Stock Returns and the Drivers of Portfolio Equity Flows in Emerging Markets *

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Abstract

This paper uses stock market returns to identify common (global) and idiosyncratic (domestic) factors in the portfolio equity inflows of emerging markets. The analysis covers 16 emerging markets from 1999 to 2015. A portfolio allocation model guides the identification strategy in vector autoregression models. The evidence is consistent with the predictions of the model. I find that global shocks mainly drive portfolio equity inflows, whereas global and domestic shocks drive stock market returns.

Keywords: Portfolio flows, total stock returns, push and pull factors, risk aversion.
JEL: F32, G11, G12, G15.

1 Introduction

Economic and financial variables of emerging markets react to both common and idiosyncratic factors. The literature studying capital flows call these push and pull factors, respectively. The push-pull framework has been widely used to study the drivers of international financial flows. This paper introduces stock market returns into the analysis and shows that they can be used to identify push and pull factors for emerging economies.

This paper proposes a simple methodology to identify push and pull factors using portfolio equity inflows and stock market returns. A portfolio allocation model guides the identification strategy. In the model, portfolio equity inflows and stock market returns are endogenous and the dynamics are driven by two types of shocks, dividend and risk aversion shocks. In

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equilibrium, stock market returns are influenced by the two shocks, while portfolio inflows are not contemporaneously affected by dividend shocks. I exploit this property to identify push and pull factors in recursive vector autoregression (VAR) models, in which portfolio equity inflows precede stock market returns.

I find that global shocks mainly drive portfolio equity inflows, whereas global and domestic shocks drive stock market returns. In particular, a reduction in the risk aversion of foreign investors increases both portfolio equity inflows and total stock returns contemporaneously, while an increase in dividends raises total stock returns and has no contemporaneous effect on portfolio equity inflows.

The analysis focuses on gross portfolio flows. Cross-border capital flows are often categorized into (i) portfolio flows, which can be either debt or equity flows; (ii) foreign direct investment (FDI), which involves controlling ownership in a firm abroad (usually 10% or more of voting shares); and (iii) other flows, which are mainly bank-intermediated funds (e.g. loans); international reserves—assets generally managed by central banks—are sometimes included as another class. Capital flows can also be categorized as gross inflows, or net purchases of domestic assets by foreign investors, and gross outflows, or net purchases of foreign assets by domestic investors. The difference between gross inflows and gross outflows is called *net* capital inflows. By the balance of payments identity, this difference is equal to minus the current account balance; for instance, a country with a current account deficit needs capital inflows to finance it so its net capital flows are positive. Early studies on capital flows in fact used net flows because they can be calculated using the more accessible current account information (Reinhart, Reinhart & Trebesch 2016) and because gross outflows were relatively small, thus usually ignored (Forbes & Warnock 2012). However, by their nature, net flows are limited by the size of the current account imbalance, while financial flows can be exchanged any number of times; thus, gross flows better reflect the sensitivity of a country's balance sheet to economic shocks (Obstfeld 2012). Indeed, most of the recent literature focuses on gross financial flows because net flows miss important dynamics. Foreign and domestic investors, for example, can respond differently to shocks (Forbes & Warnock 2012). In addition, although gross inflows and outflows generally comove, gross flows are more volatile than net flows (Broner et al. 2013).

In his survey of the empirical literature on the drivers of international financial flows to emerging markets, Koepke (2015) concludes that push factors matter most for portfolio flows, somewhat less for banking flows, and least for FDI, while pull factors matter for all three components, especially for banking flows. Meanwhile, Fratzscher (2012) finds that the relative importance of the drivers of financial flows varies over time; for instance, during the global financial crisis push factors were the main drivers, whereas in the recovery phase pull factors—like macroeconomic fundamentals—were the main drivers of portfolio flows.[1]

This paper is also related to the literature on the global financial cycle (Rey 2015), the widespread comovement in capital flows, asset prices, and credit growth across countries. At the heart of the cycle are two push factors, the Cboe's volatility index (Vix)[2] and the monetary policy of the U.S. (Forbes & Warnock 2012, Fratzscher 2012, Miranda-Agrippino & Rey 2015, Rey 2015). In particular, the cycle comoves negatively with the Vix and the monetary stance of the Federal Reserve, and their effects are particularly acute for emerging markets. When the Vix is relatively low or the U.S. monetary stance is eased, loose credit conditions in international financial markets translate into increases in financial flows to and asset prices in emerging markets. This elevates the price of collateral and fuels a reduction in credit spreads, which again increases credit availability. The mechanism is reversed when the Vix is relatively high or the U.S. monetary policy is tightend.

The rest of the paper is structured as follows. Section 2 develops the portfolio allocation model that guides the identification strategy. Section 3 describes the data sources and performs preliminary tests of the theoretical model. The empirical methodology is presented in section 4, and the results of the analysis are discussed in section 5. Section 6 concludes.

2 A Portfolio Allocation Model

This section describes a simple portfolio allocation model with two agents and two assets that is later used to inform the identification strategy in the empirical analysis.

Consider an economy with two types of investors, foreign and domestic, and a single consumption good. The domestic investor lives in a small open economy. The variables of the foreign investor are denoted with an asterisk.

The agents live for two periods. At the end of each period, a new generation of investors decides how to allocate their resources between a foreign risk-free asset and a domestic risky asset (equity) in order to maximize their utility in the next period. In other words, every period each type of investor solves a one-period portfolio allocation problem with two assets.

2.1 The Investors' Problem

The domestic investor allocates her wealth, W, between risky equity shares and risk-free bonds. Let A be the number of shares and M the number of risk-free bonds held by the

[1]Another robust finding in the literature is that during crises there is retrenchment towards home financial markets for every type of financial flow (Forbes & Warnock 2012, Fratzscher 2012, Broner et al. 2013).

[2]The Vix reflects the 30-day ahead implied volatility in traded options on the S&P 500 index. It is commonly used as a measure of risk aversion and economic uncertainty.

domestic investor. The price of the risk-free asset is normalized to 1 and the price of the risky asset is denoted by P. The budget constraint of a domestic investor borned at time t is thus

$$W_t = P_t A_t + M_t.$$

When the investor buys shares, she can have gains from both capital (difference in price) and dividends D, so her end-of-life budget constraint is given by

$$W_{t+1} = (P_{t+1} + D_{t+1}) A_t + R^* M_t = (P_{t+1} + D_{t+1}) A_t + R^* (W_t - P_t A_t),$$

where R^* is the time-invariant gross return on the foreign risk-free asset. Notice that the investor's wealth in her last period varies according to the number of shares she buys and the variability in the price and dividends; that is,

$$Var_t [W_{t+1}] = A_t^2 \sigma^2,$$

where $\sigma^2 = Var_t [P_{t+1} + D_{t+1}]$.

A mean-variance domestic investor solves the following problem

$$\max_{A_t} E_t [W_{t+1}] - \frac{\alpha}{2} Var_t [W_{t+1}],$$

where α measures the investor's risk aversion. Her demand for the risky asset is thus given by

$$A_t = \frac{E_t [P_{t+1} + D_{t+1}] - R^* P_t}{\alpha \sigma^2}.$$

The foreign investor is identical to the domestic investor except for her risk aversion, which is allowed to vary over time, so that the number of shares held by the two investors also vary over time. Accordingly, the foreign investor's demand for the risky asset is given by

$$A_t^* = \frac{E_t [P_{t+1} + D_{t+1}] - R^* P_t}{\alpha_t^* \sigma^2}.$$

As will become clear below, it is useful to re-scale the risk aversion of the foreign investor in terms of the aggregate risk aversion as follows

$$\chi_t = \frac{\alpha_t^*}{\alpha + \alpha_t^*}.$$

2.2 Equilibrium

Since there are only two investors, any amount borrowed by one is lent by the other, thus $M_t + M_t^* = 0$. Moreover, in equilibrium, the number of shares bought by both investors equal the total number of shares available, which is normalized to 1, so

$$A_t + A_t^* = 1. \tag{1}$$

Substituting the demands for the risky asset from both investors in the last equation gives the price of the risky asset

$$P_t = \frac{1}{R^*}\left(E_t\left[P_{t+1} + D_{t+1}\right] - \sigma^2 \alpha \chi_t\right). \tag{2}$$

Also, from the demands for the risky asset, we know that $A_t^*/A_t = \alpha/\alpha_t^*$, so that $1 + A_t^*/A_t = 1/\chi_t$. Combining this with equation (1) yields the demands for the risky asset as

$$\begin{aligned} A_t &= \chi_t, \\ A_t^* &= 1 - \chi_t. \end{aligned} \tag{3}$$

As a result, when the risk aversion of the foreign investor (α_t^*) increases, she will be less willing to hold the risky asset, allowing the number of shares held by the domestic investor (A_t) to increase.

2.3 Dynamics

The dynamics in the model are driven by two variables, the dividend paid by the risky asset and the re-scaled foreign risk aversion. Both variables are assumed to follow autoregressive processes of order one as follows

$$\begin{aligned} D_t &= \bar{D} + \rho_D\left(D_{t-1} - \bar{D}\right) + \epsilon_{D,t}, \\ \chi_t &= \bar{\chi} + \rho_\chi\left(\chi_{t-1} - \bar{\chi}\right) + \epsilon_{\chi,t}, \end{aligned} \tag{4}$$

where $\epsilon_{D,t} \sim N\left(0, \sigma_D^2\right)$ and $\epsilon_{\chi,t} \sim N\left(0, \sigma_\chi^2\right)$; both shocks are assumed to be serially and mutually uncorrelated. Since the risky asset is domestic and the risk-free bond is foreign, the shock to dividends, $\epsilon_{D,t}$, and the shock to the re-scaled risk aversion, $\epsilon_{\chi,t}$, are associated with idiosyncratic (pull) and common (push) drivers of the portfolio flows, respectively.

Substituting both processes into equation (2) gives the price of the risky asset in terms of the model parameters and variables known in period t,

$$P_t = \bar{P} + \frac{\rho_D}{R^* - \rho_D}\left(D_t - \bar{D}\right) - \frac{\sigma^2\alpha}{R^* - \rho_\chi}\left(\chi_t - \bar{\chi}\right), \tag{5}$$

where

$$\bar{P} = \frac{\bar{D} - \sigma^2\alpha\bar{\chi}}{R^* - 1}.$$

The price of the risky asset is thus endogenous and is influenced by both dividend and risk aversion shocks.

Equation (5) is key in determining other relevant variables. The first is the *total* return (capital gains plus dividends) on the risky asset, defined as $R_t = (P_t + D_t)/P_{t-1}$. Second, the parameter σ^2 (the variance of the price and dividends in period $t+1$) is determined by substituting equations (4) and (5) into the definition of σ^2 to get

$$\sigma^2 = \left(\frac{R^*\sigma_D}{R^* - \rho_D}\right)^2 + \left(\frac{\alpha\sigma_\chi}{R^* - \rho_\chi}\right)^2\sigma^4,$$

which is a quadratic equation in σ^2; it is assumed henceforth that σ^2 is equal to the lowest positive root of the equation. Finally, gross equity inflows, IF_t, are equal to the change in the value of the equity shares held by the foreign investor, that is,

$$IF_t = P_t\left(A_t^* - A_{t-1}^*\right) = P_t\left(-\Delta\chi_t\right), \tag{6}$$

where $\Delta\chi_t$ is the one-period difference in the re-scaled foreign risk aversion. Accordingly, an increase in the risk aversion of the foreign investor reduces gross equity inflows.

