Hot Money, Asset Price Responses and Economic Fundamentals: The Case of Emerging Markets ♣

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

Charles Ka Yui Leung, City University of Hong Kong

This version: October 2018

Abstract

Large swings in capital flows of emerging markets, which might trigger booms and busts in asset markets, are always a common concern for researchers and policymakers. Our multi-stage empirical framework enables us to extract the hot money components of different capital flows, and show that (1) except for China, hot money is the major driver in FDI, portfolio investment and loan inflows in 22 emerging markets, (2) stock prices react to hot money very differently across countries, and (3) such differential responses could be explained by the "fundamentals." Emerging markets with lower institutional quality and lower level of quality-adjusted human capital tend to have larger peak responses of stock prices. Our results survive several robustness checks. We also show that it is indeed important to include all advanced economies in the empirical analysis, and the private capital flows do behave differently from the aggregate counterpart.

JEL Classification Number: C30, E30, F30, G10, R30

Keywords: hot money, time series econometrics, permanent vs. transitionary component, financial crisis, asset price fluctuations

---

♣ Acknowledgement: We are grateful to Nan-Kuang Chen, Yin-Wong Cheung, Xu Han, Eric A. Hanushek, Vikas Kakkar, Fred Kwan, Kate Phylaktis, Chor-Yiu Sin, Byron Tsang, Hung-Jen Wang, Frank Warnock, Isabel Yan, seminar participants of the Asian Meeting of Econometric Society (Hong Kong), Asian Real Estate Society Annual Conference (Incheon), City University of Hong Kong alumni-student workshop, GCREC meeting (Hangzhou), International Association for Applied Econometrics (Sapporo) meeting, International Conference on Risk in Economics and Society (Shiga), Joint CASS-ECB-Emerging Markets Group (EMG) Workshop on International Capital Flows (London), National Taiwan University for helpful conversations. The financial support from the City University of Hong Kong is gratefully acknowledged. Part of the research is done when Leung visits the Hoover Institution, whose hospitality is gratefully acknowledged. The usual disclaimer applies.

I. Introduction

The volatility of the international capital flows (CFs) is always a common concern for researchers and policymakers.[1] CFs, especially when they quickly enter and leave an economy as "hot money" (HM), trigger booms and busts in asset markets, even threaten 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). Figure 1 illustrates these "stylized facts": Global capital inflows increased 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. Figure 1 also shows that remarkable drops in CFs are often associated with "crises," as asset prices typically experience sharp drops in those episodes, including the 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.

(Figure 1 about here)

In light of that, this paper sheds light on the following questions. First, what explains the international movements of CFs? Second, what are HM and are international CFs dominated by the HM? Third, do asset prices across countries react to an HM shock differently? If so, why? Previous 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, henceforth AEs) to the South (or Emerging Markets, henceforth EMs). The intuition is simple. If the production technologies are identical across countries, AEs, who have more capital, would have lower marginal product of capital (MPK). Capital would, therefore, moves from AEs to EMs, which are supposed to have higher MPK. In other words, CFs are driven by differences in MPK. Unfortunately, this neoclassical prediction is at

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

odds with the data, as highlighted by Lucas (1990) and many subsequent studies.[2] As an alternative, the "two-way capital flows" (TWCF) hypothesis suggests that the flows of the foreign direct investment (FDI) are in line with the neoclassical growth model, while financial investment (FI) flows from poor to rich countries, who 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 existing theories on CFs by studying the components of FI, using net CF data.[3] According to the IMF definition, the 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. Clearly, the "reserves minus gold" is dictated by the central banks, who are known to behave differently from the private sector.[4] Financial derivatives often involve hedging and speculation, which might have very different objectives from PI and loans.[5] On the other hand, PI is debt and equity securities being *directly traded* in the market, and the loan flows we extract from OI are the *non-securitized* international flows of loans. For future reference, we would label the PI and loan as "private flows" or "non-central bank flows," to highlight the fact that the reserves minus gold, as well as the derivative trading are excluded 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 the PI and loans,

---

[2] On top of the so-called Lucas puzzle on why capital does not flow from AEs to EMs, Gourinchas and Jeanne (2013) raise the allocation puzzle: CFs to EMs are not only low by size but are allocated to countries that grow less than other EMs. Cole et al. (2016) show that, due to the contractual frictions, AEs and EMs might not have the same technology.

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

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

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

[6] We are reminded that some EM, such as China, has significant amount of state-owned-enterprises (SOE), whose investment would also be included in the PI and loans. We are aware of such limitation, and our label only aims to highlight the fact that central banks, which controls the reserve, and often participate in hedging, are excluded from our analysis and we will show later that the "private flows" do behave very differently from the other components of CF.

as well as FDI, are associated with asset prices fluctuations, i.e. stock and housing prices, in EMs, which would be explained in more details.

Second, we study how HM interacts with asset prices, and take movements of the macro variables into considerations. There are several technical issues here. First, HM is not directly observed. Therefore, we need to take a stand on how we construct the time series of HM. 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. We are relieved that the results are very similar.

The second technical issue is to determine what macro-variables to be included in the analysis. While it seems reasonable to include the macro-variables in both AEs and EMs, there are too many of them to be included. Macro-variables are also correlated, and hence it is unnecessary to include all of them. We, therefore, employ a two-step factor-augmented VAR (FAVAR) model. First, a principal component analysis is conducted to extract the "common factors" among the transitionary components of macro-variables in AEs. In the second step, for *each* country and *each* asset price, three FAVAR models, *each for a different notion of hot money* (the HM components of net FDI, PI and loan inflows) as the endogenous variable, are estimated. 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 only study the stock prices from 22 Ems and house prices from 8 EMs.[8] Thus, we have around 90 FAVAR models in total. Following the sign restriction approach proposed by Ouliaris and Pagan (2016), we estimate (in real term) the responses of stock and housing prices to FDI, PI and loan HM shocks. We find important cross-country differences in stock

[7] More discussion on this point would be presented later.

[8] In order to identify HM shocks, our VAR models need to include the long-term interest rate, which is relatively scarce in EMs. This reduces the sample of EMs for investigation. More discussion on this point would be presented later.

prices responses and associate them with individual country characteristics. We provide some interpretations and possible directions for future research.

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

II. Literature review

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

a. International movement of capital flows and their determinants

In response to the empirical finding of Lucas (1990), or the "Lucas puzzle," many efforts have been devoted to understanding the direction of CFs (for instance, Gourinchas and Jeanne, 2013 and the reference therein). Bernanke (2005) argue 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 national asset bubbles result in international imbalances. Caballero et al. (2008) argue that EMs cannot generate enough savings instruments, resulting in a 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. Buera and Shin (2013) show that under the domestic financial frictions, saving rates increase but investment rates respond with a lag, leading to capital outflows. Buera and Shin (2017) show when an unexpected once-and-for-all reform eliminates non-financial distortions and liberalizes CFs, the TFP of the modelled economy rises gradually and capital flows out of it. Sandri (2014) and Angeletos and Panousi (2011) point out that the un-insurable idiosyncratic risk in EMs introduces a precautionary motive for saving. Cole et al. (2016) articulate a model where the inefficiency of financial markets hinders the most advanced technologies to be adopted. Hence, capital in EMs might not have higher MPK, which explains the Lucas puzzle.

Some studies distinguish the FDI from the 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 foreign investment takes place in EMs in the form of FDI. Wang et al. (2016) develop a model where both firms and households in EMs are borrowing constrained, 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 the two-way capital flows.

While these theories focus on the *direction* of CFs, a related issue to be resolved 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 change in stock market capitalization are important determinants for CFs to developing Asia. Forbes and Warnock (2012) identify the episodes of extreme CF movements and show that global factors, especially global risk, as well as contagion, whether 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 an 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 capital inflow shocks have a significant effect on the appreciation of housing prices. Tillmann (2013) find that capital inflow shocks lead to positive responses of stock and housing prices in a set of Asian emerging economies. On the other hand, there are authors worry that if the degree of co-movements in GDP decreases among countries, it would create a possibility of hedging and hence would have important implications to 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.

c. Hot money

This paper is also built on the literature on HM, which is too large to be reviewed. Here we highlight only a few contributions. For instance, Korinek (2011) argue that HM is a cause of serial financial crises. In his model, when a borrowing country is hit by an adverse shock, the financially constrained agents cut back consumption, leading to a fall in asset prices, which in turn, further tightens the borrowing constraints, and the agents further reduce their consumption. The equilibrium interest rate might stay below the unconstrained steady-state level, which might encourage other unconstrained countries to raise their levels of debt and hence expose to the future crises.

Notice that while HM appears frequently in the media, it is not directly observed. To examine HM, we need to measure it properly. Claessens et al. (1995) show the unreliability of categorizing CFs into “short-term” and “long-term” by using accounting labels. Following Harvey (1981, 1989), Sarno and Taylor (1999a) take into account the temporariness and reversibility properties of HM and suggest identifying HM through an unobserved-component approach. Using the U.S. capital flows to 9 Latin American and 9 Asian developing countries over the period of 1988–1997, they find that there were relatively low permanent components in equity flows, bond flows and official flows, with a large permanent component in commercial bank credit flows and almost exclusively permanent component in FDI flows. Sarno and Taylor (1999b) find relatively high reversible components in the U.S. portfolio flows to East Asian economies. Fuertes et al. (2014) find that the HM in bank credit flows from the

U.S. to 18 EMs has increased during the 2000s relative to the 1990s, even after controlling both the push and pull factors.

The current paper differs from the literature in several ways. While some authors focus on the CFs between the U.S. and other countries, or CFs to a small number of EMs, this project includes more than 20 EMs. We consider not only internal factors (or "pull factors," i.e. influence from the domestic economies) but also external factors (or "push factors," i.e. influence from advanced economies) in studying the responses of asset prices to different kinds of HM shocks.[9] While many of the existing studies conduct a cross-sectional analysis, this project builds a multi-stage dynamic estimation framework to address some potential endogeneity concerns. And while some existing studies adopt a panel data approach, this paper estimates the relationship between each type of CFs and asset prices in each country, and hence uncovers significant heterogeneity in asset price responses across countries. We then show that those differences in asset price responses could be explained by some country characteristics.[10]

III. Pattern of capital flows

[9] According to International Monetary Fund (2014), push factors include, for example, economic growth, liquidity, and level of bond yields in AEs. "Pull factors," on the other hand, refers to the factors of the recipient countries (RC) which attract CFs, such as "economic prospects" of the RC. Throughout this paper, we would use "push and pull factors" or "external and internal factors" interchangeably.
There are other studies which also distinguish the pull factors from the push factors. For instance, Fratzscher (2012) focus on the importance of pull and push factors around the 2008 financial crisis. In contrast, this paper studies a longer period of time and focuses on the impact of CFs on the asset prices in EMs.

[10] Some conference participants help us to become aware of Cesa-Bianchi et al. (2015). Their paper and ours are related but different in many aspects. On top of the sampling period, they adopt an un-balance panel approach. They also use intrapolation and extrapolation to extend their dataset. Therefore, their dataset contains more countries. They also assume to have better knowledge about some matrices and hence they can effectively estimate the structural form (more discussion on this will be provided in a later section). Since we want to differentiate the hot money shock from other shocks, we need the long term interest rate data. We adopt a balance panel approach and we did not intrapolate any data series. And we effectively estimate a partially identified system, which will be explained in more details later.

