# The Effects of U.S. Monetary Policy on International Mutual Fund Investment

Gabriele Ciminelli[a], John Rogers[b], Wenbin Wu[c]

[a] *Asia School of Business in collaboration with MIT Sloan, 2 Jalan Dato Onn, 50480 Kuala Lumpur, Malaysia*

[b] *Fanhai International School of Finance, Fudan University, Shanghai, China*

[c] *Fanhai International School of Finance, Fudan University, Shanghai, China*

---

**Abstract**

First version: August 2020

This version: November 2021

We study the effects of U.S. monetary policy on international mutual fund investment. We apply a novel variant of the shock identification procedure in Bu et al. (2020) to decompose observed U.S. monetary policy surprises into pure monetary policy shock and information shock components. We find that an increase in interest rates driven by a pure monetary policy shock leads to persistent outflows from EMs and to a lesser extent global and U.S. mutual funds. On the other hand, when rates increase following a positive information shock investors reallocate capital out of U.S. bonds and into (riskier) equity funds, both U.S. and abroad. We attribute these differences to the risk-taking channel of monetary policy. Pure monetary policy shocks heighten risk aversion, while information shocks lower the VIX. Zooming in on EM bond funds, we find that a fund's investment mandate matters. High-yield and hard-currency funds are particularly exposed to the Fed's pure monetary policy shocks, further reinforcing the role of risk-taking in driving our results. Finally, we find that, among major EMs, China funds suffer the largest outflows following Fed tightening shocks.

**Keywords:** Federal Reserve, Emerging Markets, Monetary Policy Shocks, Information Effects, Investment Funds

**JEL Codes:** E44, E52, F30, G15

---

* The first draft of this paper was written when John Rogers was Senior Adviser in the International Finance Division of the Board of Governors of the Federal Reserve System. Please address correspondence to gabriele.ciminelli@asb.edu.my.

"*China should be mindful of a potential reversal of capital flows as the US Federal Open Market Committee gets ready to kick off its monetary tapering by dialing back US$120 billion worth of monthly bond purchases, a former Chinese central bank official has warned.There are rising concerns among investors that the tapering exercise will result in a more unstable yuan, as large amounts of capital – i.e. hot money – will rush into the Chinese market as investors bet on the yuan's one-way appreciation before the tapering is completed, but then rush out again to take advantage of a stronger US dollar after the tapering is finalised.*"

— South China Morning Post, 03 November 2021

# 1. Introduction

In the aftermath of the global financial crisis, massive unconventional measures employed by the Federal Reserve triggered debates about the consequences of flooding the world with liquidity. A significant adverse consequence of this unprecedented monetary expansion was the Taper Tantrum in 2013 when the Fed expressed a future plan to gradually taper its balance sheet, which was followed by turmoil in emerging markets (EMs). Similar concerns have arisen again following the outbreak of the COVID pandemic, when the Fed restored many unconventional policies.

In this paper, we revisit the role of U.S. monetary policy in influencing capital flows into and out of global and EM funds.[1] We do so by examining the effects and transmission channels of U.S. monetary policy on international mutual funds investment, having applied a novel variant of the monetary policy shock identification procedure of Bu et al. (2020) (BRW). The procedure allows us to decompose observed U.S. monetary policy surprises into pure monetary policy shock and information shock components. New to the capital flows literature, we document that mutual funds flows exhibit very different responses to tightening movements in U.S. interest rates caused by a pure monetary policy shock and an information shock.

The pure monetary policy shock captures a sudden shift in monetary policy that is orthogonal to changes in the economic outlook. The information shock instead captures a change in the policy indicator that depends on changes in the FOMC's economic outlook (even if unexpected by the public). The importance of Fed private information was emphasized in Romer & Romer (2000), who show that the Fed's forecast of inflation was superior to commercial forecasts. The information

[1] For examples of this sizable literature, see the recent papers by Chari et al. (2020) and Dahlhaus & Vasishtha (2020) and the references there-in, as well as our more fleshed out discussion below.

effect was further analyzed by Nakamura & Steinsson (2018), Lunsford (2020), and Jarociński & Karadi (2020), as well as Bauer & Swanson (2021), who have an alternative view of the information channel. Our paper is the first to make use of this decomposition to analyze capital flows.

We find that the effects of a pure U.S. monetary policy shock on international mutual fund investment are conventional – a tightening leads to capital outflows from global and EM funds. But information shocks have distinctly different effects. A positive shock, indicating higher interest rates against the backdrop of a better economic outlook, leads to persistent outflows from U.S. bond funds and a persistent inflow to riskier funds, e.g., U.S. equity funds, and global equity and bond funds. We reconcile these different effects through the operation of the risk-taking channel of U.S. monetary policy. This channel sharply differs following pure monetary policy shocks and information shocks.

As postulated in the existing literature, there are three main transmission channels of U.S. monetary policy for international capital flows – the portfolio rebalancing channel, the risk-taking channel, and the exchange rate channel (Chari et al., 2020; Bruno & Shin, 2015). According to the portfolio rebalancing channel, investors shift their portfolios towards high-yield EM assets when global interest rates are low and hence investing in long-term advanced economies bonds generates meager returns. The opposite holds when the Fed tightens policy and interest rates rise.[2] The risk-taking channel operates through the effect of U.S. monetary policy on risk aversion (Bruno & Shin, 2015). A tightening in interest rates that increases uncertainty makes investors more reluctant to take on risky positions, leading to capital outflows from EMs and other risky funds. Finally, the exchange rate channel depends on the direct effect of the Fed's policy on the USD exchange rate, with an appreciation of the dollar leading to capital outflows from other countries, especially EMs.

