crises (Commandeur and Koopman, 2007).

(Figure 3 about here)

While equation (1) provides the general state space model, there are several variations. In the Appendix, we show how these models can be estimated using the Kaman filter and adopt AIC to choose the "optimal model," where

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

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.

Our definition of transitionary component of the capital flow is simply the original capital flow data, with the unit root component being removed,

$$TCF_t = V_t + \varepsilon_t + coefficients\ \ of\ \ outliers\ \ and\ \ level\ \ breaks\ \ at\ \ the\ \ break\ \ dates \quad (2)$$

The same procedure is applied to the transitionary components of macro variables.[14]

Since our goal is to study how the macro factors in both advanced economies and emerging markets interact with the capital flows, therefore, we use the state-space model to extract the transitionary components of all variables and put them in a FAVAR framework.[15] A priori, however, we *do not know which AE variables are more decisive* in affecting the EMs. We have access to data from 22 countries that are classified as AEs (see Appendix). Including all of them in the regression may not be practical. Furthermore, as macroeconomic variables are known to be correlated, *both across and within countries*, including all of the macroeconomic variables from the AEs is unnecessary. Therefore, we follow Stock and Watson (2002a b) to extract the principal components from macroeconomic variables as “common factors” and use those “factors” in the subsequent investigation. More specifically, this paper builds a two-step FAVAR model. First, we conduct a principal component analysis of the macro variables of six major AEs, including Australia, Canada, the Euro area, Japan, the United Kingdom, and the United States, and use those PCs to represent the impact of the developed world.[16] In the second step, for each country and asset price, we estimate three FAVAR models, including FDI, PI, and loan inflows (in real terms), as the endogenous variables. Constrained by data availability, we study the stock prices in 22 EMs based on their macro variables. For the house prices in EMs, we can cover only eight countries.

Formally, consider the vector $PC_t = \left[PC_{1_t}\ \ PC_{2_t} \dots PC_{m_t}\right]'$, where m is the number of principal components extracted from AEs. The “structural form” of the FAVAR model is:

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[14] A level break, by definition, causes a permanent shift in the stochastic level. It may represent the sudden drops. We, therefore, include the coefficients of level breaks *at the break dates* as transitionary components. We treat the slope interventions as a part of the stochastic level and hence, a part of the permanent components. An alternative is to adopt a local linear trend model. However, such a model implies an I(2) process and may not be suitable for our macro variables. See Harvey (1989) for more discussion.

[15] Some previous work, such as Fuertes et al. (2014), incorporates macro factors as *exogenous* variables to explain CFs in the unobserved component models. The focus of their paper is very different from this paper.

[16] We follow the standard procedure that all of the series are normalized to zero mean and unit variance before PCs are extracted.

$$B_0X_t = \varphi_0 + \sum_{j=1}^{p} B_jX_{t-j} + \sum_{i=0}^{q} A_iPC_{t-i} + w_t \qquad (3a)$$

where B_0 has a unit diagonal, and w_t is the residual term. The reduced form of the FAVAR model is then modeled as:

$$X_t = \varphi_0 + \sum_{j=1}^{p} \varphi_jX_{t-j} + \sum_{i=0}^{q} \theta_iPC_{t-i} + \epsilon_t \qquad (3b)$$

where φ_0 and $\epsilon_t \sim i.i.d.N(0, \Sigma_\epsilon)$ are $k \times 1$ vectors, $\{\varphi_j\}$ are $k \times k$ matrices, $\{\theta_i\}$ are $k \times m$ matrices, X_t is a $k \times 1$ vector of endogenous variables, and ϵ_t and Σ_ϵ are the innovation of the reduced-form VAR model and the variance-covariance matrix, respectively. The list of variables is provided later. p and q are the maximum numbers of lags of the endogenous and exogenous variables, respectively, selected by BIC.[17] As the macroeconomic variables of AEs are assumed to be exogenous to the system, the interactions between X_t and PC_t depend on B_0 in Equation (3a). Unfortunately, we estimate only Equation (3b) and hence are unable to recover B_0. The conventional approach is to assume some form of block-recursive structure in B_0.[18] As explained by Leeper et al. (1996) and others, some of those assumptions may have economic interpretations, and hence an assumed block-recursive structure may preclude particular economic dynamics of interest.

An alternative identification approach is to use sign restriction proposed by Faust (1998), Canova and De Nicolo (2002), Uhlig (2005), Ouliaris and Pagan (2016), and others, which may be less stringent (Lütkepohl and NetŠunajev, 2014). This paper follows the sign restriction approach proposed by Ouliaris and Pagan (2016), known as the SRC approach (sign restriction with generated coefficients).[19] Here, we provide a brief description of the SRC approach. Based on Equations (3a)

[17] Chosen by BIC, $p = 1$ for all EMs, and $q = 0$ or 1 depending on the EMs under consideration.

[18] See Christiano et al. (1999), among others. More recently, Mertens and Ravn (2013) and Stock and Watson (2012) develop a new approach to estimating SVAR. In that framework, some assumptions about the relationships between the instruments and shocks must be made. In our context, as the transitionary components of capital flows are not directly observable and may be correlated with other macroeconomic variables of AEs and EMs, we take a more conservative approach and estimate a partially identified FAVAR model. More discussion is presented in the text.

[19] Ouliaris and Pagan use simulation data to compare the performance of SRC and the traditional sign restriction recombination (SRR) approach. They conclude that SRC has some advantages over SRR: it applies to any simultaneous equations system and can incorporate a broader range of information, such as on both the parameters and impulse responses.

and (3b), $\Sigma_{\epsilon} = B_0^{-1}\Sigma_w B_0^{-1'}$, where Σ_w is the variance-covariance matrix of w_t. The SRC approach draws above-diagonal elements of B_0 at random such that sign restrictions on B_0 are satisfied. We then solve for the remaining elements of B_0 and diagonal elements of Σ_w and retain the resulting candidate solution for B_0 if all of the sign restrictions on B_0 are satisfied. The procedure for drawing the above-diagonal elements of B_0 is as follows. First, for each of the $b_{ij,0}$ elements in B_0, where $i < j$, we draw a random variable δ from the uniform distribution $U(-1,1)$. $b_{ij,0}$ is then set to be $\delta/(1 - |\delta|)$. Given the above-diagonal elements of B_0 and the innovation of reduced-form VAR model Σ_{ϵ}, the below-diagonal elements of B_0 can be solved by using a nonlinear equation solver or the instrumental variable method as discussed by Ouliaris and Pagan (2016).

Inspired by a broad range of theoretical (e.g., dynamic, stochastic general equilibrium models) and empirical studies such as Sá et al. (2011, 2014) and Tillmann (2013), we impose a set of sign restrictions for hot money (HM) inflows shock (Table 3). A positive hot money shock would increase the transitionary components of CFs and lead to an increase in economic activity (real GDP). There would be an appreciation of the real effective exchange rate as foreign demand for local currency increases, leading to a current account deficit. Lastly, as mentioned by Sá et al. (2011), to distinguish a capital inflow shock from a positive productivity shock, one should impose a *negative sign on the long-term interest rate*, as both shocks have the same set of sign restrictions except for the long-term interest rate. A capital inflow shock is supposed to lower domestic interest rates. However, short-term interest rates are primarily controlled by central banks. Thus, long-term interest rates respond to a capital inflow shock to equilibrate the market. We restrict only the first period (i.e., the impact period), as a hot money shock should be transitionary. There is also less consensus in economic theory on imposing restrictions beyond the impact period. As we are interested in a single structural shock, our model is referred to as a *partially identified* VAR model in the literature.[20] The sign pattern of each

[20] See Uhlig (2005), Fry and Pagan (2011), and Canova and Paustian (2011) for further discussion of this issue.

of the unidentified shocks we impose is different from that of the identified shock. We retain 1,000 draws for the impulse response analysis.

(Table 3 about here)

V. Data and Results

We use the best data accessible to us, which includes the series of several variables from 2003Q1 to 2017Q1 in quarterly frequency. The net capital inflows data (FDI, PI, and loans) for the EMs are collected from the Balance of Payments and International Investment Position Statistics (BOPS). We collect GDP, inflation rate, current account balance as a percentage of GDP, short-term (3-month money market rate) and long-term (10-year government bond yield) interest rates, M2 (AEs only), unemployment rate (AEs only), and stock market index data from International Financial Statistics (IFS) and OECD Statistics. We collect the housing price index data from the Bank for International Settlements. We obtain the real effective exchange rate data from Darvas (2012). If data are not available from the preceding dataset, we use data from national sources. Nominal variables are deflated by the CPI. GDP, M2, the real effective exchange rate, the stock market index, and the housing price index are converted to natural logarithm form. All of the series are seasonally adjusted.

We begin our result presentations with our state-space decomposition. We then turn to the principal component analysis. Finally, we present our results on asset price responses to hot money shocks. Descriptive statistics, including a unit root test of the series before decomposition and summary statistics of the transitionary components of each series, are reported in the Appendix.

a. State-space decomposition

Table 4 shows the summary statistics for the state space decomposition of EMs real net FDI, PI, and loan inflows, and Figure 4 provides a visualization.[21] As shown in Table 4, the assumption of *no*

[21] The interventions and selected models for the state space decomposition of macro series are provided in the Appendix.

serial correlation of standardized residuals is satisfied in general. Models containing AR(1) or AR(2) terms are not selected, and "short-run persistence" is not observed. Moreover, in the case of FDI, the estimated final level of stochastic trend components is significant for most of the countries. A non-negligible permanent component is apparent in FDI, which is consistent with previous studies.

(Table 4, Figure 4 about here)

To assess the persistence of the CFs, we use the Q-ratios. For example, the Q-ratio for the permanent component is defined as:

$$Q(\mu_t) = \frac{\sigma_\eta^2}{\max\left(\sigma_\eta^2, \sigma_\zeta^2, \sigma_\varepsilon^2\right)} \quad (3)$$

Q-ratios are scaled measures of the importance of the unobserved permanent and transitionary components of CFs. If all of the dynamics in the CFs are due to the permanent component, for instance, the Q-ratio for the stochastic trend is unity. In words, it means that a large part of the CFs remains in the country for an indeterminate period. Instead, if the dynamics of the transitionary component explain most of the variation in CFs, then the Q-ratio for the permanent component is close to zero.

Here are our results on the Q-ratios. The Q-ratios of the transitionary components of different types of CFs in all countries are equal to one, excepting all types of CFs in China and loan flows in Lithuania, indicating that real net FDI, PI, and loan inflows are *not persistent* in general. That is, most of the variation in CFs is due to the movements of the transitionary components, which is in contrast to the results reported in previous studies that FDI is persistent (Sarno and Taylor, 1999a,b; Fuertes et al., 2014). One possible explanation is that these studies focus on the capital flows of the U.S. to other countries. In contrast, this paper analyzes the capital flows into the emerging markets.

The result that even FDI flows are mainly transitionary surprised many seminar audiences. Some argue that since FDI involves transactions of a significant amount of ownership at the firm level, it should be persistent because firms do not change ownership frequently. We are two responses. First, our analysis is at the national level. Since the political, economic environment can be volatile for emerging markets, it is possible that while FDI at the firm level is persistent, FDI at the national level can be transitionary because foreign investors may become much more optimistic or pessimistic for new projects over time. Second, our FDI data comes from the IMF, which concerns the ownership of the firm. Thus, when a foreign-owned firm is purchased by a domestic firm, it will be recorded as a drop in FDI. For instance, Uber invested and operated in China and competed fiercely with local firms. In 2016, its China branch was sold to Didi, a Chinese firm. Hence, while all the cars and capital goods may stay in China, the change in the ownership of Uber-China leads to a decrease in FDI from China's point of view.