We begin by clarifying the pattern of net CFs and establish some potentially new "stylized facts."[11] Table 1 is constructed in the spirit of Ju and Wei (2010) and Wang et al. (2016).[12] Hence, we use the term "net outflows," and negative values indicate "net inflows." In Panel A, the average net FDI outflows are 0.98% and -2.09% of GDP for AEs and EMs, respectively.[13] Clearly, 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 these are consistent with the TWCF hypothesis. However, FI is a broad category, which aggregates various types of CFs. In this paper, we focus on the "non-central bank" components of FI, which are the PI and loan flows.

(Table 1 about here)

Apparently, PI and loans do not follow the same pattern as the aggregate FI. In Table 1 Panel B, the average net PI outflows are -1.13% and -0.37% of GDP for AEs and EMs, respectively. It is *not in line with* the TWCF hypothesis. In the case of loans, there is no clear direction either. Due to the inconsistency of PI and loans with *both* the neoclassical model prediction and the TWCF hypothesis, we need to first establish some stylized facts of the PI and loan flows and explain their behaviors.

Inspired by the stylized facts that significant CFs are often associated with significant 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 EMs 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).

[11] It is well known that even international "stylized facts" could change over time. For instance, see Cheung et al. (2005).
[12] The definitions of different kinds of CFs could be found in the Appendix.
[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 (as well as the AE group) because (1) they are Asian financial center (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.

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

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

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

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's and α's in equation (a) and (b), respectively. If the β's (α's) are jointly significant, then asset prices (CFs) Granger cause CFs (asset prices). The F test results reported in Table 2 clearly indicate that in most of the EMs, asset prices and CFs *Granger cause each other*. Our results here complement many previous studies which tend to use single equations to study the impact of CFs on asset prices. However, the single equation approach, while seems intuitive and popular, might overlook the possibility that CFs might not be strictly exogenous and could be affected by the real asset price movements. The results here provide support for a bi-directional causality between CFs and asset prices.

Clearly, both CFs and asset prices could be driven by some "third factors." For instance, an expected improvement in productivity, whether due to technological improvement or due to a political reform, would stimulate the real asset prices. At the same time, foreign capital would be attracted by a "high return environment." Hence, it calls for an empirical model which 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 has established that CFs and asset prices Granger cause each other. In this section, we study how the HM component of CFs interact with the asset prices. To achieve this goal, we build an empirical framework which enables us (1) to extract the transitionary components of CFs (HM), asset prices as well as the macroeconomic variables, and (2) to explicitly model the dynamic interactions among HM, asset prices and macroeconomic variables. In addition, it should allow for the possibility that asset price responses might be different across different CFs, even within the same country, even more so when we compare across countries.

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

(Figure 2 about here)

To extract the HM component from CFs and the short-run components from macro-variables, we employ the unobserved-component (UC) approach in the main text,[14] which emphasizes the temporariness and reversibility properties of the transitionary components (Sarno and Taylor, 1999a). A general state space model might 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

[14] We adopt a different approach in the robustness check section and get very similar results. More details would be presented later.

$$\begin{aligned} \mu_t &= \quad \mu_{t-1} + c + \eta_t, \qquad \eta_t \sim NID(0, \sigma_\eta^2) \\ \upsilon_t &= \rho_1 \upsilon_{t-1} + \rho_2 \upsilon_{t-2} + \zeta_t, \quad \zeta_t \sim NID(0, \sigma_\zeta^2) \end{aligned}$$

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 (or level) component, c is the slope of the trend and υ_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

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

To detect level breaks and outliers, we conduct *t*-test for auxiliary residuals. Figure 3 illustrates the point that ignoring structural breaks and outliers would lead to biased estimation. The real 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, 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 crises (Commandeur and Koopman, 2007).

(Figure 3 about here)

While equation (1) provides the general state space model, there are several variations that we could estimate, as shown in the Appendix. The appendix also shows how these models could be estimated by using Kaman Filter. We adopt AIC as the selection criteria to choose the "optimal model":

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

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.

To study the impact of the HM, we adopt the following definition:

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

It is clear that V_t, ε_t and outliers are transitionary components. A level break, by definition, causes a permanent shift in the stochastic level. However, removing level breaks from the transitionary 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 transitionary components. We treat the slope interventions as a part of the stochastic level and hence, a part of the permanent components.[15] The same procedure is applied to the transitionary components of macro-variables.

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

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

The 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 is due to the permanent component, for instance, the Q-ratio for the stochastic trend is unity, i.e. $Q(\mu_t) = \frac{\sigma_\eta^2}{\sigma_\eta^2} = 1$. This means that a large part of the CFs would remain in the country concerned for an indeterminate period of time. Instead, if most of the variation in CFs is explained by the dynamics of transitionary component, then the Q-ratio of the AR

[15] Employing a local linear trend model where the slope of the level is allowed to be time-varying might substitute some of the slope interventions. However, such model implies an I(2) process and it might not be suitable for our macro-variables. See Harvey (1989) for a discussion of local linear trend model.

component or the irregular component would be equal to 1. In that case, the CFs under consideration are dominated by HM.

Clearly, we deviate from the usual approach of employing the first difference filter to induce stationarity. A potential problem of using the first difference filter is that it might exaggerate the high-frequency component and create distortions (for example, see Baxter (1994)). The comparison between our model with the usual approach, which is reported in the appendix, suggest that our approach would provide a better explanation of the current data set. After extracting the HM component from the CFs, we investigate how the HM might affect the asset prices in EMs. As we have explained earlier, one of our identification assumptions is that the macro-factors of AEs would affect the counterparts in EMs, but not vice versa. Furthermore, we allow macro-factors and HM to interact dynamically. It leads us to adopt a factor-augmented VAR (FAVAR) framework.[16]

A priori, however, we *do not know which AE's 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 might not be practical. Since macroeconomic variables are known to be correlated, *both across and within countries*, including all the macroeconomic variables from the AEs would not be necessary. 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 employs a two-step FAVAR model. First, we conduct a principal component (PC) analysis on the macro-variables of six major AEs, namely, Australia, Canada, Euro area, Japan, the United Kingdom and the United States, and we use those PCs to represent the impact of the developed world.[17] In the second step, for each country and each asset price, three FAVAR models, with respectively net FDI, PI and loan hot money inflows (in real term)

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

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

as the endogenous variable, are estimated. Constrained by data availability, we study the stock prices in 22 EMs with their macro-variables. For house prices in EMs, we can only cover 8 countries.

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

$$B_0 X_t = \varphi_0 + \sum_{j=1}^{p} B_j X_{t-j} + \sum_{i=0}^{q} A_i PC_{t-i} + w_t \qquad (4a)$$

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

$$X_t = \varphi_0 + \sum_{j=1}^{p} \varphi_j X_{t-j} + \sum_{i=0}^{q} \theta_i PC_{t-i} + \in_t \qquad (4b)$$

where φ_0 and $\in_t \sim i.i.d.N(0, \Sigma_{\in})$ are $k \times 1$ vectors, $\{\varphi_j\}$ are $k \times k$ matrices, $\{\theta_i\}$ are $k \times m$ matrices, X_t is a $k \times 1$ vectors of endogenous variables, $\in_t$ and $\Sigma_{\in}$ are the innovation of reduced-form VAR model and variance-covariance matrix, respectively. The list of variables would be detailed later. p and q are, respectively, the maximum numbers of lags of the endogenous and exogenous variables, selected by BIC.[18] Since the macroeconomic variables of AEs are assumed to be exogenous to the system, the interactions among X_t and PC_t depend on B_0 in equation (4a). Unfortunately, we could only estimate equation (4b) and hence are unable to recover B_0. The conventional approach is to assume some form of block-recursive structure in B_0.[19] 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.

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

[19] Among others, see Christiano et al. (1999). More recently, Mertens and Ravn (2013), Stock and Watson (2012) develop a new approach in the estimation of SVAR. They use some OLS residuals to estimate B_0, and then based on the estimated B_0, they could uncover the other matrices of coefficients $\{B_j\}$. In that framework, some assumptions about the relationships between the instruments and shocks need to be made. Since they focus on the government policies in the United States, those assumptions are justified. In our context, since HM is not directly observable, and HM could be correlated with other macroeconomic variables of AEs as well as EMs, we rather take a more conservative approach here, which is to estimate a partially identified FAVAR. More discussion is presented in the text.

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 might be less stringent (Lütkepohl and NetŠunajev, 2014). This paper follows the sign restriction approach proposed by Ouliaris and Pagan (2016), known as SRC approach (sign restriction with generated coefficients).[20] Here we provide a brief description of the SRC approach. Based on equation (4a) and (4b), it could be shown that $\Sigma_{\epsilon} = B_0^{-1}\Sigma_w B_0^{-1'}$, where Σ_w is the variance-covariance matrix of w_t. The SRC approach would first draw above-diagonal elements of B_0 at random such that sign restrictions on B_0 are satisfied. Then we solve for remaining elements of B_0 and diagonal elements of Σ_w and retain the resulting candidate solution for B_0 if all 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 $b_{ij,0}$ element in B_0, where $i < j$, we draw a random variable δ from the uniform distribution $U(-1,1)$. Then $b_{ij,0}$ is 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 could be solved by using a nonlinear equation solver or the instrumental variable method as discussed in Ouliaris and Pagan (2016).

Inspired by a broad range of theoretical (e.g. DSGE models) and empirical studies such as Sá et al. (2011, 2014), Tillmann (2013), a set of sign restrictions for an HM inflows shock is imposed (Table 3). A positive HM shock would increase the HM components of CFs and lead to an increase in economic activity (real GDP). There would be an appreciation of real effective exchange rate since foreign demand for local currency increases, which leads to a current account deficit. Lastly, as mentioned in Sá et al. (2011), in order 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

[20] Ouliaris and Pagan use simulation data to compare the performance of SRC and the traditional SRR approach (sign restriction recombination). While both methods work well, relatively speaking, they conclude that SRC has some advantages over SRR: it applies to any simultaneous equations system and could incorporate a wider range of information e.g. on both the parameters and impulse responses.

set of sign restrictions except for the long-term interest rate. The idea is that a capital inflow shock is supposed to lower the domestic interest rates. However, the short-term interest rates are largely controlled by central banks. Thus, long-term interest rates would respond to a capital inflow shock to equilibrate the market. We restrict only the first period (i.e. the impact period) as an HM shock should be transitionary. There is also less consensus in economic theory about imposing restrictions beyond the impact period.[21] As we are interested in a single structural shock, our model is referred as a *partially identified* VAR model in literature.[22] The sign pattern of each of the unidentified shock we impose is different from that of the identified shock. We retain 1000 draws for the impulse response analysis.