We find evidence suggesting an important role for the risk-taking channel. Pure monetary and information shocks both increase nominal and real interest rates, leading us to downplay the portfolio rebalancing channel as the main driver of our results. However, the effects of these two shocks on risk-taking, proxied by the VIX index, are sharply different. A tightening pure monetary policy shock substantially increases risk aversion, and therefore the VIX, while positive information shocks decrease uncertainty, thereby lowering the VIX. As we document, and consistent with the portfolio capital flows literature (Ahmed & Zlate, 2014, and others), risk aversion has strong negative effects on flows to EM mutual funds, which explains why tightening pure onetary policy

[2] The portfolio rebalancing channel should be more pronounced during the zero lower bound when the short-term interest rate is close to zero and the Fed may employ large scale asset purchases (LSAPs) and forward guidance to lower long term interest rates further (Neely et al., 2010; Krishnamurthy & Vissing-Jorgensen, 2011; Fratzscher, 2012; Fratzscher et al., 2018; Chari et al., 2020).

shocks have particularly large negative effects. On the other hand, the decrease in uncertainty following positive information shocks, together with the news of higher growth, neutralizes the negative effects of higher interest rates on higher-yielding assets. This explains why investors shed riskier assets following pure monetary policy shocks but not information shocks.

The evidence on the exchange rate channel is mixed. The price of the USD shoots up (dollar appreciates) following pure monetary policy shock tightenings, while it exhibits a qualitatively similar but weaker and more sluggish response after positive information shocks. Hence, the exchange rate channel seems to work in the same direction as the risk-taking channel, but it cannot explain why investors also marginally reduce their positions in U.S. funds after pure monetary policy shocks. This instead can be rationalized with an increase in risk aversion.

We also perform some extensions to these core results. We first exploit information on funds' domicile to explore heterogeneities in the response of U.S. and EM investors. The former sharply decrease exposure to EM assets following a pure monetary policy tightening. This decrease in foreign capital in EMs is partly mitigated by EM investors themselves, who increase flows into EM funds. These results are consistent with home-bias behavior following heightened risk aversion and more generally suggest that tightening monetary policy shocks in the U.S. cause a decrease in foreign capital. We confirm this intuition by using country-level data on cross-border flows taking place through investment funds. Tightening Fed monetary policy shocks lead to a general decrease in foreign inflows, particularly debt. Although larger in EMs, this decline in foreign capital also affects the U.S. and other developed markets. On the other hand, positive information shocks cause inflows of foreign capital into U.S. equity assets, in line with the news of a stronger economy.

These results beg the natural question of what could be done by EM debt issuers to mitigate the decrease in foreign capital following tightening Fed's monetary policy shocks. To investigate, we leverage information on bond funds' investment mandate. Bond funds differ along several dimensions, including credit quality, currency denomination, and issuer of the bonds in which they can invest. These may affect the response of investors following U.S. shocks. We find that credit quality and currency denomination are important. Other things being equal, outflows from funds investing exclusively in investment grade bonds are about half as a large as outflows from other funds, following a tightening pure monetary policy shock. At the same time, funds which can invest only in hard currency (CHF, EUR, GBP, USD, YEN) bonds suffer much larger outflows than local and mixed currency funds. This result has important policy implications as it suggests that, by issuing debt in local currency, EM issuers may decrease exposure not only to exchange rate fluctuations but also to changes in risk aversion following shocks to U.S. monetary policy.

As a further extension, we explore regional heterogeneities in responses within the broad group of EM funds. We find that flows to Asian regional funds as well as funds investing in BRIC countries are particularly sensitive to U.S. monetary policy shocks. Within BRIC countries, China is especially exposed. We find outflows from China funds following a pure tightening shock to be about twice as large as outflows from global emerging market funds. African and Emerging Europe regional funds instead receive inflows following positive information shocks.

*Related Literature:* Our paper is closely related to two strands of literature. First, to the literature on international portfolio flows, especially EM portfolio flows. A vast literature investigates the effects of Fed monetary policy on EM capital flows (see Calvo et al., 1993; Burger et al., 2018; Bruno & Shin, 2015; Fratzscher, 2012; Fratzscher et al., 2018; Iacoviello & Navarro, 2019; Dahlhaus & Vasishtha, 2020, among many others).[3] In addition, Miranda-Agrippino & Nenova (2021) argue that monetary policy tightenings in both the U.S. and Euro area are followed by a global retrenchment in capital flows, and thus that ECB and Fed monetary policies propagate internationally through equivalent transmission channels. We differ from these studies to consider the role of Fed information effects, a topic that has not yet been investigated in the capital flows literature.[4]

Second, our paper is closely related to literature on Fed information effects and predictability of monetary policy shocks. As noted above, the Fed information effect refers to the view that FOMC announcements not only reveal pure monetary policy news but also private information on the economy; this leads to predictability of monetary policy shocks (see Romer & Romer, 2000; Campbell et al., 2012; Nakamura & Steinsson, 2018; Miranda-Agrippino, 2016; Jarociński & Karadi, 2020; Hansen et al., 2019; Cieslak & Schrimpf, 2019; Paul, 2019; Bauer & Swanson, 2021). Our paper is thus related to Hoek et al. (forthcoming), who find that a hike in U.S. interest rates is not always bad news for EMs. They show that an increase in U.S. interest rates stemming from stronger U.S. growth generates moderate or even opposite spillover effects on EM asset prices. These authors do not focus on capital flows and use a different and more traditional identification of U.S. monetary policy shocks.[5] In this paper, we show that Fed information shocks do not cause international capital outflows from global and EM markets—but pure monetary policy shocks do—and we analyze the transmission channels. Our main results echo closed-economy macro papers

[3] Many authors have documented how important capital flows are for other important financial and macroeconomic outcomes. Warnock & Warnock (2009) document the influence of international capital flows on long-term U.S. interest rates and Liu et al. (2020) analyze the effects of capital flow "surges" on income inequality.

[4] After the first draft of this paper was completed, we became aware of Pinchetti & Szczepaniak (2021), who also examine spillover effects of Fed information effect shocks to capital flows and many other variables. Our paper differs from theirs in a few dimensions, including (1) we use a different methodology to identify the information shocks – namely that based on (Bu et al., 2020) rather than that in Jarociński & Karadi (2020) (see the former for a comparison of these identification strategies); (2) we use microdata on capital flows while they mainly rely on macro data; and (3) we use a weekly frequency rather than monthly for estimation of the dynamics.

[5] Though they do use the Bu et al. (2020) shock measure in a robustness exercise.

that document differently-signed transmission effects to output and inflation from pure monetary policy news shocks versus information shocks (e.g., Jarociński & Karadi, 2020).