Notice also that China, whose Q-ratios of the *permanent* components are equal to one in all types of CFs, is the exception. This may reflect that in the recent decade, China has grown relatively fast, always reformed her economy, and implemented policies to attract foreign CFs compared with other EMs.[22] Indeed, Figure 4 shows that once China is removed from the EM group, the permanent components of real net FDI and PI reduce significantly, and the permanent component of real net loans change from positive to negative from 2011. Overall, the fluctuation (or the ups and downs) of all types of CFs (solid lines) is mainly driven by the transitionary components.

(Figure 5 about here)

Our state-space model also delivers an estimate of the breaks and outliers in the macro variables in AEs and MEs. While the details are shown in the Appendix, Figure 5 shows that *more than half* of the breaks and outliers occur during the global financial crisis (2007-9), which seems to be consistent with the results from previous research.

b. Principal component analysis

[22] It is beyond the scope of this paper to review the FDI policies and reality in China. See Chen (2008), Long (2003), Organization for Economic Co-operation and Development (2002), and PricewaterhouseCoopers (2017), among others.

In this paper, we extract the principal components from macroeconomic variables in AE to proxy for the "external factors" for the emerging markets. Naturally, one may wonder what these PCs represent. Table 5 highlights the significant contributors to the first five PCs. PC1 captures the common components of the real GDP and real housing prices. PC2 captures the common components of the real stock market index in most of the countries. PC3 captures the common component in the real effective exchange rate in many countries. PC4 captures the real money supply for all of the nations. Finally, PC5 captures the inflation rate, real long-term interest rate, short-term interest rate, and current account balance as a percentage of GDP in most of the countries. These results seem to be reasonable and in line with some previous research.

(Table 5 about here)

c. Impulse response functions

Finally, we estimate the impulse responses of asset prices to hot money shocks for each country and compare the magnitude of those responses across the nations.[23] An impulse response is a function, and comparing functions is not an easy task in general. To facilitate the cross-country comparison, we introduce the notion of peak response (PR). For example, assume that a few periods after an EM is impacted by a hot money shock, the transitionary component of the real stock price of that country increases by 12% relative to its steady-state value. The response then dies out over time. In this case, we define the PR of this country to a hot money shock as 0.12. Figure 6 provides a visualization of PR. To further facilitate the cross-country comparison, we consider a hot money shock with one standard deviation in size in each country. We then assess whether countries exhibit different PR, and if so, whether those differences are associated with varying characteristics of a country (such as initial

[23] The Appendix provides the impulse response graphs for all of the countries.

income level). Figures 7(a)-(f) plot the initial (2003Q1) real income per capita against the PR of real asset prices and housing prices to a real net FDI, PI, and loan hot money shock, respectively.

(Figures 6 and 7 about here)

In the case of stock prices (Figures 7(a)-(b)), interestingly, we find that for all types of hot money shocks, countries with a *lower* initial real GDP per capita (initial RGDP) tend to have a *more massive* peak response to real stock prices. In the case of real housing prices, Figures 7(d)-(f) show that the relationship between the PR to real housing prices and initial RGDP is ambiguous. As the sample in the case of house prices is small, we are unable to conduct any regression analysis. Therefore, we leave it to future research to further explore the relationship between the PR to housing prices and cross-country covariates.

A lower level of per capita GDP may reflect a not-so-healthy financial system, more inferior institutions, lower-quality human capital, long-lasting effects of historical events, etc.[24] In Table 6, we further regress the peak responses of real stock prices with respect to economic "fundamentals." In column (2) of each panel, we control for the Financial Development Index (FD). With swallow markets and a lower degree of financial market development, the asset price responses to hot money are expected to be larger. Surprisingly, the coefficients on initial RGDP are still significant, while that of the financial development index is *insignificant*. Interestingly, in column (3) of each panel, once we control for the Institutional Quality Index: Rule of Law (IQI-RL), from the Worldwide Governance Indicators constructed by the World Bank (Kaufmann et al. 2013), the relationship between initial RGDP and PR becomes statistically insignificant, while the coefficients on IQI-RL are significant. In column (4) of each panel, we replace IQI-RL with the Quality-Adjusted Human Capital Index (QA-

[24] The related literature is too large to review here. See Acemoglu et al. (2001), Acemoglu et al. (2014), Engerman and Sokoloff (2008), Hanushek et al. (2017), among others.

HCI) developed by Hanushek and Woessmann (2012, 2016). The coefficients on QA-HCI are significant in the case of FDI and PI HM shock, but not in the case of loan HM shock.

(Table 6, Figure 8 about here)

Next, we put initial RGDP, FD, IQI-RL, and QA-HCI together as expansionary variables in column (5) of each panel. We obtain similar results: the coefficients on IQI-RL are significant in all cases, while the coefficients on QA-HCI are significant in the cases of FDI and PI hot money shock. Furthermore, the adjusted R^2 values in column (5) are higher than in column (1), where initial RGDP is the only expansionary variable. In words, it means that both the institution quality and quality-adjusted human capital are vital to explain the stock price responses to short-run fluctuations in FDI and portfolio investment, while initial GDP and the degree of financial development are not. Figure 8 provides a visualization of the relationship between the magnitude of the peak responses, and the institutional quality index and the quality-adjusted human capital.

d. **Why institutional quality index: rule of law and quality-adjusted human capital index matter**[25]

To the best of our knowledge, our paper is the first to relate the heterogeneity of asset price responses to country characteristics such as human capital and institutional quality. As such, it may be worthwhile to provide more diagnosis. Countries differ in terms of not only quality-adjusted human capital but also quantities of human capital. From a policy perspective, if quantity matters, school enrollment becomes the key. However, if the quality is a critical issue, curriculum design, teacher recruitment, or other factors may matter.[26] To assess the importance of quantity versus quality measures in the current context, we replace QA-HCI with Barro and Lee's (2013) "Quantity-based"

[25] This section builds on many helpful comments from Eric Hanushek and John Taylor.

[26] The literature on how curriculum design and teacher recruitment may affect education outcomes is too large to review here. See Hanushek et al. (2018) and the references therein, among others.

Human Capital Index (BL), which includes the percentage of the population aged 15 and over who completed secondary education and re-run the regressions. As Barro and Lee human capital index updates every five years up to 2010, we use BL 2000, BL 2005, and BL 2010. As our sample starts at 2003, BL 2000 is a predetermined variable for our data, while BL 2005, BL 2010 may have some endogenous components. Table 7 clearly shows that the coefficients on BL in all of the years are *insignificant*. The adjusted R^2 values are lower than the regressions with QA-HCI.

(Tables 7 and 8 about here)

It is natural to ask why quality-adjusted human capital performs better. One conjecture is that countries with better institutions tend to have more (but not necessarily better) human capital. Table 8 shows that the correlation between BL in different years and IQI-RL is around 0.7, higher than that between QA-HCI and IQI-RL (0.5). Thus, multicollinearity may be more serious when BL is adopted.

(Table 9, Figure 9 about here)

On top of the Institutional Quality Index: Rule of Law, there are other indices that might provide similar information. For instance, Economic freedom index supplied by the Heritage Foundation, and Ease of Doing Business Report supplied by the World Bank. Also, recent research shows that the imposition of capital control may help to mitigate the effect of transitionary capital flows. We respond in the following ways. Figure 9 shows that the capital control index by Fernandez et al. (2016) is correlated with the institutional quality index: the rule of law. Notice that the imposition of capital control is a decision of the government. Specific institutional settings may facilitate or prohibit the imposition of capital control. Hence, the two indices naturally tie together. Table 9a ranks the emerging markets in our sample according to different indices: quality-adjusted human capital index, financial development index, institutional quality index, index of economic freedom, ease of doing business score, and capital control index. While countries are ranked differently by different indices, they are often ranked similarly. Table 9b ranks the emerging markets according to their peak responses to different kinds of hot money shocks. The ranks are positively correlated in the sense that countries have relatively large peak responses under one type of hot money shock would have a relatively large peak response under other kinds of hot money shocks. This suggests that there exist some common economic reasons. Table 9c presents a series of cross-sectional regressions. It is interesting to notice that controlling for the institutional quality index and the quality-adjusted human capital, the other three indices, namely, the index of economic freedom, ease of doing business score, and capital control index are all *insignificant*. Therefore, while different indices are correlated, the institutional quality index and the quality-adjusted human capital seem to capture the cross-country differences of asset price responses to different kinds of hotel money shocks.

The intuition is simple. Countries with better institutional quality may be more effective at monitoring and regulating capital flows, which leads to smaller peak responses. Furthermore, in countries with higher levels of quality-adjusted human capital, policymakers and investors may make better financial decisions on average, leading to lower peak responses of an asset price to hot money shocks.

VI. More Robustness Checks

This paper finds empirical evidence that EMs with lower institutional quality and quality of human capital tend to have higher responses of real stock prices to hot money shocks. We conduct several robustness checks, considering potential outliers, initial conditions, and the sensitivity of the results to alternating the methodology used to extract the transitionary components or generate impulse responses. We summarize the results here and report the details in the Appendix.[27]

[27] Due to the limited sample size, we are unable to provide a robustness check for the results related to housing prices.

1. We conduct a leave-one-out cross-validation check for the regression of peak responses on real GDP, financial development, institutional quality index: rule of law, and quality-adjusted human capital in Table 6. We drop one country from the sample at a time and then re-run the regression and record the coefficients on the institutional quality index: rule of law, and quality-adjusted human capital. We also drop the so-called "Fragile Four," which are characterized by large current account deficits, from our sample.[28] Some argue that these countries rely on external financing and hence become sensitive to external shocks, such as hot money shocks, and are potential outliers. Overall, the validation check indicates that although there are outliers in the regressions, the results that institutional quality and quality-adjusted human capital would negatively affect the peak responses are often being *strengthened* rather than weakened after the removal of outliers.
2. Our sample started in 2003, and therefore we use real income per capita in 2003 as the initial income level. However, if we were to classify economies into "boom" and "bust" regimes according to their aggregate output,[29] some emerging markets may be in the "boom" regime and others in the "bust" regime in 2003. This may bias our results. Thus, we use two additional metrics of initial income level: 2002 and the average real income per capita for 1990-2002. Both measures are predetermined, and the latter averages out the boom and bust periods. Again, the results that institutional quality and quality-adjusted human capital would negatively affect the peak responses remain significant in all cases.
3. One may argue that the scale of capital flows is related to the size of the economy. To address this concern, we replace the CFs with the ratio $\frac{capital\ flows_t}{GDP_{t-1}}$, that is, rescale the CFs by lagged

[28] In the media, the term "Fragile Five" is often used to describe Brazil, India, Indonesia, South Africa, and Turkey. However, Turkey is not in our sample. Therefore, we use the term "Fragile Four" instead of "Fragile Five."

[29] It is beyond the scope of this paper to discuss the literature on "business cycle classifications." See Harding and Adrian (2005), among others.

GDP, which considers the size of the economy and helps us to mitigate the endogeneity concern. We repeat the estimation and find that our conclusion still holds.

4. We use the Kalman filter to extract HM according to Equation (2). As a robustness check for constructing the HM series, we apply the band-pass filter proposed by Christiano and Fitzgerald (2003) to extract "high-frequency components" (i.e., components with periodicity between 2 and 5 quarters) in CFs and then re-estimate all of the FAVAR models using the Ouliaris and Pagan method. The results indicate that the negative relationships between peak responses, and institutional quality and quality-adjusted human capital remain significant.
5. As documented by Fry and Pagan (2011), reporting the percentiles of impulse responses may suffer from the "model identification problem" as they are calculated across different models. Therefore, we follow their approach to calculate a median target (MT) model whose impulse responses are closest to the median responses, and then use the MT model to generate a unique set of impulse responses as a robustness check. Again, the results show that negative relationships still hold.
6. Instead of using the Ouliaris and Pagan method, we re-estimate the FAVAR models and study the PR of real stock prices using Uhlig's (2005) pure sign restriction method.[30] The results show that our conclusion still holds.