(Table 3 about here)

V. Data and Results

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 loans) for EMs are collected from Balance of Payments and International Investment Position Statistics (BOPS). GDP, inflation rate, current account balance as a percentage of GDP, short-term (3-month money market rate) and long-term interest rates (10-year government bond yield), M2 (AEs only), unemployment rate (AEs only) and stock market index are collected from International Financial Statistics (IFS) and OECD Statistics. Housing price index is collected from Bank for International Settlements. The real effective exchange rate is obtained from Darvas (2012). If data are not available from the above dataset, we employ data from national sources. Nominal variables are deflated by the CPI. GDP, M2, real

[21] See Canova and Paustian (2011).

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

effective exchange rate, stock market index and housing price index are converted to natural logarithms form. All series are seasonally adjusted.

Our results would be presented in this order. We begin with the results of our state-space decomposition. We then turn to the principal component analysis. Finally, results on asset price responses to HM shocks would be presented. Descriptive statistics including 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.[23] As shown in Table 4, the assumption of no serial correlation of standardized residuals is satisfied in general.[24] 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 the previous studies.

(Table 4, Figure 4 about here)

To study more formally whether CFs are driven by HM, a Q-ratio is calculated for each of the series. The Q-ratios of the transitionary components of different types of CFs in all countries are equal to one, except 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. This 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

---

[23] The interventions and selected models for the state space decomposition of macro series are provided in the Appendix.
[24] The local level model (model 1, see the Appendix) is selected to be the best decomposition model for all the CF series except for the PI in Israel (model 4).

explanation is that these studies focus on the U.S. CFs to other countries. On the other hand, this paper analyzes aggregate CFs data of the EMs. It is possible that the net 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.[25] On the other hand, our paper studies an "aggregate scenario," where international investors, consisting of firms from different nations and industries that are facing different economic cycles. It is possible that while some investors persistently inject capital, some stop or even retrieve their investment. Therefore, FDI could contain a non-trivial component of HM. China, whose Q-ratios of the *permanent* components equal to one in all types of CFs, is the exception. It might reflect the fact that in the recent decade, China grows relatively fast, constantly reforms her economy, and implements policies to attract foreign CFs compared to other EMs.[26] 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/or 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

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

[26] 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), 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 CF in EMs. Naturally, one would wonder what these PCs represent. Table 5 highlights the major contributors of 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 real money supply for all countries. Finally, PC5 captures the inflation rate, real long-term interest rate, short-term interest rate and current account balance as % 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 HM shocks for each country and compare the magnitude of impulse responses across countries.[27] Notice that impulse response is a function and comparing functions is not an easy task in general. To facilitate a cross-country comparison, we introduce the notion of peak response (PR). For example, assumes that a few periods after an EM is impacted by a HM shock, the transitionary component of the real stock price of that country increases by 12 percent relative to its steady-state value. Then, the response dies out over time. In this case, we define the PR of this country to an HM shock to be 0.12. Figure 6 provides a visualization of PR. To further facilitate the cross-country comparison, we consider an HM shock with one standard deviation in size in each country. We could then assess whether countries exhibit different PR, and if so, whether those differences are associated with different country characteristics (such as

[27] The Appendix provides the graphs of impulse responses for all the countries.

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

(Figure 6, 7 about here)

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

Clearly, a lower level of per capita GDP itself might reflect not-so-healthy financial system, poorer institutions, lower quality human capital, long-lasting effects of historical events, etc.[28] In Table 6 we further regress PR of real stock prices with respect to economic "fundamentals". In column (2) of each Panel, we control for the financial development index (FD). The coefficients on initial RGDP are still significant, while that of FD are insignificant. Interestingly, in column (3) of each Panel, once we control for 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 a quality-adjusted human capital index (QA-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.

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

[28] The related literature is too large to be reviewed here. Among others, see Acemoglu et al. (2001), Acemoglu et al. (2014), Engerman and Sokoloff (2008), Hanushek et al. (2017), Wei (2006), etc.

cases, while the coefficients on QA-HCI are significant in the case of FDI and PI HM shock. Furthermore, the adjusted R^2's in column (5) are higher than that in column (1) where initial RGDP is the only expansionary variable. Figure 8 provides a visualization of the partial correlations.

(Table 6, Figure 8 about here)

Since, to the best of our knowledge, our paper is the first study to relate the heterogeneity of asset price responses to country characteristics such as human capital, it might worth our time to provide more diagnosis. Notice that countries differ not only in terms of quality-adjusted human capital but also quantities of human capital. From a policy perspective, if it is quantity that matters, school enrollment becomes the key. If, however, quality is the key issue, perhaps the curriculum design, the recruitment of teachers, etc. would matter.[29] To assess the importance of quantity versus quality measures in the current context, we replace QA-HCI by a "quantity-based" human capital index (BL-HCI), which is the percentage of population aged 15 and over completed secondary education, constructed by Barro and Lee (2013), and re-run the regressions. Since BL-HCI updates every five years up to 2010, we employ BL-HCI in 2000, 2005 and 2010. Since our sample starts at 2003, BL-HCI in 2000 is a pre-determined variable to our data, while BL-HCI in later years might have some "endogenous components." Table 7 shows clearly that the coefficients on BL-HCI in all years are *insignificant*. The adjusted R^2's are lower compared to the regressions with QA-HCI.

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

[29] The literature on how curriculum design and teacher recruitment might affect the education outcomes is too large to be reviewed here. See Hanushek et al. (2018), and the reference therein, among others.

Overall, the results in Table 7 and 8 indicate that the institutional quality as well as quality of human capital matter. Countries with better institutional quality might be more effective to monitor and regulate HM, which leads to smaller peak responses. And countries with higher level of quality-adjusted human capital, the policymakers, as well as investors, might make better financial decisions on average, leading to lower peak responses in the asset price to HM.

(Table 7, 8 about here)

VI. Robustness Checks

This paper finds empirical evidence that EMs with lower institutional quality and quality of human capital tend to have a higher response of real stock prices to HM shocks. We conduct several robustness checks, including the consideration of potential outliers, the initial conditions, the sensitivity of the results in alternating the methodology in extracting HM, or in generating the impulse responses, etc. We summarize the results here and report the details in the Appendix.[30]

1. A leave-one-out cross-validation check is conducted for the regression of PR on RGDP, FD IQI-RL and QA-HCI in Table 6. We drop one country from the sample at a time, then re-run the regression and record the coefficients on IQI-RL and QA-HCI. We also drop the so-called "Fragile Four" which are characterized by large current account deficits, from our sample.[31] Some argue that these countries rely on external financing, and hence become sensitive to external shocks, e.g. an HM shock, and are potential outliers. Overall, the validation check indicates that although there are outliers in the regressions, we are relieved to learn that the two negative relationships (PR vs. IQI-RL and PR vs. QA-HCI) are likely to be *under-estimated* rather than *over-estimated*.

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

[31] In the media, the term "Fragile Five" is often used. They are 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."

2. Our sample starts at 2003 and therefore, we use real income per capita in 2003 as the initial income level. However, if we could classify an economy into "boom" and "bust" regimes according to their aggregate output,[32] it is possible that for some EMs, they were in the "boom" regime while some were in the "bust" regime in 2003. This could lead to bias results. Thus, we employ two additional measures of the initial income level: 2002 and average of 1990-2002 real income per capita. Notice that both are predetermined, and the latter averages out the boom and bust periods. The results show that the negative relationship between PR and QA-HCI in the case of FDI and PI HM shock, and the negative relationship between PR and IQI-RL in all cases are still significant.
3. One might argue that the scale of the CFs is related to the size of the economy. To address this concern, we replace the CFs by the ratio $\frac{capital\ flows_t}{GDP_{t-1}}$, i.e. re-scaling the CFs by lagged GDP, which takes the size of the economy into consideration and helps us to mitigate the endogeneity concern. We then repeat the whole estimation procedures and find that our conclusion still holds.
4. In this paper, 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 2-5 quarters) in CFs and then re-estimate all the FAVAR models by using the Ouliaris and Pagan method. The results indicate that the negative relationships are still significant.
5. As documented by Fry and Pagan (2011), reporting the percentiles of impulse responses might suffer from the "model identification problem" as they are calculated across different models. We, therefore, follow their approach to calculate a median target (MT) model whose impulse responses are the closest to the median responses, then use the MT model to generate a unique

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

set of impulse responses as a robustness check. Again, the results show that the negative relationships still hold.

6. Instead of the using the Ouliaris and Pagan method, we re-estimate the FAVAR models and study the PR of real stock prices by employing Uhlig (2005) pure sign restriction method.[33] The results show that our conclusion still holds.

VII. More Diagnosis

To further deepen our understanding of the results, we conduct two diagnostic analysis in this section. While the details are provided in the Appendix, we provide a summary here.

First, we assess the importance of using 6 AEs. Notice that this paper extracts PCs from 6 AEs while in the previous literature, some authors use US-only macro-variables to represent the advanced economies. We, therefore, would repeat the whole analysis with US-only macro-variables in the principal component analysis and examine the differences.

Following the same econometric framework as in section IV, we find that: (1) in all cases (FDI, PI and loan HM shock), the partial correlation between PR and IQI-RL, with FD and RGDP being controlled for, is *weakened* if US-only PCs are employed in the FAVAR model. This is not surprising since EMs might not be only affected by the U.S. but also other AEs. Omitting the macro factors of other AEs might result in bias estimates. (2) The partial correlation between PR and QA-HCI is *not affected* regardless of whether "6 AEs PCs" or "US-only PCs" are employed.

Second, we assess the importance of focusing on the private CFs. In this paper, we focus on PI and loans, while much previous research studies FI as a whole. To assess the difference, we apply the same econometric framework to study FI. However, we cannot find any significant relationship in this case.

---

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

In other words, including the official flows (e.g. reserve) and financial derivatives would affect our conclusion on how HM impacts the asset prices.

VIII. Conclusion

This paper examines carefully the relationship between CFs (and HM) and asset prices movements in EMs. We find that PI and loans are inconsistent with both the neoclassical model as well as the TWCF hypothesis. At the same time, CFs are significantly associated with stock and housing prices in most of the EMs in our sample. We then construct HM series for FDI, PI and loan inflows in 22 EMs, and find that, with the exception of China, even FDI is dominated by HM. We also document significant heterogeneity in the impulse response of stock and housing prices to different types of HM shocks (i.e. FDI, PI and loans). We show further that countries with lower institutional quality and lower level of quality-adjusted human capital tend to have larger peak responses of stock prices. Our empirical evidence echoes with the recent literature which concerns about the capacity of the relatively less developed EMs to absorb HM without appropriate policies.[34] Regarding housing prices, we find no clear patterns due to a small sample of countries.

Notice that our approach deviates from, and hence is complementary to the previous literature. A different FAVAR for each type of CFs in each EM for each asset price is estimated. Effectively, we allow the asset prices to interact with domestic as well as foreign macroeconomic variables differently across countries, across types of CFs and across asset prices. With such flexibility, we are able to uncover important heterogeneity in asset price responses to CFs that might be overlooked. Moreover, we establish an empirical link between "fundamentals" (such as institutional quality and quality-adjusted human capital) and asset price responses.[35]

[34] The literature on the desirability of different government policies on CFs is too large to be reviewed here. Among others, see Forbes et al. (2015), Korinek (2018), Korinek and Sandri (2016), among others.