In the next section, we describe our dataset and methodology. In section 3, we display our main results, including the effects on capital flows from monetary policy shocks and information shocks. We also perform several robustness exercises. In section 4, we estimate the transmission channels of U.S. monetary policy. In section 5, we report some extensions on the effects of U.S. monetary policy, including geographic heterogeneity. Section 6 concludes.

## 2. Dataset and Methodology

The dataset covers the period from January 2000 to December 2020, spanning over 150 FOMC meetings. It includes almost 28,000 investment funds.

### 2.1. U.S. Monetary Policy

Monetary policy in the U.S. is set by the Federal Open Market Committee (FOMC), which holds eight scheduled meetings every year. The committee discusses current and expected future economic conditions, decides monetary policy accordingly, and reveals its thinking and policies to the public in various ways, including through the FOMC Statement. It is well known that a major part of changes of monetary policy is due to systematic reactions to economic conditions, and that to measure "pure" monetary policy shocks, it is important to take into consideration the information effect component of FOMC announcements. Traditional SVAR and high-frequency approaches might both fail to appropriately identify monetary policy shocks because information effects are simultaneously revealed with exogenous monetary policy changes by the Fed.

Following Bu et al. (2020), we use a heteroscedasticity-based, partial least squares (PLS) approach, exploiting the sensitivity of different outcome variables to FOMC announcements, to identify shocks to U.S. monetary policy. Through this PLS approach, which is essentially the same as the Fama-MacBeth method, we are able to separate pure monetary policy shocks from the information content of FOMC announcements. Our PLS approach consists of three steps. In the first step we run time-series regressions to estimate the sensitivity of interest rates at different maturities to FOMC announcements. In the second step, for each time $t$, we regress the cross-section of outcome variables onto their corresponding estimated sensitivity from step one. In a third step, which is new to this paper, we back out the information content of the monetary policy news from the pure monetary policy shock. The advantage of this PLS three-step approach is that it has very mild data requirements and it is simple to implement.

Next, we lay out a simple framework to illustrate the PLS approach. For more details, please refer to Bu et al. (2020). The monetary policy shock $e_t$ is assumed to be unobservable. We further assume that the (observable) changes in Treasury yields around FOMC announcement days are driven by the monetary policy shock $e_t$ and a non-monetary policy shock $\epsilon_t$, which can include the information content $\eta_t$ of FOMC announcements. Bu et al. (2020) show that monetary policy shocks can be identified as long as the information effects in the long-run yields ($\eta_{L,t}$) are very weak, or the information signal driving the short and long-run yields ($\eta_{S,t}$ and $\eta_{L,t}$) are different, an implication that is supported by Hansen et al. (2019).

In the first step, we estimate the sensitivity of each outcome variable (zero-coupon yields with maturities of 1 to 30 years) to monetary policy via time-series regressions, according to:

$$\Delta R_{i,t} = \alpha_i + \gamma_i e_t + \epsilon_{i,t} \tag{1}$$

where $\Delta R_{i,t}$ is the change in the zero-coupon yield with i-year maturity and $\epsilon_{i,t}$ is the error term, which can include the information content driving the short and long-run yields ($\eta_{S,t}$ and $\eta_{L,t}$). We assume the error term $\epsilon_{i,t}$ and the unobserved monetary shock $e_t$ are uncorrelated. As in Bu et al. (2020) and Hansen et al. (2019), we further assume that the identification assumptions are satisfied. We then normalize the unobserved monetary policy shock to have a one-to-one relationship with the 5-year Treasury yield.[6] Due to our normalization, we can rewrite Equation (1) as:

$$\Delta R_{i,t} = \theta_i + \beta_i \Delta R_{5,t} + \xi_{i,t} \tag{2}$$

The errors-in-variables problem caused by background noises can be eliminated using identification through heteroskedasticity. As shown in Bu et al. (2020), the estimated $\beta_i$ coefficients are proportional to the underlying true $\gamma_i$ coefficients.

The second step is to extract the pure monetary policy shock from monetary policy news through cross-sectional regressions of $\Delta R_{i,t}$ on the estimated sensitivity index $\hat{\beta}_i$ for each time t:

$$\Delta R_{i,t} = \delta_i + e_t^{pure} \hat{\beta}_i + v_{i,t}, \quad for\ t = 1, 2, \cdots, T \tag{3}$$

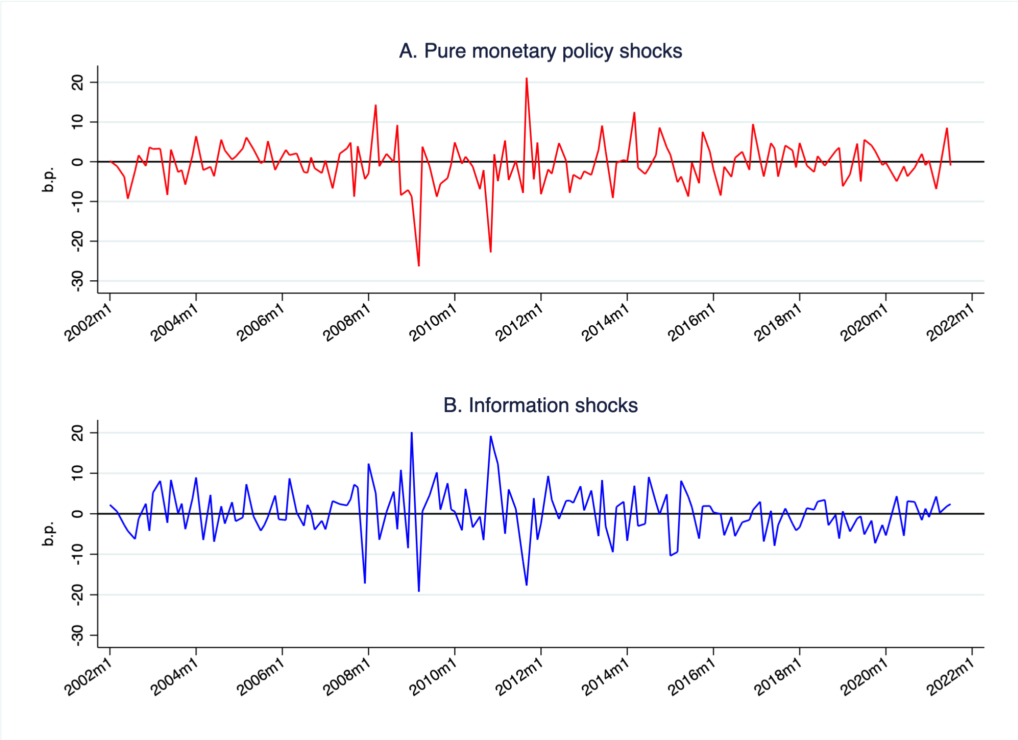
where $e_t^{pure}$ is the coefficient of interest. The pure monetary policy shock series is then obtained as the series of these $T$ estimated coefficients.