VII. More Diagnosis

To further deepen our understanding of the results, we conduct two diagnostic analyses in this section. While the details are provided in the Appendix, we offer a summary here. First, we assess the importance of using six advanced economies. Although some authors have used U.S.-only macro

[30] We avoid using the penalty function approach, as Arias et al. (2018) propose that such an approach would introduce additional sign restrictions on unrestricted variables.

variables to represent AEs, we extract PCs from six AEs. Therefore, we repeat the whole analysis with U.S.-only macro variables in the principal component analysis and examine the differences.

Following the same econometric framework as in Section IV, we arrive at two findings. (1) In all cases (FDI, PI, and loan hot money shock), the partial correlation between peak responses and institutional quality index: rule of law, with financial development and initial real GDP being controlled for, is *weakened* if U.S.-only PCs are used in the FAVAR model. This is not surprising, as EMs may be affected by not only the U.S. but also other AEs. Omitting the macro factors of other AEs may result in biased estimates. (2) The partial correlation between peak responses and quality-adjusted human capital is *not affected* regardless of whether "six AEs PCs" or "U.S.-only PCs" are used.

Second, we assess the importance of focusing on private capital flows. Although much of the previous research considers financial flows as a whole, we focus on PI and loans. To assess the difference, we apply the same econometric framework to study FI. However, we find *no significant relationship* in this case. In other words, including the official flows (e.g., reserve) and financial derivatives would affect our conclusion on how HM impacts asset prices.

VIII. Conclusion

This paper carefully examines the relationship between the transitionary components of capital flows and asset price movements in emerging markets (EM). The time-series behaviors of portfolio investment (PI) and loans are inconsistent with both the neoclassical model and two ways capital flow hypothesis. Instead, these private sector capital flows are significantly associated with stock and housing prices in most of the EMs in our sample. Except for China, the transitionary components of FDI, PI, and loans dominate the permanent counterparts in the 22 EM we examine. More importantly, we document significant heterogeneity in the impulse responses of stock and housing prices in all these private sector capital flows. We further show that countries with the lower institutional quality and lower levels of quality-adjusted human capital tend to have more elaborate peak responses to stock prices. This result survives several robustness checks. Thus, the "over-reaction" of stock prices can be improved through long-term economic policies to enhance the degree of the rule of law and the quality of human capital. Regarding housing prices, we find no clear patterns due to the small sample of countries.

Our approach deviates from and hence is complementary to the previous literature. We estimate a different FAVAR model for each type of capital flow in each EM for each asset price. Effectively, we allow the asset prices to interact with domestic and foreign macroeconomic variables differently across countries, types of CF, and asset prices. With such flexibility, we can uncover substantial heterogeneity in asset price responses to CFs that may be overlooked. Moreover, we establish an empirical link between "fundamentals" (such as institutional quality and quality-adjusted human capital) and asset price responses.[31]

We believe these findings carry academic and policy implications. For instance, as some dynamic, stochastic general equilibrium models are constructed to match the impulse responses of the model with the data, our results relating the institutional quality, and quality-adjusted human capital level to peak impulse responses may inform future theoretical modeling. Similarly, countries with different levels of institutional quality, and quality-adjusted human capital should expect their responses to different kinds of CFs to be very different, and hence that the "optimal" policy may differ across countries. This paper indicates that continuous improvement in institutional quality and quality of education may contribute to not only economic growth, as many authors have emphasized, but also financial market stability in the long run. Future research may further explore such linkages.

[31] For instance, Backus et al. (2014) relate demographic factors to low-frequency capital flows. Thus, the literature has a very different research focus.

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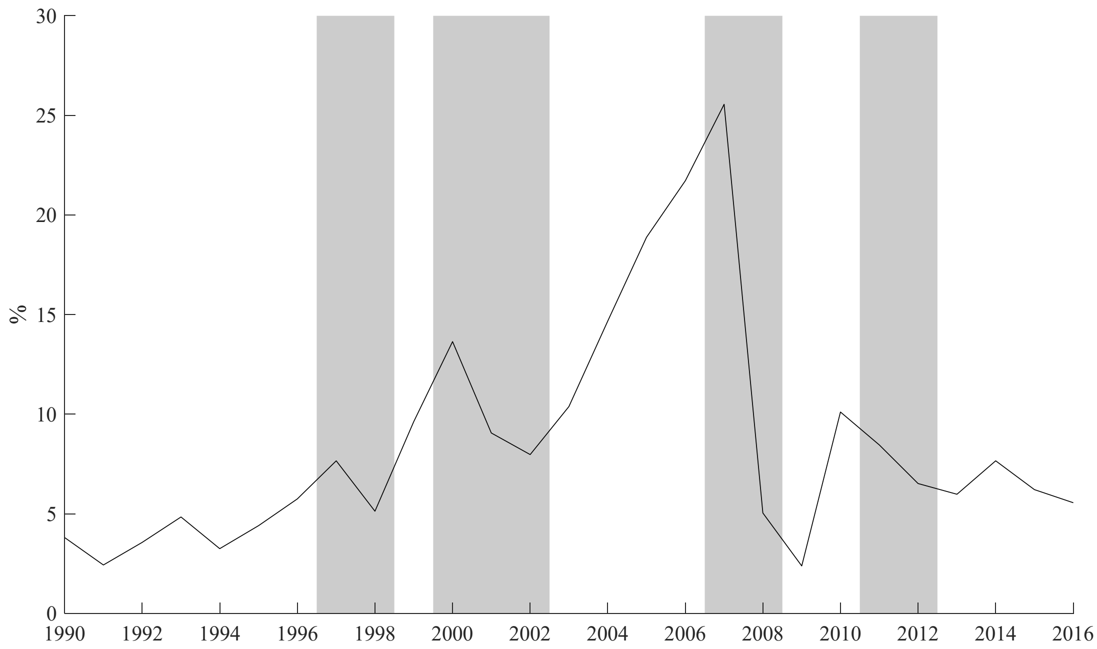
Figure 1 World's gross capital inflows as a percentage of World GDP



Notes: Shaded areas indicate Asian Financial Crisis in the late 1990s, the bursting of the dot-com bubble in early 2000s, the Global Financial Crisis in late 2000s and the European sovereign debt crisis in early 2010s. Data source: World Economic Outlook (world's GDP), Balance of Payments and International Investment Position Statistics (gross capital inflows) and author's calculation.

