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Capital Flows and GDP in Emerging Economies and the Role of Global Spillovers*

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Abstract

This paper provides a global analysis of capital flow impacts on GDP for selected emerging economies. As additional control variables, we also include currency reserves and effective exchange rates in our analysis. We distinguish between gross and net capital flows and also assess the impact of both FDI and portfolio flows. Accounting for the fact that common factors have been the main drivers of capital flows while country-specific determinants ('pull' factors) drive the response to such shocks, we analyze shocks to country groups but consider country-specific responses based on a Bayesian time-varying panel VAR framework in the spirit of Canova and Ciccarelli (2009). Based on a sample of 24 economies, our results show a robust positive effect of capital flows on GDP. Except for Korea, both gross and net capital flows display a positive impact for around two quarters. The impact of effective exchange rates on GDP hardly offers an explanation for a possible transmission of capital flow effects with effective depreciations both positively and negatively linked to GDP. We also find that the effect of net portfolio flows is even more positive compared to net FDI flows for emerging economies. Finally, we provide evidence that the importance of global factors increases in times of crises.

Keywords: Bayesian econometrics, capital flows, exchange rates, FDI, Panel VAR

JEL classification: C32, F31, F32

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1 Introduction

The different facets of financial integration have been the subject of controversial discussions in recent years. In particular, the ambiguous effects of capital flows have led to different views and policy suggestions for emerging economies (Bertaut *et al.*, 2012; Ostry *et al.*, 2012; Forbes *et al.*, 2015; Korinek and Sandri, 2016). Some economists argue that the recent financial downturn has had a large impact on capital flow patterns (Fratzscher, 2012). Forbes (2014) labels the recent development as financial deglobalization and finds that financial flows increase over time, fall sharply in times of crisis and do not rebound to anything close to the pre-crisis levels.[1] Concerns have been raised in particular for emerging markets as their capital flows will remain at low levels in 2016 (IIF, 2016). However, the structure of international capital flows has also changed in the sense that the degree of capital flows from and to advanced economies has decreased while the weight of emerging markets in global GDP has increased. Multinationals also increasingly affect capital flows by shifting their taxable profits to avoid taxes (Jones and Temouri, 2016).

Similar to the discussion about global current account imbalances, costs and benefits of financial integration in the form of capital flows are potentially different for surplus and deficit economies. They bear the potential to result in optimal allocation of production and improved economic performance. While financial markets per se have become more globalized, emerging economies have experienced the most drastic changes of their financial system over the last decades. Capital flows have played a key role in this context while inflows are responsible for fueling domestic financial markets and investments and unwinding outflows are potentially harming the domestic economy, for example during the Asian crisis. Rapidly increased foreign capital inflows are labeled as 'surges' and include several potential risks like contagion, suboptimal transmission of capital flows into the domestic economy and disruptive adjustments. Countries with underdeveloped financial systems are particularly vulnerable in case of 'sudden stops', which are reversals of capital flows (Forbes and Warnock, 2012).[2] International capital flows can create significant financial instability in emerging economies (Korinek and Sandri, 2016). Capital flow liberalization is more beneficial and less risky if countries have reached specific thresholds of financial and institutional development (IMF, 2012).

[1] International capital inflows were only 1.6% of global GDP in 2013, ten times less than the peak of 16% in 2007 (Forbes, 2014).

[2] One view according to the first generation model of currency crisis is that unwinding capital flows result in speculative attacks on domestic currencies (Krugman, 2000).

The macroeconomic implications of capital flows are closely related to exchange rates and currency reserves. If a country experiences large capital inflows, an accumulation of currency reserves is often considered to be aimed at improving competitiveness through preventing domestic appreciations although conclusive evidence of this view is hard to establish (Aizenman and Lee, 2008). From 1999 to the beginning of the subprime crisis in September 2008, foreign exchange reserves held by developing countries had more than quadrupled (Beck and Rahbari, 2011).[3]

This paper contributes to the literature by analyzing the macroeconomic linkages and effects of capital flows and reserve accumulation from a new global perspective. We focus on two main questions: (1) Is GDP in emerging markets affected by capital flows? (2) Are possible effects different for capital flows from emerging and industrial economies? Capital flows to emerging economies have historically mainly comprised foreign direct investments (FDIs) while recent capital flows mainly consisted of short-term inflows such as portfolio investments (IIF, 2015). We therefore examine effects stemming from capital flows both at an aggregated and a disaggregated level. Putting the effects on GDP over the last decades under closer scrutiny is well suited to analyze whether emerging markets have surpassed the (theoretically) required thresholds to experience a positive effect resulting from capital flows if both the overall size and the structure have increased over the sample period under investigation. In order to account for possible transmission channels, we also consider exchange rate effects stemming from capital flows. To tackle the questions mentioned above, we impose a factorization that allows for one common factor for industrialized economies and one for emerging markets besides country- and variable-specific factors which accounts for linkages between both groups. Relying on an extension of the data set of Forbes and Warnock (2012), we analyze effects of both net and gross capital flows and explicitly include the period of the recent financial crisis. Besides this aggregated perspective, we also assess the impact of both FDI and portfolio flows on GDP. Our quarterly data set compromises 24 economies and includes India, Korea, Mexico, the Philippines, South Africa, and Thailand as emerging economies. We are aware that some of these countries might be considered as industrial economies nowadays after experiencing economic and financial transformations over the sample period under investigation.

The need to consider a global perspective when analyzing effects of capital flows and financial integration is obvious. However, even if a panel of countries is analyzed, a caveat of previous

[3]Fukuda and Kon (2010) analyze an unbalanced panel for the period between 1980 and 2004 and find a positive influence of foreign exchange reserves on economic growth which is not observed when controlling for an impact through investment.

studies is that they are not considering cross-country dynamics of capital flows and macroeconomic aggregates (Blanchard *et al.*, 2015b). Such a setting does not account for common shocks which have turned out to be a key driver of capital flows and their volatility and the resulting dynamics during the recent crisis (Broto *et al.*, 2011; Fratzscher, 2012).[4] The corresponding effects still have also been highly heterogeneous across countries so that a country aggregation when analyzing a response to shocks might result in biased conclusions. Altogether, common 'push' factors have been the main drivers of capital flows during the crisis, while country-specific determinants ('pull' factors) have been dominant in accounting for the resulting dynamics, in particular for emerging markets (Fratzscher, 2012). The consideration of cross-country dependencies is also crucial when emerging markets are analyzed based on historical evidence during the nineties. The Asian crisis is a textbook example of a situation where capital flow spillover effects resulted in contagion and significantly affected the real economy. Therefore, it is reasonable to consider the impact of a shock to all emerging economies rather than a country-specific shock while the response to those shocks should be examined based on country-specific responses. Moreover, time-varying coefficients are another essential modeling tool in the present context. Over the last decades, changes in the international financial architecture have coincided with a transformation of capital flows. According to the global savings glut hypotheses, capital flows from emerging markets to the US have been considered as one explanation of the US housing price bubble prior to the subprime crisis. As outlined above, this pattern changed recently when capital flows decreased significantly.

To account for these issues, we a adopt a Bayesian time-varying panel vector autoregression (VAR) framework in the spirit of Canova and Ciccarelli (2009) which offers two types of advantages over single-country or two-country VARs: First, the use of cross-sectional information can help to overcome the problem of having too small sample periods and therefore to achieve better estimates. Second, the model is able to capture shocks resulting from lagged interdependencies between countries, instead of treating them as 'common shocks' as in the case of single- or two-country VARs (Canova and Ciccarelli, 2009). In addition, the chosen framework has several benefits compared to reasonable alternatives offered by the recent literature such as factor models (often also labeled as factor augmented VAR models) or global VAR models. Compared to traditional factor models in the spirit of Stock and Watson (2002), the factor structure imposed by Canova and Ciccarelli (2009) has three advantages. First, opposed to the factors in a Stock and Watson (2002)-type model, the

[4]Portfolio flows by investors are for example not only driven by past returns but also positively correlated across countries and regions (Froot *et al.*, 2001).

constructed regressors (i.e. indices) by Canova and Ciccarelli (2009) are observable and do not need to be estimated using a data-driven framework. Second, in contrast to factors, indices entail a direct economic interpretation. Third, it is computationally pretty costly to estimate the factor loadings in a time-varying fashion (Koop and Korobilis, 2014). Moreover, the panel VAR structure used in our study shares the general idea of global VAR models introduced by Pesaran *et al.* (2004), but it has also advantages compared to the latter. First, global VARs do neither allow for time-variations in the coefficients nor account for potential lagged interdependencies between the cross-sectional units. Second, N is assumed to be large for global VARs which is not necessarily required in our case. Finally, global VARs impose a structure on the interdependencies present in the data by restricting all cross-section units to share the same dynamics on the variables (Canova and Ciccarelli, 2013). Our overall findings show that the effects of capital flows for emerging markets are mostly positive but differ for flows from emerging markets and industrial economies and between FDI and portfolio flows.

The reminder of this paper is organized as follows. A review of the literature and a descriptive analysis of capital flows are provided in the subsequent section. Section 3 describes our data set and Section 4 our empirical methodology. Section 5 presents our empirical findings and Section 6 concludes.

2 Capital flows and previous literature

Free capital flows across borders do not necessarily result in an efficient capital allocation and positive growth effects (Ahmed and Zlate, 2014). Several studies deal with the macroeconomic effects of financial integration via capital flows, focusing on different aspects. Prior to the recent financial crisis, evidence seemed to suggest a positive effect of capital liberalization on economic growth (Bekaert *et al.*, 2005). When analyzing capital flows, net and gross capital flows should both be taken into account since gross capital flows are larger and much more volatile relative to net capital flows (see Table 1) and also act more pro-cyclical (Broner *et al.*, 2011). A potential drawback of relying solely on net flows is that some flows net out and are only visible if gross flows are considered. This argument has also been raised in the context of bank flows (Shin, 2012). This could result in different GDP effects. Figures 1 and 2 display the capital flows for the emerging economies under investigation. Figure 1 shows gross and net flows for all economies while Figure

2 provides a direct comparison of the gross and net flows for each emerging economy. A look at these figures is useful for understanding cycles and developments on capital flows and illustrating the importance of allowing for time-varying dynamics within our empirical framework.

*** Insert Table 1 and Figures 1 to 2 about here ***

The well-known increase in size and volatility in capital flows over time is fairly obvious for both gross and net flows, in particular when comparing the beginning and the end of the sample period. While the increase in terms of volatility and level is moderate until the end of the nineties, the increase after the Millennium until the beginning of the subprime crisis is striking. The graphs also point to instabilities in capital flow dynamics prior to the subprime crisis which has for example been discussed for equity flows (Bekaert *et al.*, 2002). Inspecting specific characteristics at a country level, Korea, Thailand and the Philippines have all experienced a temporary blip in capital flows during the Asian crisis in the nineties while capital flows of India and South Africa have increased continuously throughout the sample period. The gross flows suggest that the recent crisis has also resulted in a huge temporarily shift rather than a permanent change in capital flows, which resembled level and volatility prior to the crisis. In contrast, an inspection of the net flows shows that the underlying structure has been subject to changes in some cases with Korea experiencing reversed inflows after the crisis. The upcoming years will show whether a changing pattern in the spirit of long-run financial decoupling will materialize for some economies over the long-run.

In addition, Figure 3 provides FDI and portfolio inflows and illustrates that both measures are positively correlated while the latter is more volatile. The graph showing US capital inflows (Figure 3, Panel (c)) illustrates the huge increase of portfolio inflows to the US prior to the subprime crisis. Although inflows significantly dropped afterwards, portfolio flows increased again shortly after 2009 before displaying different cycles and higher volatility thereafter. A similar pattern can be observed for emerging economies with some of them, for example Korea, experiencing large portfolio outflows while others facing a similar but less strong drop. Figure 4 reports the time series patterns of the shares of FDI, portfolio and other flows in total capital flows aggregated over all economies and illustrates that portfolio and other flows display a higher volatility than FDI flows and also constitute a greater share of overall capital flows. A recent study by Reinhardt *et al.* (2013) has demonstrated that financial openness affects the evolution of capitals flows for emerging

markets. Panels (a) and (b) of Figure 5 therefore provide the Aizenman *et al.* (2008) measure of exchange rate stability and financial openness for the emerging markets under consideration to illustrate the policy path over time for these countries. Such a de facto measure offers a better reflection of the conducted policy compared to the de jure classification by the IMF. Higher values of these indices indicate more stable movement of the exchange rate against a base currency and more capital account openness, respectively. These findings show that emerging markets have mostly increased their exchange rate variability and capital account openness over time. Panel (c) in Figure 5 illustrates the World Bank measure of the financial system deposit to GDP and illustrates that the size of financial markets in the emerging economies under investigation has also increased over the sample period under consideration.

*** Insert Figures 3 to 5 about here ***

The literature on the effects of capital flows is enormous and only some main results are described in the following. The question whether capital inflows have expansionary or contractionary effects on GDP in emerging markets is still subject to discussion (Blanchard *et al.*, 2015b). The effects are not similar across economies and potentially exhibit asymmetries and time-varying patterns (Eng and Wong, 2016). Forbes and Warnock (2012) distinguish between surges, stops and retrenchment as different episodes of capital flows since 1980. When focusing on the underlying effects, our quarterly panel VAR approach differs from previous studies which often rely on annual data and focus on correlation rather than causality (Bluedorn *et al.*, 2013) or restrict the analysis on panel regressions neglecting lagged interdependencies between the cross-section units (Blanchard *et al.*, 2015b). A consequent causality analysis of capital flow impacts on GDP which also addresses international spillovers in a fully endogenous and time-varying framework still presents a gap in the literature. This is of particular relevance for emerging markets where short-run portfolio flows are driven by global 'push' factors to a large extent (Ananchotikul and Zhang, 2014). While early work prior to the currency crises in the nineties has argued that country-specific factors are more important compared to global factors (Chuhan *et al.*, 1998), subsequent studies (Kim, 2000) have identified external global factors such as production or interest rate shocks as the main drives of capital flows to developing and emerging markets such as Asia or South America. A recent study by Hannan (2017) identify global risk aversion as a 'push' factor of capital flows in emerging

markets after 2009.