[6] Results using normalization to the 2-year rate are effectively identical.

In a third step, new to this paper, we back out the information component as the residuals from projecting the benchmark 5-yr interest rate onto the estimated series $\{e_t^{pure}\}_{t=1}^{T}$.

Figure 1 plots the pure monetary policy shock and information effect shock over time. Table 1 displays descriptive statistics. Both shocks have been important in driving interest rates following FOMC meetings in the last two decades. Both series display higher variability during the GFC and subsequent zero lower bound (ZLB) periods.

**Figure 1: Fed's shocks over time**




*Notes:* The figure plots the pure monetary policy shock and information shock components identified from Fed monetary policy surprises over time.

**Table 1: Descriptive statistics on Fed's shocks**

| | | Pure monetary policy shocks | | | Information shocks | | |
|---|---|---|---|---|---|---|---|
| | obs | mean | abs. mean | s.d. | mean | abs. mean | s.d. |
| **2002-2007** | 49 | -0.10 | 3.20 | 3.85 | 0.58 | 3.80 | 5.21 |
| **GFC** | 9 | -2.90 | 6.90 | 11.79 | 0.45 | 8.83 | 11.6 |
| **ZLB** | 54 | -0.86 | 5.14 | 6.43 | 1.19 | 6.05 | 6.90 |
| **2015-2019** | 32 | 0.38 | 3.25 | 3.94 | -1.85 | 2.83 | 3.12 |
| **COVID** | 12 | -0.92 | 2.73 | 3.82 | 0.61 | 2.80 | 3.35 |
| **All sample** | 156 | -0.49 | 3.96 | 5.54 | 0.29 | 4.46 | 5.97 |

**Notes:** Means and standard deviations are in basis points. GFC denotes the Global Financial Crisis period (December 2007 to June 2009). ZLB denotes the zero lower bond period after the GFC (July 2009 to December 2015). COVID denotes the January 2020 to July 2021 period.

## 2.2. Investment Funds

To measure allocations into investment funds we rely on Emerging Portfolio Funds Research (EPFR), a commercial data provider popular among financial professionals to track trends in the investment fund industry and also used in academic research (see Converse et al., 2018; Fratzscher, 2012, among others). EPFR receives data from individual funds and then disseminates these data to its subscribers. Fund flows ($F_{i,t}$) is our main variable of interest. It measures total net purchases of fund $i$'s shares, during period $t$ made by individual investors. To standardize flows among different funds, we also source data on assets under management by fund $i$ at the beginning of period $t$ ($A_{i,t}$). Finally, since fund flows partly depend on past returns, we collect data on period-on-period changes in net asset value (NAV), excluding changes due to new investors' flows $n_{i,t}$. Both assets and flows are expressed in USD ($), while NAV returns are in percent.

Emerging Portfolio Fund Research also provides information a fund's investment mandate. Hence, for all funds, we collect information on its geographical focus, and, for bond funds, we additionally collect information on whether they invest in (i) sovereign, corporate or both types of funds, (ii) investment-grade, high-yield, or both types of funds, and (iii) hard currency, local currency or both types of funds.

EPFR data are available at the daily, weekly and monthly frequencies. For our analysis we opt for weekly data, which cover more funds than daily data but still allows for a proper identification of the effects of Fed monetary policy on fund flows.[7] The data are available beginning in 2001 and 2004 for equity and bond funds, respectively.

Initially, relatively few funds reported to EPFR, but the sample of reporting funds has steadily grown over time. In 2017, the funds covered by EPFR cumulatively held over $24 trillion of assets, representing roughly half of the entire industry. We exclude funds that only invest in Advanced Economies other than the U.S., as U.S. monetary policy is unlikely to be a major determinant of investment decisions in this kind of funds.[8] Our focus is thus on funds with mandate to invest (i) in the U.S. only, (ii) in EMs, or (iii) in any country in the world (Global funds).

To minimize the potential for measurement error, we screen the data by excluding funds that are in the sample for less than one year, as well as small funds, defined as those with less than $10 million of assets on average, and we censor abnormal jumps, defined as observations having flows larger than one-third of assets in absolute value.[9] Table 2 reports basic descriptive statistics. Our

[7] The week is defined to start on Thursday at the beginning of the U.S. trading day.
[8] We also drop bond funds investing in U.S. municipal bonds and bank loans.
[9] This is equivalent to windsorizing less than the top and bottom percentiles of observations.

**Table 2: Descriptive statistics of funds covered**

| Mandate | # funds | % domiciled in the U.S. | Assets mean | Assets s.d. |
|---|---|---|---|---|
| **U.S. - equity** | 7788 | 76.5 | 1188.2 | 5204.6 |
| **Global - equity** | 6492 | 35.6 | 711.9 | 2481.5 |
| **EMs - equity** | 4688 | 17.9 | 487.0 | 1956.5 |
| **Total - equity** | 18939 | 47.9 | 861.3 | 3843.9 |
| **U.S. - bond** | 4186 | 83.9 | 1129.3 | 3376.3 |
| **Global - bond** | 2788 | 15.0 | 739.1 | 1882.6 |
| **EMs - bond** | 1798 | 11.7 | 467.6 | 980.7 |
| **Total - bond** | 8761 | 47.2 | 895.0 | 2702.3 |

**Notes:** Columns denoted "# funds", and "% domiciled in U.S." respectively report the number of funds covered and the share of funds domiciled in the U.S. Means and standard deviations are in USD.

sample comprises about 19,000 equity and 9,000 bond funds, with a bit less than half of them being domiciled in the U.S. There is large dispersion in fund size, as the standard deviation of assets is about three (bond) to four-and-half (equity funds) times the mean.