The model now provides a way to measure the exogenous push factor. While gross equity inflows (IF_t) and the total return on the risky asset (R_t) are affected by dividend and risk aversion shocks, the number of shares held by the investors (A_t and A_t^*) is not influenced by dividend shocks. As a result, gross equity inflows net of valuation effects, IF_t/P_t, are only affected contemporaneously by shocks to the (re-scaled) foreign risk aversion. In this sense, gross equity inflows net of valuation effects are a way to measure the exogenous push factor since IF_t/P_t, unlike R_t, is completely isolated from idiosyncratic (dividend) shocks. This comes directly from equation (3); the model allows the foreign investor to make changes in her holdings of the risky asset based on changes in her risk aversion regardless of changes in the dividend paid by the domestic risky asset.

2.4 Simulations

The model is calibrated to reflect the correlation between gross equity inflows and total stock returns observed in the data as well as some statistical moments of the dividend yield, D_t/P_t.

Table 5 in section 3 shows that the correlation between gross equity inflows and total stock returns is equal to 0.21. In addition, a high dividend yield in the U.S. seems a good approximation for a medium dividend yield in emerging markets. Gomes, Kogan & Zhang (2003) and Conover, Jensen & Simpson (2016) report an average dividend yield in the U.S. of 4.3% with a standard deviation of 1.4%, as well as the first three autocorrelations equal to 0.60, 0.36 and 0.26. Table 1 shows the parameters used to calibrate the model.

$\bar{D}$	ρ_D	σ_D	$\bar{\chi}$	ρ_χ	σ_χ	α	R^*
3	0.6	0.1	0.7	0.5	0.05	10	1.04

Table 1: Calibration of Parameters

Figures 1 and 2 show the impulse response functions implied by the model for the price, total stock returns and gross equity inflows to dividend and risk aversion shocks, respectively. It is assumed that each process is hit by a one-standard-deviation shock at period 0.

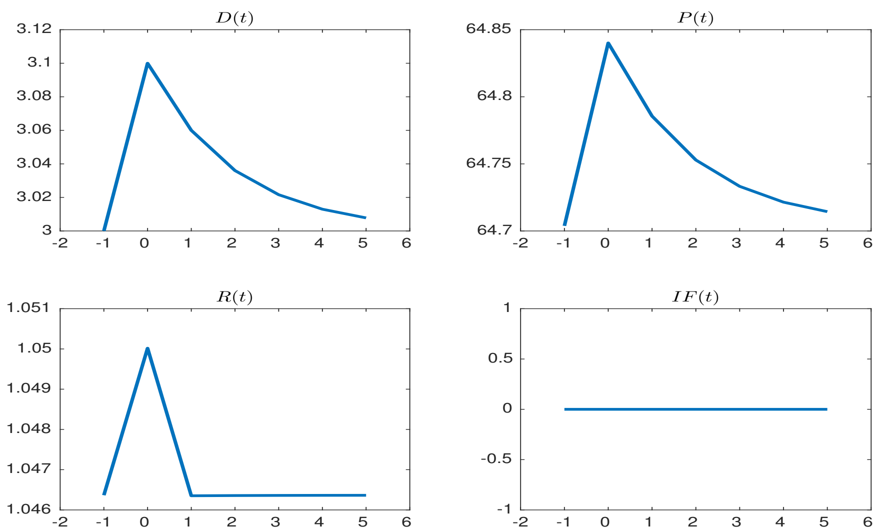

Figure 1: Impulse Responses to a Positive Dividend Shock

Figure 1 shows that a positive dividend shock increases the price of the risky asset contemporaneously. Given the positive relationship between P_t and R_t, the total return on the risky asset also increases at the time of the shock but returns to its pre-shock level in the next period. Finally, as explained above, gross equity inflows do not react at all to a dividend shock. This property is exploited later in the identification strategy.

Due to its usefulness for the analysis in section 5, figure 2 shows the effects of a decline in the risk aversion of the foreign investor (a *negative* risk aversion shock). At the time of the shock, the price of the risky asset, the total return and equity inflows all three increase. However, due to the negative relationship between R_t and P_{t-1} and the positive relationship between IF_t and χ_{t-1}, both the total return and equity inflows decline one period after the shock. Intuitively, after the shock, the total return is lower given the euphoria caused by the reduction in the risk aversion of the foreign investor who, as a result, reduces her holdings of the risky asset. The resulting decline in gross equity inflows one period after the shock, however, does not completely offset the strong increase at the time of the shock.

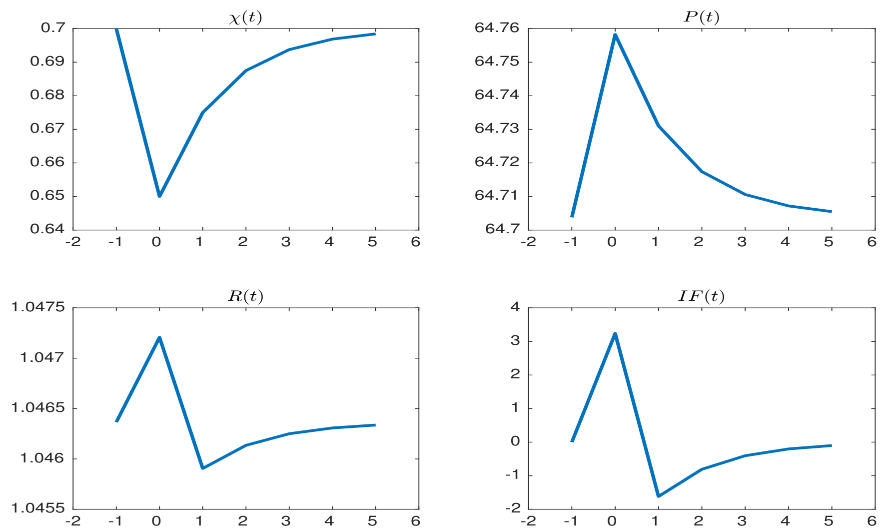

Figure 2: Impulse Responses to a Negative Risk-Aversion Shock

The same calibration is now used to perform $100,000$ simulations of the variables in the model. Table 2 reports the means and standard deviations of the simulated variables. The calibration implies that $\bar{P} = 64.7$ and, thus, an average dividend yield of 4.64%. Also the first three autocorrelations (not reported) of the simulated dividend yield are equal to 0.599, 0.3593 and 0.2156, which are very close to the ones reported by Gomes, Kogan & Zhang (2003); however, the model had difficulty replicating the 1.4% standard deviation of the dividend yield mentioned above. Finally, it is worth highlighting that the standard deviation of gross equity inflows net of valuation effects (IF_t/P_t) is less than 2% that of gross equity inflows (IF_t).

	P_t	R_t	IF_t	IF_t/P_t	D_t/P_t	D_t	χ_t	$\Delta\chi_t$
Mean	64.704	1.046	0.002	0	0.046	3.001	0.7	0
Std. Dev.	0.182	0.004	3.741	0.058	0.002	0.125	0.058	0.058

Table 2: Statistics from Simulations

Table 3 shows the correlations of the simulated variables.[3] Consistent with the calibration of the parameters, the correlation from the simulations between gross equity inflows and

[3]Except for the correlation between gross equity inflows and total stock returns, the results are robust to different combinations of the parameters.

total stock returns is close to the sample correlation reported in the next section (table 5). Also, in line with the assumptions and results of the model, the correlation between the two types of shocks is close to zero and the correlations of IF_t (and IF_t/P_t) with D_t and, most importantly, with $\epsilon_{D,t}$ are close to zero. What is worth pointing out is that there is a perfect correlation between IF_t and IF_t/P_t. Thus, according to the model, IF_t can also be considered as contemporaneously isolated from dividend shocks as IF_t/P_t.

	P_t	R_t	IF_t	IF_t/P_t	D_t/P_t	D_t	χ_t	$\Delta\chi_t$	$\epsilon_{D,t}$	$\epsilon_{\chi,t}$
P_t	1									
R_t	0.764	1								
IF_t	0.168	0.259	1							
IF_t/P_t	0.168	0.259	1	1						
D_t/P_t	0.929	0.765	-0.019	-0.019	1					
D_t	0.938	0.768	-0.006	-0.006	1	1				
χ_t	-0.347	-0.125	-0.499	-0.499	0.026	0.001	1			
$\Delta\chi_t$	-0.168	-0.259	-1	-1	0.019	0.006	0.499	1		
$\epsilon_{D,t}$	0.751	0.965	-0.005	-0.005	0.8	0.8	-0.002	0.005	1	
$\epsilon_{\chi,t}$	-0.297	-0.222	-0.866	-0.866	0.026	0.004	0.866	0.866	0.002	1

Table 3: Correlations from Simulations

3 Assessing the Implications of the Model

This section describes the data used in the analysis and tests the implications of the portfolio allocation model using panel regressions with country fixed effects. The evidence is in line with the predictions of the model.

3.1 Data

The sample starts in the second quarter of 1999 and ends in the third quarter of 2015. The analysis is conducted for 16 emerging markets: Argentina, Chile, China, Colombia, Czech Republic, Hungary, Indonesia, Korea, Mexico, Peru, Philippines, Russia, South Africa, Taiwan, Thailand, and Turkey. Countries were selected based on data availability for the sample period.

Gross portfolio equity flows are obtained from the IMF balance of payments statistics, they are expressed in current U.S. dollars (USD) and scaled by each country's nominal GDP (also in current USD).

To account for *both* capital and dividend gains when investing in emerging markets, I use the MSCI total return index in USD net of taxes for the stock market of each emerging economy in the sample.[4] The log difference of the index is used to approximate the total stock return for a country. Unfortunately, the decomposition of the index into indexes for P_t and D_t is not publicly available, which restricts constructing the gross equity inflows net of valuation effects (IF_t/P_t). Notwithstanding, based on the results from the simulations of the model, I use the the gross equity inflows directly (i.e. IF_t instead of IF_t/P_t).

Data on real GDP growth and the nominal exchange rate (local currency per USD) is taken from the IMF international financial statistics. To be able to compare the results on the exchange rate, I standardize the nominal exchange rate for each country.

The Cboe's volatility index (Vix) is used as a measure of risk aversion and economic uncertainty. Meanwhile, the effective federal funds rate (EFFR) calculated by the New York Fed is used to measure the stance of monetary policy in the U.S. Since the Vix and the EFFR are available daily, their average over the quarter is used as their quarterly values.