[35] Needless to say, there are contributions relating to the economic fundamentals and CFs. But they tend to focus business

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, institutional quality and quality-adjusted human capital level to peak impulse responses might inform the future theoretical modeling. Similarly, countries with different levels of real GDP per capita, institutional quality and quality-adjusted human capital should expect that their responses to different kinds of CFs could be very different, and hence the "optimal" policy could differ across countries. This paper indicates that continuous improvement in institutional quality and quality of education might contribute not only to the economic growth, which has been emphasized by many authors before, but also to the financial market stability in the long run. Future research might further explore such linkages.

cycle or low-frequency components. For instance, Backus et al. (2013) relate the demographic factors to the low-frequency CFs. Thus, that literature has a very different research focus.

Reference

Acemoglu, D., F. Gallego and J. Robinson (2014), "Institutions, human capital and development," *Annual Review of Economics*, 6, 875-912.

Acemoglu, D., S. Johnson and J. Robinson (2001), "The colonial origins of comparative development: an empirical investigation," *American Economic Review*, 9, 1369-1401.

Aizenman, J., Y. W. Cheung and H. Ito, (2015), "International reserves before and after the global crisis: Is there no end to hoarding?," *Journal of International Money and Finance*, 52(C), 102-126.

Angeletos, G. M. and V. Panousi (2011), "Financial integration, entrepreneurial risk and global imbalances," *Journal of Economic Theory*, 146, 863-96.

Arias, J. E., J. F. Rubio-Ramirez and D. F. Waggoner (2018), "Inference based on structural vector autoregressions identified with sign and zero restrictions: theory and applications," *Econometrica*, 86, 685-720.

Backus, D., T. Cooley and E. Henriksen (2013), "Demography and low-frequency capital flows," NBER Chapters, in: NBER International Seminar on Macroeconomics 2013, pages 94-102 National Bureau of Economic Research, Inc

Bank of International Settlements (2011), "Portfolio and risk management for central banks and sovereign wealth funds," BIS paper No. 58.

Barro, R. and J. W. Lee (2013), "A new data set of educational attainment in the world, 1950-2010," *Journal of Development Economics*, 104, 184-98.

Baxter, M. (1994), "Real exchange rates and real interest differentials: Have we missed the business-cycle relationship?," *Journal of Monetary Economics*, 33, 5-37.

Bernanke, B. (2005), "The global saving glut and the U.S. current account deficit," The Federal Reserve Board Speech.

Buera, F. J. and Y. Shin (2013), "Financial frictions and the persistence of history: a quantitative exploration," *Journal of Political Economy*, 121, 221-72.

Buera, F. J. and Y. Shin (2017), "Productivity growth and capital flows: The dynamics of reforms," *American Economic Journal: Macroeconomics*, 9, 147-85.

Caballero, R., E. Farhi and P. O. Gourinchas (2008), "An equilibrium model of global imbalances and low interest rates," *American Economic Review*, 98, 358-93.

Canova, F. and G. De Nicolo (2002), Monetary disturbances matter for business fluctuations in the G-7, *Journal of Monetary Economics*, 49, 1131-59.

Canova, F. and M. Paustian (2011), "Business cycle measurement with some theory", *Journal of Monetary Economics*, 58, 345-61.

Cerutti, E., S. Claessens and A. K. Rose (2017), “How important is the global financial cycle? Evidence from capital flows,” IMF, mimeo.

Cesa-Bianchi, A., Cespedes, L. and A. Rebucci (2015), “Global Liquidity, House Prices, and the Macroeconomy: Evidence from Advanced and Emerging Economies,” *Journal of Money, Credit and Banking*, 47(S1), 301-335.

Chari, V. V. and P. J. Kehoe (2003), “Hot money” *Journal of Political Economy*, 111, 1262-92.

Chen, Y. (2008), “The legal climate for foreign investment in China after its WTO accession,” *Bond Law Review*, 20, 30-51.

Cheung, Y.W.; M. Chinn and A.G. Pascual (2005), “Empirical exchange rate models of the nineties: Are any fit to survive?,” *Journal of International Money and Finance*, 24, 1150-75.

Christiano, L. J., M. Eichenbaum and C. Evans (1999), “Monetary policy shocks: What have we learned and to what end?,” in J. B. Taylor & M. Woodford (ed.), Handbook of Macroeconomics, volume 1, chapter 2, pages 65-148. New York: Elsevier.

Christiano, L. J. and T. J. Fitzgerald (2003), “The band pass filter,” *International Economic Review*, 44, 435-65.

Claessens, S., Dooley, M. P. and A. Warner (1995), “Portfolio capital flows: Hot or cold?,” *World Bank Economic Review*, 9, 153-74.

Cole, H. L., J. Greenwood and J. M. Sanchez (2016), “Why doesn't technology flow from rich to poor countries?,” *Econometrica*, 84, 1477-1521.

Commandeur, J.F. and Koopman, S.J. (2007), “An introduction to state space time series analysis,” Oxford: Oxford University Press.

Darvas, Z. (2012), “Real effective exchange rates for 178 countries: A new database,” Bruegel working paper 2012/06.

Doyle, B. M., and J. Faust (2005), “Breaks in the variability and comovement of G-7 economic growth,” *Review of Economics and Statistics*, 87, 721-740.

Engerman, S. L., and K. L. Sokoloff (2008), “Debating the role of institutions in political and economic development: Theory, history, and findings,” *Annual Review of Political Science*, 11, 119-135.

Faust, J. (1998), “The robustness of identified VAR conclusions about money,” *Carnegie-Rochester Conference Series in Public Policy*, 49, 207-44.

Forbes, K. J. and F. E. Warnock (2012), "Capital flow waves: surges, stops, flight, and retrenchment," *Journal of International Economics*, 88, 235-51.

Forbes, K., M. Fratzscher and R. Straub (2015), "Capital-flow management measures: What are they good for?" *Journal of International Economics*, 96, S76-S97.

Fratzscher, M. (2012), "Capital flows, push versus pull factors and the global financial crisis," *Journal of International Economics*, 88(2), 341-356.

Fry, R. and A. Pagan (2011), "Sign restrictions in structural vector autoregressions: A critical review," *Journal of Economic Literature*, 49, 938-60.

Fuertes, A-M., K. Phylaktis and C. Yan (2014), "Hot money in bank credit flows to emerging markets during the banking globalization era," *Journal of International Money and Finance*, 60, 29-52.

Gabaix, X. (2016), "Power laws in economics: An introduction," *Journal of Economic Perspectives*, 30, 185-206.

Gourinchas, P. O. and O. Jeanne (2013), "Capital flows to developing countries: The allocation puzzle," *Review of Economic Studies*, 80, 1484-1515.

Grenville, S. (1998) The Asia crisis, capital flows and the international financial architecture, Reserve Bank of Australis, speech delivered at the Monash University.

Hanushek, E. A., J. Ruhose and L. Woessmann (2017). "Knowledge capital and aggregate income differences: Development accounting for US states," *American Economic Journal: Macroeconomics*, 9(4), 184-224.

Hanushek, E. A., and L. Woessmann (2012), "Do better schools lead to more growth? Cognitive skills, economic outcomes, and causation," *Journal of Economic Growth*, 17, 267-321.

Hanushek, E. A., and L. Woessmann (2016), "Knowledge capital, growth, and the East Asian miracle," *Science*, 351(6271), 344-345.

Hanushek, E. A., M. Piopiunik and S. Wiederhold (2018), "The value of smarter teachers: International evidence on teacher cognitive skills and student performance," *Journal of Human Resources*, forthcoming.

Harding, D. and A. Pagan (2005), "A suggested framework for classifying the modes of cycle research", *Journal of Applied Econometrics*, 20, 151-59.

Harvey, A.C. (1981), "Time series models," Philip Allan, Hemel Hempstead.

Harvey, A.C. (1989), "Forecasting, structural time series models and the Kalman filter," Cambridge Univ. Press, Cambridge, MA.

International Monetary Fund (2014), “Managing volatile capital flows: Experiences and lessons for Sub-Saharan African frontier markets,” mimeo.

Ju, J. and S-J. Wei (2010), “Domestic institutions and the bypass effect of international capital flow,” *American Economic Journal: Economic Policy*, 2, 173-204.

Kalemi-Ozcan, S., E. Papaioannou and J. L. Peydro (2013), “Financial regulation, financial globalization and the synchronization of economic activity,” *Journal of Finance*, 26, 835-53.

Kaminsky, G. L. (1999), “Currency and banking crises: The early warnings of distress,” IMF, mimeo.

Kaminsky, G. L. and C. M. Reinhart. (1998), “Financial crises in Asia and Latin America: Then and now,” *American Economic Review*, 88, 444-48.

Kaufmann D., A. Kraay and M. Mastruzzi (2010), “The worldwide governance indicators: a summary of methodology, data and analytical issues,” World Bank Policy Research Working Paper No. 5430.

Korinek, A. (2011), “Hot money and serial financial crises,” *IMF Economic Review*, 59, 306-339.

Korinek, A. (2018), “Regulating capital flows to emerging markets: An externality view,” *Journal of International Economics*, 111, 61-80.

Korinek, A. and D. Sandri (2016), “Capital controls or macroprudential regulation?” *Journal of International Economics*, 99 (S1), 27-42.

Kose, M. A., C. Otrok and E. Prasad (2012), “Global business cycles: Convergence or decoupling?,” *International Economic Review*, 53, 511-538.

Laibson, D and J. Mollerstrom (2010), “Capital flows, consumption booms and asset bubbles: a behavioural alternative to the savings glut hypothesis,” *Economic Journal*, 120, 354-74.

Lane P. R., G. M. Milesi-Ferretti (2017), "International financial integration in the aftermath of the global financial crisis", IMF, mimeo.

Leeper, E., C. A. Sims and T. Zha (1996), “What does monetary policy do?,” *Brookings Papers on Economic Activity*, 27(2), 1-78.

Long, G. (2003), “China’s policies on FDI: review and evaluation”, Center for Global Development, mimeo.

Lucas, R. E. (1990), “Why doesn't capital flow from rich to poor countries?,” *American Economic Review*, 80, 92-96.

Lütkepohl, H., and A. NetŠunajev (2014), “Disentangling demand and supply shocks in the crude oil market,” *Journal of Applied Econometrics*, 29, 479-496.

Martin, M. and W. Morrison (2008), “China’s ‘hot money’ problems,” Congressional Research Service, Washington, DC., mimeo.

Mendoza, E., V. Quadrini and J-V. Rois-Rull (2009), "Financial integration, financial development, and global imbalances", *Journal of Political Economy*, 117, 371-416.

Mercado, R., and C-Y. Park (2011), “What drives different types of capital flows and their volatilities in developing Asia?,” Asian Development Bank, mimeo.

Mertens, K. and M. Ravn (2013), “The dynamic effects of personal and corporate income tax changes in the United States,” *American Economic Review*, 103, 1212-47.

Milesi-Ferretti, G. M. and C. Tille (2011), "The great retrenchment: International capital flows during the global financial crisis", *Economic Policy*, 290-346.

Ng, S. and P. Perron (2001), "Lag length selection and the construction of unit root tests with good size and power", *Econometrica*, 69, 1519-54.