Appendix Figure A1 plots aggregate weekly flows, in percent of assets, to U.S., Global, and EM bond and equity funds.

### Country-level data

Besides fund-level information on investors' allocations into individual funds, EPFR also provides country-level information on total purchases of country $y$'s assets by funds domiciled in country $x$.[10] For each country, we collect data on total assets purchased by funds domiciled in foreign countries, which we take as proxy of cross-border gross portfolio inflows. After dropping countries which are covered for less than 54 weeks or for which assets managed by reporting funds are less than $10 million on average, we are left with panel of 113 countries, including the U.S., 27 other developed markets and 50 emerging and frontier markets according to the MSCI classification.[11]

## 2.3. Other Variables

We also source data on additional variables to use as controls in our regressions. The first set of controls is U.S. macroeconomic releases, which may affect investment behavior as they provide direct information about the state of the economy and noisy signals about likely future monetary policy. We consider the four releases that have the largest impact on financial markets (Faust et al., 2007; Beber & Brandt, 2009; Swanson & Williams, 2014; Gilbert et al., 2017) – non-farm payroll employment net creation, month-on-month core CPI inflation, retail sales percent change, and

[10] EPFR construct these data by aggregating information from a subset of funds that report their country weights.
[11] MSCI classifies countries in three groups according to market accessibility: developed markets, emerging markets and frontier markets. 44 countries included in our sample are not covered by the MSCI. We refer to them as other markets.

the ISM manufacturing PMI index. Since market participants form expectations about upcoming macroeconomic releases, we follow standard practice in the literature and identify their unexpected — 'surprise' — component.[12] To do so, we collect data on the median response to a Bloomberg's survey asking economic analysts about their expectation and subtract the median expectation from the actual release. We also collect data on the TED spread, a measure of tightness in the U.S. interbank market, obtained as the difference between the 3-month U.S. Treasury bill and LIBOR rates. Relevant data are sourced from Bloomberg and Thomson Reuters Datastream.

To compare our results to those that would be obtained using alternative approaches to identify monetary policy shocks we source additional variables. First, we collect data on the current federal funds rate, the federal funds rate expected following the subsequent FOMC meeting, as well as eurodollar futures rates expected 2, 3, and 4 quarters ahead; with these, we construct an alternative measure of monetary policy "news". Second, we source the information shock and monetary policy shock variables of Jarociński & Karadi (2020).[13]

To explore potential transmission channels, we source data on the VIX index, a measure of expected financial market volatility, the USD index (the DXY) as well as 5-year nominal and real (TIPS) U.S. government bond yields from Thomson Reuters Datastream. The dataset is completed with measures on the price and the level of risk sourced from Bekaert et al. (2021).

## 2.4. Econometric Framework

To trace out the dynamic response of fund flows to pure monetary policy and information shocks, we estimate local projections. This approach was pioneered by Jordà (2005) and has been widely used as a flexible alternative to autoregressive distributed lag specifications (Auerbach & Gorodnichenko, 2012; Jordà & Taylor, 2016; Romer & Romer, 2017; Ramey & Zubairy, 2018). We consider a 5-week window, including the week of the FOMC meeting and the following four.

To apply the local projections method in the context of fund flows, we first construct the dependent variable as the ratio of cumulative flows to fund $i$ over horizon $t+k$ to assets under management of fund $i$ at time $t$. Then, for each $k = 0, .., 4$, we regress our dependent variable onto both the monetary policy and information shock variables at time $t$. In practice, we estimate:

$$\frac{\sum_{j=0}^{k} F_{i,t+j}}{A_{i,t}} = \beta^k e_t + \gamma^k i_t + \sum_{l=1}^{24} \left( \sigma_l^k \frac{F_{i,t-l}}{A_{i,t-l}} + \phi_l^k n_{i,t-l} \right) + \delta_i + \varepsilon_{i,t} \tag{4}$$

[12] See Gürkaynak et al. (2005); Boyd et al. (2005); Beber & Brandt (2009), and Swanson & Williams (2014) among others.

[13] The information and monetary policy shock variables in Jarociński & Karadi (2020) paper are up to end-2016. We source updated data (to March 2019) from Marek Jarocinski's website (`https://marekjarocinski.github.io/`).

where subscripts $i$ and $t$ denote fund and time respectively; the superscript $k$ denotes the horizon considered; $F_{i,t}$ denotes fund flows (investors' total net purchases of fund $i$'s shares during period $t$, in USD); $A_{i,t}$ is the volume of assets under management by fund $i$ at the beginning of period $t$, in USD; $e_t$ and $i_t$ are our pure monetary policy and information shock variables, which take values equal to the respective shock in FOMC meeting weeks and 0 otherwise; $n_{i,t}$ denotes fund $i$'s net returns over period $t$; $\delta_i$ are investment fund fixed effects that take into account time-invariant fund characteristics; and $\varepsilon_{i,t}$ is the error term, assumed to be uncorrelated with the regressors.

Since a large literature has shown investors purchases of shares to depend on the fund's past performance, we add 24 lags of one-period fund returns (captured by the term $\sum_{l=1}^{24} \phi_l^k n_{i,t-l}$).[14] Lastly, the specification accounts for autocorrelation in fund flows by including 24 lags of one-period flows in the regression (captured by the term $\sum_{l=1}^{24} \sigma_l^k (F_{i,t-l}/A_{i,t-l})$). The $\beta^k$s and $\gamma^k$s are the coefficients of interest. They measure the mean cumulative response over the $t+k$ horizon of fund flows to a 10 basis points monetary policy and information shock respectively.

We perform the estimation through OLS with two-way clustered standard errors (fund $i$ and time $t$). This clustering approach accounts for both autocorrelation in flows within the same fund and for cross-fund correlation in flows within the same period. To show the results, we plot impulse response functions (IRFs), which we construct using the $\hat{\beta}_k^f$s and $\hat{\gamma}_k^f$s for the point estimate and their respective standard errors to derive 68 and 90 percent confidence bands.[15]

## 3. Main results

In what follows, we present estimates of the response of fund flows to, first, monetary policy shocks and, second, information shocks. We close the section by discussing alternative specifications and other sensitivity analyses.