Finally, the Chinn–Ito index (Chinn & Ito 2008) is used as a measure of financial openness. The index is standardized between 0 and 1, a higher value means a more financially-open country. Since the index has an annual frequency, linear interpolation is used to get a quarterly frequency.

3.1.1 Summary Statistics

Table 4 presents summary statistics of the variables. Relative to GDP growth, total stock returns are lower on average but much more volatile. Similarly, relative to portfolio equity *outflows* as a share of GDP, equity inflows are lower on average but slightly more volatile. Also notice that the percentage change of the Vix, a proxy for the *change* in the risk aversion of the foreign investor in the model, is close to zero on average but is very volatile. Finally, the countries in the sample are on average mid-way regarding financial openness according to the Chinn–Ito index.

Table 5 shows the correlation between the variables. As can be seen, total stock returns and portfolio equity flows covary negatively with the Vix, whereas their correlation with the *percentage change* of the Vix is still negative but stronger. The signs of these unconditional correlations remain after controlling for different variables as shown next.

3.2 Conditional Correlations

The implications of the portfolio allocation model regarding risk-aversion shocks can be tested using panel regressions with country fixed effects. The model predicts that portfolio equity inflows, IF_t, are inversely related to the contemporaneous risk aversion of the foreign

[4] The results are robust to using the gross (instead of net) total return index.

Variable	Obs	Mean	Std. Dev.	Min	Max
Net Total Stock Returns	1056	2.17	17.53	-71.96	81.07
Equity Inflows %GDP	1056	0.50	2.01	-14.60	14.79
Equity Outflows %GDP	1030	0.70	1.96	-14.68	16.53
Vix	1056	20.85	8.07	11.03	58.60
% Change in Vix	1040	-0.36	21.95	-49.75	84.89
Effective Fed Funds Rate	1056	2.07	2.15	0.07	6.51
Stand. Exchange Rate	1056	-0.03	0.96	-2.14	3.73
GDP Growth	1056	4.23	3.90	-16.34	16.24
Chinn–Ito Index	1056	0.51	0.30	0.00	1.00

Table 4: Summary Statistics

	Vix	%Vix	TR	IF	OF	FED	ZFX	%Y	C-I
Vix	1								
% Change in Vix	0.38	1							
Net Total Stock Returns	-0.26	-0.46	1						
Equity Inflows %GDP	-0.16	-0.22	0.21	1					
Equity Outflows %GDP	-0.07	-0.11	0.12	0.17	1				
Effective Fed Funds Rate	-0.11	0.11	-0.03	0.08	0.06	1			
Stand. Exchange Rate	0.09	0.05	-0.07	0.04	-0.05	-0.01	1		
GDP Growth	-0.3	0.06	0.04	0.06	-0.02	0.19	-0.04	1	
Chinn–Ito Index	-0.02	0.01	0.02	-0.1	0.14	-0.06	0	-0.15	1

Table 5: Correlations

investor, χ_t, but positively related to its one-period lag, χ_{t-1}. It also predicts that the total stock return, R_t, increases with the price of the risky asset, P_t, but decreases with its one-period lag, P_{t-1}. Since P_t is negatively related to χ_t (see equation (5)), it follows that R_t decreases with χ_t and increases with χ_{t-1}. Therefore, IF_t and R_t react in the same direction to changes in χ_t and χ_{t-1} (see figure 2). To test these implications, the (log of the) Vix is assumed to be a measure of the re-scaled foreign risk aversion, χ_t.

Tables 6 and 7 report the correlation of the total stock returns and portfolio equity inflows, respectively, with the Vix conditioning on different variables.[5] As can be seen, the implications of the model hold under different specifications. Both variables react negatively to an increase in $\log(Vix_t)$ and positively to an increase in $\log(Vix_{t-1})$. In all cases, the effects are statistically significant.

The results in tables 6 and 7 also provide valuable insights about the role of push and pull factors for portfolio equity flows and stock market returns. While the exchange rate and

[5]Table 7 is similar in spirit to Eichengreen, Gupta & Masetti (2017), and is consistent with their table 12. However, they do not consider the effect of $\log(Vix_{t-1})$.

	Dependent Variable: Net Total Stock Returns					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(Vix_t)$	-38.611***	-38.63***	-38.627***	-38.292***	-38.363***	-38.048***
	(2.284)	(2.29)	(2.292)	(2.294)	(2.297)	(2.298)
$\log(Vix_{t-1})$	33.598***	33.64***	33.55***	34.381***	33.408***	34.26***
	(2.277)	(2.302)	(2.355)	(2.334)	(2.355)	(2.334)
Fed Funds Rate		0.028	0.025	-0.048	0.021	-0.052
		(0.224)	(0.23)	(0.229)	(0.23)	(0.229)
Lag GDP Growth			-0.017		-0.026	
			(0.144)		(0.144)	
Lag Chinn–Ito I.			-0.97		-1.132	
			(3.68)		(3.678)	
GDP Growth				0.295**		0.288*
				(0.147)		(0.147)
Chinn–Ito Index				0.576		0.546
				(3.814)		(3.812)
Std. FX					-0.785	-0.75
					(0.499)	(0.498)
Constant	16.592***	16.465***	17.304***	11.856**	17.051***	11.528**
	(4.418)	(4.533)	(5.448)	(5.622)	(5.446)	(5.622)
R-squared	0.2209	0.2209	0.2202	0.223	0.222	0.2248
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1040	1040	1040	1040	1040	1040
N	16	16	16	16	16	16

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Correlates of Total Stock Returns

the federal funds rate play no role in explaining stock market returns, they are important for portfolio equity flows, even after controlling for the Vix. The opposite is true for GDP growth.

These results are robust to an alternative specification. The portfolio allocation model predicts a negative correlation between portfolio equity flows and the change in the risk aversion of the foreign investor (IF_t and $\Delta\chi_t$), since portfolio equity inflows are determined by minus the difference in the re-scaled foreign risk aversion (see equation (6)). The same can be shown to be true for R_t.

Tables 8 and 9 in the Annex present equivalent results to those in tables 6 and 7 but for the log difference of the Vix. Again, the results confirm the implications of the model. Stock market returns and portfolio equity flows react negatively to an increase in the (percentage) change of the Vix.

In summary, the evidence from panel regressions is consistent with the predictions of the

	Dependent Variable: Gross Portfolio Equity Inflows %GDP					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(Vix_t)$	-2.23***	-2.281***	-2.278***	-2.258***	-2.319***	-2.299***
	(0.265)	(0.265)	(0.265)	(0.266)	(0.265)	(0.266)
$\log(Vix_{t-1})$	1.65***	1.762***	1.738***	1.82***	1.76***	1.841***
	(0.264)	(0.266)	(0.272)	(0.27)	(0.272)	(0.27)
Fed Funds Rate		0.075***	0.079***	0.071***	0.079***	0.072***
		(0.026)	(0.027)	(0.027)	(0.027)	(0.026)
Lag GDP Growth			-0.009		-0.008	
			(0.017)		(0.017)	
Lag Chinn–Ito I.			0.172		0.197	
			(0.426)		(0.425)	
GDP Growth				0.02		0.021
				(0.017)		(0.017)
Chinn–Ito Index				0.297		0.302
				(0.442)		(0.441)
Std. FX					0.123**	0.125**
					(0.058)	(0.058)
Constant	2.211***	1.877***	1.882***	1.405**	1.922***	1.46**
	(0.513)	(0.524)	(0.63)	(0.651)	(0.629)	(0.65)
R-squared	0.0569	0.0634	0.0572	0.054	0.06	0.0576
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1040	1040	1040	1040	1040	1040
N	16	16	16	16	16	16

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Correlates of Portfolio Equity Inflows

portfolio allocation model of section 2.

4 Empirical Methodology

This section explains the models used to identification the push and pull factors, namely recursive and panel VAR models.

4.1 Recursive VAR Model

Consider the following structural VAR model for n variables with p lags and sample size T,

$$B_0 y_t = b + B_1 y_{t-1} + \ldots + B_p y_{t-p} + w_t, \quad t = 1, \ldots, T, \tag{7}$$

where y_t is a $(n \times 1)$ vector of endogenous variables, b is a $(n \times 1)$ vector of structural parameters, B_i is a $(n \times n)$ matrix of structural parameters for $i = 0, 1, \ldots, p$; in particular, B_0 is an invertible matrix governing the contemporaneous interactions between the variables in the structural model (Kilian & Lütkepohl 2017). Finally, w_t is a $(n \times 1)$ vector of structural shocks that, conditional on past information and the initial conditions $y_0, \ldots, y_{1-p}$, is normally distributed with mean zero and covariance matrix equal to the identity matrix I_n.

The reduced-form representation of the structural model in (7) is given by

$$y_t = c + A_1 y_{t-1} + \ldots + A_p y_{t-p} + u_t, \quad t = 1, \ldots, T, \tag{8}$$

where $A_j = B_0^{-1} B_j$ for $j = 1, \ldots, p$, $c = B_0^{-1} b$, $u_t = B_0^{-1} w_t$ and $E_t [u_t u_t'] = \Sigma = (B_0' B_0)^{-1}$. That is, A_j, c and Σ contain structural parameters and the reduced-form innovations u_t are a weighted average of the structural shocks w_t.

A common way to identify w_t from u_t is to impose a recursive structure on the contemporaneous relations between the variables. In this way, the innovations in the reduced-form model (8) are orthogonalized using a Cholesky decomposition of the covariance matrix Σ. The ordering of the variables in the VAR is thus relevant. This approach implicitly assumes that the first variable is exogenous to the other variables, the second variable is exogenous to the third up to the last one, and so on.

4.1.1 A Simple Strategy to Identify Push and Pull Factors

Let y_t contain portfolio equity inflows net of valuation effects and stock market returns (so $n = 2$). According to the portfolio allocation model in section 2, total stock returns (R_t) are affected by dividend and risk aversion shocks, whereas portfolio equity inflows net of valuation effects (IF_t/P_t) are not contemporaneously influenced by dividend shocks, so the model suggests the ordering of the two variables. Namely, according to the model, portfolio equity inflows net of valuation effects should precede total stock returns in the reduced-form version of the VAR model.

Although an index for the price of the risky asset (P_t), necessary to compute the portfolio equity inflows net of valuation effects, is not available, the results from the simulations in section 2.4 suggest that portfolio equity inflows can be used instead. Therefore, in the absence of IF_t/P_t, the identification strategy relies on the variables IF_t and R_t, in that order.

4.2 Panel VAR Model

Panel VAR models are useful to study the interactions between different units, countries in this case. A panel VAR model consists of N units each one having n endogenous variables, with p lags, over T periods.

A standard way to estimate panel VAR models is to use the mean-group estimator described in Pesaran & Smith (1995). This framework assumes that both the VAR coefficients and the covariance matrix are heterogeneous across units but share a common mean.