Organization for Economic Co-operation and Development (2002), “Foreign direct investment in China: Challenges and prospects for regional development,” OECD, mimeo.

Ouliaris, S. and A. Pagan (2016), “A method for working with sign restrictions in structural equation modelling,” *Oxford Bulletin of Economics and Statistics*, 78, 605-22.

PricewaterhouseCoopers (2017), “China unveils 20 measures to further open up the economy to foreign investment,” PricewaterhouseCoopers, mimeo.

Prasad E., R. Rajan, and A. Subramanian (2006), “Patterns of international capital flows and their implications for economic development,” IMF, mimeo.

Reinhart, C. and K. Rogoff (2011), This time is different: Eight centuries of financial folly, Princeton: Princeton University Press; Reprint edition.

Sá, F., P. Towbin and T. Wieladek (2011), “Low interest rates and housing booms: the role of capital inflows, monetary policy and financial innovation,” Bank of England, mimeo.

Sá, F., P. Towbin and T. Wieladek (2014), “Capital inflows, financial structure and housing booms, monetary policy and financial innovation,” *Journal of the European Economic Association*, 12, 522-546.

Sandri, D. (2014), “Growth and capital flows with risky entrepreneurship,” *American Economic Journal: Macroeconomics*, 6, 102-23.

Sarno, L. and M. P. Taylor (1999a), "Hot money, accounting labels and the permanence of capital flows to developing countries: An empirical investigation," *Journal of Development Economics*, 59, 337-64.

Sarno, L. and M. P. Taylor (1999b), "Moral hazard, asset price bubbles, capital flows, and the East Asian crisis: The first tests," *Journal of International Money and Finance*, 18, 637-57.

Stock, J.H., and M.W. Watson (2002a), "Forecasting using principal components from a large number of predictors," *Journal of the American Statistical Association*, 97, 1167-79.

Stock, J.H., and M.W. Watson (2002b), "Macroeconomic forecasting using diffusion indexes," *Journal of Business and Economic Statistics*, 20, 147-62.

Stock, J.H., and M.W. Watson (2012), "Disentangling the channels of the 2007-2009 recession," *Brookings Papers on Economic Activity*, Spring, 81-135.

Svirydzenka, K. (2016), "Introducing a new broad-based index of financial development," IMF Working Paper, WP/16/5.

Tillmann, P. (2013), "Capital inflows and asset prices: Evidence from emerging Asia," *Journal of Banking and Finance*, 37, 717-29.

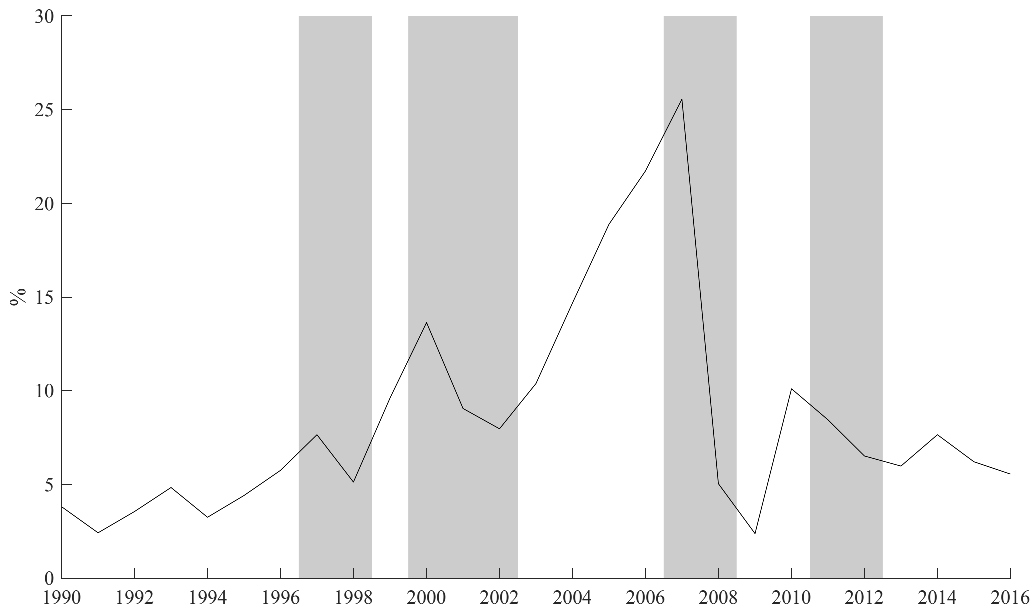
Tong, H. and S-J. Wei (2011), "The composition matters: Capital inflows and liquidity crunch during a global economic crisis," *Review of Financial Studies,* 24, 2023-52.

Uhlig, H. (2005), "What are the effects of monetary policy on output? Results from an agnostic identification procedure" *Journal of Monetary Economics*, 52, 381-419.

Wang, P., Y. Wen and Z. Xu (2016), "Two-way capital flows and global imbalances," *Economic Journal*, 127, 229-69.

Wei, S-J. (2006), "Connecting two views on financial globalization: can we make further progress?," *Journal of Japanese and International Economics*, 20, 459-81.