### 3.1. The effects of monetary policy shocks

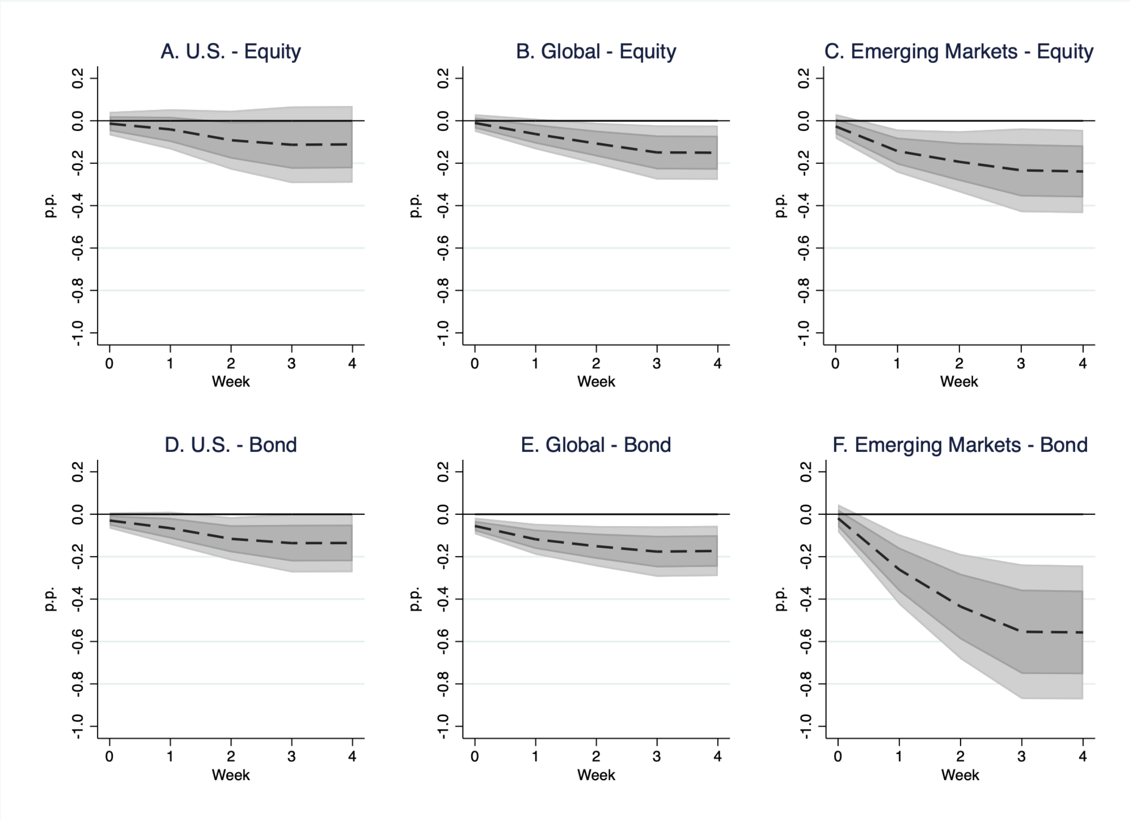
Figure 2 shows the effect of a 10 basis point Fed pure monetary policy shock on fund flows (measured in percentage points of assets), over the full sample (September/2001 to December/2020 for equity funds and February/2004 to December/2020 for bond funds). Panels A, B, and C (D, E, and F) present impulse responses for, respectively, U.S., Global and EMs equity (bond) funds. Black

[14] As the analysis is at the weekly frequency, including 24 lags is equivalent to account for past fund flows and returns over the previous six months. In a sensitivity analyses, we show that the results do not depend on the chosen lag structure.

[15] We examined whether the statistical significance of our results changes if we instead used (Driscoll & Kraay, 1998) standard errors, which are robust to very general forms of cross-sectional as well as temporal dependence. Those confidence bands are very close to those obtained through double clustering (figures C11 and C12).

dotted lines report point estimates. 68% and 90% standard error confidence intervals are displayed as deep and shallow gray areas respectively.[16]

**Figure 2: Investment fund flows after a 10 b.p. pure monetary policy shock**




*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Responses are obtained estimating the $\beta^k$ coefficients from Equation 4. Estimates are normalized to show responses to a 10 b.p. shock.

A Fed tightening shock has negative and persistent effects on flows to all types of funds. These effects are largest and more precisely estimated for EM funds. Four weeks after a 10 b.p. shock, flows to EM equity and bond funds are estimated to be about 0.3 and 0.6 p.p. lower, respectively. The same shock has smaller but still statistically significant negative effects on flows to global equity and global bond funds (the response is about -0.2 p.p. four weeks after the shock). The response of flows to U.S. funds is similar but less precisely estimated. Overall, these results confirm earlier findings that EM flows are particularly sensitive to U.S. monetary policy (Chari et al., 2020).