Figure 2 The econometric framework

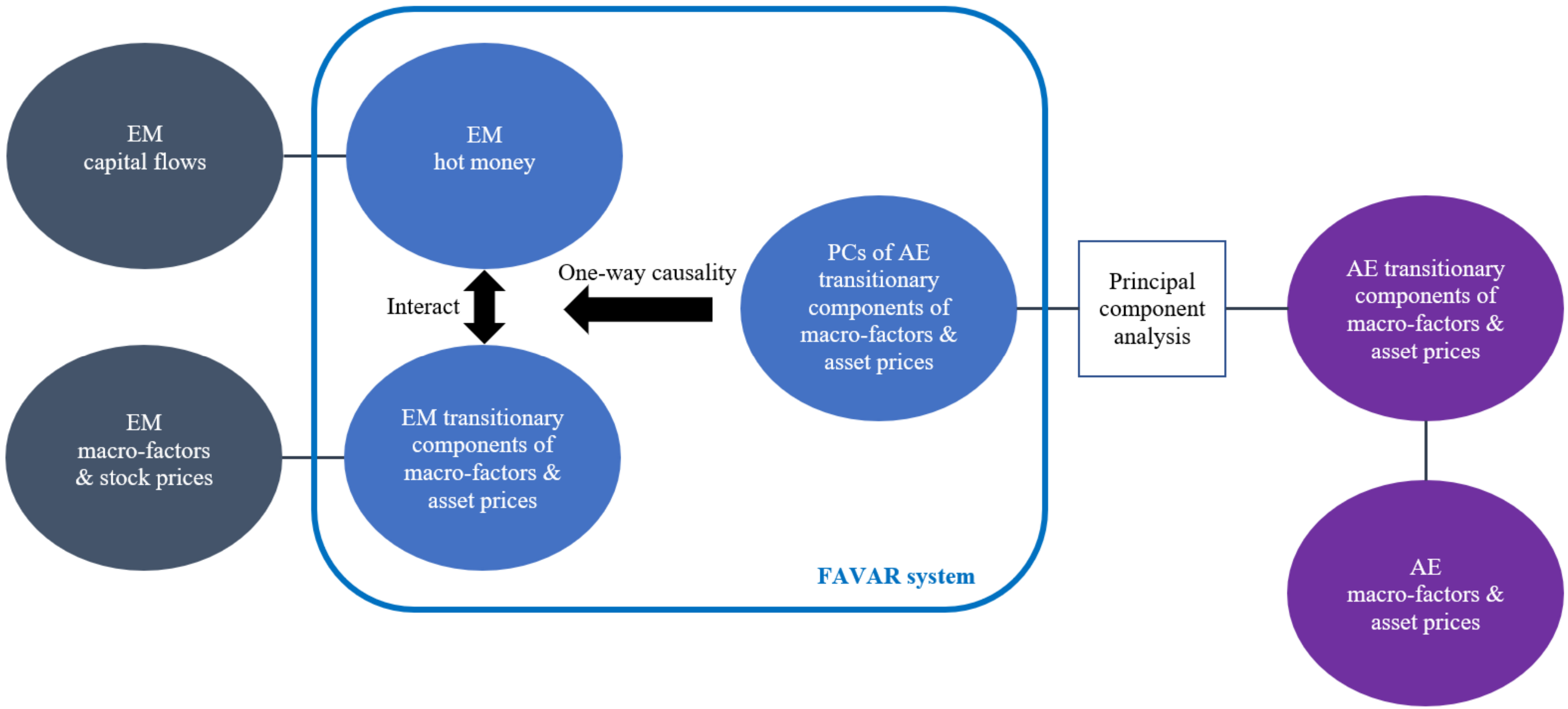


Figure 3 An example of structural break and estimation

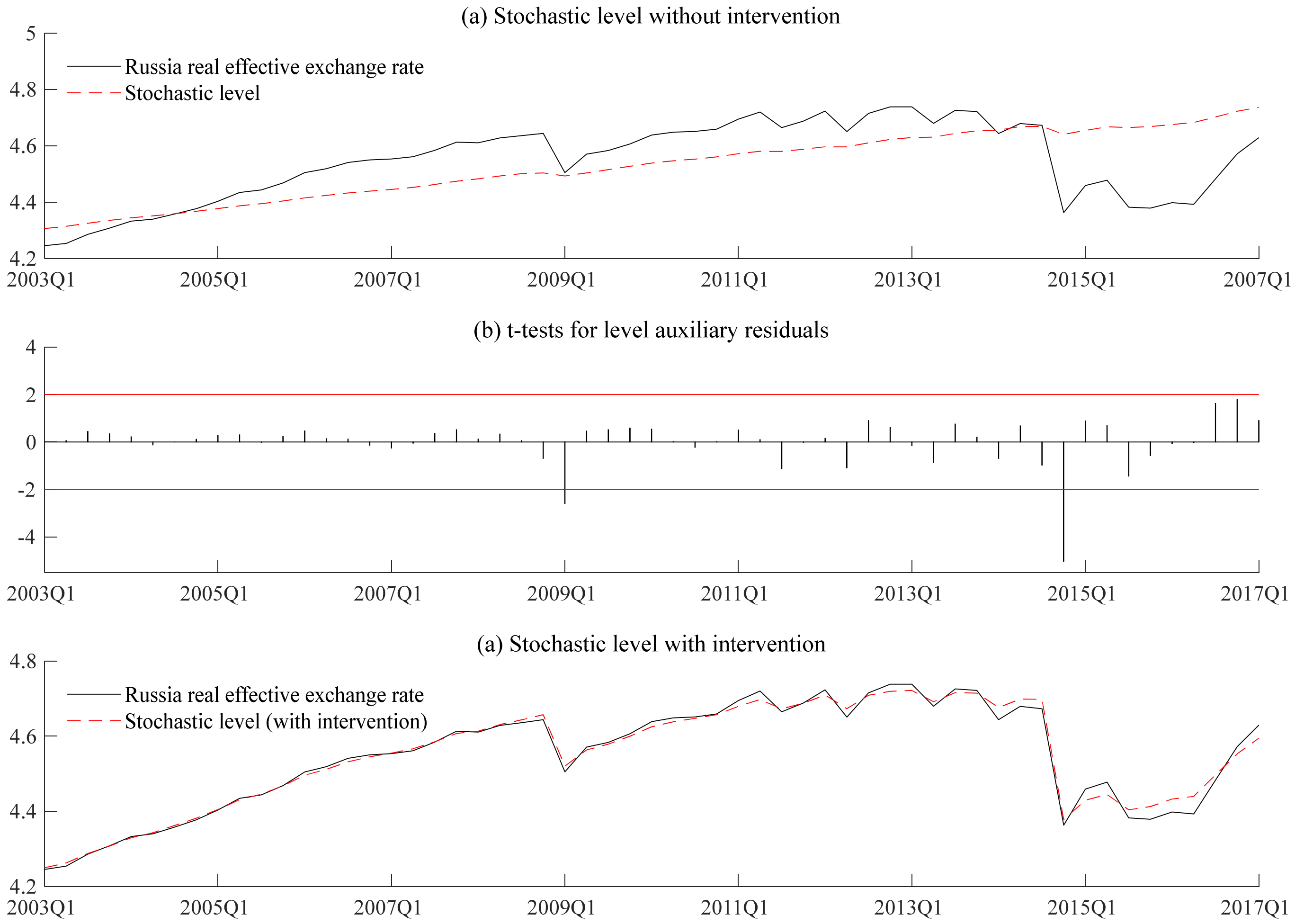
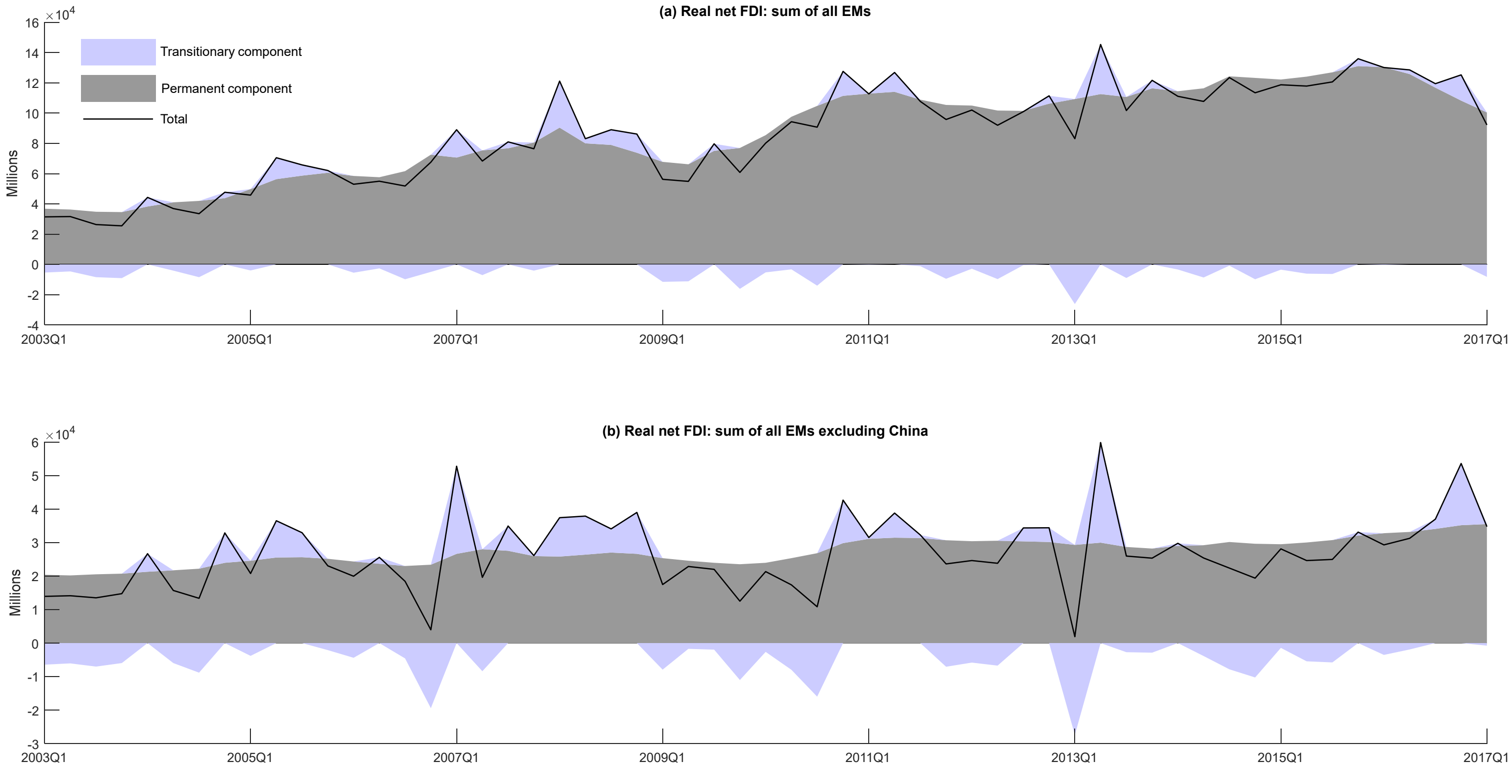
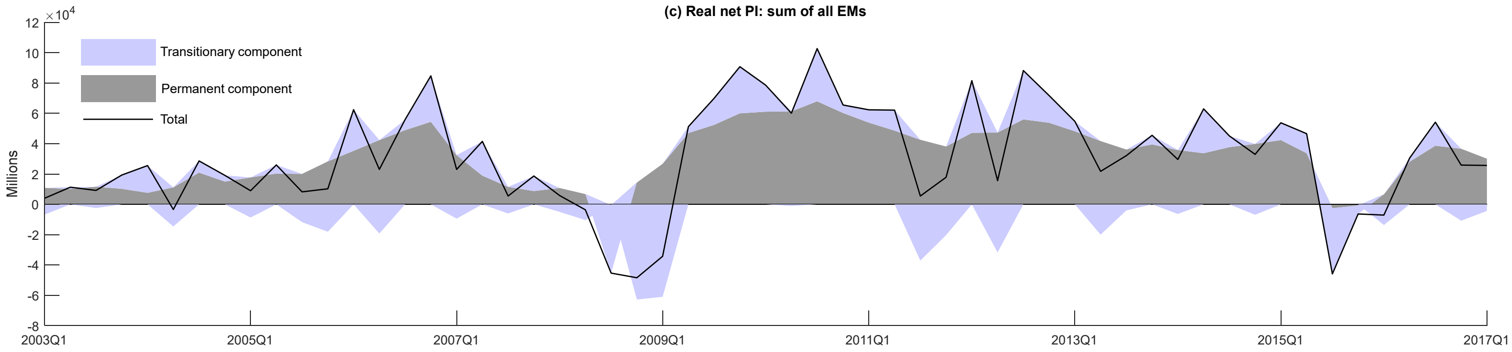


Figure 4 Composition of real net capital inflows: sum of EMs



Note: Loan data is not available in Malaysia, thus Figure 4(e) and (f) consists of a sample of 21 countries in the EM group.

Figure 4 (con't)



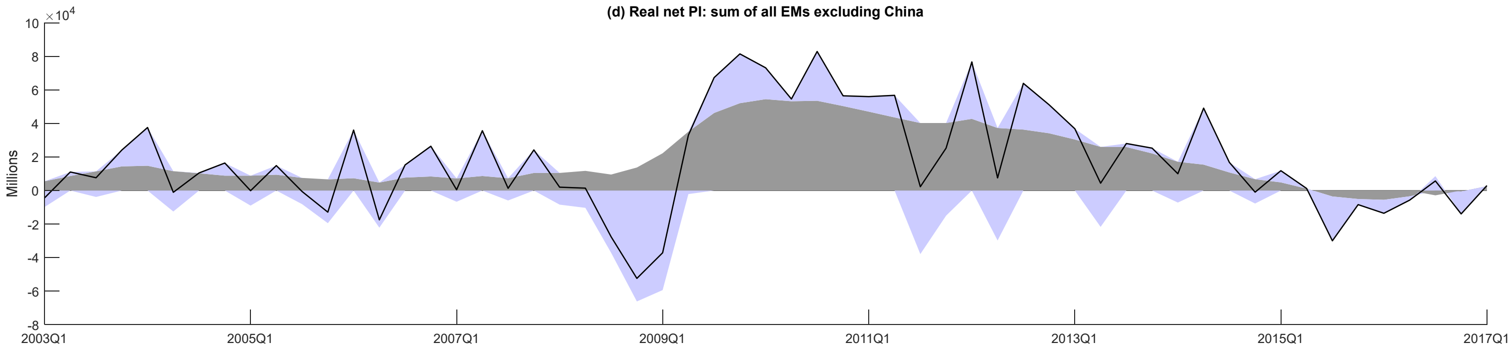
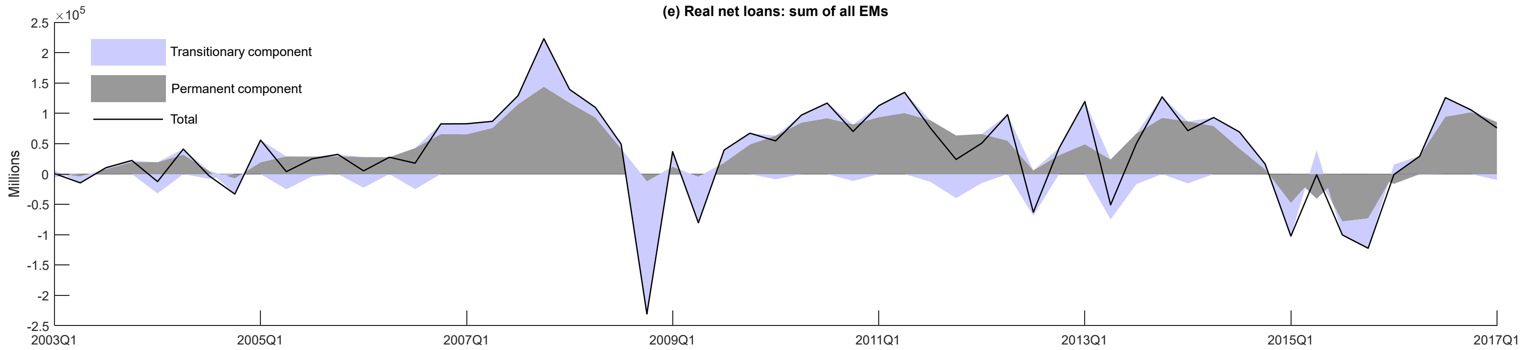


Figure 4 (con't)