Exchange rates offer a possible transmission for capital flow effects on GDP. According to a standard open-economy macro model, capital inflows appreciate the domestic currency which might negatively affect domestic exports. However, such effects might be offset by positive output effects due to an increasing credit volume in emerging markets (Blanchard *et al.*, 2015b). We therefore analyze effects of capital flows on both exchange rates and GDP. Some studies indeed have provided evidence for forecasting power of net foreign asset positions and capital flows on bilateral exchange rates (Della Corte *et al.*, 2012). Another strand of the literature considers the opposite causality, for example by analyzing the effect of exchange rate uncertainty on different components of net portfolio flows (Caporale *et al.*, 2015). A distinction of FDI and portfolio flows is necessary in the context of uncertainty and volatility (Pagliari and Hannan, 2017). Portfolio flows are often considered to be more sensitive to exchange rate volatility while FDI flows are less affected due to their long-term character. A reversal of portfolio flows in case of sudden stops is often assumed to be responsible for increasing volatility and negative macroeconomic effects. However, the fact that FDI flows also frequently result from tax avoiding activities of multinational firms suggests that this view is too simplistic.[5] [6]

In this context, currency reserve accumulation is often considered to have a positive effect on economic growth by preventing an appreciation through interventions. Interventions are also considered as a general policy tool for dealing with capital flows (Blanchard *et al.*, 2015a). However, a positive effect on growth through a domestic depreciation or a delayed appreciation depends on several factors such as the degree of exchange rate pass-through and the reaction of other countries which might result in competitive hoarding, sometimes referred to as a currency war scenario (Aizenman and Lee, 2008). Steiner (2014) argues that reserve accumulation has the potential to introduce systemic risk and to delay economic reforms required to achieve a domestic driven growth path while Dominguez (2012) finds that higher reserve accumulation prior to the recent crisis is associated with higher post-crisis GDP growth. The fact that both currency reserves and GDP contain a deterministic trend over the full sample period, leads to a general co-movement which does

[5] See for instance `http://www.taxjustice.net/2014/11/10/netherlands-worlds-largest-source-fdi/`.

[6] Exchange rate volatility is also often considered as part of a possible transmission channel when analyzing linkages between GDP, exchange rates and capital flows (Comunale, 2017). Instead of using the growth rate of the nominal effective exchange rate, we have therefore also used the standard deviation of each quarter calculated with monthly data as a simple volatility measure. These additional findings are not included in the paper (but available upon request) and generally report less significant effects. Another potential transmission channel which we do not account for is the possibility that (real) exchange rate misalignments negatively affect GDP. This relationship has recently been identified for European countries by Comunale (2017).

not necessarily reflect causality.

3 Data

The main source of our capital flow data is the International Monetary Fund's (IMF) Balance of Payments (BOP) statistics database. In order to obtain a broad coverage on both the cross-sectional dimension as well as on the time dimension, we have extended the capital flow data set by Forbes and Warnock (2012). Forbes and Warnock (2012) have compiled this data set based on IMF data and modified it adequately for the use in empirical analysis. Since their data set ends in 2010, we have extended and updated the time series using growth rates of the respective time series taken from the most recent IMF BOP data or, if not available from the IMF data taken from national sources. For most countries, we calculate extrapolated values based on the growth rates starting in 2008Q1.

Following Forbes and Warnock (2012), we use standard terminology and define gross capital inflows as the sum of inflows of direct investment, portfolio and other inflows, and gross outflows as the sum of direct investment, portfolio and other outflows. Gross capital flows are defined as the sum of gross outflows and gross inflows, while net capital flows are defined as gross inflows minus gross outflows. The resulting data set provides quarterly time series of gross and net capital flows for up to 37 countries (OECD countries and emerging economies) from 1981Q1 to 2013Q4. However, our country choices as well as our sample period are restricted by data availability for other endogenous variables under observation. Therefore, we consider a sample period running from 1988Q1 to 2013Q4 including $T = 104$ time series observations for a set of 24 economies (i.e. $N = 24$) which include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the UK, and the US (classified as industrialized economies) as well as India, Korea, Mexico, the Philippines, South Africa, and Thailand (classified as emerging markets). We are aware that several additional emerging economies could be taken into account. However, all emerging economies under observation have experienced capital flows for a sufficient degree of time and have undergone a transformation of their financial system. All of them have also experienced stops in capital flows according to the classification by Forbes and Warnock (2012). In addition, Mexico and the three Asian economies (i.e. Korea, the Philippines, and Thailand) have also been subject to currency crises during the nineties.

Besides net or gross capital flows (or their disaggregated counterparts, i.e. FDI and portfolio, respectively), we include nominal effective exchange rates defined as quarterly averages, currency reserves, and the gross domestic product (GDP) as endogenous variables into our VAR model (i.e. $G = 4$).[7] The corresponding data on GDP and currency reserves has been obtained from the International Monetary Fund via Thomson Reuters Datastream. Effective exchange rates have been taken from the Bank for International Settlements and their calculations are based on 26 trading partners and time-varying weights which are derived from manufacturing trade flows and capture both direct bilateral trade and third-market competition by double-weighting (Klau and Fung, 2006). All endogenous variables are taken as growth rates normalized to a mean of zero and a variance of unity.[8]

In order to check whether the panel of each variable is affected by cross-sectional dependence (CD), we have applied the CD test proposed by Pesaran *et al.* (2004). Table 2 reports the corresponding findings and provides clear evidence for cross-sectional dependence since the null of cross-sectional independence can be rejected at conventional levels (i.e. 1, 5, and 10%) for each variable considered. This finding highlights the importance to account for cross-unit lagged interdependence as already mentioned in the Introduction.

*** Insert Table 2 about here ***

[7] We have also tested the variables included in our panel VAR model for Granger non-causality relying on the test proposed by Dumitrescu and Hurlin (2012). The corresponding results are not reported to save space but are available upon request. These clearly show that we have dynamics going into both directions (i.e. from and also to capital flows) and thus it is important to consider all variables as endogenous as done in our framework. In addition, relying on the real effective exchange rate does not change the overall findings. The corresponding results are also available upon request.

[8] The main reason for using growth rates is that each series can be considered as stationary and therefore the entire VAR model is stationary as well. In order to check for robustness, we have also re-run the whole analysis relying on the normalized level of each series. The corresponding results confirm our findings achieved while using growth rates but are not reported in the paper to save space. These can be provided upon request.

4 Empirical methodology

4.1 Panel vector autoregression

We apply a panel vector autoregression (VAR) in the tradition of Canova and Ciccarelli (2009).[9] In order to illustrate the approach, we start with the formulation of the VAR model in the following

$$y_{it} = \sum_{j=1}^{p_1} D_{it,j} Y_{t-j} + \sum_{j=1}^{p_2} C_{it,j} W_{t-j} + e_{it}, \tag{1}$$

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$ are the indices for the cross-section units and the time period, respectively. Therefore, the number of cross-section units (i.e. countries) is N and the length of each time series is T. y_{it} denotes a $G \times 1$ vector of variables for each i and is compressed to a $NG \times 1$ vector $Y_t = (y'_{1t}, \ldots, y'_{Nt})'$ in the following. W_t represents a $q \times 1$ vector of exogenous variables that also includes a constant term and e_{it} stands for a $G \times 1$ vector of random errors. In addition, $D_{it,j}$ and $C_{it,j}$ are coefficient matrices of order $G \times GN$ and $G \times q$ for each lag j, where p_1 is the lag length of the endogenous and p_2 of the exogenous variables.

The benefit of this specification is that it allows for cross-unit lagged interdependencies and time-variation in the coefficients. However, this high degree of flexibility does not come without costs. Without imposing any restriction there are more coefficients to estimate that observations available ($k = NGp_1 + qp_2$ per equation and per t). To avoid that we impose a factor structure on the model given in Eq. (1). For this it is necessary to stack the G rows of the matrices $D_{it,j}$ and $C_{it,j}$ in the $k \times 1$ vector δ_{it}^{g}. Then, we define $\delta_{it} = (\delta_{it}^{1\prime}, \ldots, \delta_{it}^{G\prime})'$ to be an $Gk \times 1$ vector and $\delta_t = (\delta'_{1t}, \ldots, \delta'_{Nt})'$ to be an $NGk \times 1$ vector, which will be factored as follows

$$\delta_t = \sum_{f=1}^{F} \Xi_f \theta_{ft} + u_t \quad \text{with} \quad u_t \sim \mathcal{N}(0, \Omega \otimes V). \tag{2}$$

θ_{ft} is a low-dimensional vector describing the factor and Ξ_f is its corresponding matrix for each factor f. u_t is an $NGk \times 1$ vector of unmodeled and idiosyncratic error terms present in δ_t. The covariance matrix of u_t consists of the $NG \times NG$ matrix Ω and the $k \times k$ matrix $V = \sigma^2 I_k$. In our empirical model we choose a factorization with $F = 3$ factors of the following form

$$\delta_t = \Xi_1 \theta_{1t} + \Xi_2 \theta_{2t} + \Xi_3 \theta_{3t} + u_t, \tag{3}$$

[9] See also Canova and Ciccarelli (2013) for an excellent overview of the panel VAR literature.

where θ_{1t} is a 2×1 vector of common factors, one for industrialized economies (IE) and one for emerging markets (EM), θ_{2t} is a $N \times 1$ vector of country-specific factors and θ_{3t} is a $G \times 1$ vector of variable-specific factors. Therefore, the corresponding indices are constructed as follows: $\chi_{11t} = \sum_{\text{IE}} \sum_g \sum_j y_{ig,t-j}$, $\chi_{12t} = \sum_{\text{EM}} \sum_g \sum_j y_{ig,t-j}$, $\chi_{2it} = \sum_g \sum_j y_{ig,t-j}$, $i = 1, \ldots, N$, and $\chi_{3gt} = \sum_i \sum_j y_{ig,t-j}$, $g = 1, \ldots, G$. As a result $\theta_t = (\theta'_{1t}, \theta'_{2t}, \theta'_{3t})'$ is a vector of order $(2 + N + G) \times 1$.

In the following we define $\mathbf{X_t} = (Y'_{t-1}, \ldots, Y'_{t-p_1}, W'_{t-1}, \ldots, W'_{t-p_2})'$, $X_t = I_{NG} \otimes \mathbf{X'_t}$, and $\Xi = (\Xi_1, \Xi_2, \Xi_3)$. Then, Eq. (1) can be rewritten as

$$Y_t = X_t \delta_t + E_t = X_t(\Xi \theta_t + u_t) + E_t \equiv \chi_t \theta_t + \zeta_t, \tag{4}$$

where E_t is an $NG \times 1$ vector of normally distributed error terms with zero mean and variance-covariance matrix Ω, $\chi_t \equiv X_t \Xi$ is a matrix of constructed regressors (i.e. indices) that are also observable, and $\zeta_t \equiv X_t u_t + E_t$ is a vector of the reparameterized error terms.[10] In this reparameterized version the panel VAR model includes a substantially smaller number of regressors and the factors θ_{it} load on these. This solves the overparameterization problem of the original VAR.

In order to allow for time-variation in the factors, we apply the law of motion given by

$$\theta_t = \theta_{t-1} + \eta_t, \quad \text{with} \quad \eta_t \sim \mathcal{N}(0, B_t), \tag{5}$$

where η_t is independent of E_t and u_t, and $B_t = \text{diag}(B_1, \ldots, B_F) = \gamma_1 B_{t-1} + \gamma_2 B_0$.

4.2 Inference

Markov Chain Monte Carlo (MCMC) methods can be applied to obtain the posterior distributions of the time-varying factors θ_{it} (see Canova and Ciccarelli (2009) for details). To illustrate the MCMC routine followed in our study, consider the likelihood of the reparameterized model given in Eq. (4)

$$L(\theta, \Upsilon | Y) \propto \prod_t |\Upsilon_t|^{-1/2} \exp\left[-\frac{1}{2} \sum_t (Y_t - \chi_t \theta_t)' \Upsilon_t^{-1} (Y_t - \chi_t \theta_t) \right], \tag{6}$$

with

$$\Upsilon_t = (1 + \sigma^2 \mathbf{X'_t X_t}) \Omega \equiv \sigma_t \Omega \tag{7}$$

[10] It is worth to note that the χ_{it}'s are non-orthogonal linear combinations of the regressors of the original VAR given in Eq. (1). However, the existing correlation between the χ_{it}'s decreases with G, N, and the number of lags included in the VAR.

and the prior distribution for $(\Omega^{-1}, \sigma^{-2}, B^{-1})$ is as follows[11]

$$p(\Omega^{-1}, \sigma^{-2}, B^{-1}) = p(\Omega^{-1})p(\sigma^{-2})\prod_f p(B_f^{-1}), \quad f = 1, \ldots, F, \tag{8}$$

with

$$p(\Omega^{-1}) = \mathcal{W}(z_1, Q_1), \quad p(\sigma^{-2}) = \mathcal{G}(a_1/2, a_2/2), \quad p(B_f^{-1}) = \mathcal{W}(z_{2f}, Q_{2f}). \tag{9}$$

We apply a Gibbs sampler to approximate the posterior distribution, since an analytical computation is infeasible. In order to illustrate this, the notation is simplified as follows. $Y^T = (Y_1, \ldots, Y_T)$ denotes the data and $\psi = (\Omega^{-1}, \sigma^{-2}, B^{-1}, \{\theta_t\})$ the parameters, where $\psi_{-\alpha}$ is ψ excluding the parameter α.