## 3.2. The effects of information shocks

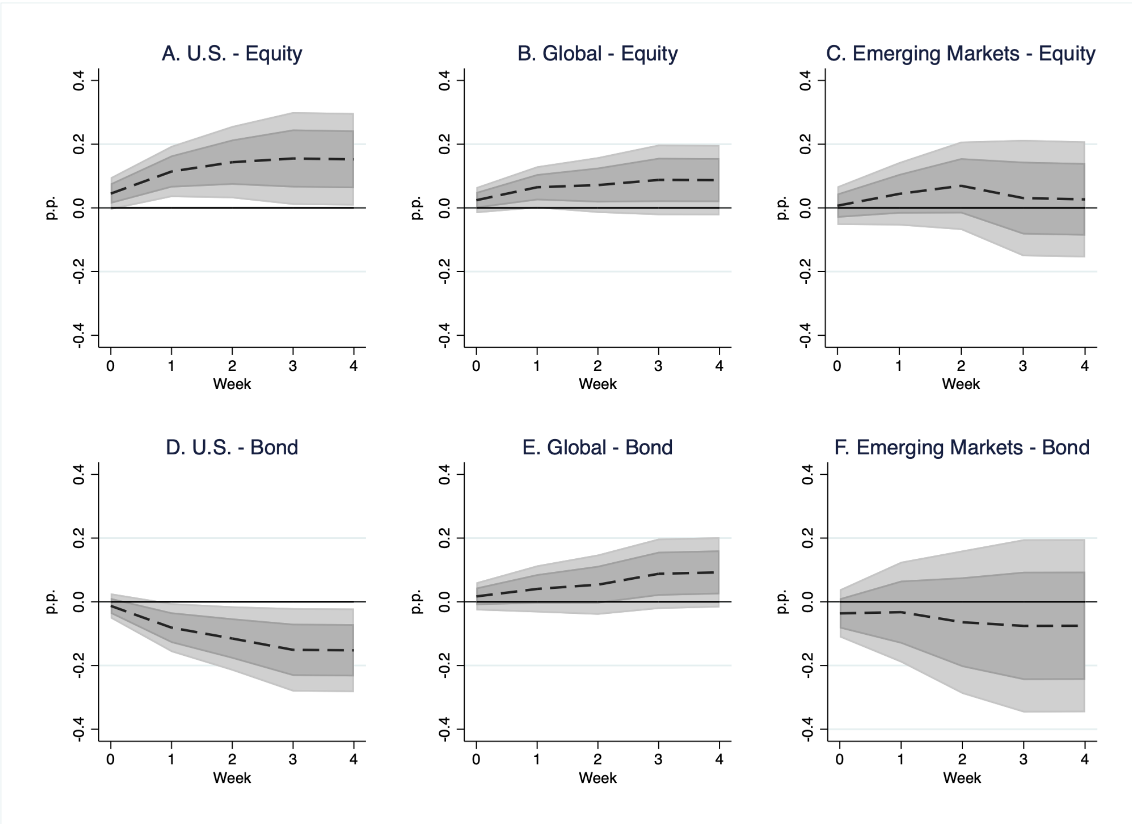
Next, we turn to the effect of Fed information shocks. The question of interest here is whether an increase of interest rates engineered on the back of higher growth expectations (information shock)

[16] Figure 2 and the others presented in this paper show the effects of a 10 b.p. positive shock. The effects of a negative shock are merely the opposite of those represented in the figures.

affects fund flows in a way that differs from an increase in interest rates that is due to a change in the pure monetary policy shock.

The results (Figure 3 below) indicate that the effects of information shocks on fund flows differ from those of pure monetary policy shocks in several important ways. First, positive information shocks lead investors to modestly rebalance their portfolios into equity funds. We estimate flows to U.S. and Global equity funds to be respectively about 0.2 and 0.1 p.p. higher four weeks after a 10 b.p. shock, while the effect on flows to EMs equity funds is still positive but not statistically significant. Second, positive information shocks lead investors to redeem shares from U.S. bond funds. The effect of a 10 b.p. shock is exactly the opposite of that on U.S. equity flows (-0.2 p.p. after four weeks). The effect on global bond fund flows is positive although small and only marginally significant, while flows to EMs bond funds display flat responses. Overall, these results suggest that the private sector investors revise upwards their belief about the state of the economy and thus increase equity investment, particularly in the U.S., after positive information shocks.

**Figure 3: Investment fund flows after a 10 b.p. information shock**




*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Responses are obtained estimating the $\gamma^k$ coefficients from Equation 4. Estimates are normalized to show responses to a 10 b.p. shock.

Taken together, our estimates indicate that it is crucial to disentangle pure monetary policy shocks from information shocks in order to study the response of mutual funds flows to Fed monetary policy. While an increase in interest rates due to a pure monetary policy shock decreases fund flows across the board, an increase in interest rates due to expectation of higher growth (information shocks) may increase fund flows in some cases. As we show next, relying on identification strategies that do not allow to distinguish pure monetary policy from information shocks may lead to the incorrect conclusion that Fed policy does not affect fund flows.

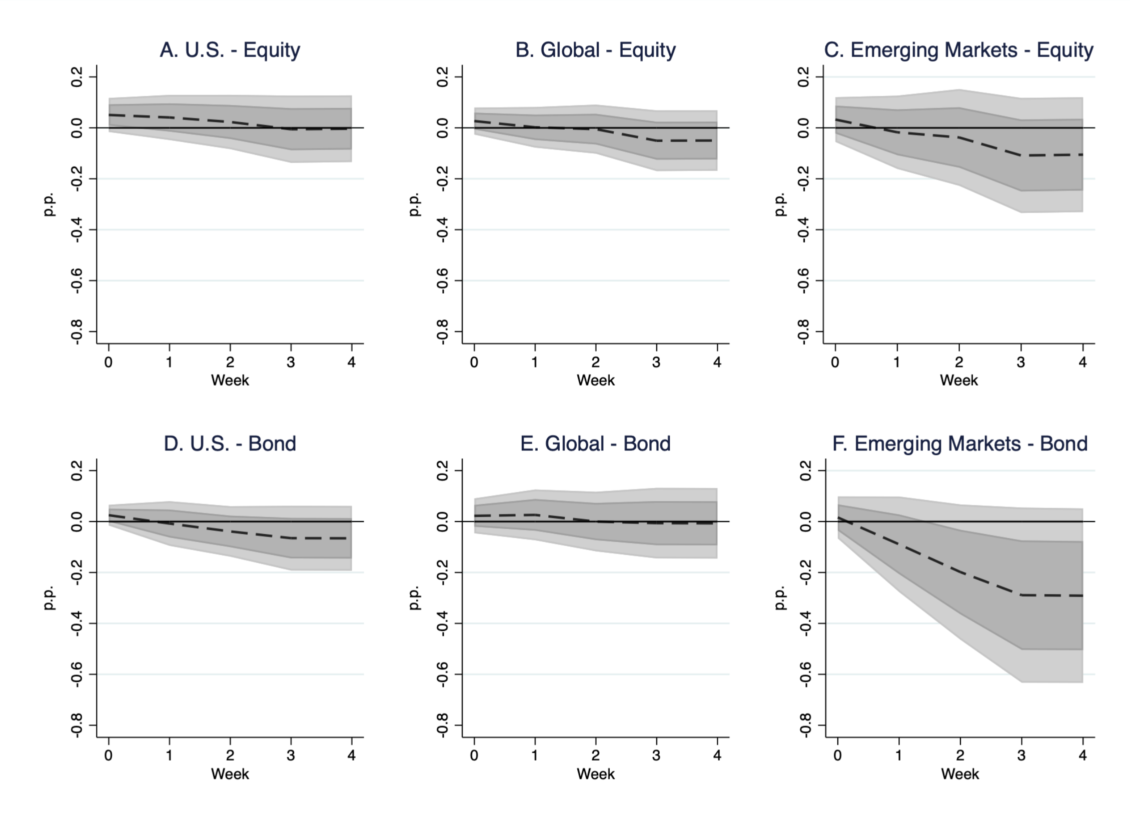
## 3.3. Results without separating monetary policy and information shocks