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

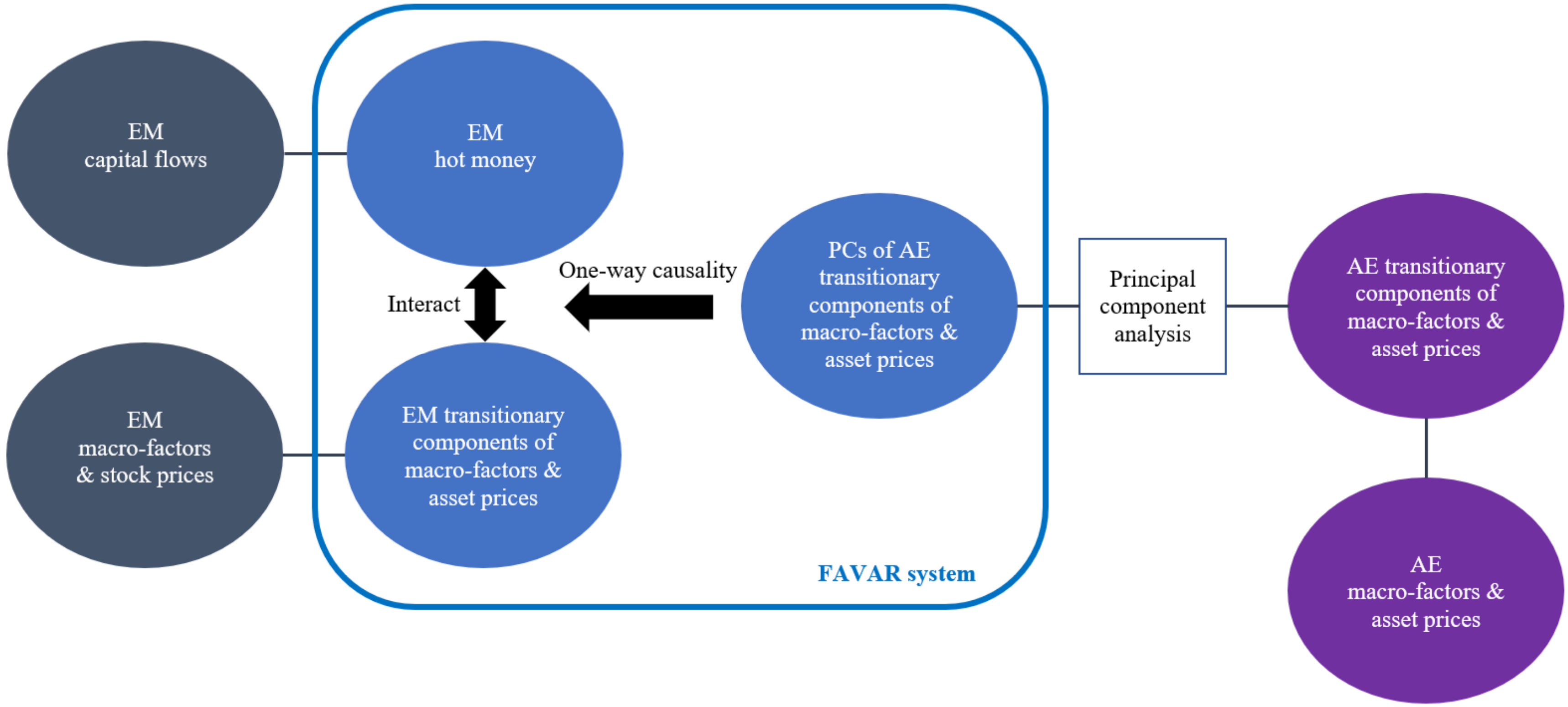


Figure 3 An example of structural break and estimation

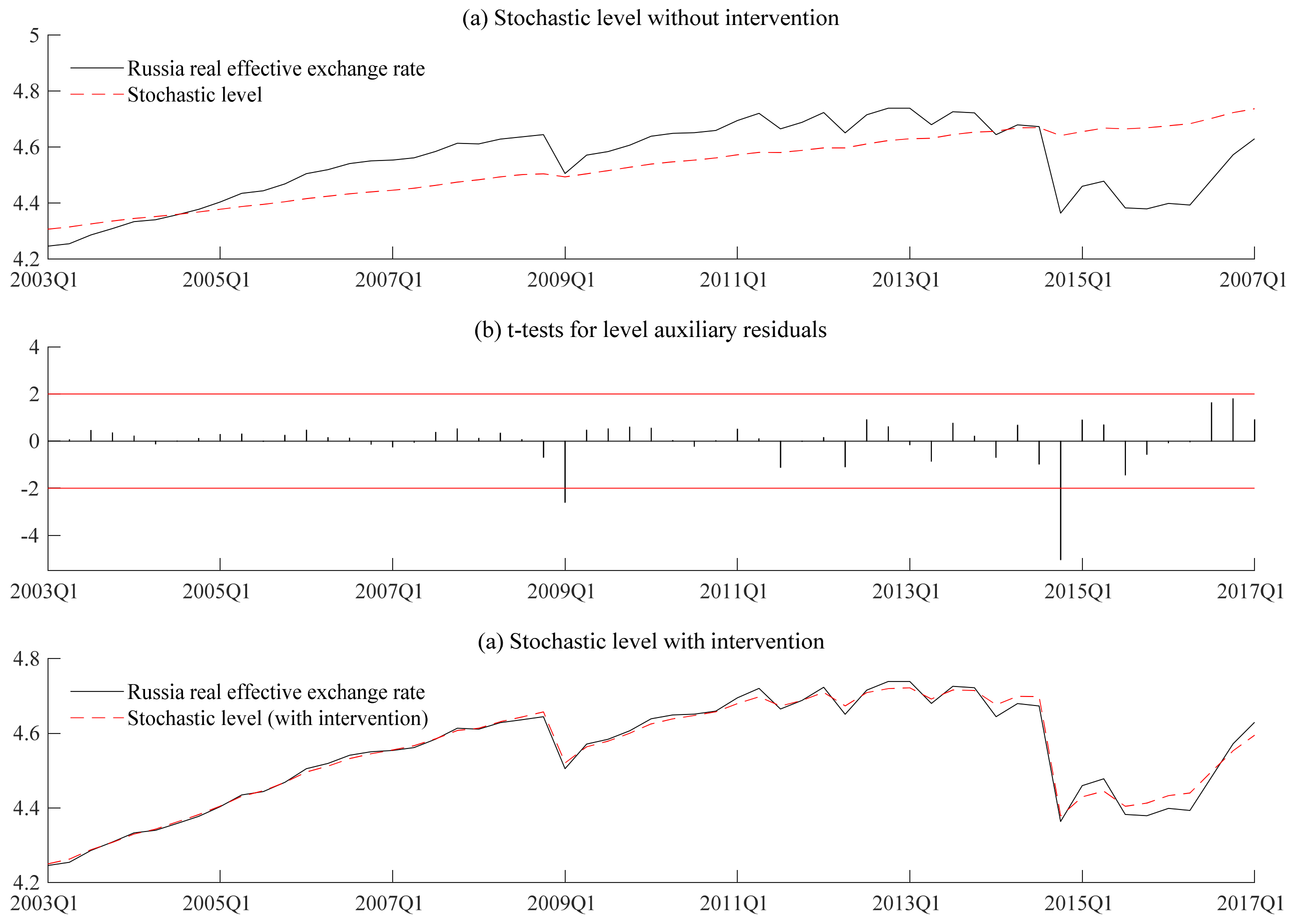
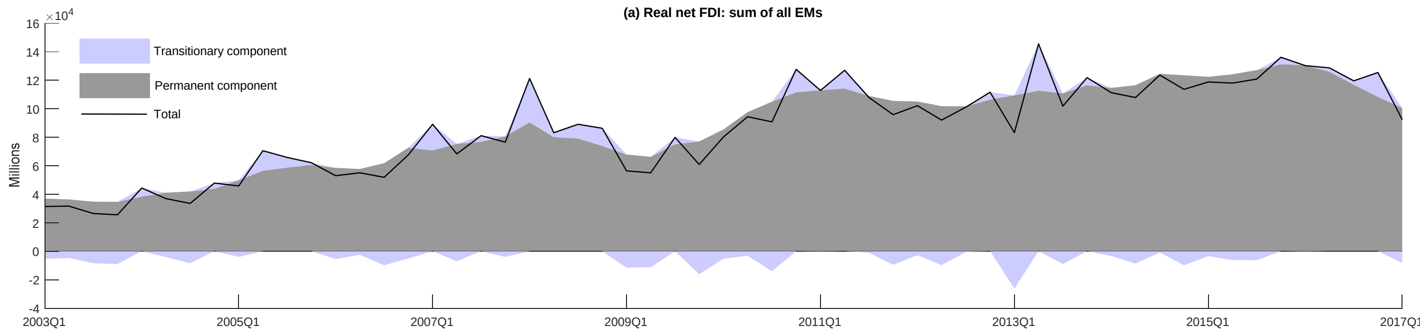
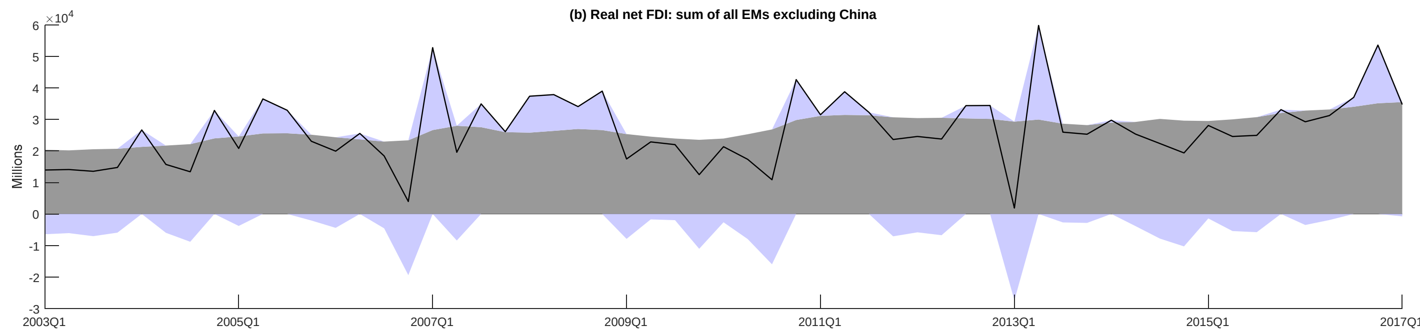


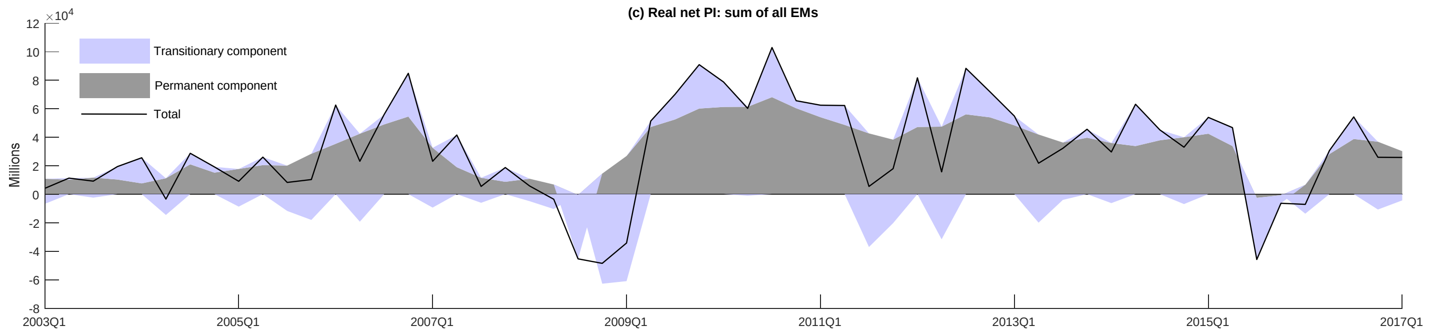
Figure 4 Composition of real net capital inflows: sum of EMs





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)



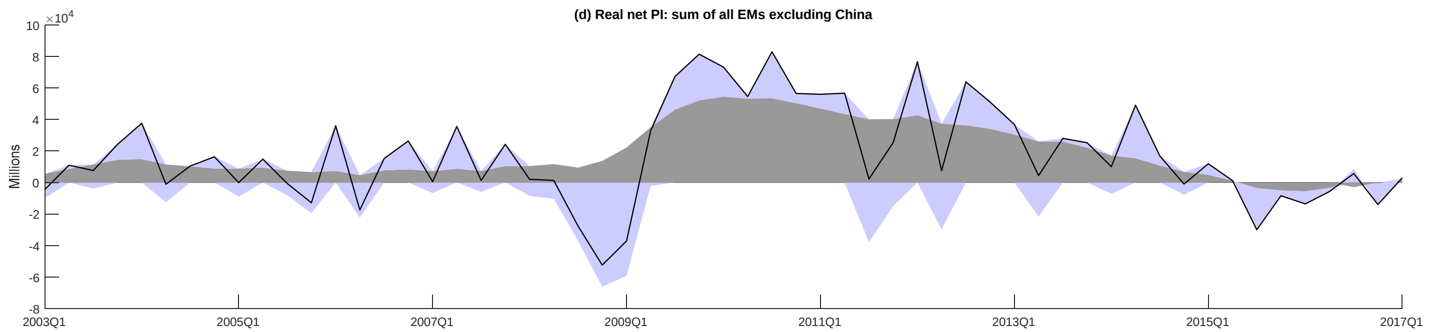
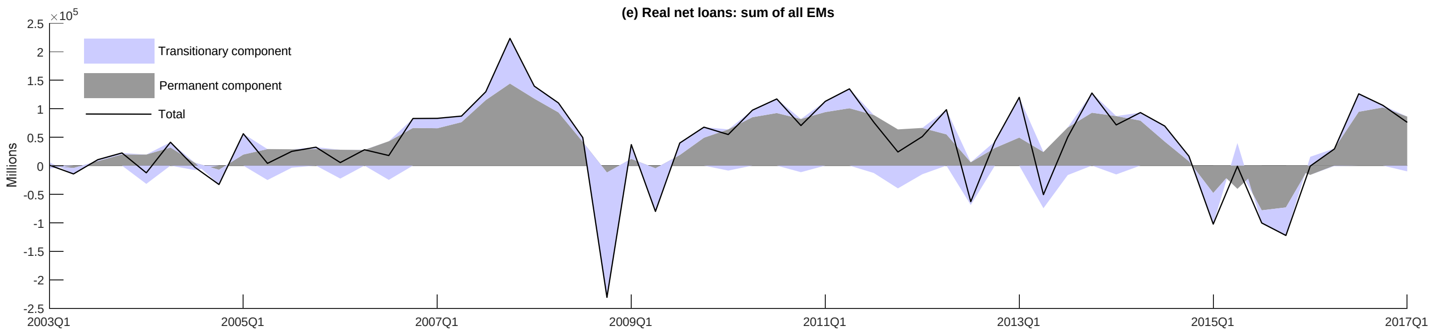


Figure 4 (con't)