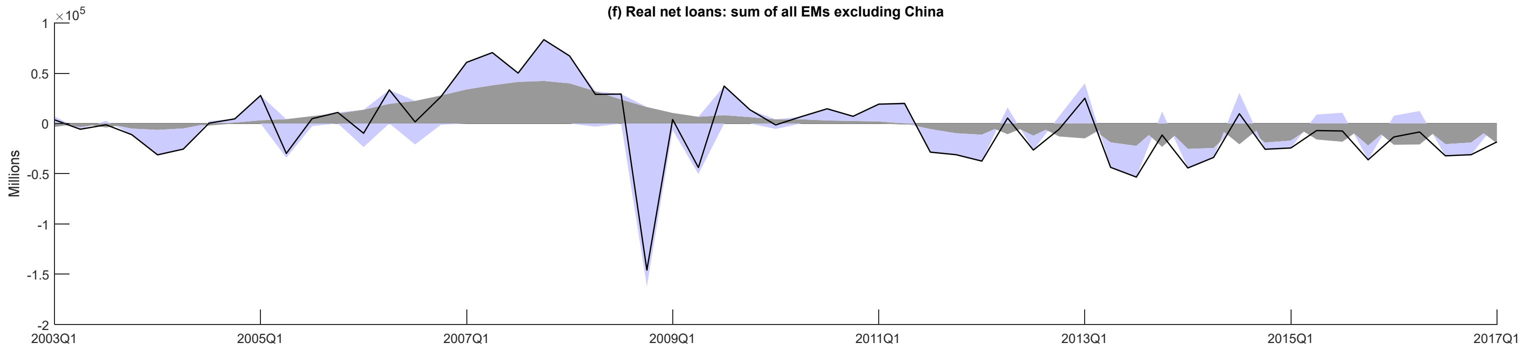
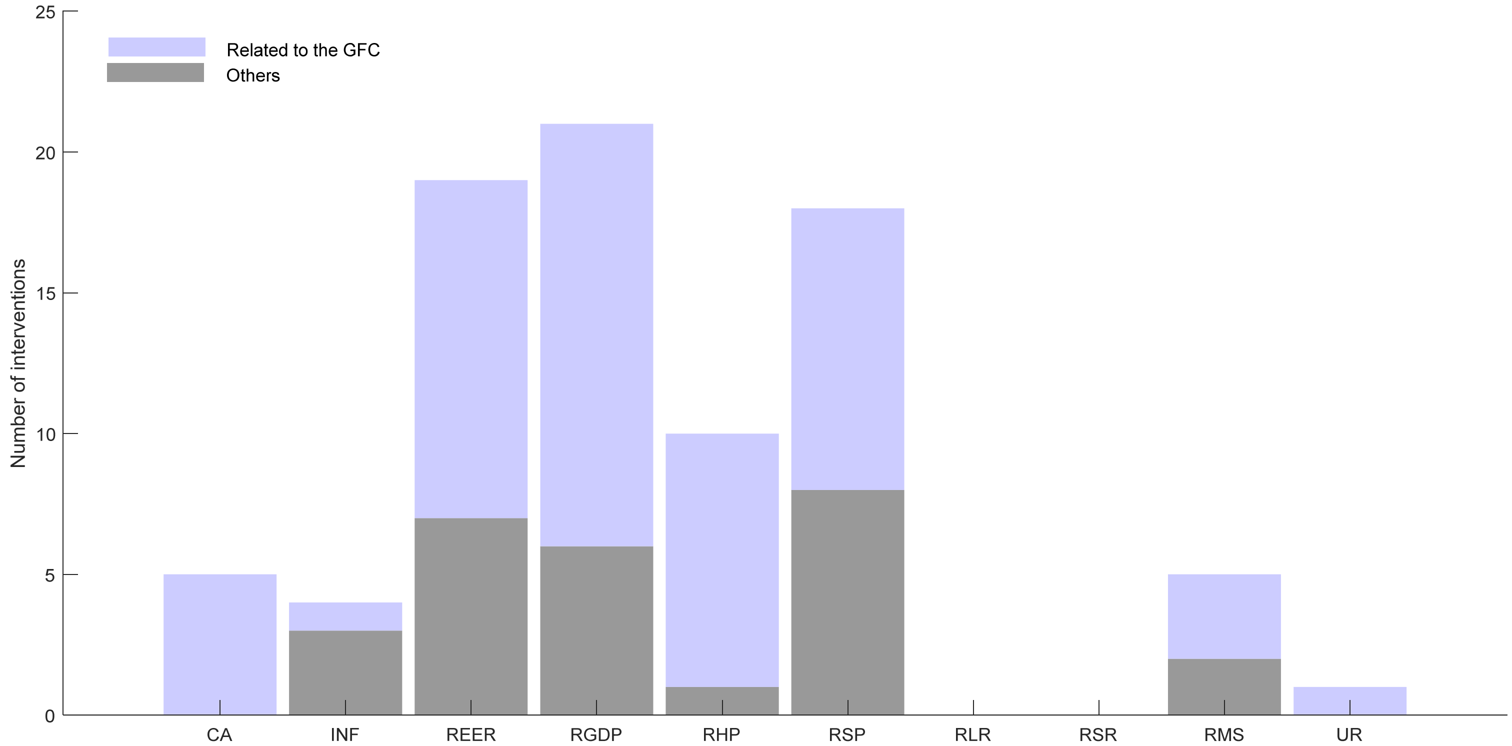


Figure 5 Number of interventions detected in macro-variables in AEs and EMs



Notes: Abbreviations: 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 prices; RHP: real housing prices; UR: unemployment rate.

Figure 6 Example of peak response (PR)

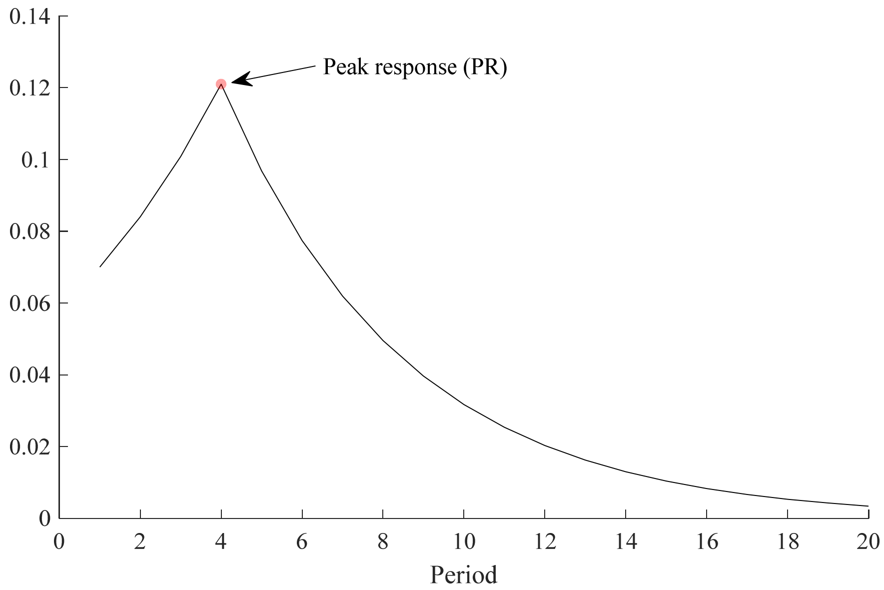
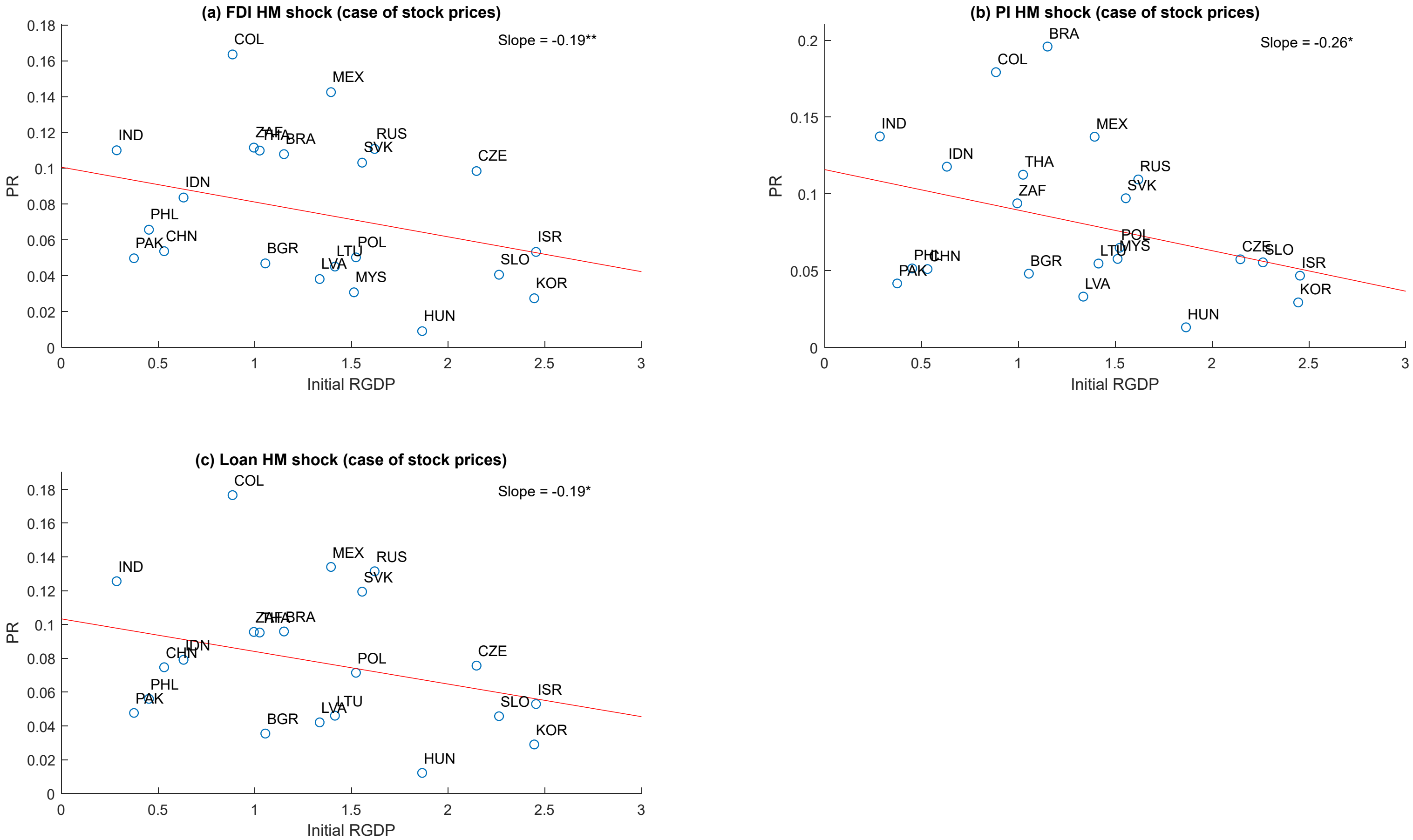


Figure 7 PR and RGDP



Notes: Red solid line: regression line. *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively. Figure 7 (a) and (b) consist of 22 countries. Loan data is not available in Malaysia, thus Figure 7 (c) and (f) consist of 21 and 7 countries, respectively. Appendix shows the abbreviations of the countries.