The conditional posteriors are given by

$$\Omega^{-1}|Y^T, \psi_{-\Omega} \sim \mathcal{W}(z_1 + T, \hat{Q}_1), \quad B_f^{-1}|Y^T, \psi_{-B_f} \sim \mathcal{W}(T \cdot \dim(\theta_t^f) + z_{2f}, \hat{Q}_{2f}), \tag{10}$$

$$\sigma^{-2}|Y^T, \psi_{-\sigma^2} \propto (\sigma^{-2})^{a_1/2-1} \exp\left[-\frac{a_2\sigma^{-2}}{2}\right] \cdot L(\theta, \mathrm{Y}|Y^T), \tag{11}$$

with

$$\hat{Q}_1 = \left[Q_1^{-1} + \sum_t (Y_t - \chi_t\theta_t)\sigma_t^{-1}(Y_t - \chi_t\theta_t)'\right]^{-1}, \tag{12}$$

and

$$\hat{Q}_{2f} = \left[Q_{2f}^{-1} + \sum_t (\theta_t^f - \theta_{t-1}^f)(\theta_t^f - \theta_{t-1}^f)'\right]^{-1}. \tag{13}$$

The conditional posterior for σ^{-2} is non-standard. Therefore, we run a Metropolis-Hastings step within the Gibbs to achieve draws for this parameter. This is done using a random walk kernel $(\sigma^2)^n = (\sigma^2)^c + v$ with $v \sim \mathcal{N}(0, d^2)$. The candidate's acceptance probability is equal to the ratio of the kernel of the density of $(\sigma^2)^n$ to the one of $(\sigma^2)^c$.

Finally, the conditional posterior of $(\theta_1, \ldots, \theta_T|Y^T, \psi_{-\theta})$ is computed by the following Kalman filter recursions

$$\theta_{t|t} = \theta_{t-1|t-1} + (R_{t|t-1}\chi_t F_{t|t-1}^{-1})(Y_t - \chi_t\theta_{t-1|t-1}), \tag{14}$$

$$R_{t|t} = [I - (R_{t|t-1}\chi_t F_{t|t-1}^{-1})\chi_t](R_{t-1|t-1} + B), \tag{15}$$

[11]The chosen prior reflects the underlying assumptions regarding the importance of common factors which has to be reflected by the data to avoid misspecification (Koop and Korobilis, 2016). We feel that the data characteristics and the findings regarding common factors justify our specification. See Korobilis (2016) for a discussion of priors, their role for sparsity in the context of multi-country models and possible modifications of the prior configuration adopted here.

$$F_{t|t-1} = \chi_t R_{t|t-1} \chi_t' + \Upsilon_t. \tag{16}$$

The output of the Kalman filter is used to obtain the sample $\{\theta_t\}$ as follows. θ_T is simulated from $\mathcal{N}(\theta_{T|T}, R_{T|T})$, θ_{T-1} from $\mathcal{N}(\theta_{T-1}, R_{T-1})$, ..., θ_1 from $\mathcal{N}(\theta_1, R_1)$ with

$$\theta_t = \theta_{t|t} + R_{t|t} R^{-1}_{t+1|t}(\theta_{t+1} - \theta_{t|t}), \quad \text{and} \quad R_t = R_{t|t} - R_{t|t} R^{-1}_{t+1|t} R_{t|t}. \tag{17}$$

The starting values $\theta_{0|0}$ and $R_{0|0}$ can be obtained from a training sample or by choosing small values.

We have run the MCMC 30 times with 2,100 draws and a burn-in of 100. Furthermore, we set $a_1 = 10$ and $a_2 = 1$. $p(\Omega^{-1}) = \mathcal{W}(z_1, (z_1 \Omega_{OLS})^{-1})$ with $z_1 = NG + 47$ and Ω_{OLS} as the covariance matrix of the residuals derived from univariate autoregressions.[12]

4.3 Impulse response analysis

Generally, it is possible to compute an impulse response as the difference between two realizations of $y_{t+\tau}$, where one assumes a one-time shock in the jth component of $e_{t+\tau}$ at time $t+1$ and the other no shock. However, this proceeding is inadequate in our case since we allow the structural coefficients to change over time. Hence, in this case impulse responses can be computed as the difference between two conditional expectations of $y_{t+\tau}$ conditional on the data (Y^t), the factors (θ_t), the parameters that determine the law of motion of the coefficients as well as all future shocks (Koop *et al.*, 1996; Canova and Ciccarelli, 2009). The only distinction between this two conditional expectations is that one is also conditional on a random draw for the current shocks, whereas the other conditioned on the unconditional value of the current shocks.

To formalize this, $\mathcal{U}_t = (\zeta_t', \eta_t')'$ denotes the vector of reduced-form shocks while $\mathcal{Z}_t = (H_t^{-1}\zeta_t', H_t^{-1}\eta_t')'$ is the vector of structural shocks with $E_t = H_t v_t$, $H_t H_t' = \Omega$ so that $\text{var}(v_t) = I$. $H_t = J \cdot K_t$ with $K_t K_t' = I$, J is a lower triangular matrix that orthogonalizes the shocks, and $\mathcal{V}_t = (\Omega, \sigma^2, B_t)$. $\bar{\mathcal{Z}}_{j,t}$ denotes a particular realization of $\mathcal{Z}_{j,t}$ and $\mathcal{Z}_{-j,t}$ represents structural shocks excluding the one to the jth component of $\mathcal{Z}_t$. Finally, we define $\mathcal{F}_t^1 = (Y^{t-1}, \theta^t, \mathcal{V}_t, H_t, \mathcal{Z}_{j,t} = \bar{\mathcal{Z}}_{j,t}, \mathcal{Z}_{-j,t}, \mathcal{U}_{t+1}^{t+\tau})$ and $\mathcal{F}_t^2 = (Y^{t-1}, \theta^t, \mathcal{V}_t, H_t, \mathcal{Z}_{j,t} = E(\mathcal{Z}_{j,t}), \mathcal{Z}_{-j,t}, \mathcal{U}_{t+1}^{t+\tau})$. Then responses to an impulse in the jth compo-

[12] The degrees of freedom z_1 haven been chosen to approximately match the sample size T.

nent of $\mathcal{Z}_t$ at period t are given as

$$IR(t, t+\tau) = E(Y_{t+\tau}|\mathcal{F}_t^1) - E(Y_{t+\tau}|\mathcal{F}_t^2), \quad \tau = 1, 2, \ldots. \tag{18}$$

Given that, the responses can be obtained as follows:

(1) Choose t, τ, and J and draw $\Omega^l = H_t^l(H_t^l)'$ as well as $(\sigma^2)^l$ from their posterior distributions and u_t^l from $\mathcal{N}(0, (\sigma^2)^l I \otimes H_t^l(H_t^l)')$. Then, calculate $y_t^l = \chi_t\theta_t + H_t v_t + X_t u_t^l$.

(2) Draw $\Omega^l = H_{t+1}^l(H_{t+1}^l)'$, $(\sigma^2)^l$, B_{t+1}^l, and η_{t+1}^l from their posterior distributions. Then, use this to compute the factors θ_{t+1}^l and the indices χ_{t+1}. Draw u_{t+1}^l from $\mathcal{N}(0, (\sigma^2)^l I \otimes H_{t+1}^l(H_{t+1}^l)')$ and calculate $y_{t+1}^l = \chi_{t+1}\theta_{t+1}^l + H_{t+1}v_{t+1} + X_{t+1}u_{t+1}^l$, $l = 1, \ldots, L$.

(3) Repeat step 2 and compute θ_{t+k}^l, y_{t+k}^l, $k = 2, \ldots, \tau$.

(4) Repeat steps 1-3 setting $v_{t+k} = E(v_{t+k})$, $k = 0, \ldots, m$ using the draws for the shocks obtained in steps 1-3.

5 Empirical results

Time-variation in the coefficients

Figure 6 illustrates the usefulness of common factors and time-varying coefficients as two modeling tools embedded in our empirical framework. For both gross and net flows, the overall importance of common factors varies over time. An interesting pattern is that the global factor stemming from industrial economies seems to become more important in the aftermath of a crises as observed after 2009 or in the late 1990s. On the other hand, Figure 7 illustrates that the importance of country-specific factors turns out to be less volatile and is hardly affected by the crisis. The time-variation we observe suggests that allowing for time-varying coefficients is an important feature and that gradual changes are more in line with the data compared to the occurrence of discrete break points.

*** Insert Figures 6 and 7 about here ***

Owing to the fact that we consider a rich set of both cross-section and country-specific dynamics, our following interpretation relies on selected impulse response functions which are related to effects on GDP for emerging economies as our main questions of interest. We distinguish between shocks from industrial and emerging markets through considering separate impulse response functions for shocks to both groups. We start by analyzing the effects of capital flows on GDP and access exchange rates as a possible transmission channel as a next step.

Causalities between capital flows and GDP

Figures 8 and 9 provide impulse functions for a response of GDP to capital flows. For all emerging economies, domestic net capital flows have a significantly positive impact on GDP at the 68% confidence level with significance for India, Thailand, and the Philippines also emerging at the 95% level (see Fig. 8, Panel (a)). In all cases, the positive effect diminishes after around 2 quarters. The same pattern holds for gross capital flows although the significance is less pronounced in some cases with a positive and significant effect at a 95% confidence interval only observed for Thailand (see Fig. 8, Panel (b)). Interestingly, the pattern is partly different compared to a shock on capital flows in industrial economies as reported in Figure 9. Net capital flows only have a positive impact on GDP for India and the Philippines at the 95% level while the effect is even negative for Korea at the 68% level. However, the effects are more significant if gross capital flows are considered so that the overall results are only different for Korea.

*** Insert Figures 8 and 9 about here ***

This finding offers interesting implications. Firstly, the result that increasing capital flows in the considered emerging economies have a clear positive effect on GDP is possibly due to the consideration of a comparable long period of investigation. Sudden stop losses in case of a reversal in capital flows mostly occur for comparable short periods and are less relevant if a longer sample is considered. Secondly, the finding that the positive effect of net capital flows is more pronounced for shocks in emerging markets is also plausible since capital flows between industrial economies which do not necessarily affect emerging economies can dominate net flows for emerging markets. In contrast, gross flows also reflect capital flows to emerging markets. Finally, a somehow surprising result is that the differences between net and gross flows essentially display a similar im-

pact. Although gross capital flows tend to be more pro-cyclical and more volatile than net inflows (Bluedorn *et al.*, 2013), the similar impact on GDP suggests that volatility of capital flows does not transmit into significant GDP effects.

Figures 10 and 11 put the reversed causality from GDP on capital flows under closer scrutiny. Previous evidence has suggested that fundamentals such as interest rate differentials and output growth are important determinants of net private capital inflows in emerging markets (Ahmed and Zlate, 2014). Pro-cyclical capital flows might for example occur if growth and capital flows are bilaterally linked. Except for Korea, the effect of GDP in emerging economies is significant for at least two quarters at the 95% level. Once again, the picture for net capital flows is less pronounced with only India and the Philippines experiencing a positive effect in case of an increase of GDP in emerging markets. Overall, the different results for Korea are in line with the descriptive evidence in Section 2 which suggests persistent changes to Korea's capital flows after the recent crisis. Although South Korea was the first OECD country to escape the negative economic growth zone after the crisis in 2008, it still has limited capacity to stabilize the financial market and to control capital flows (Yoon, 2011).

*** Insert Figures 10 and 11 about here ***

Linkages between effective exchange rates and GDP

Figure 12 considers the exchange rate effect on GDP. Analyzing the link between effective exchange rates and GDP is important in the present context since exchange rates offer a possible transmission channel stemming from capital flows. However, the relationship between capital flows and effective exchange rates potentially displays different patterns. Even if the bilateral exchange rate, for example against the dollar, is fixed, effective exchange rates might still fluctuate to a significant degree due to third-country effects. For this reason, we do not distinguish between countries with different exchange rate regimes. In general, exchange rates have resulted in several controversies when it comes to policy recommendations. In the present context, a frequent line of reasoning is that some emerging economies rely on fixed exchange rates and an export-led growth strategy. Exchange rate adjustment is also among the candidates considered for a correction of global current

account balances and the underlying capital flows.

*** Insert Figure 12 about here ***

The findings display ambiguous and surprising patterns. Effects are mostly insignificant at the 95% confidence level. At the 68% level, an effective appreciation in emerging markets leads to an increase in domestic GDP for Korea, Mexico and South Africa while the opposite is observed for India, Thailand and the Philippines. Although previous research by di Mauro *et al.* (2008) also finds a hardly significant response of GDP to effective exchange rates for a sample period running from 1980 to 2007, the positive linkage between appreciation and GDP for Korea, Mexico and South Africa is still remarkable. We have also considered the effects of capital flows shocks on exchange rates. The results are available upon request and suggest that the effects are mostly insignificant. Overall, we fail to find significant evidence that exchange rates offer a possible transmission channel for capital flow effects on GDP. Direct theoretical explanations are not embedded in our framework but there is for example plenty of evidence that an incomplete pass-through mechanism might offer an explanation for a weak link between international trade and exchange rate depreciations. Another line of reasoning is that most emerging markets under investigation have experienced a currency crisis during which depreciations and (short-run) decreases in GDP coincide.

Several additional estimations have been considered. The growth effect of reserve accumulation partly turns out to be positive for the GDP of emerging economies. However, this pattern is potentially due to a common deterministic trend in both variables which also generates a certain degree of co-movement in growth rates. Results of capital flow shocks for industrial economies are not presented here for the sake of clarity. All other country-specific impulse response functions are available upon request.

Analysis of disaggregated capital flows

A core issue in any discussion related to capital flows is the underlying character of the corresponding aggregates. Capital inflows potentially bear completely different dynamics even if the observed value is equivalent. We adopt the most common distinction between FDI and portfolio flows.[13]

[13]The findings for other flows (mainly bank loans) did not provide additional insights and have therefore be omitted from the paper.

In this regard, the bipolar view is that FDI flows should enhance economic growth due to their long-term character while portfolio flows introduce short-term volatility and are more vulnerable in the context of 'sudden stops'.