If each unit responds to itself, the model for each unit i is

$$y_{i,t} = A_i^1 y_{i,t-1} + \ldots + A_i^p y_{i,t-p} + \varepsilon_{i,t}, \quad t = 1, \ldots, T,$$

where $y_{i,t}$ is a $(n \times 1)$ vector containing the endogenous variables of unit i, A_i^k is a $(n \times n)$ matrix of coefficients for $k = 1, \ldots, p$, and $\varepsilon_{i,t}$ is a $(n \times 1)$ vector of residuals with $\varepsilon_{i,t} \sim N(0, \Sigma_i)$.

Stacking over the T sample periods, the model for unit i can be re-written as (see Dieppe, Legrand & van Roye 2016)

$$y_i = \bar{X}_i \beta_i + \varepsilon_i, \tag{9}$$

where y_i is a $(nT \times 1)$ vector, $\bar{X}_i$ is a $(nT \times q)$ matrix with $q = n^2 p$, β_i is a $(q \times 1)$ vector, and ε_i is a $(nT \times 1)$ vector with $\varepsilon_i \sim N(0, \Sigma_i \otimes I_T)$.

The mean-group estimator assumes that the vector β_i for each unit i can be decomposed into a common element and an idiosyncratic one, so that

$$\beta_i = b + b_i,$$

where b is the mean or average effect and $b_i \sim N(0, \Sigma_b)$.

To obtain an estimate of b, one first estimates β_i for each unit i by OLS. The mean-group estimator for b is then obtained as their average,

$$\hat{b} = \frac{1}{N} \sum_{i=1}^{N} \hat{\beta}_i.$$

The standard error for the mean-group estimator is given by

$$\hat{\Sigma}_b = \frac{1}{N(N-1)} \sum_{i=1}^{N} \left(\hat{\beta}_i - \hat{b}\right) \left(\hat{\beta}_i - \hat{b}\right).$$

5 VAR Analysis

This section presents the estimation of the push and pull factors. The evidence is consistent with the predictions of the portfolio allocation model, and indicates that push shocks mainly drive portfolio equity inflows, whereas push and pull shocks drive stock market returns.

The results are reported in three stages. The impulse response functions to the two shocks from recursive and panel VAR models are analyzed first, followed by a variance decomposition analysis to see the relative importance of the shocks. Finally, the correlations between the estimated structural shocks and the Vix are reported.

5.1 Impulse Responses

The reduced-form VAR model in (8) is estimated for each of the 16 emerging markets with portfolio equity inflows and total stock returns, in that order, as endogenous variables. This implements the strategy described in section 4.1.1 and thus allows me to identify the structural shocks, which will be referred to as push and pull shocks henceforth, respectively. The optimal lag for all the countries in the sample is $p = 1$ according to the Bayesian information criterion, which is not surprising given the nature of the endogenous variables, portfolio flows and stock returns.

Figures 5-8 in the Annex present the impulse responses (with 95% confidence intervals) for all the countries in the sample. Since the model in (8) is estimated individually, it is possible to estimate it for some countries not included in the panel due to data availability and only as a robustness check. The additional countries are Brazil, India, Malaysia, and Poland;[6] their impulse responses are shown in figure 9.

In general, the empirical impulse responses are consistent with the theoretical impulse responses in figures 1 and 2. In most countries, a positive push shock increases both portfolio equity inflows and total stock returns contemporaneously; note that a positive push shock here is equivalent to a *negative* (re-scaled) foreign risk aversion shock in the portfolio allocation model. Exceptions to this pattern are observed for Chile and Colombia where total stock returns *decrease* after a positive push shock. For some countries, the response after a push shock points slightly in the opposite direction in line with the theoretical response. Meanwhile, a positive pull shock increases total stock returns and (by construction) has no contemporaneous effect on portfolio equity inflows; after the shock, however, the effect on portfolio equity inflows is ambiguous.

The panel VAR model is estimated using the same variables and lag for four groups of countries: all 16 countries, Asia, Latin America, and Europe & Middle East.[7] The respective impulse response functions are shown in figures 10 and 11.

Again, the empirical impulse responses are line with the theoretical impulse responses

[6]Data on total stock returns for Brazil and India is available from 2001 Q1 onwards. Data on portfolio equity flows for Malaysia is available from 2002 Q1 to 2009 Q4 and for Poland from 2000 Q1 onwards.

[7]Asia: China, Indonesia, Korea, Philippines, Taiwan, and Thailand. Latin America: Argentina, Chile, Colombia, Mexico, and Peru. Europe & Middle East: Czech Republic, Hungary, Russia, and Turkey.

in general. A positive push shock increases both portfolio equity inflows and total stock returns contemporaneously, except for Latin America which reflects the responses of Chile and Colombia identified above. A positive pull shock increases total stock returns contemporaneously. Unlike the impulse responses from the recursive VAR, now the response *after* a positive pull shock on portfolio equity inflows is no longer ambiguous in three of the four groups. Portfolio equity inflows increase following a positive pull shock; the effect, however, is quantitatively small.[8]

In summary, the empirical impulse responses are consistent with the predictions of the portfolio allocation model.

5.2 Variance Decompositions

The estimation of the recursive and panel VAR models produces an estimate for the structural shocks every period. The estimated shocks from both models are similar. To save space, this subsection and the next use the estimated shocks from the individual recursive VAR models.

Figures 3 and 4 display the historical decompositions for portfolio equity inflows and the total stock returns, respectively. The contribution of push shocks is shown in blue, the contribution of pull shocks is shown in red and the contribution of the deterministic part is shown in green.

The decompositions show that portfolio equity inflows are mainly driven by push shocks. These results are in line with the findings summarized by Koepke (2015), namely that push factors matter most for portfolio flows. Meanwhile, total stock returns are mainly influenced by pull shocks but push shocks also play an important role in the stock market returns of some regions, especially in Asia, and over some periods of time, like in Korea, Thailand and Turkey during the global financial crisis.

5.3 Correlations

The final step in the analysis is to compare the estimated push and pull shocks agains the Vix to see the extent to which the it can be associated with push shocks.

Table 10 shows the correlations of the Vix with the estimated push and pull shocks in portfolio equity inflows and total stock returns.[9] With the exception of the stock returns of Colombia, the correlations of the Vix with the push shocks in both variables is positive,

[8] Compare, for example, the reaction of portfolio equity inflows to a push shock.

[9] As noted above, a positive push shock in the VAR models is equivalent to a negative risk aversion shock in the portfolio model. To compare them with the Vix, the estimated push shocks are multiplied by -1.

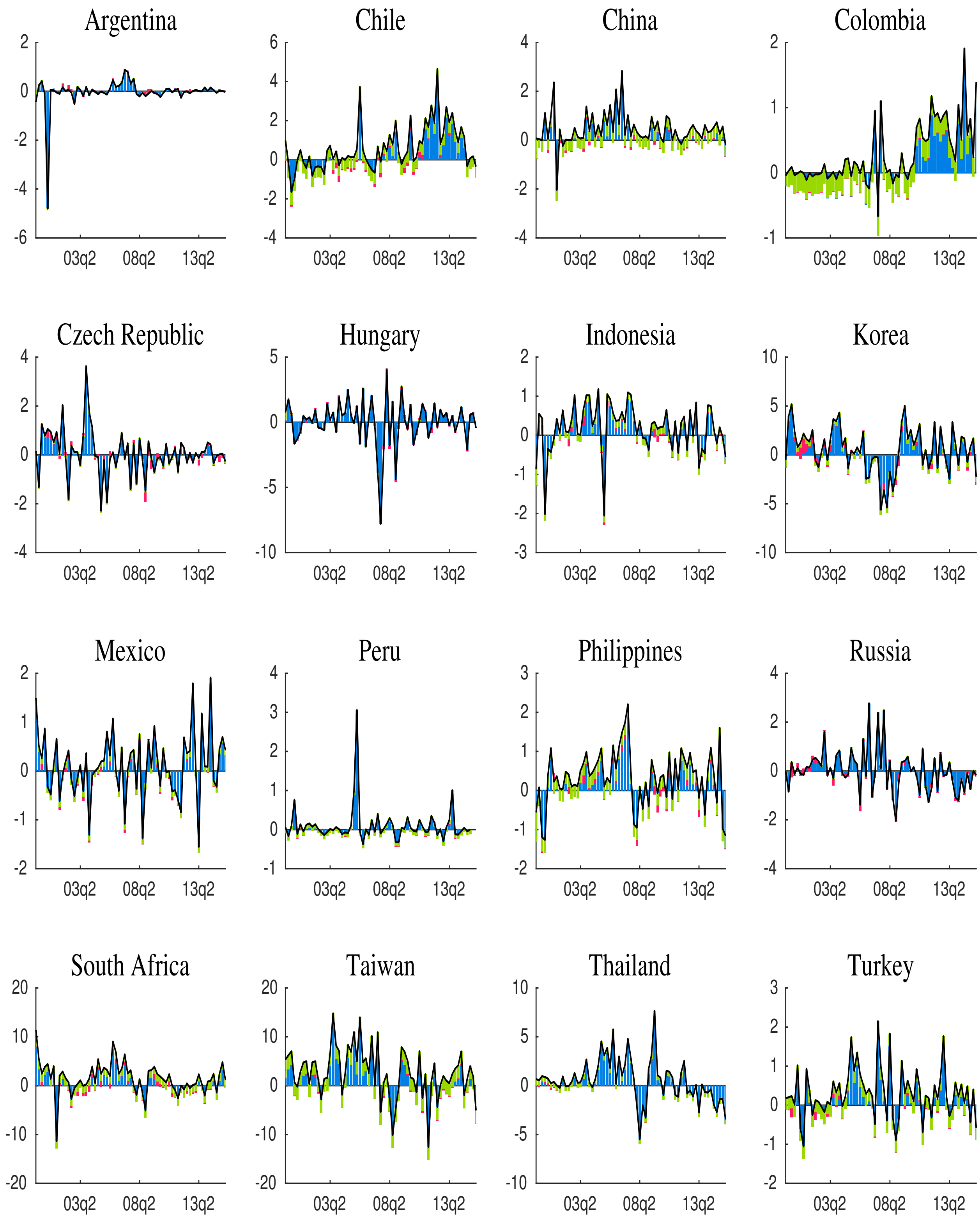

Figure 3: Historical Shock Decomposition for Portfolio Equity Inflows (as %GDP)
The contribution of push shocks is shown in blue, the contribution of pull shocks is shown in red and the contribution of the deterministic part is shown in green. The solid line represents the total. The x-axis displays the date in quarters, while the y-axis is measured in percent of GDP.