Figure 7 (con't)

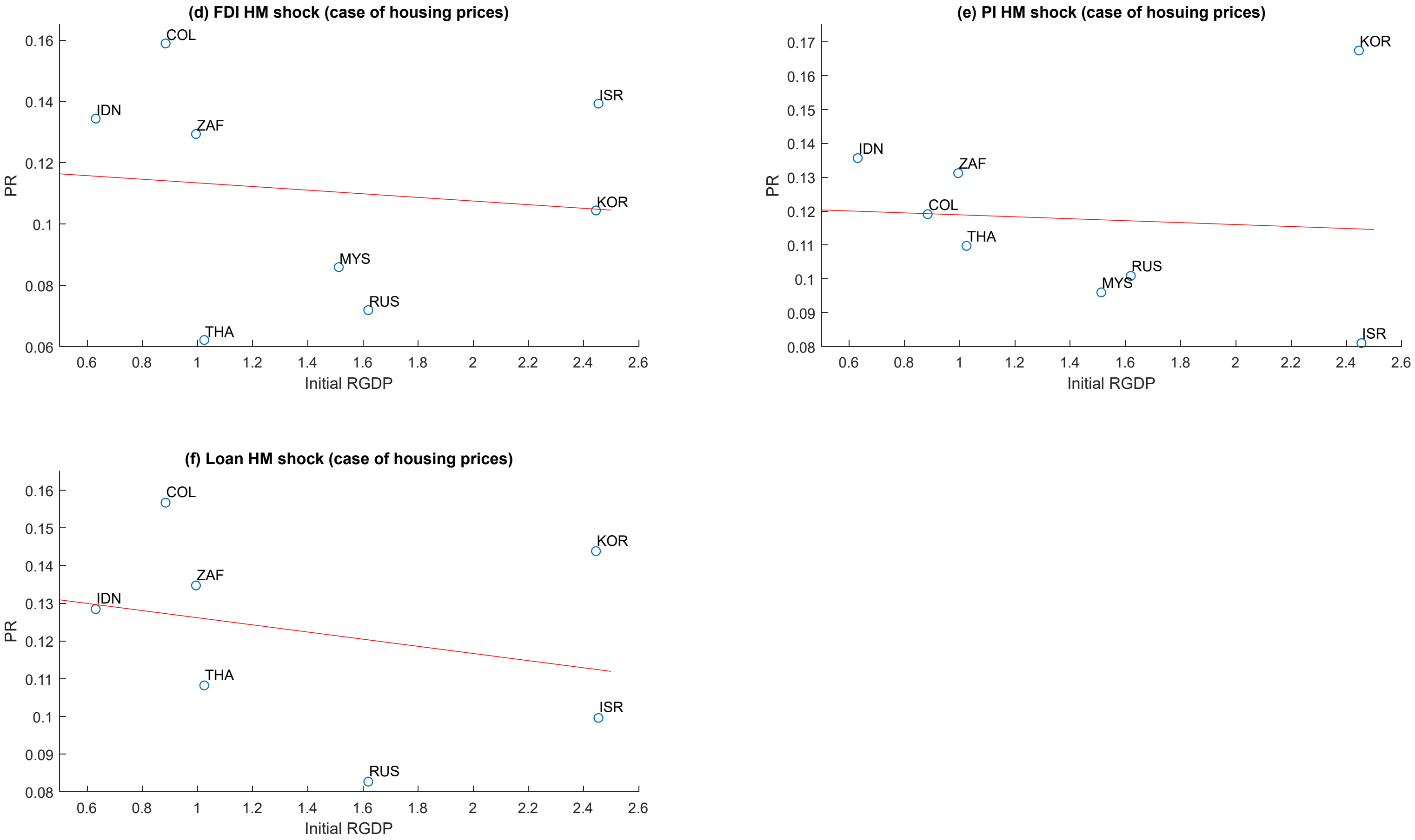
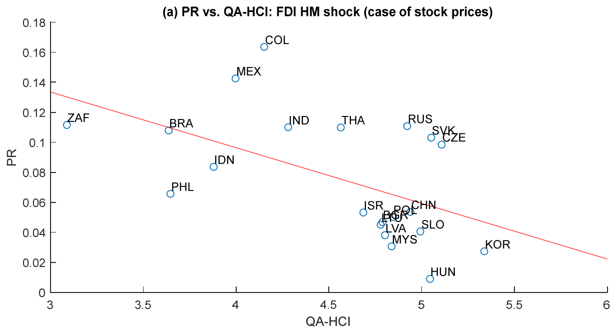
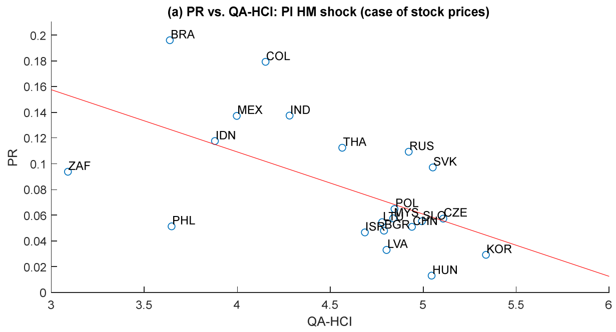


Figure 8a Relationship between peak response of stock price (PR) and quality-adjusted human capital index (QA-HCI)





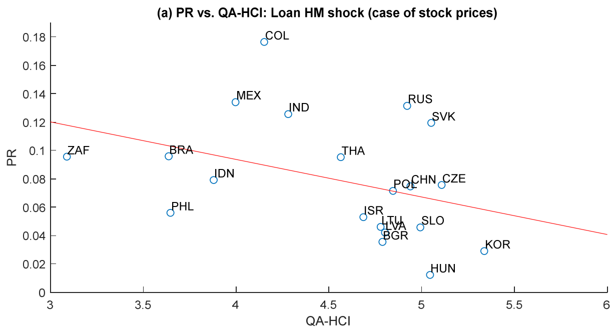


Figure 8b Relationship between peak response of stock price (PR) and institutional quality index: rule of law (IQI-RL)

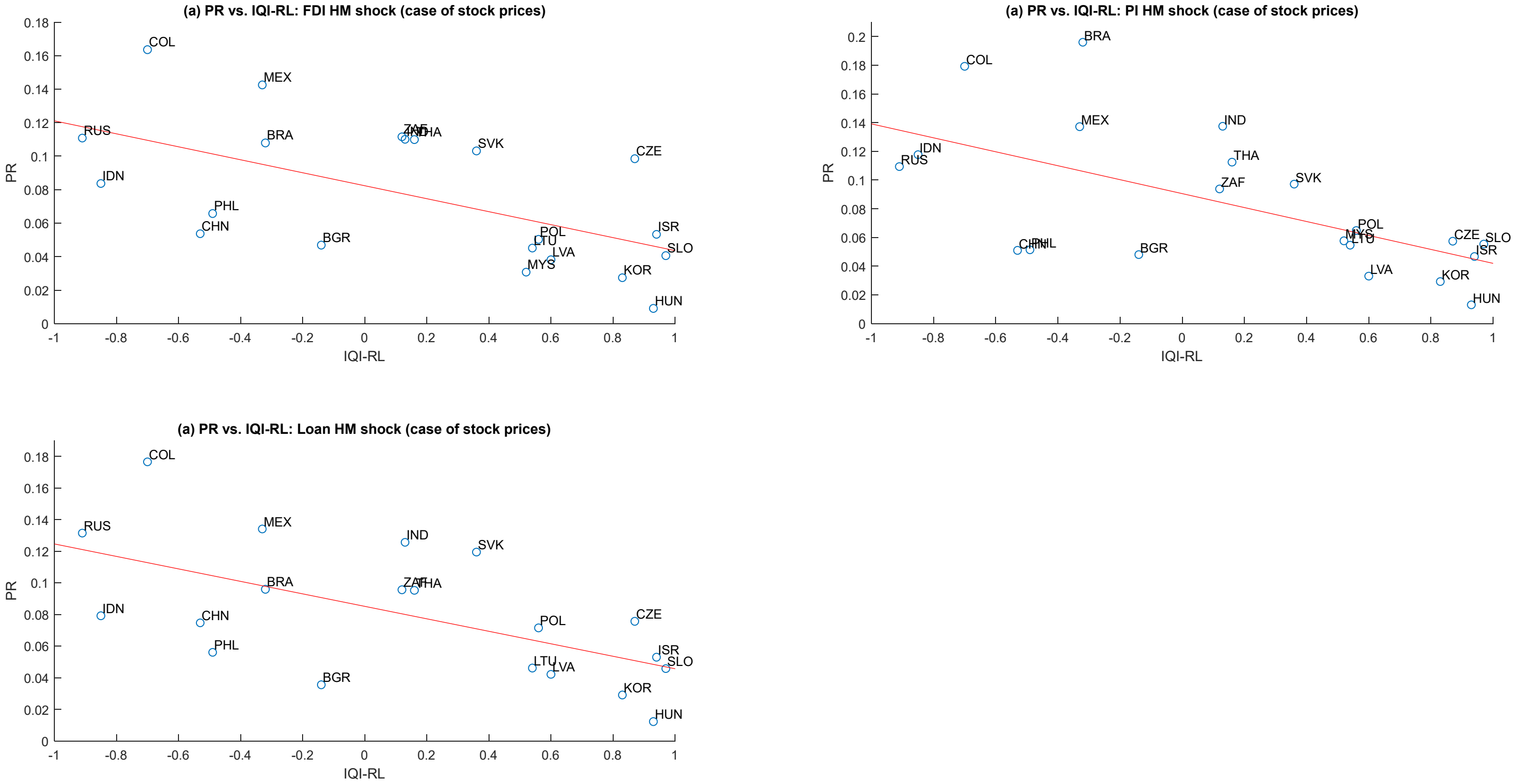


Figure 9 Relationship between institutional quality index: rule of law (IQI-RL) and capital control index

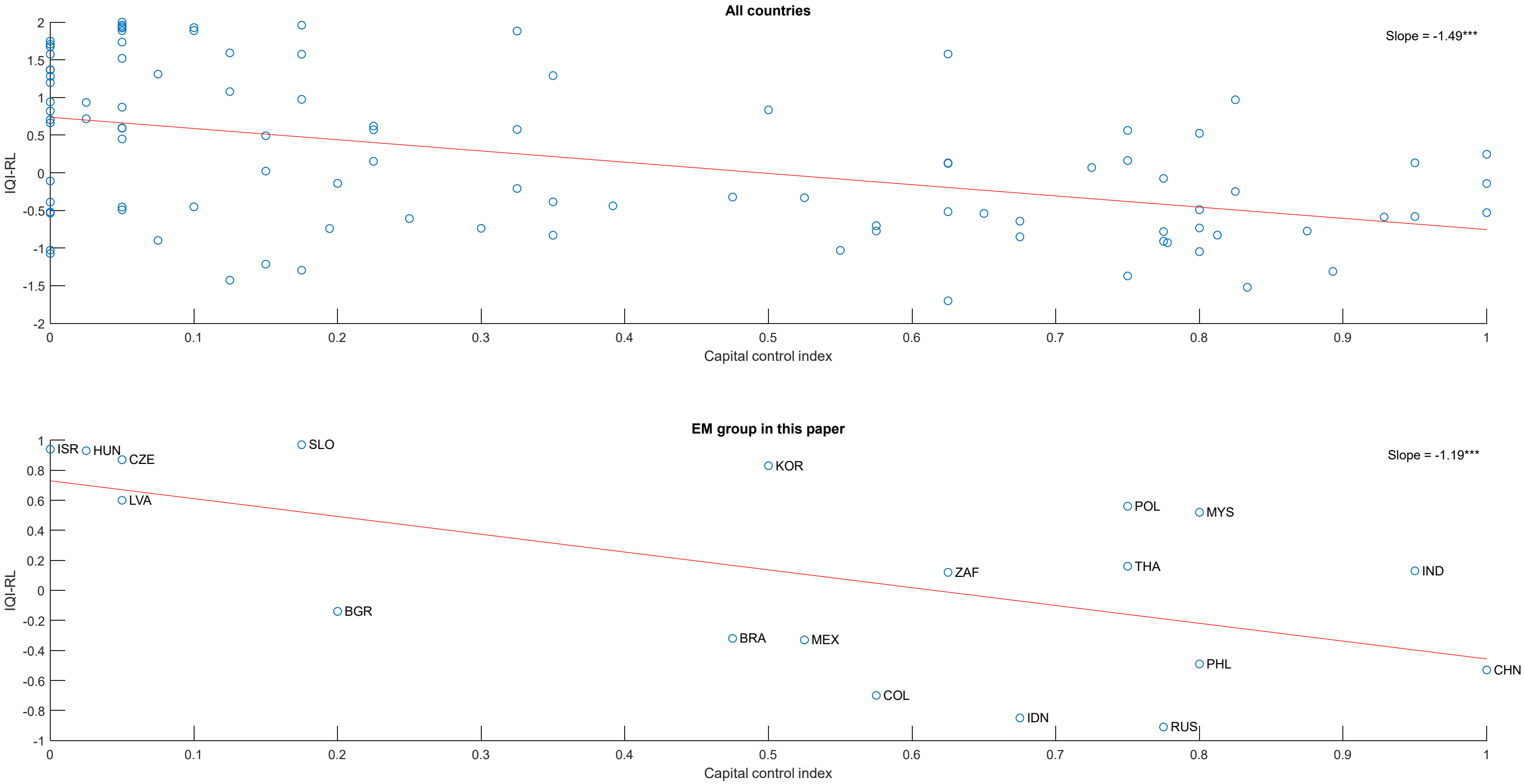


Table 1 Pattern of net capital outflows by country groups

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)	
AE	EM	AE	EM
0.98	-2.09	-0.55	1.2