To shed some light on this question, Figures 13 to 17 focus on disaggregated capital inflows as well as net and gross flows for both FDI and portfolio and their resulting effects on economic growth. Although the results for inflows shown in Figure 13 display the same general character, portfolio flows even seem to have a more positive impact in some cases. While the results for India, Thailand and the Philippines are essentially equivalent, the effect of portfolio flows is more positive for Korea and South Africa. The effect for Korea is even negative in case of FDI inflows. The impact on Mexican GDP is insignificant in both cases. There are two obvious explanations for this pattern. On the one hand, FDI is not necessarily productive and on the other, portfolio flows are potentially transmitted in an effective way. It is also important to keep in mind that effects of FDI might only materialize over the very long-run and are often motivated by market-seeking reasons or the incentive to avoid taxes. The empirical evidence until 2004 suggests that FDIs in South Africa are by market rather than efficiency-seeking reasons. Investments into India and other Asian countries have followed a split pattern, with most FDIs being of a market-seeking character but with a small yet very significant efficiency-seeking sector oriented to export (Estrin and Meyer, 2004).

*** Insert Figures 13 to 17 about here ***

Our results regarding portfolio flows are in line with findings prior to the financial crisis which suggest that openness to portfolio flows enhances economic growth for emerging markets even if unwinding capital flows occur (Ferreira and Laux, 2009). It is remarkable that we observe a similar pattern despite the fact that we account for the recent financial crisis and global spillover effects. The amplified impact of portfolio flows on asset price volatility in emerging markets during the crisis (Ananchotikul and Zhang, 2014) does not seem to transmit into negative GDP effects over the full sample period.

6 Conclusion

This paper has shed some light on the inter-linkages between capital flows, currency reserves and exchange rates and their impact on GDP for emerging economies. In contrast to previous studies,

we focus on shocks to capital flows in either industrial or emerging markets as a whole to address spillover and contagion effects. Relying on a Bayesian panel VAR approach which allows for cross-section lagged interdependencies and time-varying coefficients; we establish a robust positive effect of capital flows on GDP. Except for Korea, both gross and net flows display a positive impact for around two quarters. A distinction between FDI and portfolio flows also provides a positive impact on GDP with somehow surprisingly results which indicate an even more positive effect for portfolio flows in some cases. This shows that the strong impact of portfolio flows on asset price volatility during the recent crisis period does not result in negative GDP effects over the full sample period. Effective exchange rate changes on GDP hardly offer an explanation for a possible transmission of capital flow effects with effective depreciations both positively and negatively linked to GDP. We have also shown that the effects of net portfolio flows are more positive compared to net FDI flows while the effects for gross flows partly display a different pattern. The impact on Mexican and South African GDP is more positive for gross FDI flows while the effect on Korean GDP is more negative. The different findings of gross and net flows illustrate the need for a distinction and are possibly due to different returns on investments abroad. These findings contradict the view that FDI enhances economic growth while portfolio flows are more responsible for short-term financial market effects. The mixed evidence regarding the effect of FDI flows also might simply reflect that such flows are not necessarily related to the global allocation of investment or production resources with a large amount simply reflecting market-seeking reasons or financial recycling with the purpose of avoiding taxes. Disentangling those dynamics, for example based on micro-level perspective is an important issue for further research. A clear distinction between the effects of flows from emerging and industrial economies is complicated by the fact that the relative effects differ for net and gross flows.

The reversed pattern of Korean capital flows clearly demonstrates the need to account for country-specific dynamics. While negative GDP effects of capital flows mostly occur in the short-run which are reversed, Korea has experienced a negative effect if the whole sample period is taken into account. Unsurprisingly, Korea is currently considering capital controls to stabilize financial markets in cases of sudden capital outflows. However, similar to exchange rates, the history of the international monetary system has shown that a successful control of international capital markets is hard to achieve. Despite their positive effect on GDP, dealing with short-run unwinding capital flows remains one of the challenges on global financial markets. The unpredictability of such flows

represents a major task in this context. Recent research suggests that certain capital controls and macroprudential measures can be effective in reducing financial fragility but that such actions are frequently not capable of achieving their stated aims (Forbes *et al.*, 2015).

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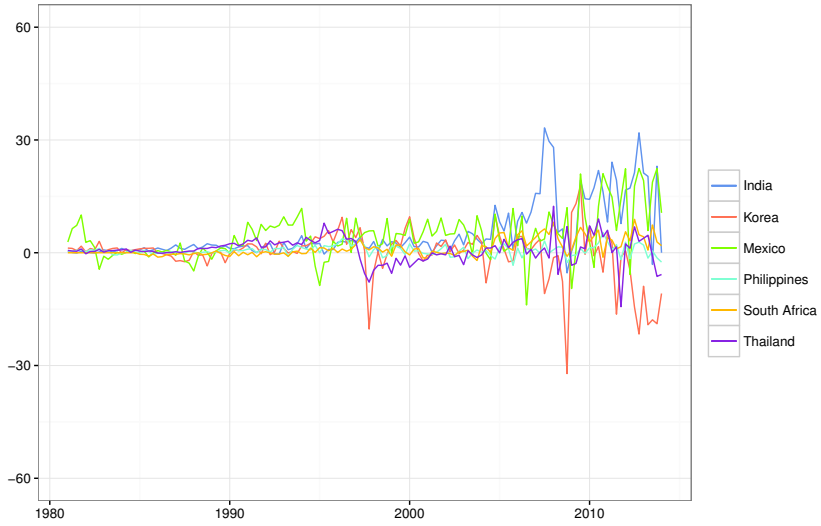
Figures

FIGURE 1 **Capital flows of emerging economies**

The plots show the net and gross capital flows (in billions of US dollar) of six emerging economies under consideration (i.e. India, Korea, Mexico, the Philippines, South Africa, and Thailand) for a sample period running from 1981Q1 to 2013Q4.

(a) Net capital flows:



(b) Gross capital flows:

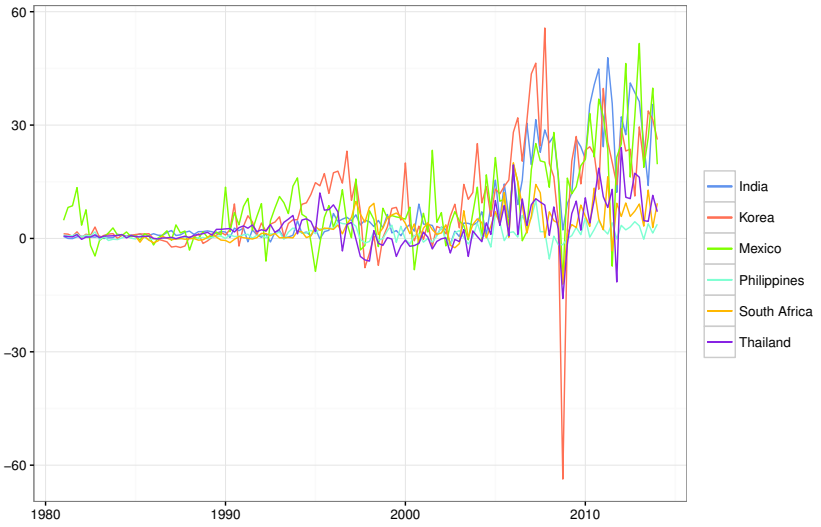


FIGURE 2 **Capital flows of emerging economies**

The plots show the individual net and gross capital flows (in billions of US dollar) of six emerging economies under consideration (i.e. India, Korea, Mexico, the Philippines, South Africa, and Thailand) for a sample period running from 1981Q1 to 2013Q4.

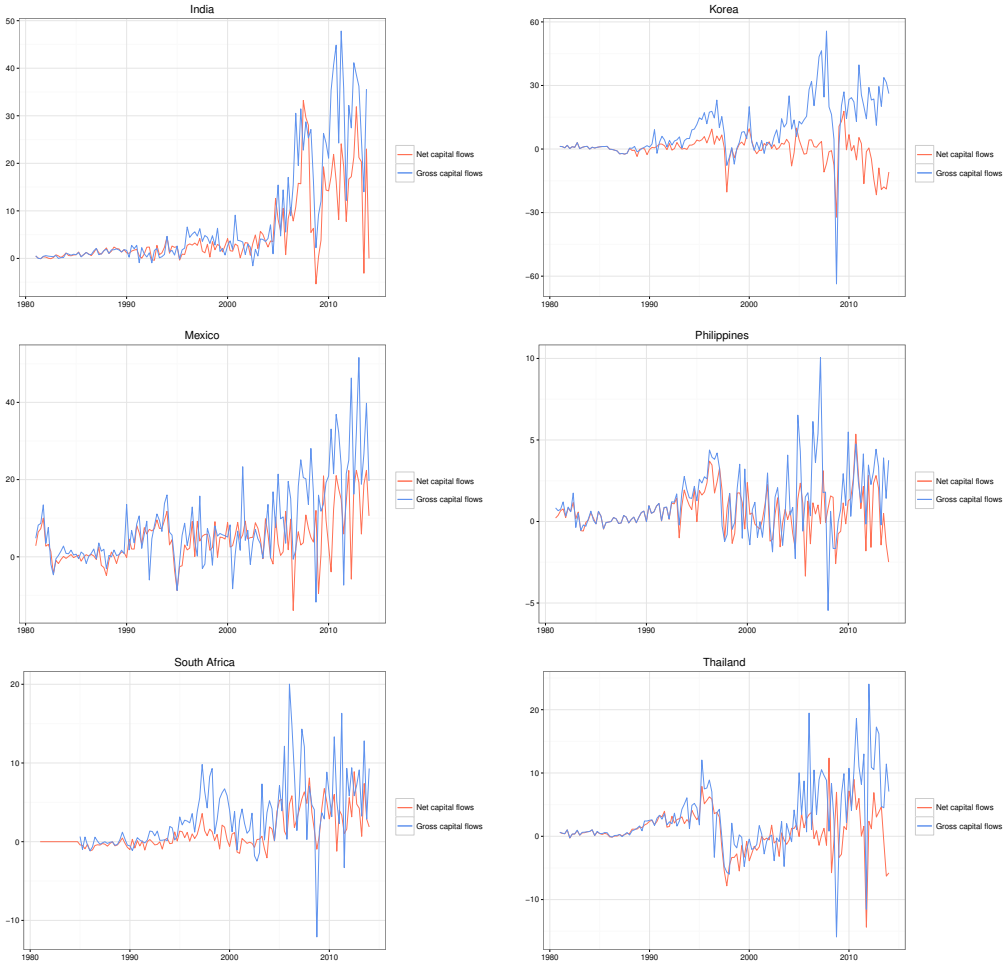
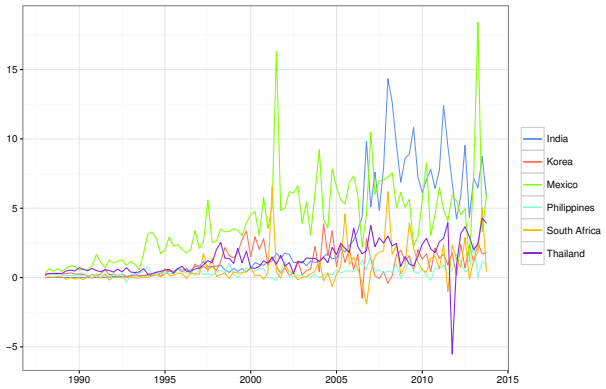


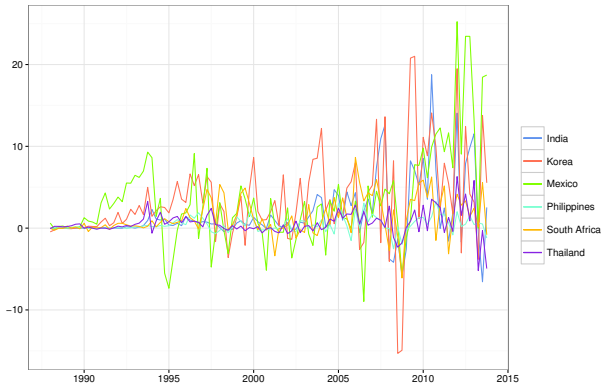
FIGURE 3 **FDI and portfolio inflows of emerging economies and the US**

The plots show the FDI and portfolio inflows (in billions of US dollar) of six emerging economies under consideration (i.e. India, Korea, Mexico, the Philippines, South Africa, and Thailand) and the US for a sample period running from 1981Q1 to 2013Q4.

(a) FDI inflows:



(b) Portfolio inflows:



(c) US inflows:

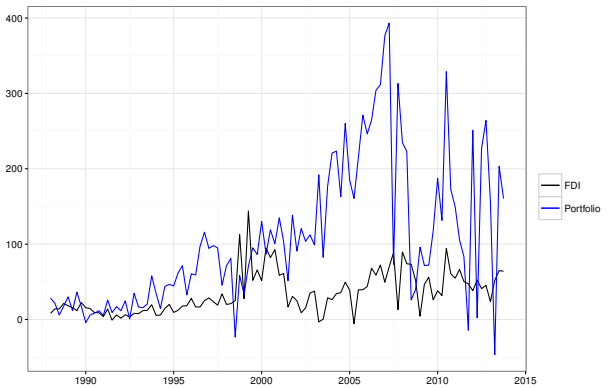


FIGURE 4 **Global capital flow shares**

The plot shows the percentage shares of FDI, portfolio and other flows on a global level (i.e. calculated with aggregated flows based on the 24 economies under observation) for a sample period running from 1981Q1 to 2013Q4.