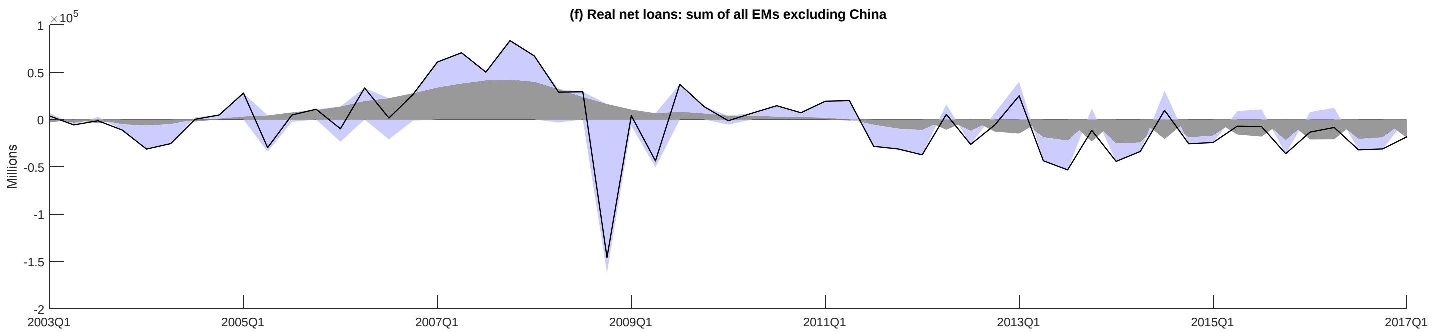
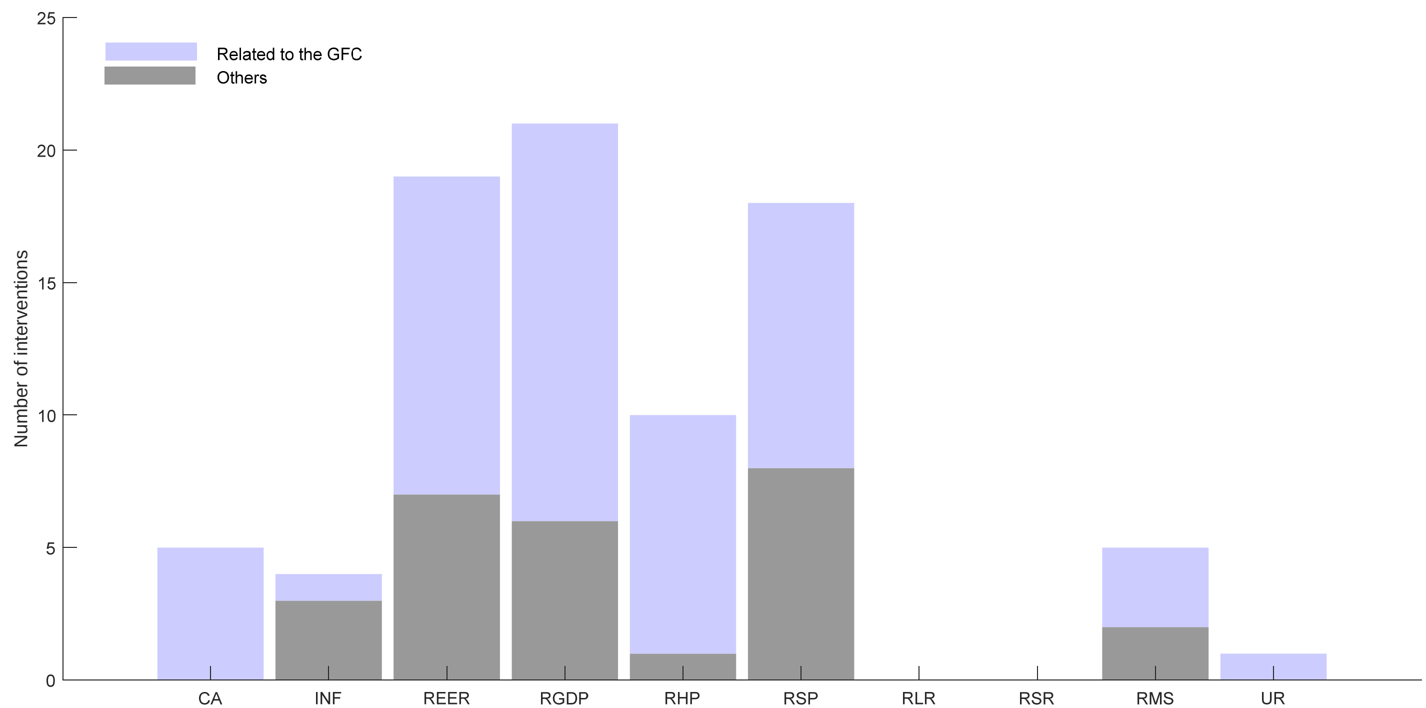


Figure 5 Number of interventions detected in macro-variables in AEs and EMs



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)

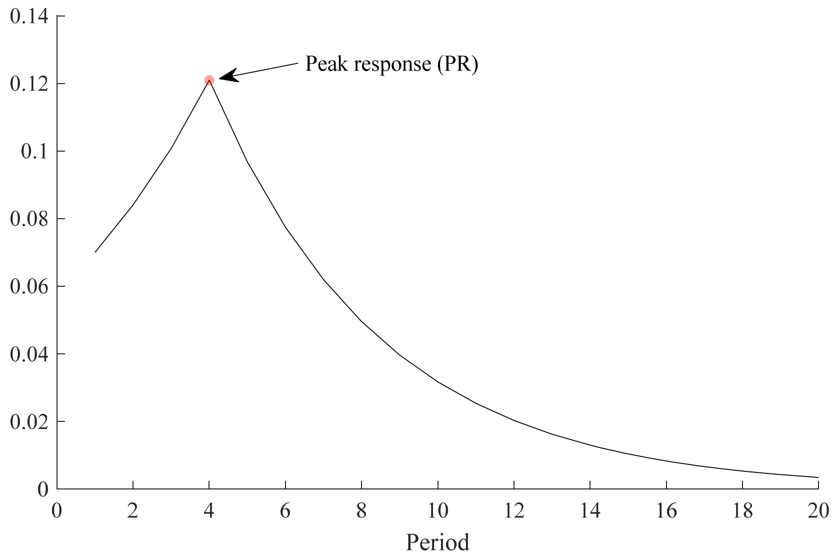
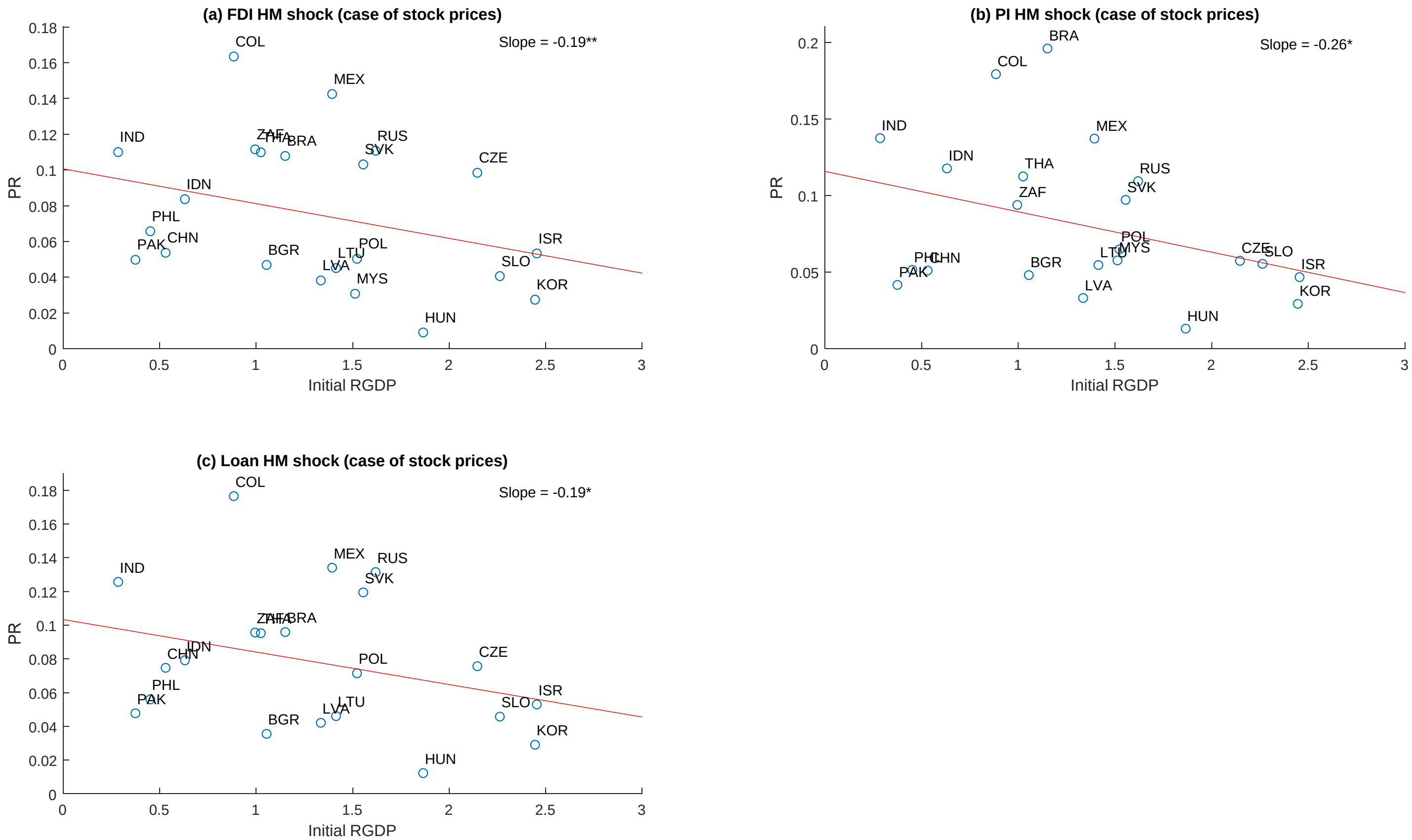
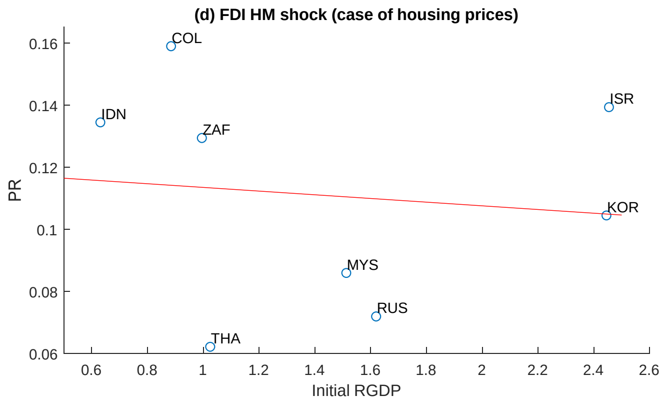


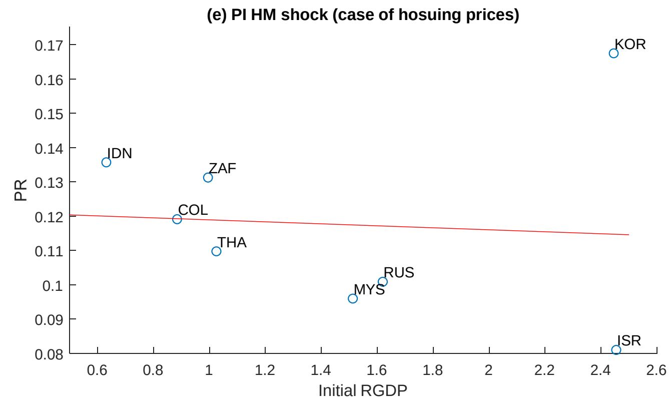
Figure 7 PR and RGDP



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)