Panel B

Net PI outflows as a percentage of GDP 2003-2016 (average within the group)		Net loans outflows as a percentage of GDP 2003-2016 (average within the group)	
AE	EM	AE	EM
-1.13	-0.37	-0.86	-0.29

Notes: Data is collected from Balance of Payments and International Investment Position Statistics (net capital outflows) and International Financial Statistics (GDP). There are 30 countries in the EM and 22 counties in the AE group. We take Ju and Wei (2010) as a reference for the classification of country groups. However, Hong Kong and Singapore are not included in the EM group (as well as the AE group) because (1) they are financial center in EM (Lane and Milesi-Ferretti, 2017); (2) they are outliers in the EM group: for example, their average net PI outflows in 2003-2016 are 15.2% and 13.4% of GDP, respectively. Countries in different groups are indicated in Appendix. Loan data is not available in Malaysia, thus there are 29 EM countries in net loan outflows. The definitions of different kinds of CFs could be found in Appendix.

Table 2 F statistic of Granger causality test between CFs and asset prices in EMs

Hypothesis	Brazil	Bulgaria	China	Colombia	Czech	Hungary	India	Indonesia	Israel	Korea	Latvia
FDI does not Granger Cause RSP	16.05	10.67	7.58	13.25	7.95	16.47	9.95	27.48	8.28	3.62	7.27
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
RSP does not Granger Cause FDI	3.59	22.57	10.59	12.66	5.54	8.29	28.03	6.39	4.01	2.95	17.24
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.03)	(0.00)
PI does not Granger Cause RSP	7.29	1.34	1.74	3.76	0.24	4.65	6.33	5.67	5.21	3.61	6.17
	(0.00)	(0.27)	(0.16)	(0.01)	(0.91)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)
RSP does not Granger Cause PI	24.17	1.34	14.75	18.97	1.05	1.5	3.92	21.29	4.6	4.38	6.1
	(0.00)	(0.27)	(0.00)	(0.00)	(0.39)	(0.22)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Loans does not Granger Cause RSP	8.52	2.95	0.66	58.71	6.79	2.68	2.5	5.29	21.86	24.87	7.83
	(0.00)	(0.03)	(0.62)	(0.00)	(0.00)	(0.04)	(0.06)	(0.00)	(0.00)	(0.00)	(0.00)
RSP does not Granger Cause Loans	3.72	2.46	1.48	7.45	1.02	2.83	2.2	6.96	5.02	4.14	11.7
	(0.01)	(0.06)	(0.23)	(0.00)	(0.41)	(0.04)	(0.08)	(0.00)	(0.00)	(0.01)	(0.00)
FDI does not Granger Cause RHP	-	-	-	0.82	-	-	-	5.98	1.98	6.12	-
	-	-	-	(0.52)	-	-	-	(0.00)	(0.11)	(0.00)	-
RHP does not Granger Cause FDI	-	-	-	5.75	-	-	-	5.63	15.82	10.24	-
	-	-	-	(0.00)	-	-	-	(0.00)	(0.00)	(0.00)	-
PI does not Granger Cause RHP	-	-	-	4.86	-	-	-	3.49	9.92	8.00	-
	-	-	-	(0.00)	-	-	-	(0.01)	(0.00)	(0.00)	-
RHP does not Granger Cause PI	-	-	-	8.76	-	-	-	13.81	4.43	8.85	-
	-	-	-	(0.00)	-	-	-	(0.00)	(0.00)	(0.00)	-
Loans does not Granger Cause RHP	-	-	-	9.85	-	-	-	5.21	4.7	20.21	-
	-	-	-	(0.00)	-	-	-	(0.00)	(0.00)	(0.00)	-
RHP does not Granger Cause Loans	-	-	-	21.37	-	-	-	25.07	2.03	15.62	-
	-	-	-	(0.00)	-	-	-	(0.00)	(0.11)	(0.00)	-

Table 2 (con't)

	Lithuania	Malaysia	Mexico	Pakistan	Philippines	Poland	Russia	Slovak	Slovenia	South Africa	Thailand
FDI does not Granger Cause RSP	0.92	2.67	8.25	16.4	4.11	29.7	0.37	6.66	2.28	24.72	15.4
	(0.46)	(0.04)	(0.00)	(0.00)	(0.01)	(0.00)	(0.83)	(0.00)	(0.08)	(0.00)	(0.00)
RSP does not Granger Cause FDI	5.9	14.7	1.11	6.78	7.88	1.97	7.13	9.69	6.56	7.35	9.89
	(0.00)	(0.00)	(0.36)	(0.00)	(0.00)	(0.12)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
PI does not Granger Cause RSP	2.76	8.1	10.66	3.31	28.13	48.66	15.74	3.73	5.6	16.71	8.52
	(0.04)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
RSP does not Granger Cause PI	1.7	6.07	20.76	4.53	2.97	6.17	5.16	10.46	4.4	1.97	4.18
	(0.17)	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.12)	(0.01)
Loans does not Granger Cause RSP	1.64	-	22.24	4.85	8.33	3.42	11.81	5.42	7.15	11.75	35.22
	(0.18)	-	(0.00)	(0.00)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
RSP does not Granger Cause Loans	5.04	-	10.05	6.64	2.88	1.49	34.02	14.72	7.74	6.21	5.04
	(0.00)	-	(0.00)	(0.00)	(0.03)	(0.22)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
FDI does not Granger Cause RHP	-	2.07	-	-	-	-	2.51	-	-	13.34	4.07
	-	(0.1)	-	-	-	-	(0.06)	-	-	(0.00)	(0.01)
RHP does not Granger Cause FDI	-	0.63	-	-	-	-	5.85	-	-	5.96	1.55
	-	(0.64)	-	-	-	-	(0.00)	-	-	(0.00)	(0.2)
PI does not Granger Cause RHP	-	15.2	-	-	-	-	309.54	-	-	8.74	4.63
	-	(0.00)	-	-	-	-	(0.00)	-	-	(0.00)	(0.00)
RHP does not Granger Cause PI	-	32.53	-	-	-	-	35.01	-	-	1.93	0.2
	-	(0.00)	-	-	-	-	(0.00)	-	-	(0.12)	(0.94)
Loans does not Granger Cause RHP	-	-	-	-	-	-	8.62	-	-	6.55	2.39
	-	-	-	-	-	-	(0.00)	-	-	(0.00)	(0.07)
RHP does not Granger Cause Loans	-	-	-	-	-	-	7.82	-	-	9.29	4.31
	-	-	-	-	-	-	(0.00)	-	-	(0.00)	(0.01)

Notes: Data are cyclical components (6-32 cycles) extracted by using Christiano and Fitzgerald (2003) filter and their sources are provided in section V. The sampling period is from 2003Q1 to 2017Q1. The number of lags is four. FDI: real net FDI inflows; PI: real net PI inflows; Loans: real net loan inflows; RSP: real stock prices; RHP: real housing prices. Due to data availability, we employ 22 and 8 EM in the regressions involving RSP and RHP respectively. Also, Loan data is not available in Malaysia, the results are omitted accordingly.

Table 3 Sign restrictions

Variables restricted in the first period (i.e. on impact)	Sign
HM components of real net capital inflows	+
Transitionary components of real effective exchange rate	+
Transitionary components of real GDP	+
Transitionary components of current account balance % of GDP	-
Transitionary components of real long-term interest rate	-
Other variables	Unrestricted

Table 4 Summary statistics of the unobserved-component models

(a) FDI

Country	Model	Final level of stochastic trend component	Q-ratio Permanent (Stochastic trend)	Q-ratio Transitionary (Irregular)	Ljung-Box	Intervention
Brazil	1	19153.44 ***	0.17	1	0.8	
Bulgaria	1	-3.43	0.6	1	0.39	
China	1	64782.52 ***	1	0.89	0.59	
Colombia	1	1516.16 ***	0.24	1	0.36	
Czech	1	827.44 **	0.01	1	0.23	
Hungary	1	560.77 ***	0	1	0.21	
India	1	7926.95 ***	0.08	1	0.21	
Indonesia	1	3335.5 ***	0.12	1	0.13	
Israel	1	319.07	0	1	0.55	
Korea	1	-5077.9 ***	0.43	1	0.34	
Latvia	1	64.34	0.83	1	0.38	
Lithuania	1	74.35	0.03	1	0.64	
Malaysia	1	589.86	0.05	1	0.13	
Mexico	1	5464.88 ***	0.02	1	0.31	
Pakistan	1	543.2 ***	0.57	1	0.61	
Philippines	1	963.6 ***	0.24	1	0.9	Outlier: 2007Q2
Poland	1	1592.73 ***	0.01	1	0.24	
Russia	1	-1700.99	0	1	0.18	
Slovak	1	39.33	0.06	1	0.26	
Slovenia	1	221.53 ***	0.03	1	0.43	
South Africa	1	-221.68	0.04	1	0.14	
Thailand	1	-1515.77 ***	0.07	1	0.57	Outlier: 2011Q4

Note: *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively.
The null of Ljung–Box test is no residual serial correlation.

Table 4 (con't)

(b) Portfolio investment

Country	Model	Final level of stochastic trend component	Q-ratio		Ljung-Box	Intervention
			Permanent (Stochastic trend)	Transitionary (Irregular)		
Brazil	1	-4870.85	0.36	1	0.22	Outlier: 2008Q4
Bulgaria	1	-5.02	0	1	0.68	
China	1	26620.81 ***	1	0.34	0.17	
Colombia	1	1151.07 **	0.05	1	0.58	
Czech	1	7134.77 ***	0.26	1	0.32	
Hungary	1	-1100.68	0.07	1	0.17	
India	1	3556.18 ***	0	1	0.06	
Indonesia	1	4036.36 ***	0.02	1	0.53	
Israel	4	-931.39	0.01	1	0.37	
Korea	1	-10844.55 ***	0.48	1	0.95	
Latvia	1	-94.59	0	1	0.15	
Lithuania	1	-720.012 ***	0.09	1	0.54	
Malaysia	1	-2237.23	0.04	1	0.19	
Mexico	1	7143.28 ***	0.05	1	0.11	Outlier: 2009Q1
Pakistan	1	214.71	0.08	1	0.38	
Philippines	1	-892.49 *	0.06	1	0.57	
Poland	1	1919.79	0.59	1	0.57	
Russia	1	549.46	0.4	1	0.31	
Slovak	1	-542.52	0.13	1	0.24	
Slovenia	1	-954.87 *	0.31	1	0.41	
South Africa	1	2457.1 ***	0	1	0.15	Outlier: 2008Q4
Thailand	1	-2124.95 **	0.14	1	0.31	

(c) Loans

Country	Model	Final level of stochastic trend component	Q-ratio Permanent (Stochastic trend)	Q-ratio Transitionary (Irregular)	Ljung-Box	Intervention
Brazil	1	-5563.6**	0.04	1	0.88	
Bulgaria	1	207.77	0.31	1	0.35	
China	1	105661.38***	1	0.74	0.84	
Colombia	1	313.24*	0	1	0.13	
Czech	1	5952.52***	0.07	1	0.37	
Hungary	1	-1671.2	0.06	1	0.11	
India	1	-3483.12	0.36	1	0.23	
Indonesia	1	-800.48	0	1	0.81	
Israel	1	-236.74	0.07	1	0.17	
Korea	1	-34197.7***	0.1	1	0.92	Outlier: 2008Q4
Latvia	1	-139.49	0.49	1	0.23	
Lithuania	1	1291.53***	1	0.53	0.75	Outlier: 2016Q1
Malaysia	-	-	-	-	-	-
Mexico	1	-5828.09***	0.01	1	0.12	
Pakistan	1	1253.53***	0.18	1	0.26	
Philippines	1	-323.42	0.07	1	0.16	
Poland	1	-896.52	0.24	1	0.06	
Russia	1	-5533.14	0.02	1	0.11	Outlier: 2008Q4
Slovak	1	954.5	0.16	1	0.26	
Slovenia	1	307.69	0.5	1	0.11	
South Africa	1	1028.79***	0	1	0.15	
Thailand	1	-1976.31*	0.05	1	0.15	

Table 5 Major contributors of principal components

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

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; RHP: real housing price; UR: unemployment rate.