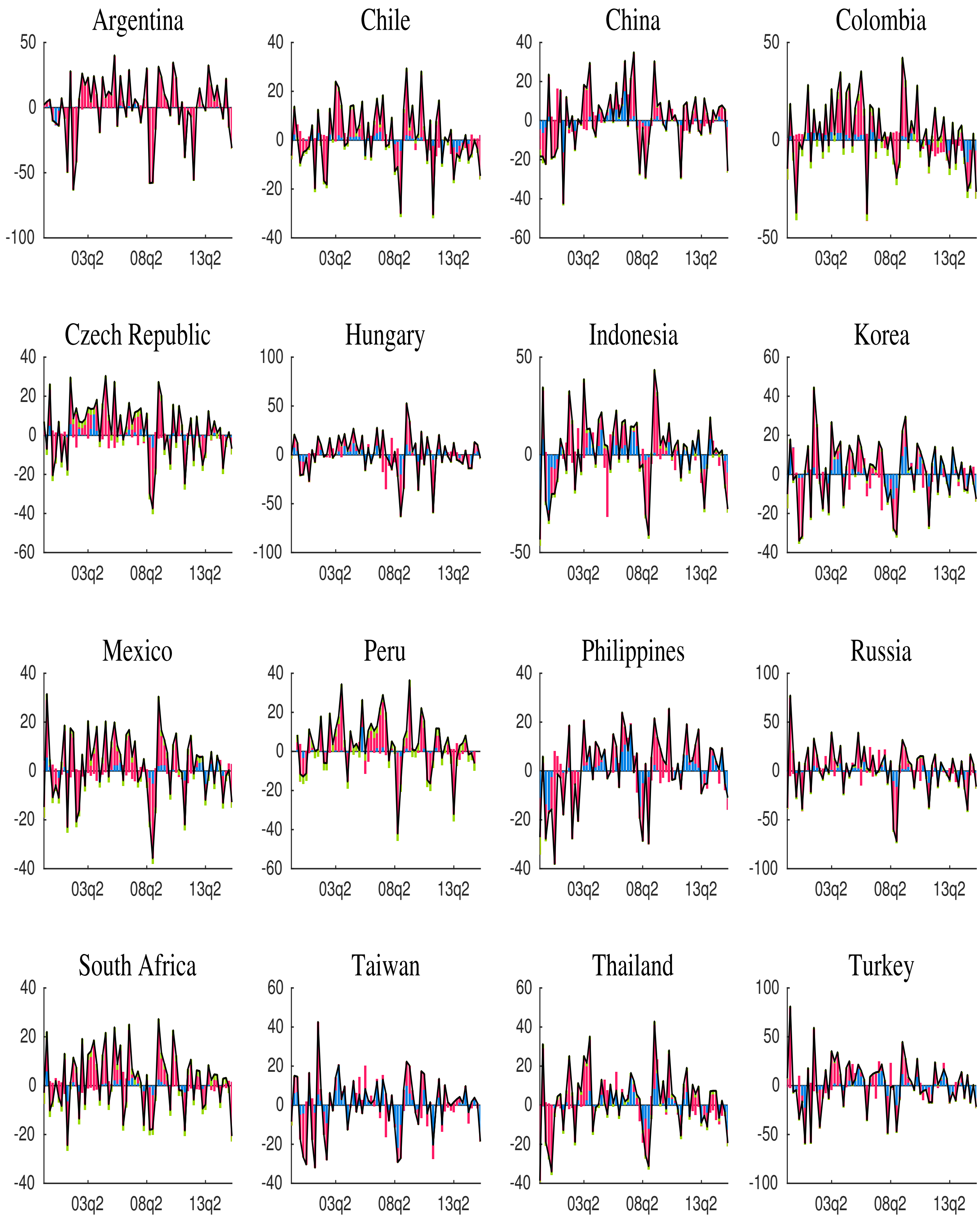

Figure 4: Historical Shock Decomposition for Total Stock Returns
The contribution of push shocks is shown in blue, the contribution of pull shocks is shown in red and the contribution of the deterministic part is shown in green. The solid line represents the total. The x-axis displays the date in quarters, while the y-axis is measured in percentage points.

although statistically significant in half of the countries in the sample. This conforms with the idea that the correlations of the total stock returns among emerging markets tend to be correlated and that the Vix is a relevant common factor.

The correlations of the Vix with the pull shocks provide additional insights. Pull shocks in total stock returns are always negatively correlated with the Vix, in line with the evidence above that push and pull factors play a role in driving stock market returns. Finally, the correlations of the Vix with the pull shocks in portfolio equity inflows are interesting. With the exception of Turkey, all the correlations are statistically significant. The correlations have positive and negative signs, suggesting that international investors differentiate among emerging markets when allocating their portfolio equity flows. This provides a new angle to look at the influence of the global financial cycle on emerging markets.

6 Conclusions

The push-pull framework has proven to be a useful approach to study the drivers of capital flows. This paper shows that total stock returns can be used to identify push and pull factors in emerging markets.

The evidence is consistent with the predictions of a portfolio allocation model. A reduction in the risk aversion of foreign investors increases both gross equity inflows and total stock returns contemporaneously, while a positive shock to dividends only increases total stock returns at the time of the shock. Indeed gross equity inflows are mainly driven by common shocks, whereas total stock returns are influenced by both common and idiosyncratic shocks.

More sophisticated models can be used to further test these results. For example, the portfolio allocation model not only suggests the order of the variables for the recursive VAR but it gives the direction of the effects. Future research can then make use of sign-identified VAR models. The analysis can also be extended to include portfolio debt inflows along with total returns on debt instruments. The portfolio allocation model can also be extended so that it is able to determine portfolio outflows, which can help to further refine a sign-identified model. Therefore, although the results in this paper provide a useful benchmark, more work remains to be done in this regard.

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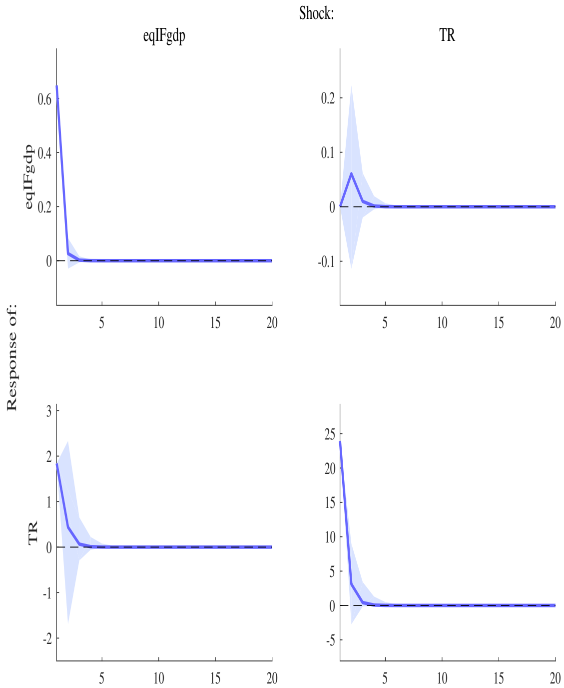
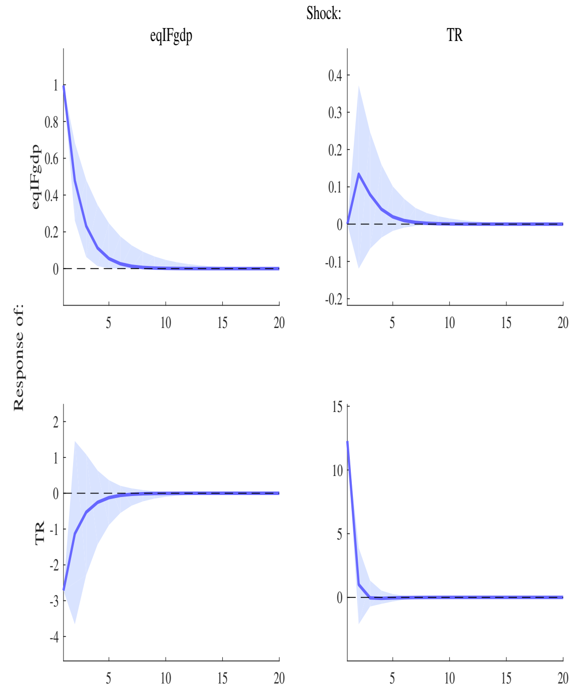
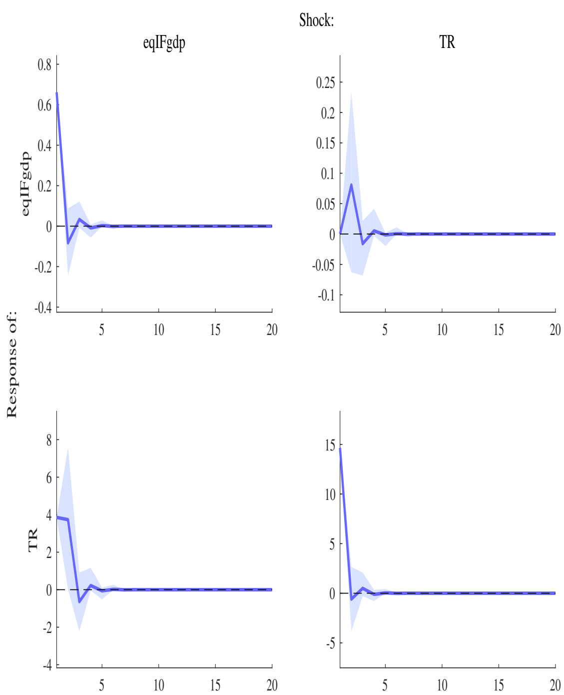