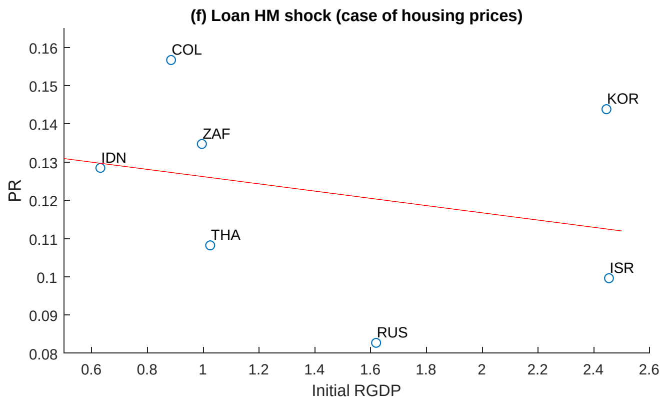
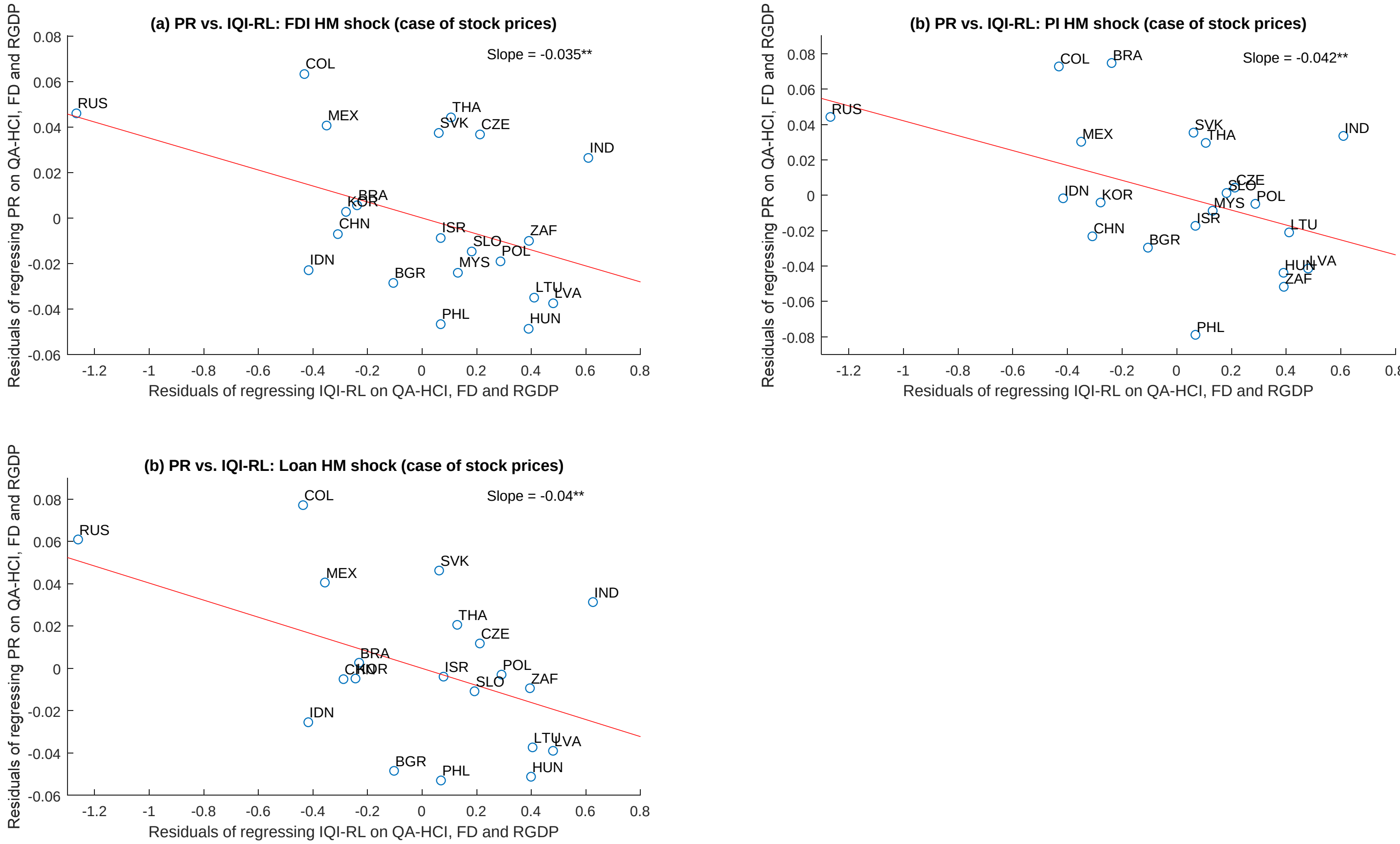


Figure 8 Partial correlation



Notes: Red solid line: regression line. *, ** and *** indicate that the estimated coefficient is statistically significant at 10%, 5%, and 1% level, respectively. Figure 8 (a), (b), (d) and (e) consist of 21 countries since QA-HCI data is not available in Pakistan. Loan data is not available in Malaysia, thus Figure 8 (c) and (f) consist of 20 countries, respectively. Appendix shows the abbreviations of the countries.

Figure 8 (con't)

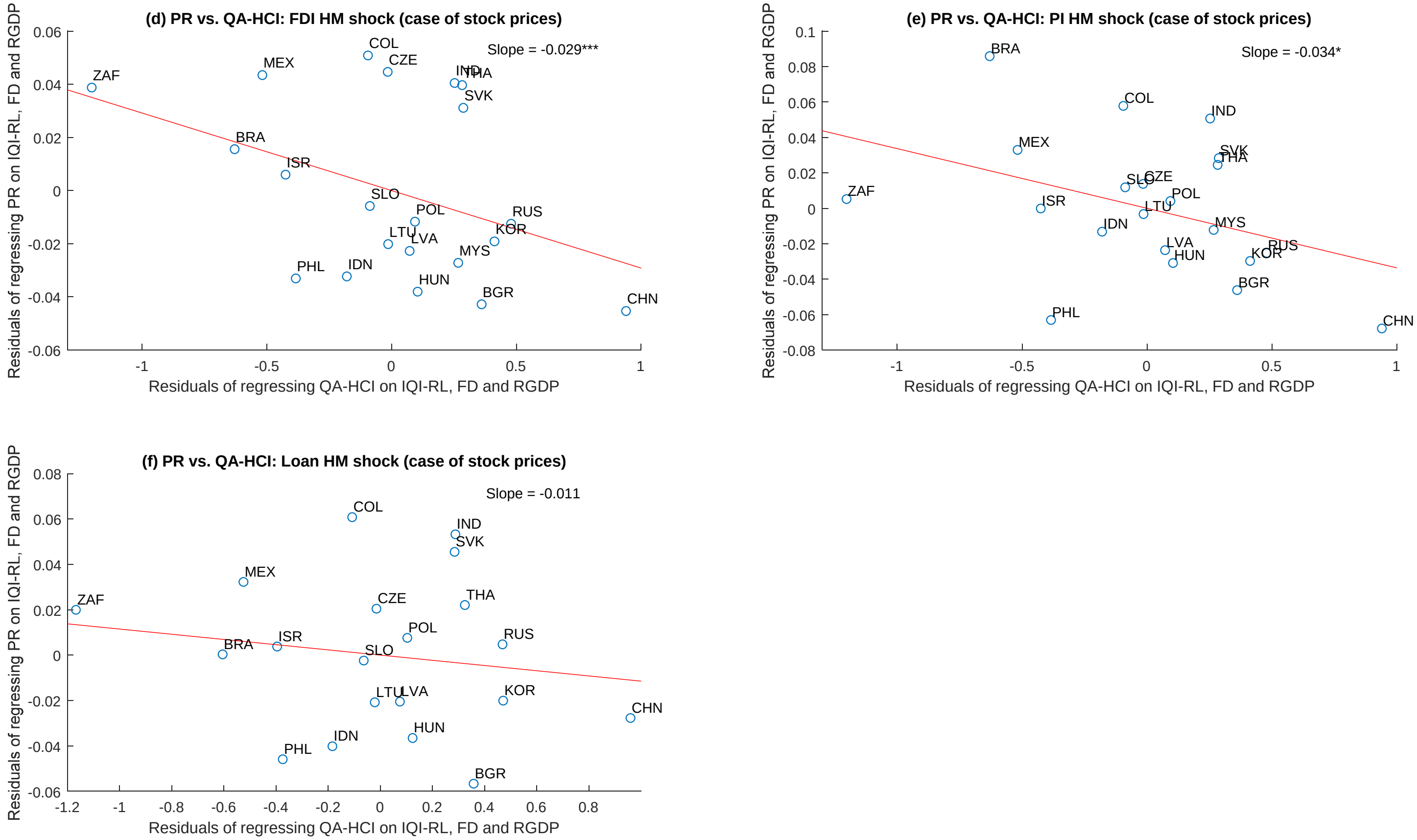


Table 1 Pattern of net capital outflows by country groups

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 Permanent (Stochastic trend)	Q-ratio Transitionary (Irregular)	Ljung-Box	Intervention
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		Ljung-Box	Intervention
			Permanent (Stochastic trend)	Transitionary (Irregular)		
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.
	RHP	RHP	RHP		RHP	RHP
PC1	RGDP		RGDP		RGDP	RGDP
				CA		CA
	UR					
		RSP	RSP	RSP	RSP	RSP
PC 2		UR	UR			UR
				RGDP		
	REER	REER	REER			REER
PC 3	UR				UR	
	RSR	RSP			REER	RMS
	CA					
PC 4	RMS	RMS	RMS	RMS	RMS	RMS
			CA	RHP		
	INF	INF	INF	INF	INF	INF
	CA	CA	CA	CA	CA	CA
PC 5	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** (0.01)	-0.021* (0.012)	0.005 (0.016)	-0.006 (0.011)	-0.021 (0.021)	-0.034** (0.013)	-0.035** (0.017)	0.0001 (0.021)	-0.011 (0.017)	0.014 0.026)	-0.025** (0.01)	-0.022* (0.011)	0.005 (0.017)	-0.016 (0.011)	0.013 (0.023)
FD		-0.042 (0.063)			-0.046 (0.056)		0.01 (0.081)			0.007 (0.056)		-0.035 (0.06)			-0.032 (0.057)
IQI-RL			-0.043*** (0.014)		-0.035** (0.013)			-0.049** (0.02)		-0.042** (0.016)			-0.043*** (0.015)		-0.04** (0.015)
QA-HCI				-0.033*** (0.012)	-0.029*** (0.008)				-0.041* (0.024)	-0.034* (0.02)				-0.016 (0.013)	-0.011 (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 (0.021)	0.018 (0.02)	0.012 (0.02)	0.007 (0.02)	0.014 0.026)	0.01 (0.027)	0.004 (0.025)	0.001 (0.022)	0.013 (0.023)	0.01 (0.023)	0.007 (0.021)	0.007 (0.019)
FD	-0.046 (0.056)	-0.068 (0.064)	-0.048 (0.059)	-0.024 (0.061)	0.007 (0.056)	-0.021 (0.098)	-0.003 (0.093)	-0.016 (0.078)	-0.032 (0.057)	-0.033 (0.069)	-0.02 (0.057)	-0.024 (0.046)
IQI-RL	-0.035** (0.013)	-0.03* (0.017)	-0.036* (0.017)	-0.042** (0.019)	-0.042** (0.016)	-0.036 (0.014)	-0.041 (0.025)	-0.044* (0.024)	-0.04** (0.015)	-0.04** (0.013)	-0.043** (0.019)	-0.042** (0.023)
QA-HCI	-0.029*** (0.008)				-0.034* (0.02)				-0.011 (0.01)			
BL-HCI 2000		-0.091 (0.082)				-0.017 (0.083)				-0.021 (0.053)		
BL-HCI 2005			-0.043 (0.082)				-0.062 (0.067)				-0.003 (0.064)	
BL-HCI 2010				-0.001 (0.077)				-0.028 (0.051)				-0.004 (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-HCI: % 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-HCI: Barro and Lee (2013).

Table 8 Correlation between the independent variables in the regressions

	B2000	B2005	B2010	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.

The appendix will be available upon request.