Table 6 Regression of the PR

Independent variable	Dependent variable														
	Panel A					Panel B					Panel C				
	PR of real stock prices: FDI HM shock					PR of real stock prices: PI HM shock					PR of real stock prices: loan HM shock				
Column	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Initial RGDP	-0.025**	-0.021*	0.005	-0.006	-0.021	-0.034**	-0.035**	0.0001	-0.011	0.014	-0.025**	-0.022*	0.005	-0.016	0.013
	(0.01)	(0.012)	(0.016)	(0.011)	(0.021)	(0.013)	(0.017)	(0.021)	(0.017)	0.026)	(0.01)	(0.011)	(0.017)	(0.011)	(0.023)
FD		-0.042			-0.046		0.01			0.007		-0.035			-0.032
		(0.063)			(0.056)		(0.081)			(0.056)		(0.06)			(0.057)
IQI-RL			-0.043***		-0.035**			-0.049**		-0.042**			-0.043***		-0.04**
			(0.014)		(0.013)			(0.02)		(0.016)			(0.015)		(0.015)
QA-HCI				-0.033***	-0.029***				-0.041*	-0.034*				-0.016	-0.011
				(0.012)	(0.008)				(0.024)	(0.02)				(0.013)	(0.01)
R^2	0.14	0.16	0.35	0.29	0.46	0.19	0.19	0.38	0.35	0.48	0.15	0.16	0.36	0.19	0.38
Adjusted R^2	0.1	0.07	0.27	0.21	0.32	0.15	0.1	0.31	0.28	0.35	0.1	0.06	0.29	0.09	0.22
No. of countries	21	21	21	21	21	21	21	21	21	21	20	20	20	20	20

Notes: Initial RGDP: initial (2003) real GDP per capita (in 10 thousand USD); FD: initial (2003) financial development index; IQI-RL: initial (2003) institutional quality index: rule of law; QA-HCI: quality-adjusted human capital index. Robust standard errors are used. Standard errors are shown in parentheses. *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively. We drop Pakistan in all the regressions since QA-HCI data is not available. Malaysia is not included in Panel C regressions since Loan data is not available. Data source: Initial RGDP: Penn World table 9.0; FD: Svirydzenka (2016); IQI-RL: Kaufmann, Kraay and Mastruzzi (2010); QA-HCI: "average test score in math and science, primary through the end of secondary school, all years" from Hanushek and Woessmann (2012).

Table 7 Regression of the PR: quantity-based human capital index

Independent variable	Dependent variable											
	Panel A				Panel B				Panel C			
	PR of real stock prices: FDI HM shock				PR of real stock prices: PI HM shock				PR of real stock prices: loan HM shock			
Column	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
RGDP	-0.021	0.018	0.012	0.007	0.014	0.01	0.004	0.001	0.013	0.01	0.007	0.007
	(0.021)	(0.02)	(0.02)	(0.02)	0.026)	(0.027)	(0.025)	(0.022)	(0.023)	(0.023)	(0.021)	(0.019)
FD	-0.046	-0.068	-0.048	-0.024	0.007	-0.021	-0.003	-0.016	-0.032	-0.033	-0.02	-0.024
	(0.056)	(0.064)	(0.059)	(0.061)	(0.056)	(0.098)	(0.093)	(0.078)	(0.057)	(0.069)	(0.057)	(0.046)
IQI-RL	-0.035**	-0.03*	-0.036*	-0.042**	-0.042**	-0.036	-0.041	-0.044*	-0.04**	-0.04**	-0.043**	-0.042**
	(0.013)	(0.017)	(0.017)	(0.019)	(0.016)	(0.014)	(0.025)	(0.024)	(0.015)	(0.013)	(0.019)	(0.023)
QA-HCI	-0.029***				-0.034*				-0.011			
	(0.008)				(0.02)				(0.01)			
BL 2000		-0.091				-0.017				-0.021		
		(0.082)				(0.083)				(0.053)		
BL 2005			-0.043				-0.062				-0.003	
			(0.082)				(0.067)				(0.064)	
BL 2010				-0.001				-0.028				-0.004
				(0.077)				(0.051)				(0.068)
R^2	0.46	0.39	0.36	0.35	0.48	0.42	0.39	0.39	0.38	0.37	0.36	0.36
Adjusted R^2	0.32	0.23	0.2	0.19	0.35	0.27	0.24	0.23	0.22	0.2	0.2	0.2
No. of countries	21	21	21	21	21	21	21	21	20	20	20	20

Notes: Initial RGDP: initial (2003) real GDP per capita (in 10 thousand USD); FD: initial (2003) financial development index; IQI-RL: initial (2003) institutional quality index: rule of law; QA-HCI: quality-adjusted human capital index; BL: % of population aged 15 and over completed secondary education. Robust standard errors are used. Standard errors are shown in parentheses. *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively. We drop Pakistan in all the regressions since QA-HCI data is not available. Malaysia is not included in Panel C regressions since Loan data is not available. Data source: Initial RGDP: Penn World table 9.0; FD: Svirydzenka (2016); IQI-RL: Kaufmann, Kraay and Mastruzzi (2010); QA-HCI: "average test score in math and science, primary through the end of secondary school, all years" from Hanushek and Woessmann (2012). BL: Barro and Lee (2013).

Table 8 Correlation between the independent variables in the regressions

	BL 2000	BL 2005	BL 2010	HCI
FD	-0.02	-0.08	-0.08	0.14
GDP	0.67***	0.63***	0.54***	0.6***
HCI	0.71***	0.62***	0.39*	-
IQI	0.7***	0.7***	0.71***	0.53***

*, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively.

Table 9a Descending Order of emerging markets (EM) according to different indices

Ranking within EM	Quality-adjusted human capital index	Financial development index (in 2003)	Institutional quality index: rule of law (in 2003)	Index of economic freedom (in 2003)	Ease of doing business score (in 2016)	Capital control index (in 2003)
1	Korea	Korea	Slovenia	Lithuania	Korea	Israel
2	Czech	Malaysia	Israel	Korea	Lithuania	Hungary
3	Slovak	Israel	Hungary	Czech	Latvia	Latvia
4	Hungary	Thailand	Czech	South Africa	Malaysia	Czech
5	Slovenia	South Africa	Korea	Latvia	Poland	Slovenia
6	China	Slovenia	Latvia	Thailand	Czech	Bulgaria
7	Russia	Brazil	Poland	Mexico	Slovak	Brazil
8	Poland	Hungary	Lithuania	Colombia	Russia	Korea
9	Malaysia	India	Malaysia	Brazil	Slovenia	Mexico
10	Latvia	China	Slovak	Hungary	Israel	Colombia
11	Bulgaria	Russia	Thailand	Israel	Bulgaria	South Africa
12	Lithuania	Poland	India	Poland	Mexico	Indonesia
13	Israel	Czech	South Africa	Philippines	Hungary	Poland
14	Thailand	Philippines	Bulgaria	Malaysia	Thailand	Thailand
15	India	Mexico	Brazil	Slovak	Colombia	Russia
16	Colombia	Slovak	Mexico	Slovenia	South Africa	Malaysia
17	Mexico	Indonesia	Philippines	Bulgaria	China	Philippines
18	Indonesia	Bulgaria	China	Indonesia	Indonesia	India
19	Philippines	Latvia	Colombia	China	Brazil	China
20	Brazil	Colombia	Indonesia	India	Philippines	
21	South Africa	Lithuania	Russia	Russia	India	

Notes: Capital control index is *not available* for Lithuania and Slovak.

Table 9b Descending Order of Peak Responses of the Emerging Market Equity Prices under "hot money shocks"

Ranking within EM	FDI HM shock	PI HM shock	Loan HM shock
1	Colombia	Brazil	Colombia
2	Mexico	Colombia	Mexico
3	South Africa	India	Russia
4	Russia	Mexico	India
5	India	Indonesia	Slovak
6	Thailand	Thailand	Brazil
7	Brazil	Russia	South Africa
8	Slovak	Slovak	Thailand
9	Czech	South Africa	Indonesia
10	Indonesia	Poland	Czech
11	Philippines	Malaysia	China
12	China	Czech	Poland
13	Israel	Slovenia	Philippines
14	Poland	Lithuania	Israel
15	Pakistan	Philippines	Pakistan
16	Bulgaria	China	Lithuania
17	Lithuania	Bulgaria	Slovenia
18	Slovenia	Israel	Latvia
19	Latvia	Pakistan	Bulgaria
20	Malaysia	Latvia	Korea
21	Korea	Korea	

Table 9c Regression results regarding

Recall that our original regression in the paper is:

$$peak\ \ response = c + \beta_1 real\ \ GDP + \beta_2 human\ \ capital + \beta_3 insitutional\ \ quality + \beta_4 financial\ \ development$$

To include all the indices in one regression is not feasible due to the limited sample size. Since the coefficient of the degree of financial development, β_4 , is always insignificant. Therefore, we replace "financial development" by difference indices.

Dependent variable	Peak response of stock price, case of FDI HM shock			Peak response of stock price, case of PI HM shock			Peak response of stock price, case of loan HM shock		
Real GDP	0.019	0.013	0.014	0.021	0.014	0.020	0.020	0.009	0.005
Human capital	-0.031***	-0.021*	-0.029**	-0.039**	-0.034*	-0.029*	-0.017*	-0.010	-0.013
Institutional quality	-0.035*	-0.042*	-0.037**	-0.039*	-0.042*	-0.042**	-0.033	-0.041	-0.041**
Capital control	0.008	-	-	0.020	-	-	0.041	-	-
Economic freedom	-	0.001	-	-	0.00004	-	-	0.00001	-
Ease of doing business	-	-	0.0004	-	-	-0.001	-	-	0.0006
R^2	0.48	0.45	0.44	0.51	0.48	0.49	0.47	0.37	
Adjusted R^2	0.33	0.31	0.30	0.37	0.35	0.36	0.30	0.21	
No. of countries	19	21	21	19	21	21	18	20	

Source: Economic freedom index is from the Heritage Foundation, https://www.heritage.org/index/ . Ease of Doing Business Report is from the World Bank, http://www.doingbusiness.org/en/reports/global-reports/doing-business-2019 . The Capital Control Index is from Fernandez et al. (2016), available at http://www.columbia.edu/~mu2166/fkrsu/