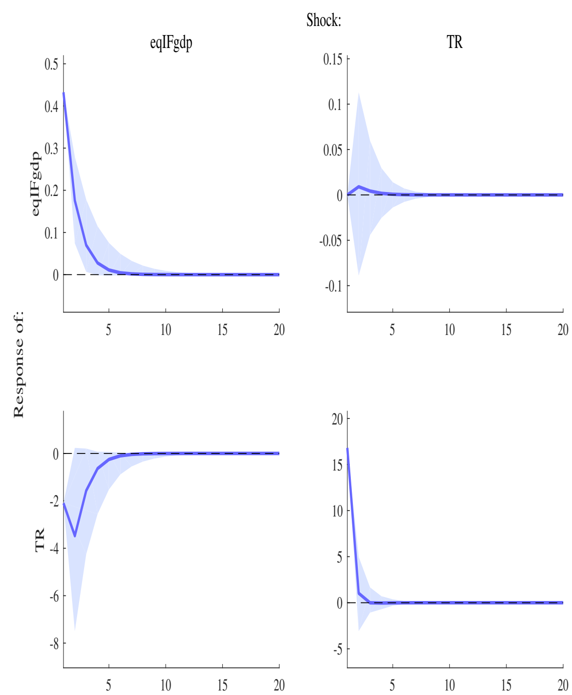
(a) Argentina



(b) Chile

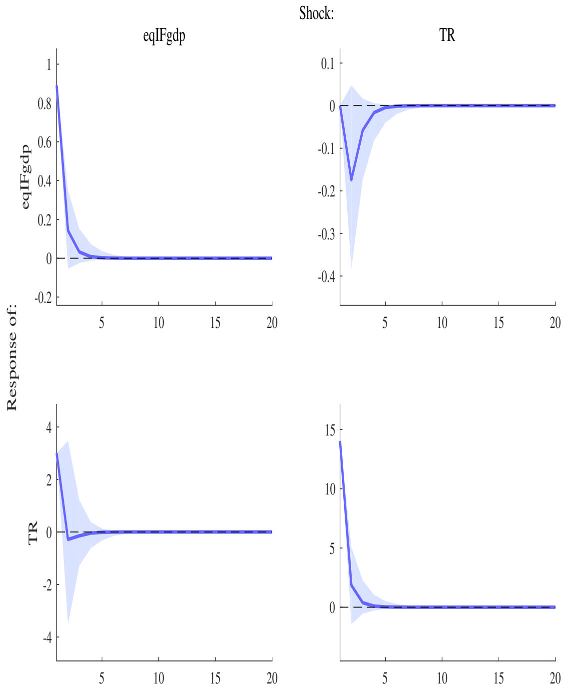


(c) China

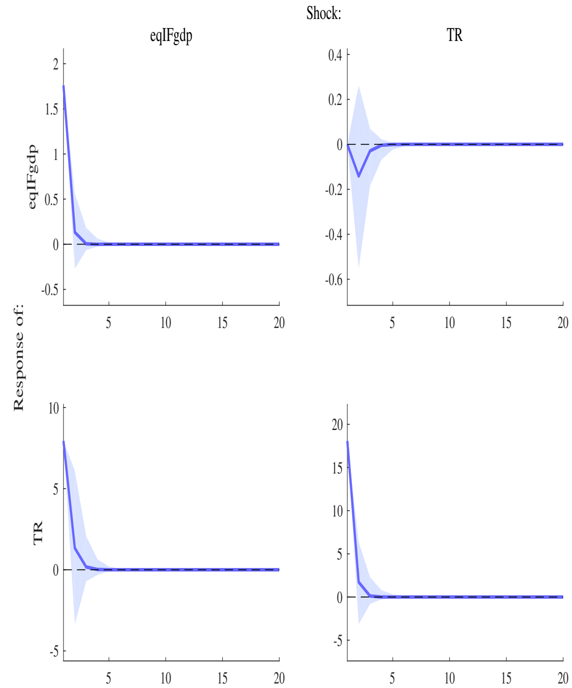


(d) Colombia

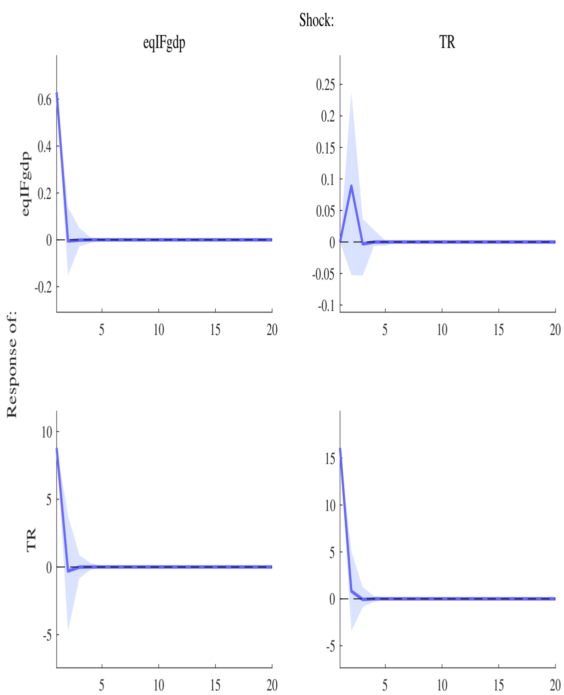
Figure 5: Impulse Response Functions to Push and Pull Shocks - A



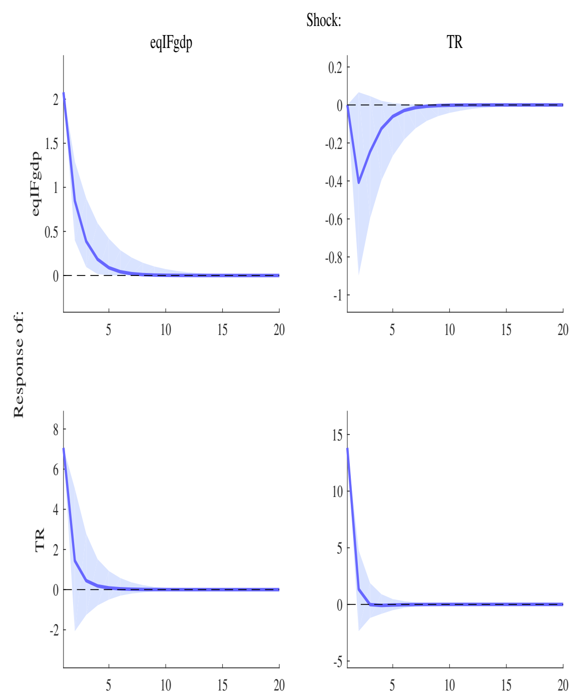
(a) Czech Republic



(b) Hungary

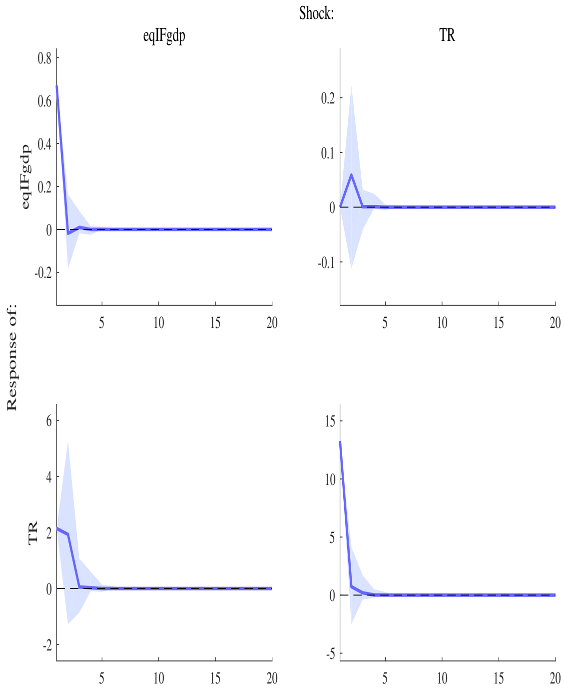


(c) Indonesia

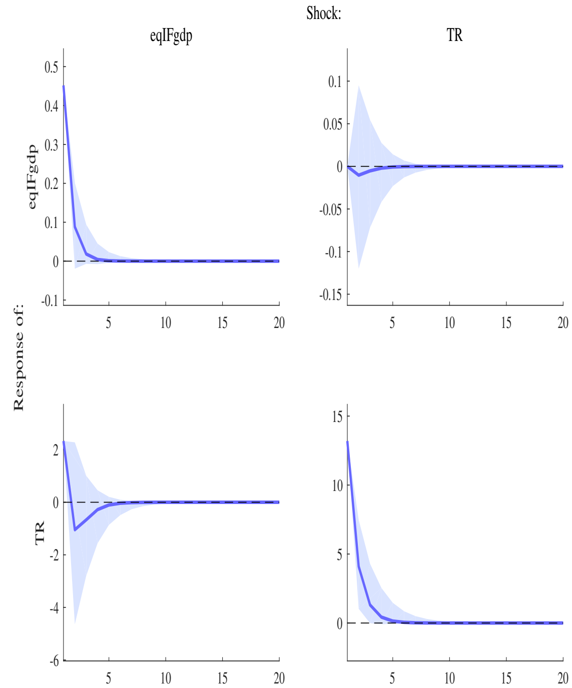


(d) Korea

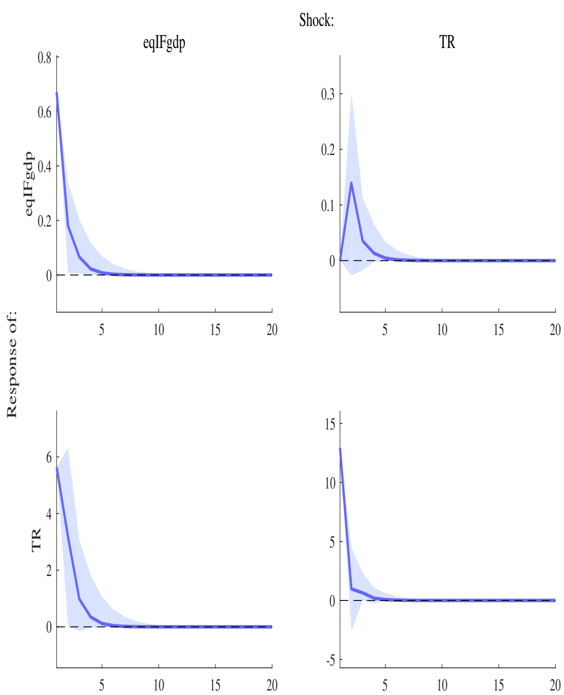
Figure 6: Impulse Response Functions to Push and Pull Shocks - B