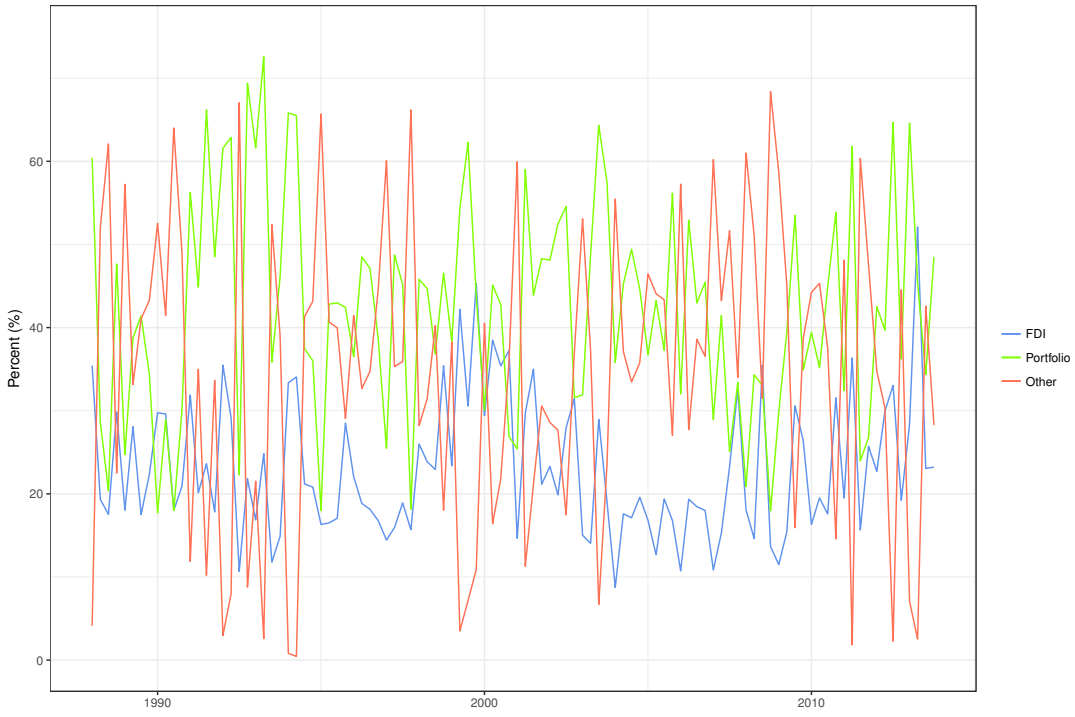
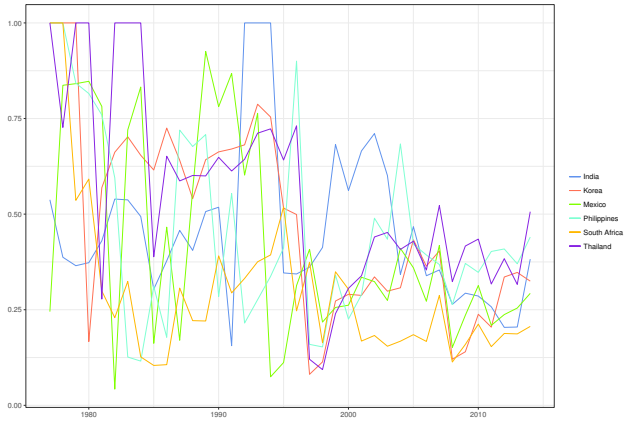


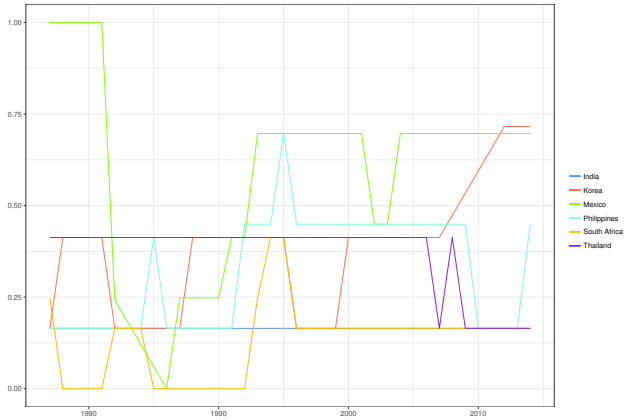
FIGURE 5 **Trilemma indexes for emerging economies**

The plots in panel (a) and (b) show two of the three Trilemma indexes provided by Aizenman *et al.* (2008) for the six emerging economies under consideration (i.e. India, Korea, Mexico, the Philippines, South Africa, and Thailand) for a sample period running from 1977 to 2014. Panel (c) shows the financial system deposits to GDP ratio taken from the Global Financial Development Database provided by the World Bank for a sample period running from 1988 to 2014. The latter is not available for Korea.

(a) Exchange rate stability index:



(b) Financial openness index:



(c) Financial system deposits to GDP:

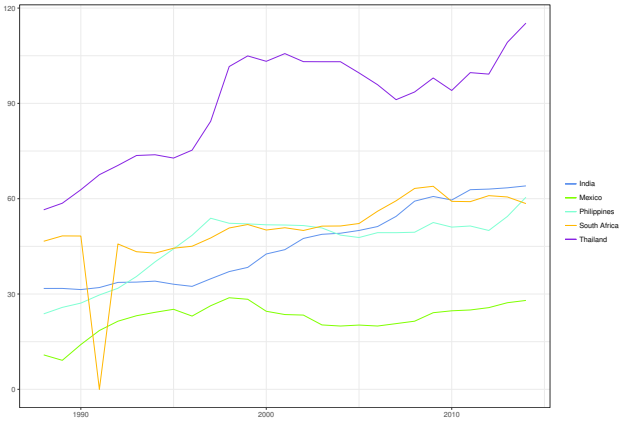
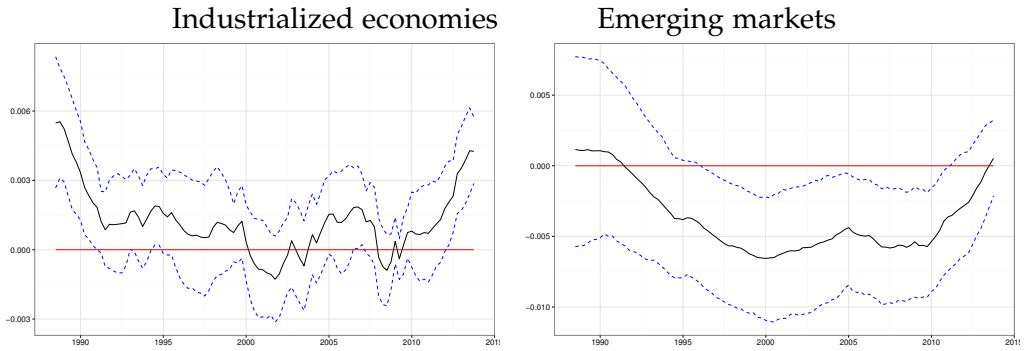


FIGURE 6 **Time-varying coefficients of common factors**

The plots show the time-varying coefficient estimates of both common factors included in θ_{1t} for a sample period running from 1981Q3 to 2013Q4. The coefficient estimates are represented by the median of the posterior distribution at each point in time (the blue dashed lines report the corresponding 10 and 90% quantiles). Panel (a) gives the coefficients for the panel VAR model including net capital flows and panel (b) for the panel VAR model including gross capital flows.

(a) Net capital flows:



(b) Gross capital flows:

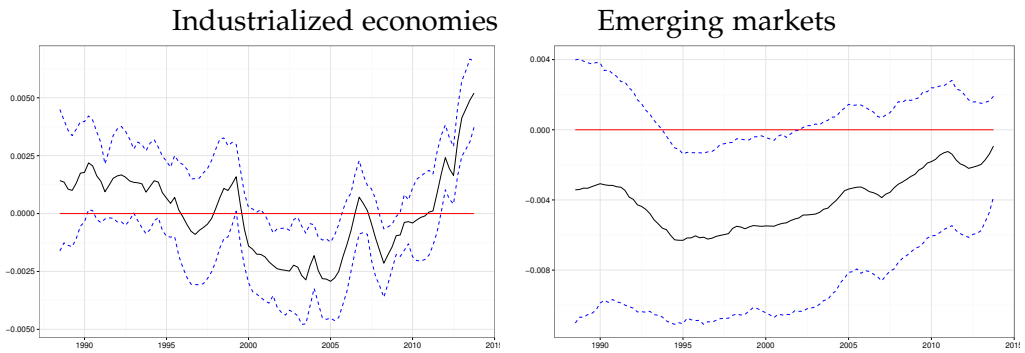


FIGURE 7 **Time-varying coefficients of country-specific factors**

The plots show the time-varying coefficient estimates of the country-specific factors for the six emerging economies and three major industrialized economies (i.e. Germany, Japan, and the US) included in θ_{2t} for a sample period running from 1981Q3 to 2013Q4. The coefficient estimates are represented by the median of the posterior distribution at each point in time (the blue dashed lines report the corresponding 10 and 90% quantiles).

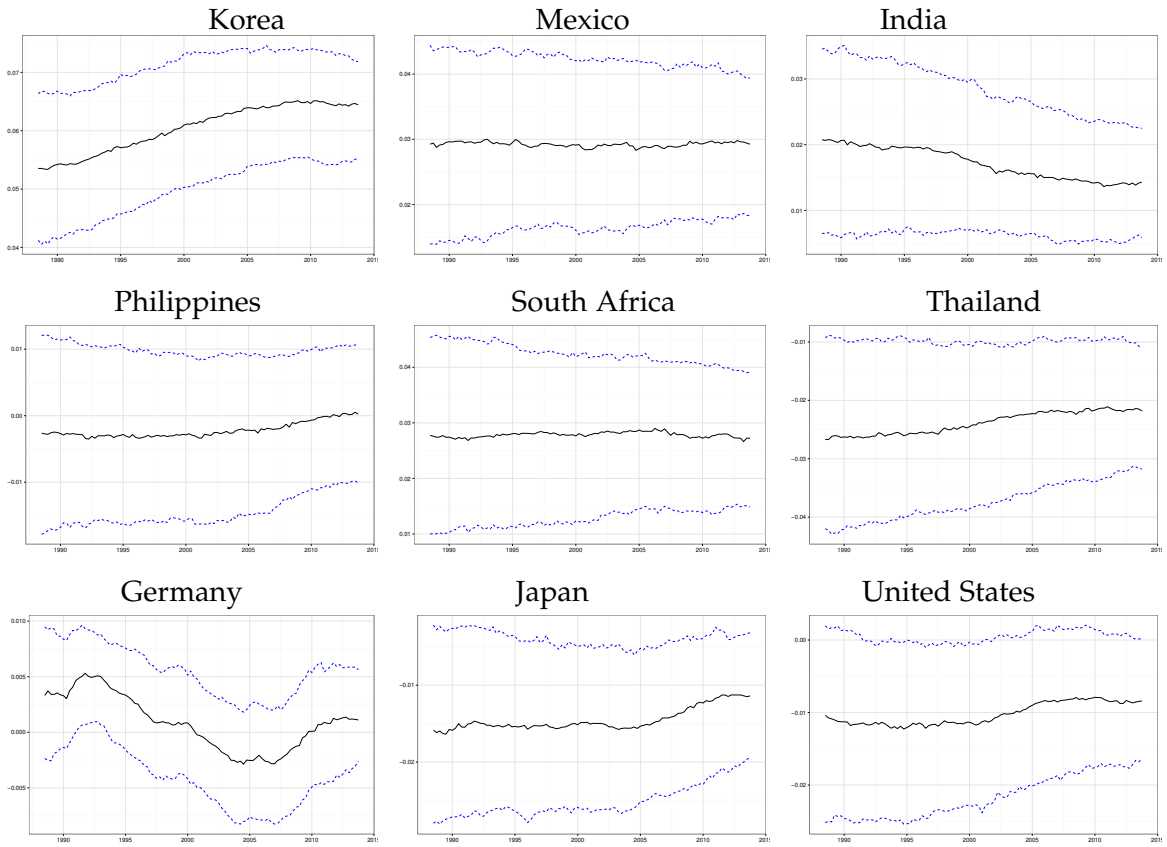
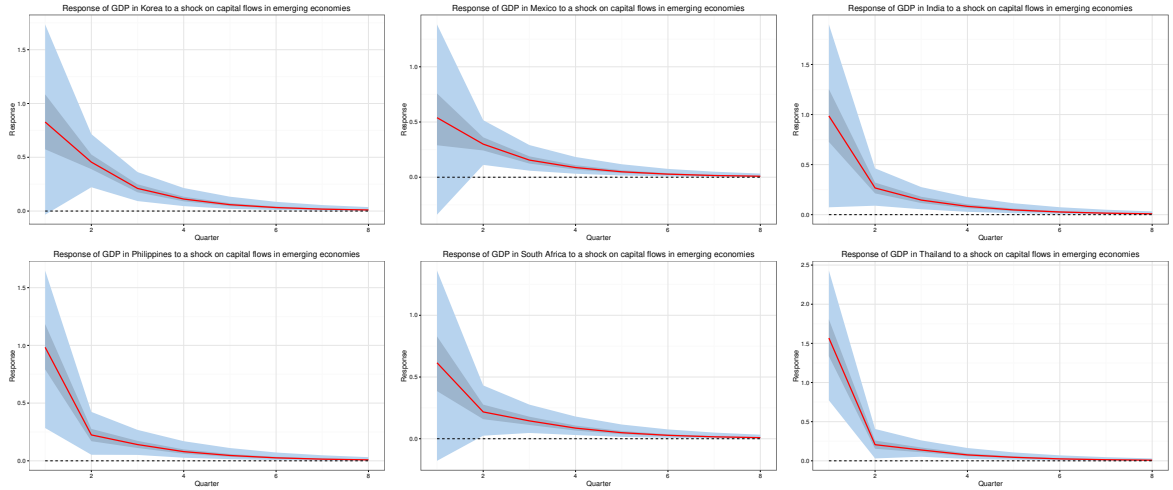


FIGURE 8 **Response of GDP in emerging economies to a shock on capital flows in emerging economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on capital flows in emerging economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net capital flows and panel (b) to a shock on gross capital flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net capital flows:



(b) Gross capital flows:

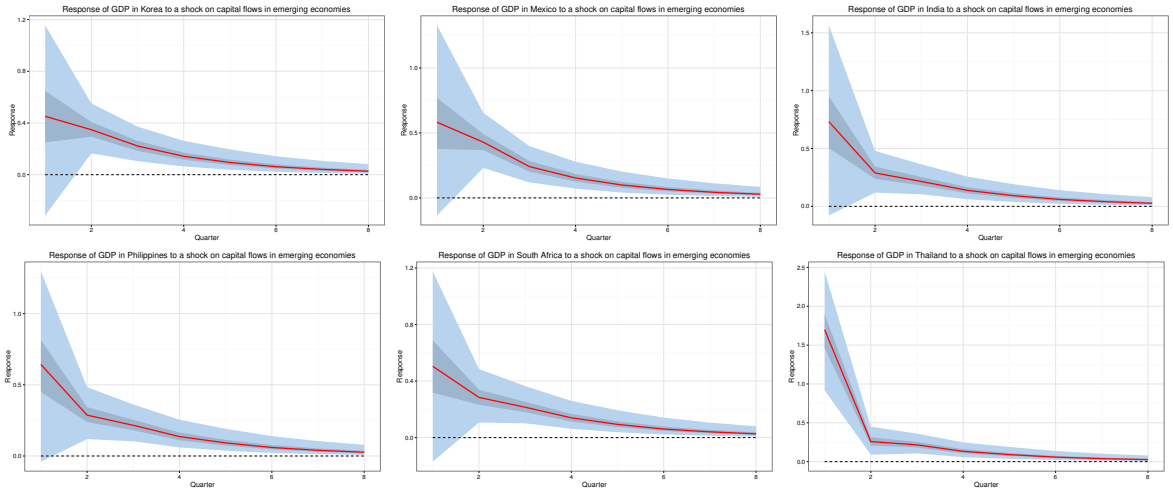
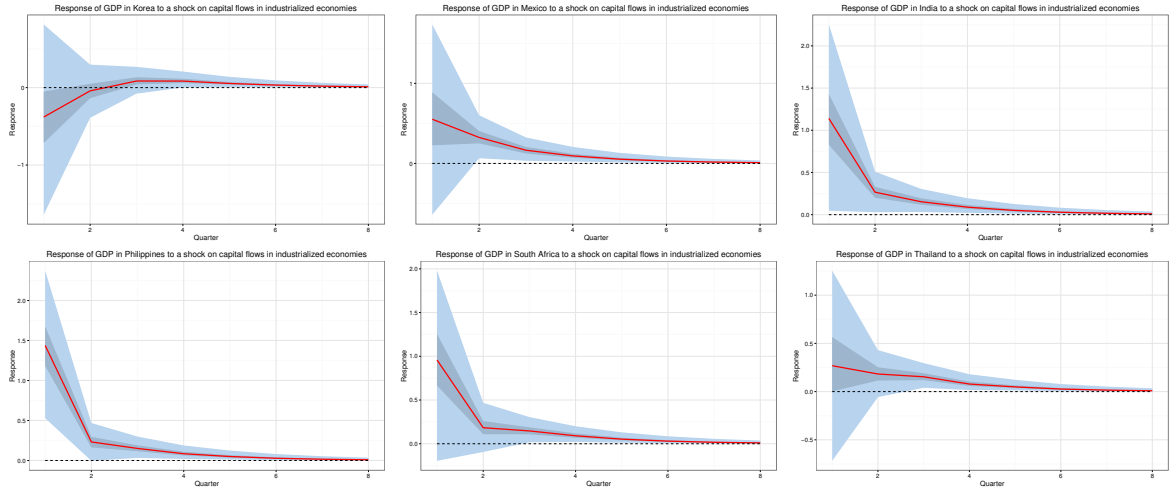


FIGURE 9 **Response of GDP in emerging economies to a shock on capital flows in industrialized economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on capital flows in industrialized economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net capital flows and panel (b) to a shock on gross capital flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net capital flows:



(b) Gross capital flows:

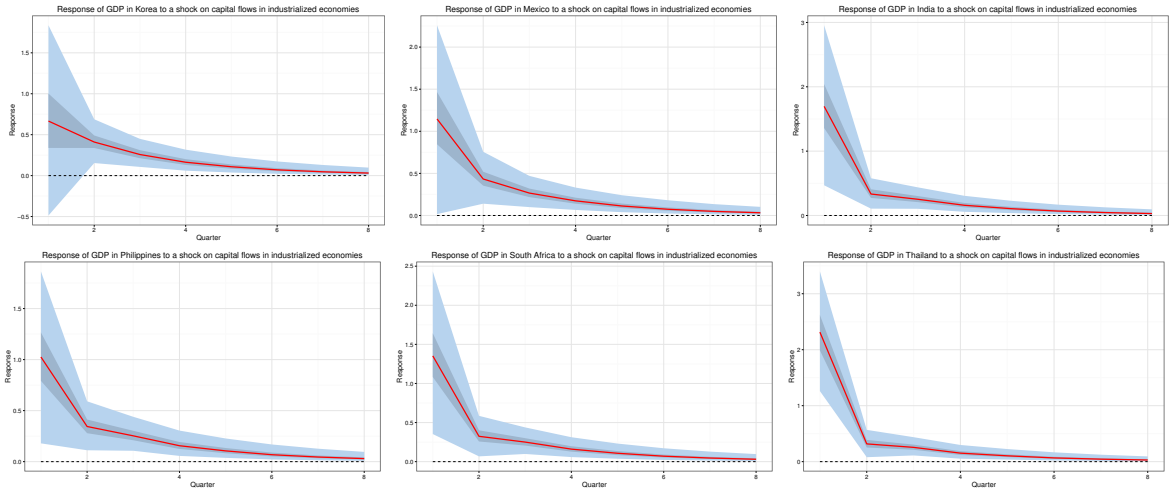
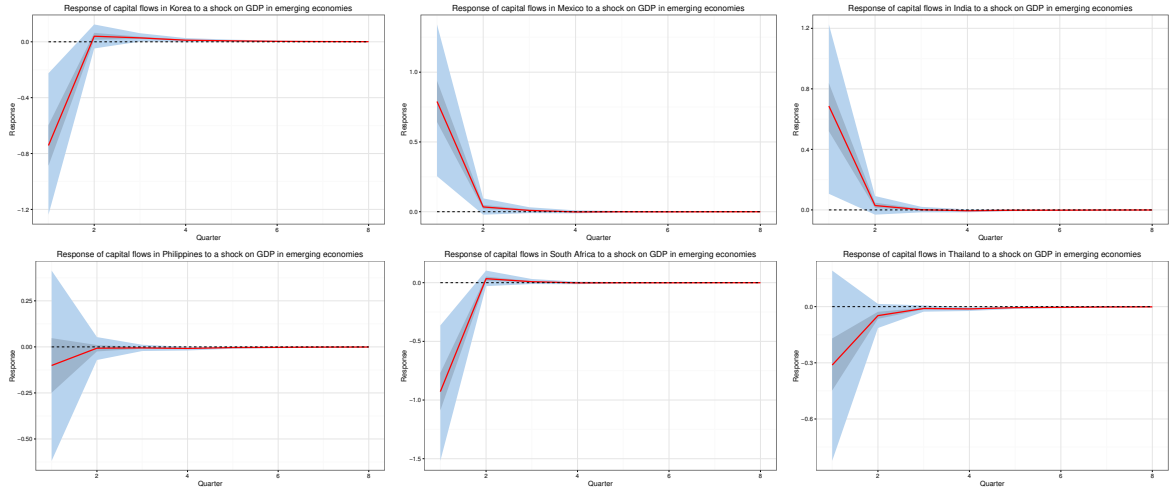


FIGURE 10 **Response of capital flows in emerging economies to a shock on GDP in emerging economies**

The plots show the reaction of the emerging economies individual capital flows to a common shock on GDP in emerging economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net capital flows and panel (b) to a shock on gross capital flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net capital flows:



(b) Gross capital flows:

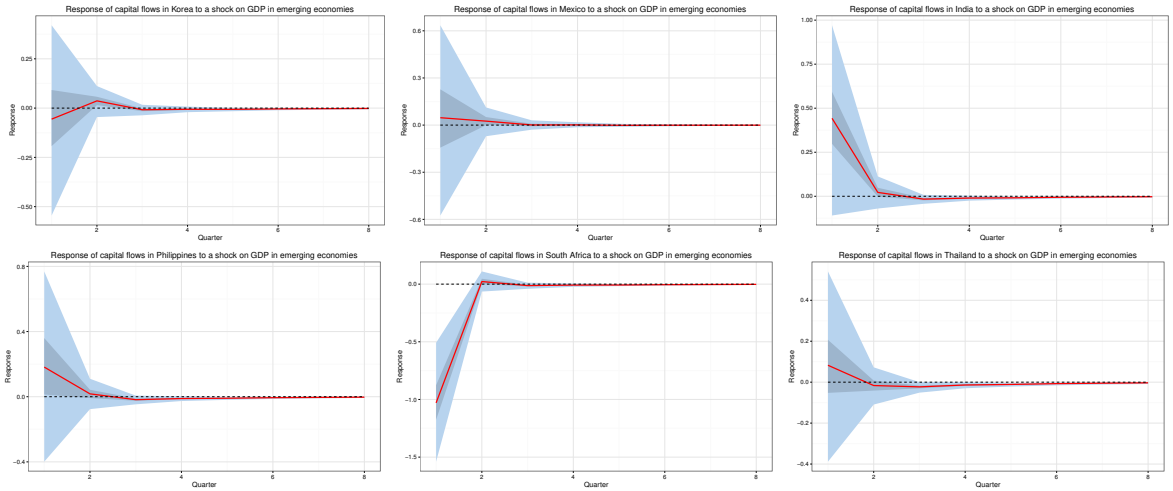
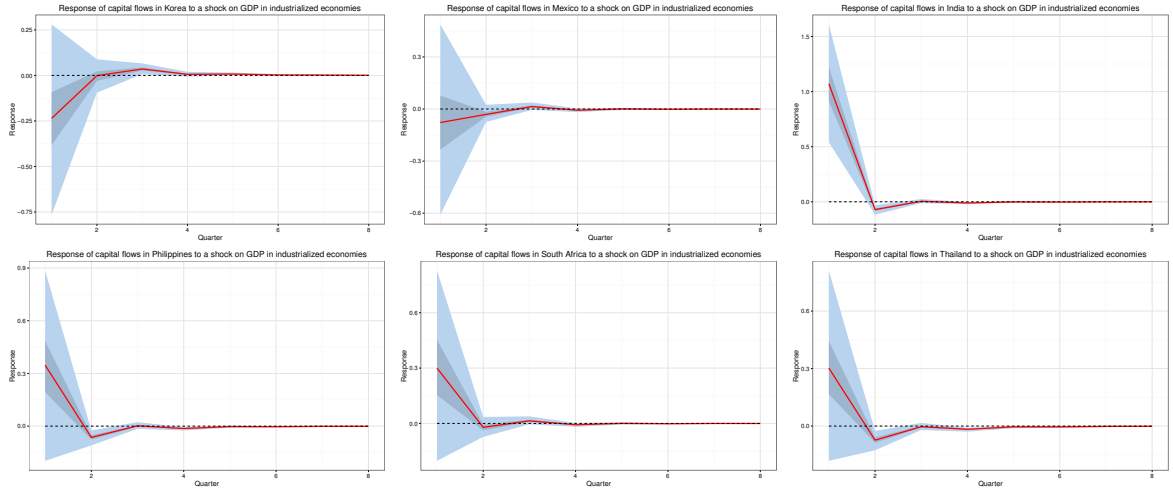


FIGURE 11 **Response of capital flows in emerging economies to a shock on GDP in industrialized economies**

The plots show the reaction of the emerging economies individual capital flows to a common shock on GDP in industrialized economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net capital flows and panel (b) to a shock on gross capital flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net capital flows:



(b) Gross capital flows:

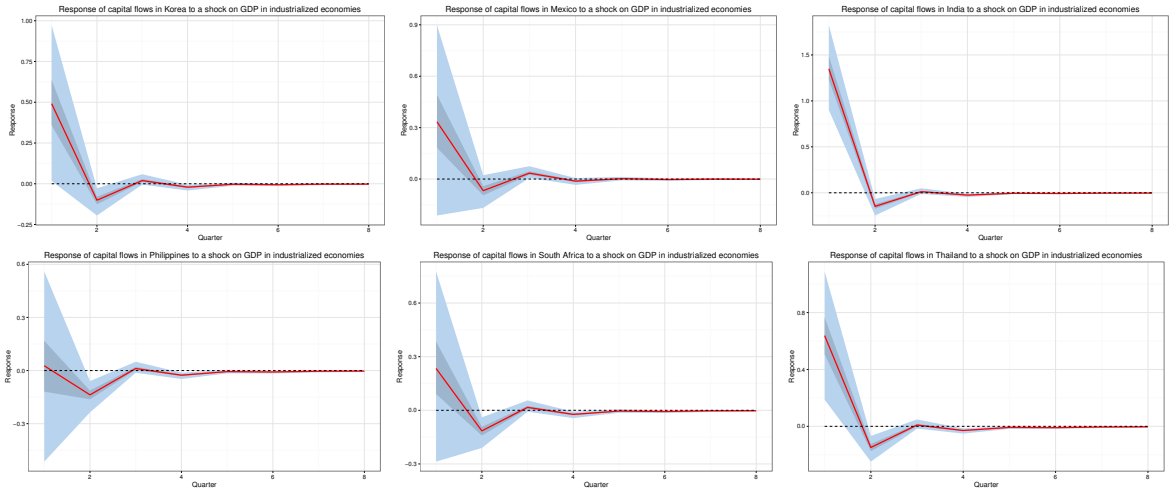
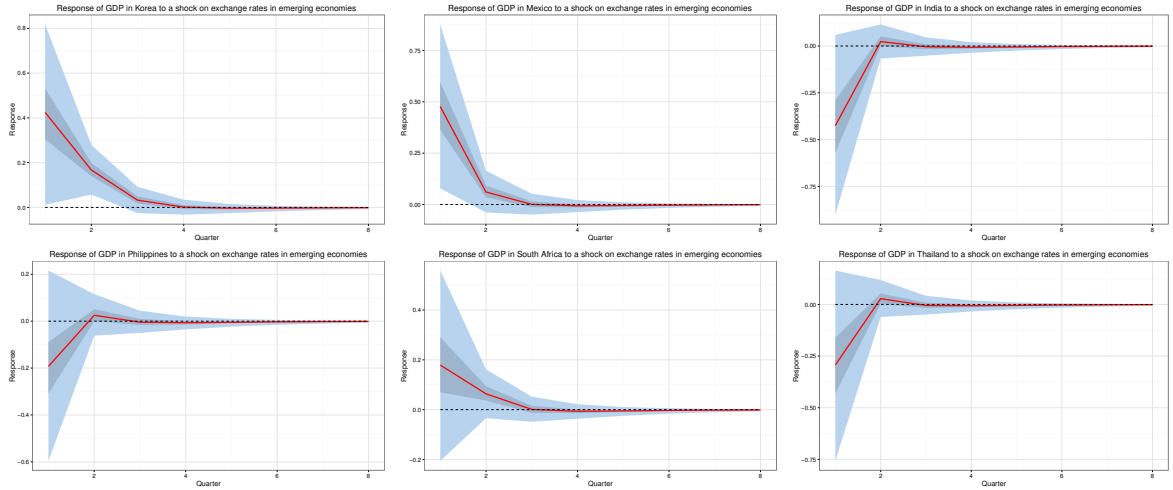