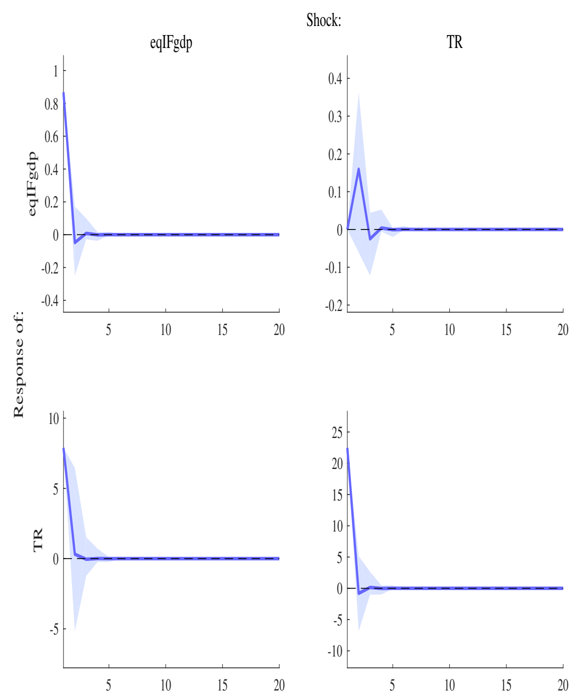
(a) Mexico



(b) Peru

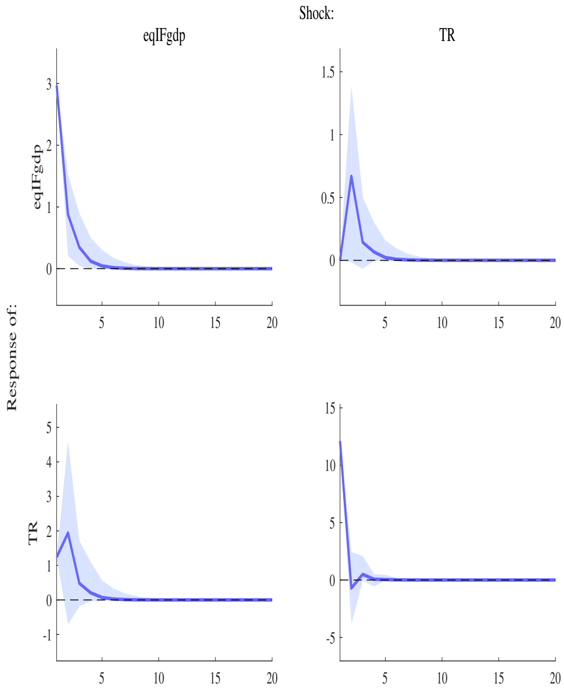


(c) Philippines

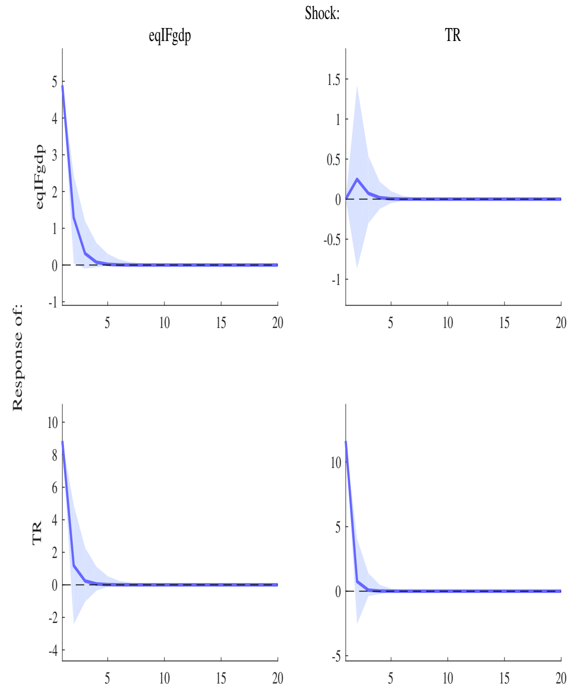


(d) Russia

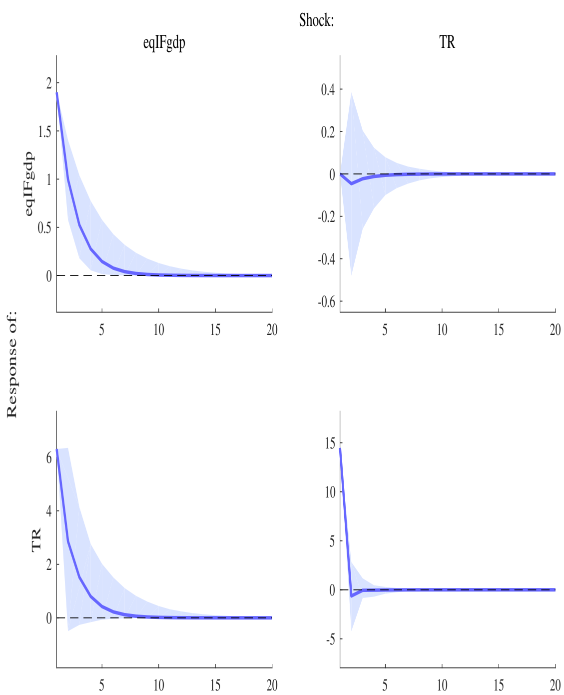
Figure 7: Impulse Response Functions to Push and Pull Shocks - C



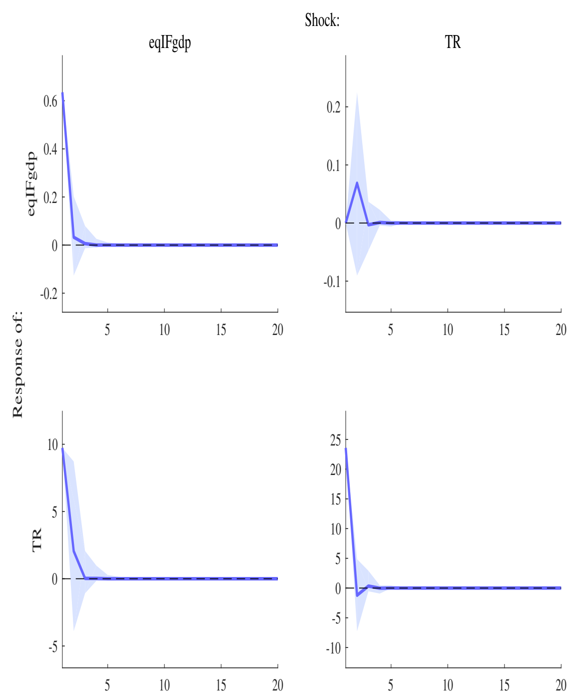
(a) South Africa



(b) Taiwan

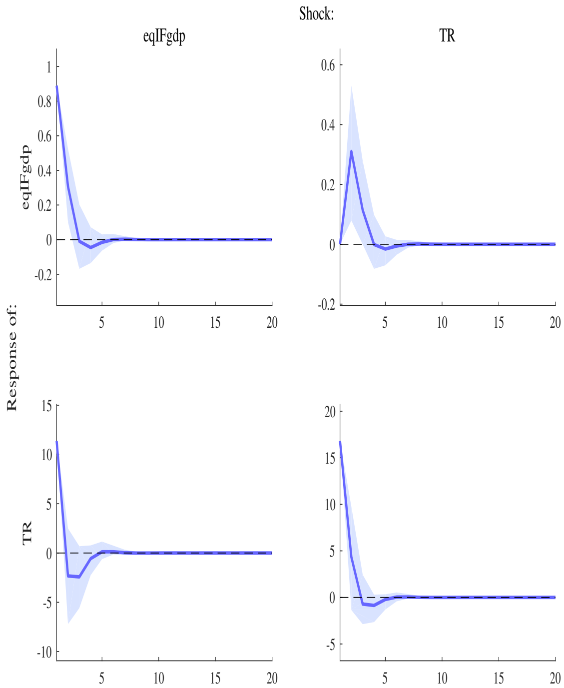


(c) Thailand

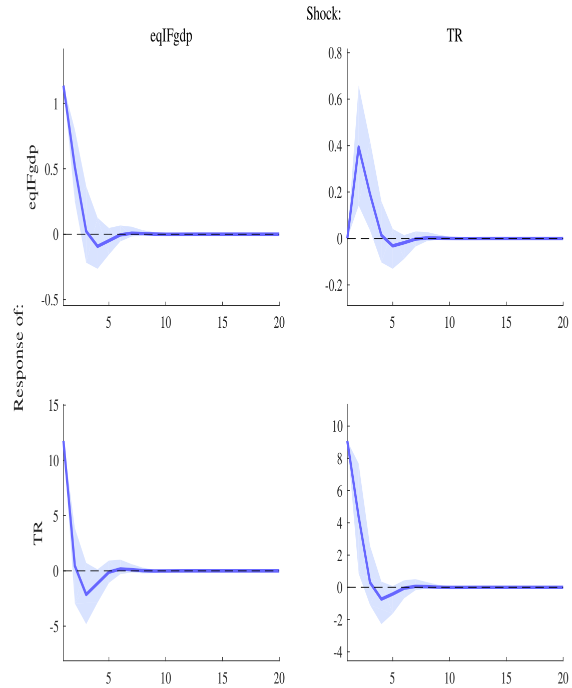


(d) Turkey

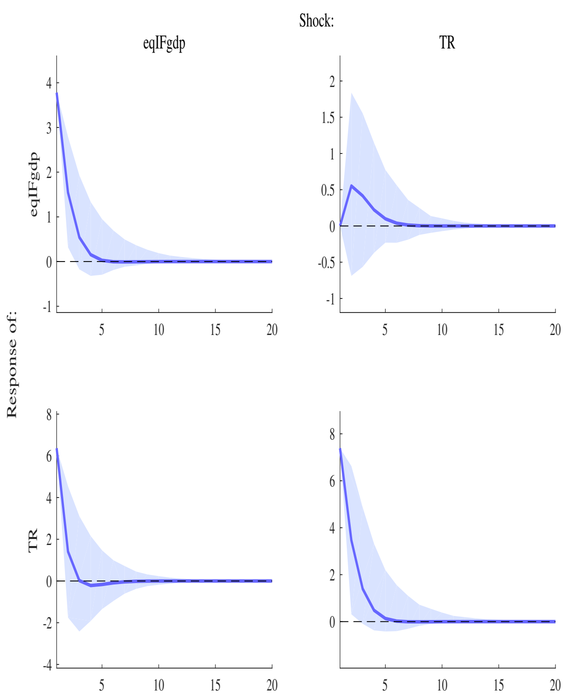
Figure 8: Impulse Response Functions to Push and Pull Shocks - D