FIGURE 12 **Response of GDP in emerging economies to a shock on exchange rates in emerging economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on exchange rates in emerging economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction using net capital flows and panel (b) using gross capital flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net capital flows:



(b) Gross capital flows:

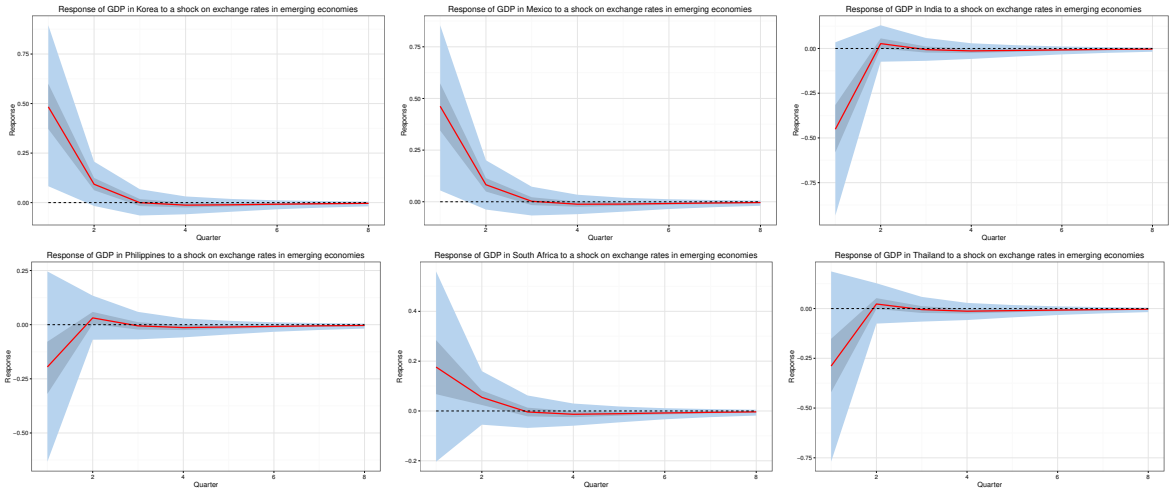
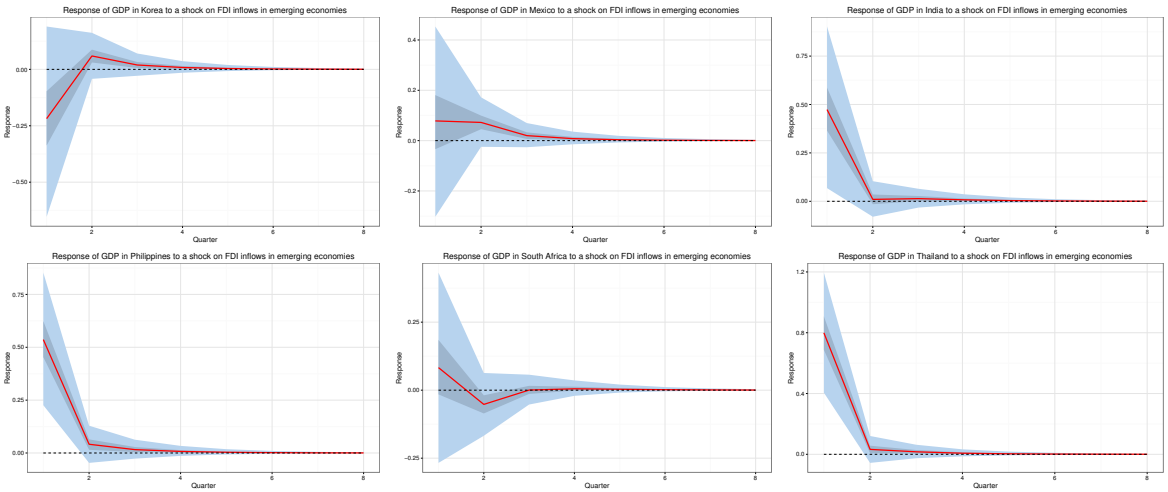


FIGURE 13 **Response of GDP in emerging economies to a shock on FDI and portfolio inflows in emerging economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on FDI inflows in emerging economies and to a common shock on portfolio inflows in emerging economies, respectively. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on FDI inflows and panel (b) to a shock on portfolio inflows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) FDI inflows:



(b) Portfolio inflows:

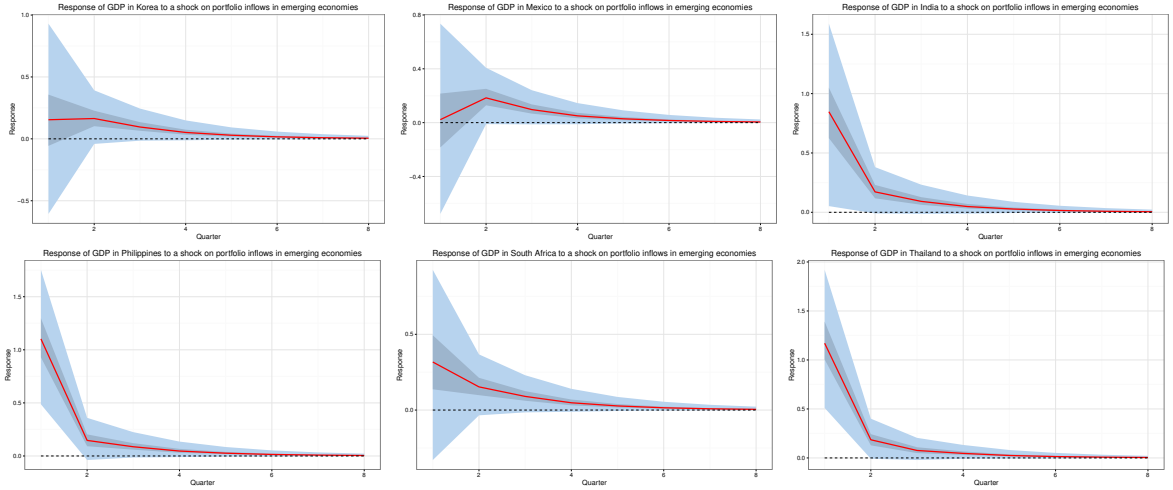
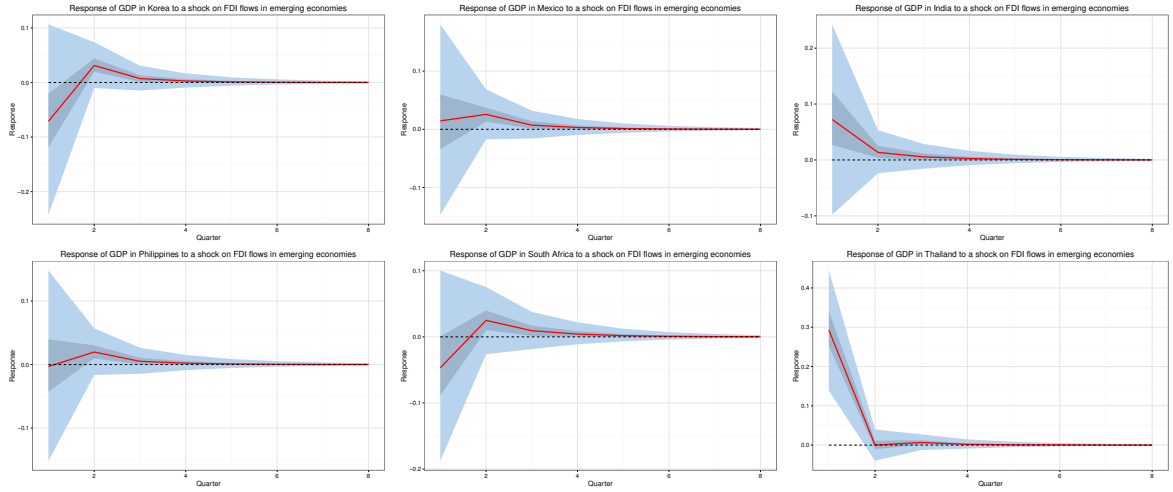


FIGURE 14 **Response of GDP in emerging economies to a shock on FDI flows in emerging economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on FDI flows in emerging economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net FDI flows and panel (b) to a shock on gross FDI flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net FDI flows:



(b) Gross FDI flows:

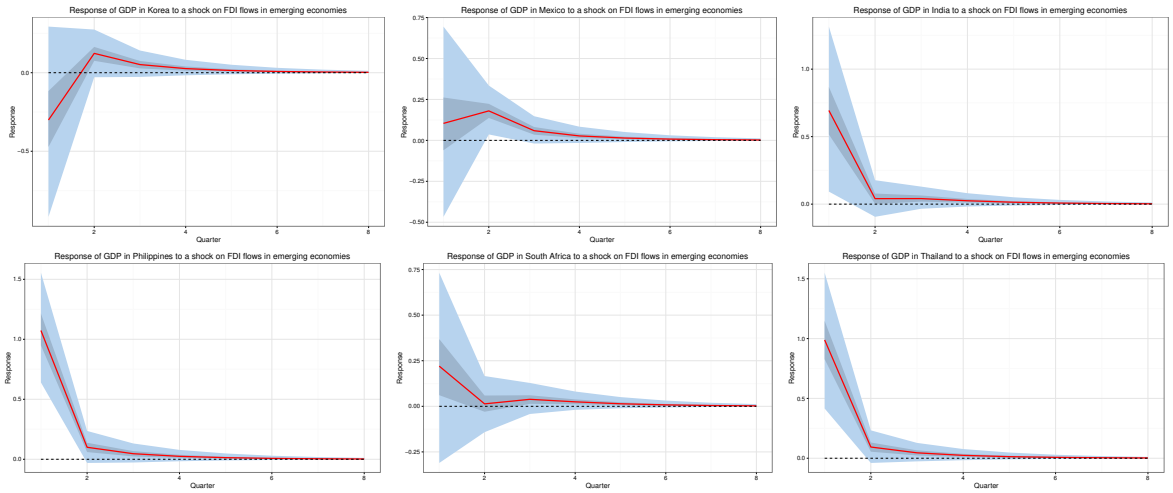
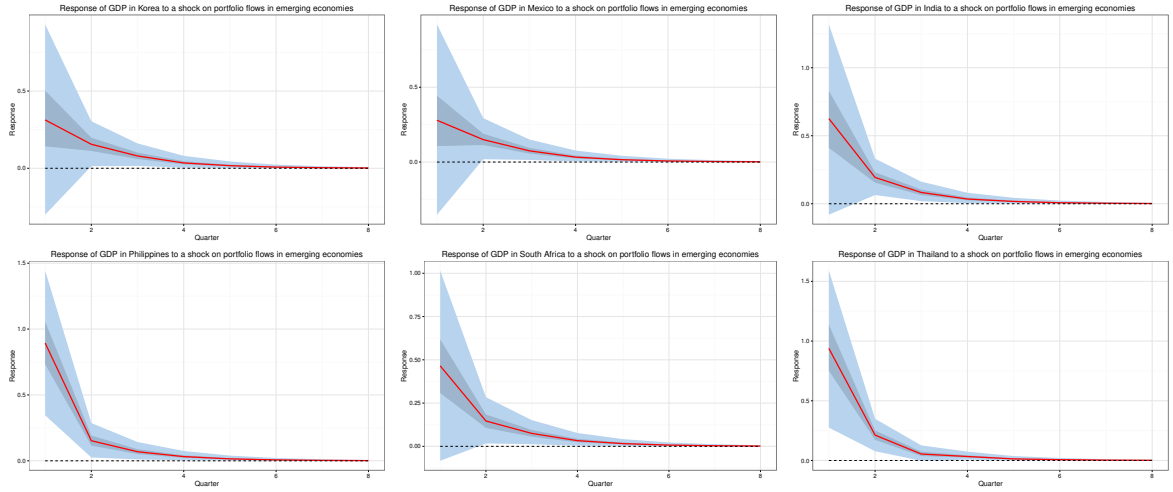


FIGURE 15 **Response of GDP in emerging economies to a shock on portfolio flows in emerging economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on portfolio flows in emerging economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net portfolio flows and panel (b) to a shock on gross portfolio flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net portfolio flows:



(b) Gross portfolio flows:

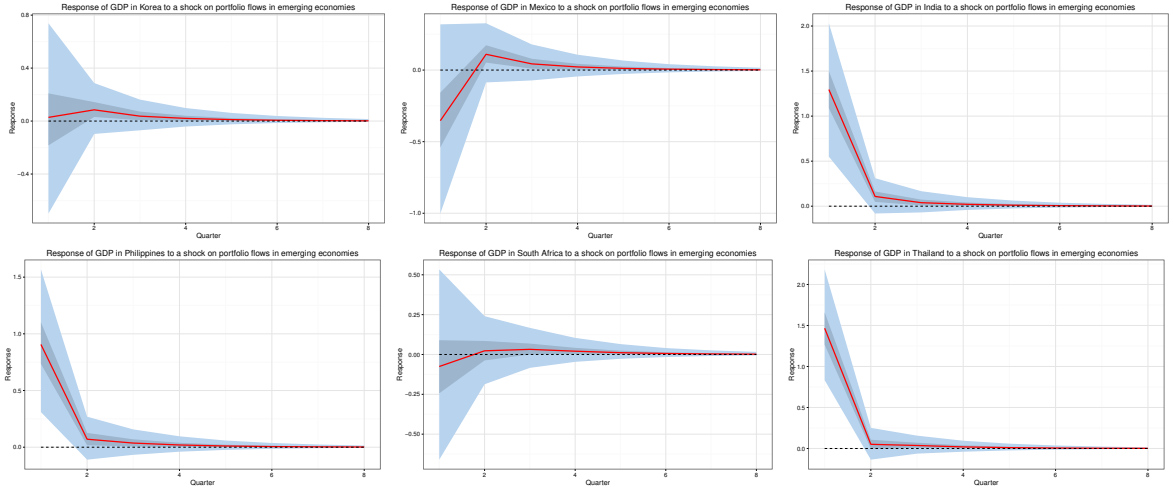
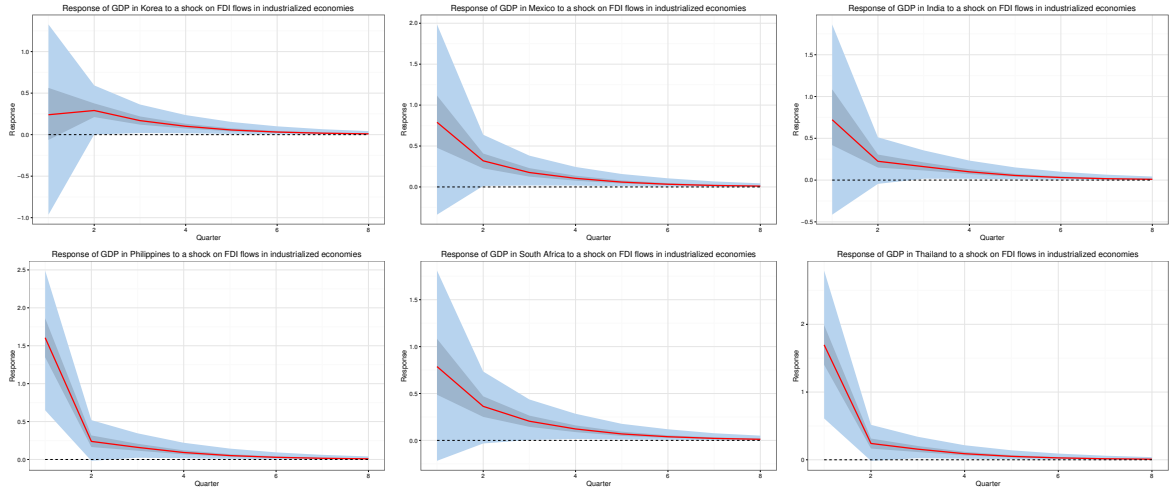


FIGURE 16 **Response of GDP in emerging economies to a shock on FDI flows in industrialized economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on FDI flows in industrialized economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net FDI flows and panel (b) to a shock on gross FDI flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net FDI flows:



(b) Gross FDI flows:

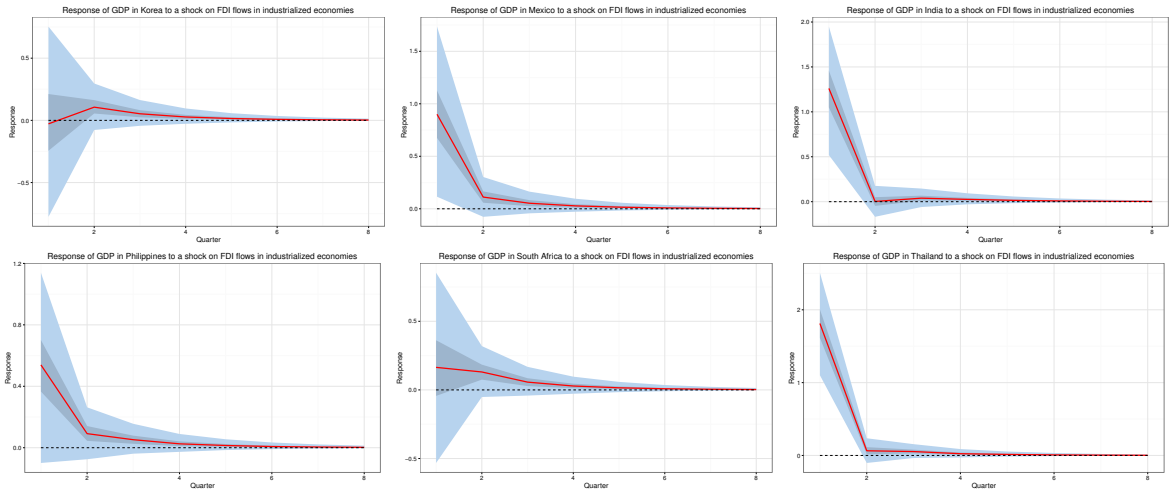
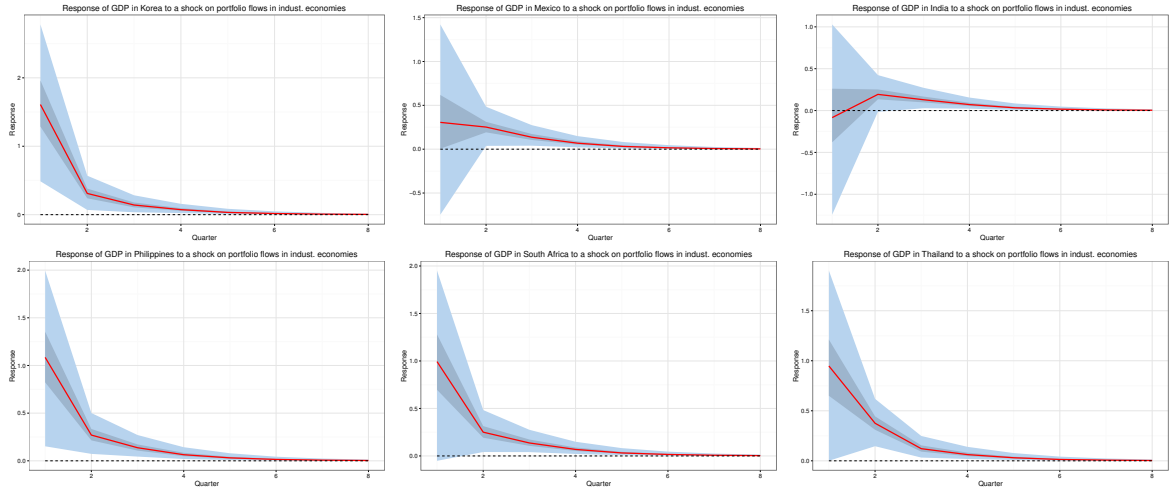


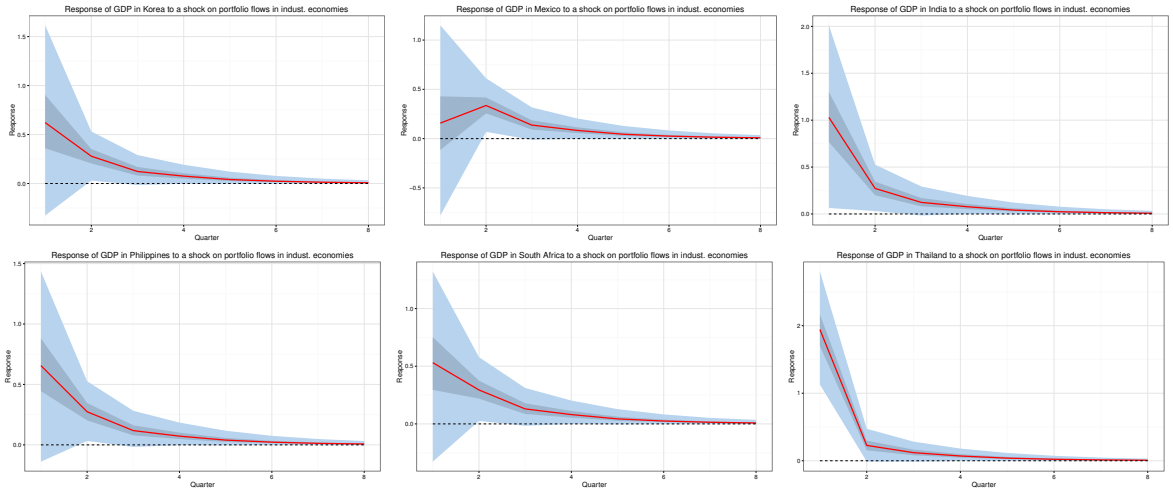
FIGURE 17 **Response of GDP in emerging economies to a shock on portfolio flows in industrialized economies**

The plots show the reaction of the emerging economies individual GDPs to a common shock on portfolio flows in industrialized economies. This response is shown for Korea, Mexico, India, the Philippines, South Africa, and Thailand as the emerging economies included in our study. Panel (a) gives the corresponding reaction to a shock on net portfolio flows and panel (b) to a shock on gross portfolio flows. The reaction is represented by the solid red line and the corresponding confidence bands by blue shadings (the 95% level in light blue and the 68% in gray blue). The dashed black line displays the zero line.

(a) Net portfolio flows:



(b) Gross portfolio flows:



Tables

TABLE 1 **Descriptive statistics of capital flows**

	Net capital flows					Gross capital flows				
	Min	**Max**	**Median**	**Mean**	**Std.dev.**	**Min**	**Max**	**Median**	**Mean**	**Std.dev.**
Australia	-8.1090	26.8290	5.1870	7.3561	6.3953	-77.3960	111.2924	13.4620	25.6996	28.8121
Austria	-11.4300	5.7720	0.1015	-0.4936	3.2484	-104.9276	219.3920	8.6420	15.91610	35.0280
Belgium	-11.4149	12.1693	-1.0548	-0.9391	3.4189	-202.4441	509.0036	42.7419	70.3123	109.3985
Canada	-12.0980	21.0869	1.6745	2.2823	8.0138	-16.2930	137.9030	22.6175	33.0256	29.0411
Denmark	-23.7399	15.5173	-0.2665	-0.8869	4.7234	-38.7231	70.7740	7.8605	11.1303	18.8544
Finland	-10.2035	29.2324	-0.8425	-0.1610	4.8642	-60.4829	145.4976	6.0950	12.4373	28.1863
France	-70.4800	87.4674	-2.3650	-0.6541	20.8322	-434.0520	565.7800	59.1950	96.1376	143.7859
Germany	-94.2200	59.9800	-12.6450	-19.3662	30.5590	-441.2186	619.0286	86.9800	108.8692	150.6786
Ireland	-15.9915	19.1101	0.0030	0.9078	5.1907	-175.7319	384.4030	22.4710	53.6914	84.4902
Japan	-78.4896	110.0200	-19.6500	-18.2399	26.8932	-213.4500	373.1253	55.9238	68.0595	107.8414
Netherlands	-31.8865	13.2325	-5.5340	-6.2298	8.7341	-464.7221	324.4210	38.2791	47.5625	93.5838
New Zealand	-8.5926	5.91884	0.7725	0.8073	1.9639	-9.8258	16.3299	1.2655	1.7751	3.8565
Norway	-27.2948	6.72900	-2.2085	-5.2789	7.5439	-58.1089	108.7640	7.3782	17.9420	30.3071
Portugal	-3.3480	8.59941	1.6910	2.0429	2.4298	-30.3387	50.1348	6.0400	7.9347	12.1008
Spain	-17.9159	55.5963	5.6375	8.0177	12.7229	-104.9230	226.6420	29.6915	40.9577	51.9359
Sweden	-21.6050	13.6280	-0.6970	-1.7696	6.5326	-59.4992	147.3120	15.6640	21.2955	27.9100
UK	-53.4491	114.0600	6.9782	10.4256	24.5800	-1452.2874	1747.3900	117.4750	176.6255	397.8869
US	-17.2900	298.0800	54.1061	83.0303	75.0361	-431.4185	1291.2000	241.6900	287.4785	291.1201
India	-5.3706	33.2240	2.7787	6.3904	8.0283	-1.5700	47.8252	3.8960	10.0990	12.5159
Korea	-37.6649	20.8494	0.7696	-0.3845	8.0725	-63.6734	55.6960	9.2695	11.2136	14.0424
Mexico	-13.8890	25.5294	5.0880	5.7340	7.2620	-11.7270	51.6090	6.8400	10.0220	11.5498
Philippines	-3.3500	6.77782	0.7735	0.7575	1.5849	-5.4570	10.0550	1.1359	1.4224	2.1393
South Africa	-2.0570	8.92952	0.7250	1.5135	2.3421	-12.1089	20.0260	2.7595	3.5993	4.5900
Thailand	-14.3078	12.3590	1.3980	1.0467	3.6931	-15.9097	24.0494	2.4160	3.5066	6.0573

Note: The table reports the minimum, the maximum, the median, the mean, and the standard deviation (Std.dev.) for net and gross capital flows for all economies under observation (i.e. industrialized and emerging economies) for the sample period running from 1988Q1 to 2013Q4.

TABLE 2 **Pesaran's cross-sectional dependence test**

Variable	**Test statistic**	***p*-value**
Net capital flows	-2.1406	0.0323
Gross capital flows	-1.9311	0.0535
GDP	8.9955	0.0000
Effective exchange rates	5.5281	0.0000
Currency reserves	38.1930	0.0000

Note: The table reports the test statistic and the corresponding *p*-value for the cross-sectional dependence test suggested by Pesaran *et al.* (2004). The test has been applied to the panel of the first differences of each variable as considered in our panel VAR model. The test tests the null hypothesis of cross-sectional independence. Therefore, a rejection implies cross-sectional dependence within the panel of countries considered.