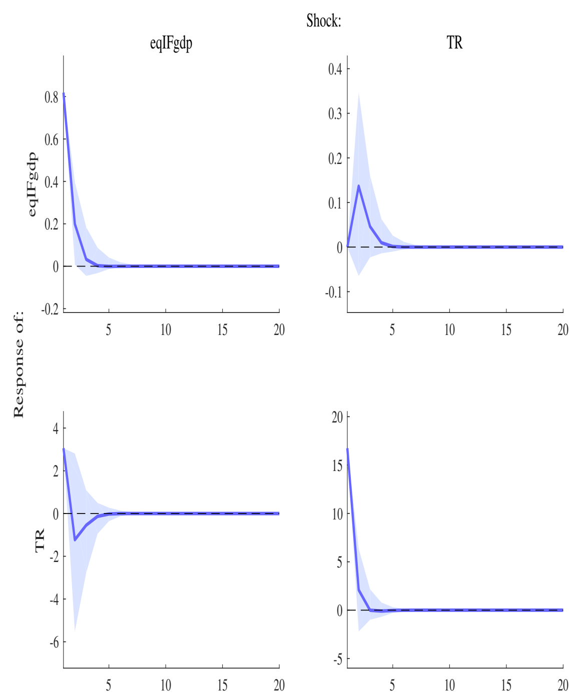
(a) Brazil



(b) India

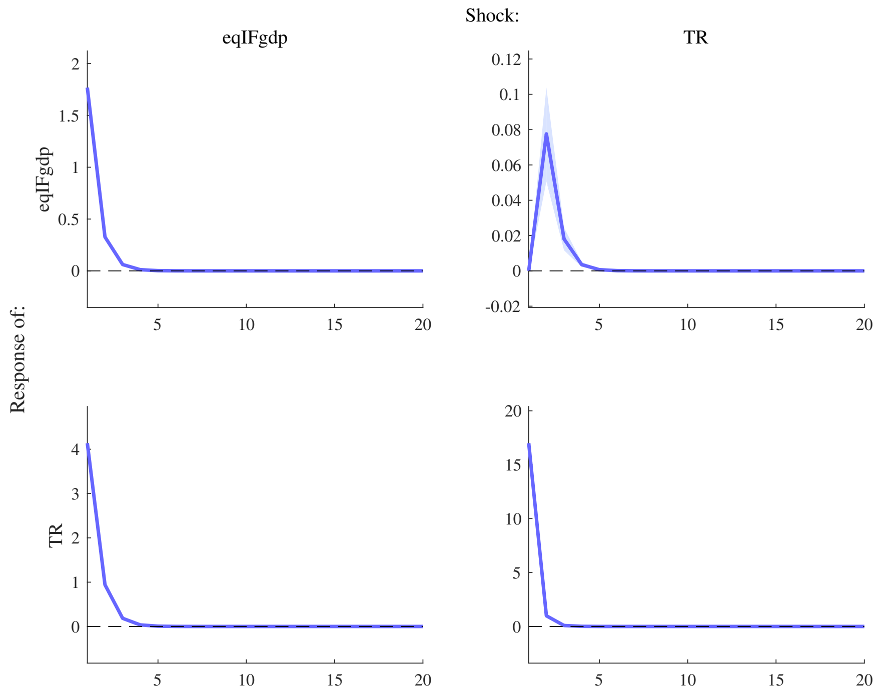


(c) Malaysia

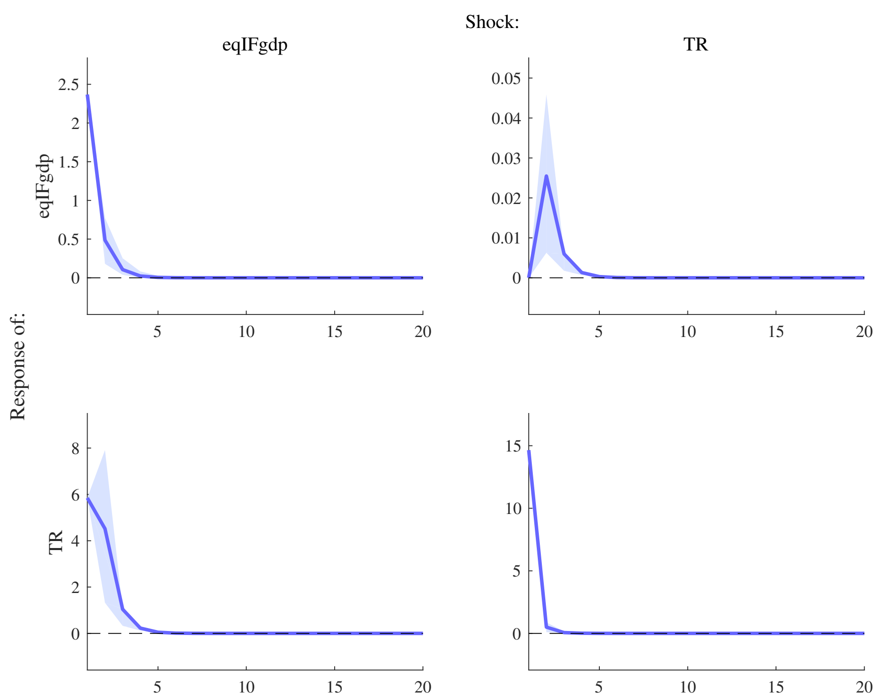


(d) Poland

Figure 9: Impulse Response Functions to Push and Pull Shocks - E
The countries in this figure are not included in the panel. The span of data used for these countries is explained in footnote 6.

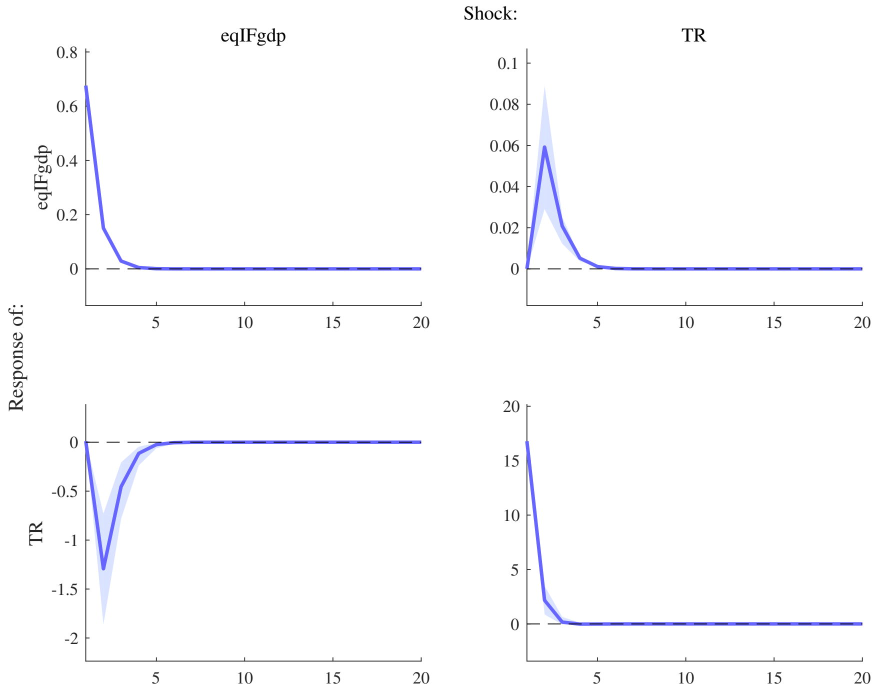


(a) All (16) Countries

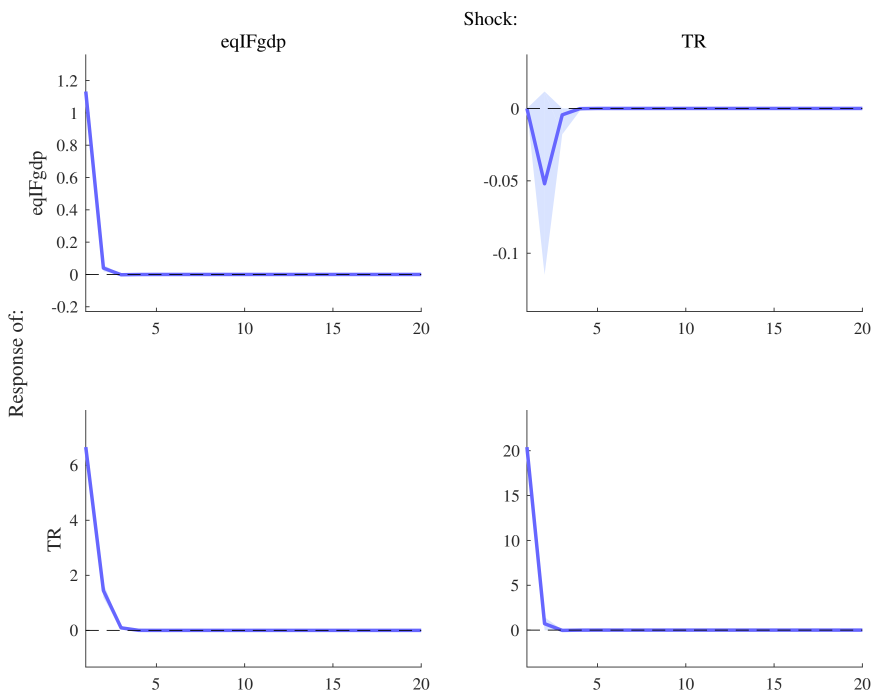


(b) Asia

Figure 10: Impulse Response Functions to Push and Pull Shocks - Panel VAR



(a) Latin America



(b) Europe and Middle East

Figure 11: Impulse Response Functions to Push and Pull Shocks - Panel VAR

	Dependent Variable: Net Total Stock Returns					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(Vix_t/Vix_{t-1})$	-0.361***	-0.362***	-0.364***	-0.365***	-0.362***	-0.363***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Eff. Fed Funds Rate		0.122	0.085	-0.01	0.079	-0.015
		(0.224)	(0.23)	(0.229)	(0.23)	(0.229)
Lag GDP Growth			0.112		0.099	
			(0.139)		(0.139)	
Lag Chinn–Ito I.			0.227		0.016	
			(3.678)		(3.677)	
GDP Growth				0.417***		0.407***
				(0.139)		(0.139)
Chinn–Ito Index				1.611		1.543
				(3.8)		(3.797)
Std. Exchange Rate					-0.865*	-0.811
					(0.501)	(0.498)
Constant	1.678***	1.431**	0.912	-0.914	1.072	-0.835
	(0.476)	(0.658)	(2.113)	(2.178)	(2.113)	(2.177)
R-squared	0.2122	0.2124	0.2127	0.2179	0.2149	0.22
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1040	1040	1040	1040	1040	1040
N	16	16	16	16	16	16

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Correlates of Total Stock Returns using the Change in the Vix

	Dependent Variable: Gross Equity Inflows %GDP					
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(Vix_t/Vix_{t-1})$	-0.019***	-0.02***	-0.02***	-0.021***	-0.021***	-0.021***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Eff. Fed Funds Rate		0.084***	0.085***	0.076***	0.086***	0.076***
		(0.026)	(0.027)	(0.027)	(0.027)	(0.026)
Lag GDP Growth			0.004		0.006	
			(0.016)		(0.016)	
Lag Chinn–Ito I.			0.299		0.327	
			(0.425)		(0.425)	
GDP Growth				0.033**		0.035**
				(0.016)		(0.016)
Chinn–Ito Index				0.413		0.423
				(0.44)		(0.439)
Std. Exchange Rate					0.114**	0.118**
					(0.058)	(0.058)
Constant	0.485***	0.314***	0.14	-0.023	0.119	-0.035
	(0.055)	(0.076)	(0.244)	(0.252)	(0.244)	(0.252)
R-squared	0.0477	0.0562	0.0458	0.0451	0.0479	0.0481
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1040	1040	1040	1040	1040	1040
N	16	16	16	16	16	16

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Correlates of Equity Inflows using the Change in the Vix

	Push Shocks in		Pull Shocks in	
	Inflows	Returns	Inflows	Returns
Argentina	0.04	0.07	-0.5***	-0.3**
Chile	0	0	-0.46***	-0.2
Colombia	0.2	-0.3**	-0.36***	-0.25**
Mexico	0.1	0.24*	-0.45***	-0.35***
Peru	0.23*	0.08	0.42***	-0.12
Czech Republic	0.14	0.1	0.39***	-0.33***
Hungary	0.25**	0.27**	0.33***	-0.33***
Russia	0.16	0.17	-0.35***	-0.24*
Turkey	0.37***	0.4***	-0.16	-0.07
China	0.21*	0.35***	-0.28**	-0.14
Indonesia	0.11	0.11	-0.3**	-0.24*
Korea	0.15	0.1	0.4***	-0.26**
Philippines	0.22*	0.26**	-0.36***	-0.25**
Taiwan	0.35***	0.3**	-0.22*	-0.05
Thailand	0.16	0.15	0.23*	-0.13
South Africa	0.26**	0.35***	-0.36***	-0.21*

p-values are calculated for testing the null hypothesis of no correlation.
*** p<0.01, ** p<0.05, * p<0.1.

Table 10: Correlations of the Vix with the Estimated Push and Pull Shocks in Portfolio Equity Inflows and Total Stock Returns.