Our identification of monetary policy shocks and information effects differs from previous literature, which typically relies on a structural vector autoregression (VAR) approach (among others Christiano et al., 1999; Romer & Romer, 2004) or on the change in different sets of interest rates within a tight window around the release of the FOMC monetary policy decision (see for instance Nakamura & Steinsson, 2018) or stock prices and interest rates (see for instance Jarociński & Karadi, 2020) to identify monetary policy *news* shocks. In this section, we investigate how our results would change if we followed this alternative method.

Following Nakamura & Steinsson (2018), we use a composite measure of monetary policy news obtained as the first principal component of the unanticipated change over the 30-minute window around FOMC monetary policy decisions of (i) the current federal funds rate, (ii) the federal funds rate expected following the subsequent FOMC meeting, and (iii) the eurodollar future rates expected 2, 3, and 4 quarters ahead. Relative to a measure of monetary policy identified relying only on the high-frequency change in the current federal funds rate, this approach has the advantage of accounting for *forward guidance* shocks, which have become important in the post-GFC period. We then re-estimate Equation (4) replacing the $e_t$ and $i_t$ variables with this alternative high-frequency measure of monetary policy news, which does not distinguish between monetary policy shocks and information effects. Except for flows to EM bond funds, for which we find information effects not to be particularly important, the new results are sharply different from our baseline (Figure 4). Because these new estimates mix together the often opposite effects of pure monetary policy and information shocks, they lead to generally flat responses and the incorrect inference that Fed monetary policy shocks are not influential.

How do our baseline results compare to those that would be obtained using the approach of Jarociński & Karadi (2020) to decompose monetary policy news between pure monetary policy shock and information shock components? A key difference between our approach and that of Jarociński & Karadi (2020) lies in the fact that we exploit movements in the entire yield curve to derive our shock variables while these authors only use changes in the policy rate rates expected over a short horizon, which result in their series displaying a low variability during ZLB periods.

**Figure 4: Investment fund flows after a 10 b.p. monetary policy "news" (without separating pure monetary policy and information shocks)**




*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Responses are obtained estimating the $\beta^k$ coefficients from an alternative specification of Equation 4 in which the $e_t$ and $i_t$ variables are replaced by a composite high frequency measure of monetary policy news. Estimates are normalized to show responses to a 10 b.p. shock.

Comparing the two sets of shock series, we find that the two pure monetary policy shock variables have a fairly high correlation, while the two information shock variables do not.

Estimates of the effect of pure monetary policy shocks obtained using Jarociński & Karadi (2020) series are qualitatively in line with ours (Figure B1 in Appendix B). However, the estimated effect of information shocks is different (Figure B2) and runs against results of closed-economy macro models: the response of investments into U.S. and Global & EM equity funds is sharply negative under JK, while investments into bond funds display negative but not statistically significant responses.

## 3.4. Robustness checks and alternative specifications

In this section we check the robustness of our baseline results to a battery of different specifications. The results from these exercises are reported as figures in Appendix C. Each figure shows baseline IRFs together with point estimates obtained from these different specifications. We first check that our results are robust to different lag structures and estimate two additional specifications in which we respectively include 28 and 32 lags of fund flows and NAV returns (Figures C1 and C2). We also verify that the results are not affected by controlling for shocks happening within the $t+k$ horizon (also shown in Figures C1 and C2).[17]

Insofar as our shock series represent truly exogenous shocks, our results should not be affected by the inclusion of control variables. We verify that this is actually the case by adding three sets of controls in the regression specification (Figures C3 and C4): (i) the surprise component of major U.S. macroeconomic releases, which may affect fund flows (Fratzscher, 2012), (ii) the VIX index, which is known to have important effects on portfolio investments and capital flows to, in particular, EMs (Ahmed & Zlate, 2014), and (iii) the TED spread, a measure of tightness in the U.S. interbank market, obtained as the difference between the 3-month U.S. Treasury bill and LIBOR rates.[18]. We also check that our results are not driven by particular funds (Figures C5 and C6) and exclude, in turn, funds domiciled in low-tax countries, funds domiciled in EMs and small funds (those in the lower quartile of mean assets).

Finally, we consider alternative samples. First, since large funds are more relevant for the broader implications of fund flows for capital flows, we estimate Equation (4) on the subsample of funds with mean assets in the upper quartile (Figures C7 and C8). Second, we estimate Equation (4) on the post-GFC sample (Figures C9 and C10). Albeit quantitatively different in some cases, the new estimates are broadly in line, and not statistically different from our baseline, thus suggesting that the results estimated for the full sample are quite general.

## 4. Transmission Channels

In this section, we explore portfolio rebalancing, the response of the USD exchange rate and variation in risk appetite and uncertainty as potential transmission channels for our baseline reduced form results. According to the portfolio rebalancing channel, investors rebalance their portfolios towards higher-yielding assets following monetary policy decisions that lower the yields on safe government bonds. Fratzscher et al. (2018); Chari et al. (2020) find this channel to have led investors to rebalance their portfolios towards EM assets after the adoption of unconventional monetary policies in the U.S. and other advanced markets in the wake of the GFC. Hence, one possible explanation for our results is that Fed's pure monetary policy shocks increase (real) interest rates in the U.S., while information shocks do not. This would explain why we find that investors react to pure

[17] According to Teulings & Zubanov (2014) the local projection model can be mis-specified if there exist shocks happening within the horizon $t+k$ that are not captured by the period $t$ explanatory variable. This is unlikely to be a problem in our set-up since the FOMC generally meets with a 6-week or even longer interval. However, we still control for forward shock variables as suggested by Teulings & Zubanov (2014).

[18] The U.S. macroeconomic releases that we consider are the non-farm payroll employment (NFP), the core CPI inflation, the retail sales and the ISM manufacturing PMI releases

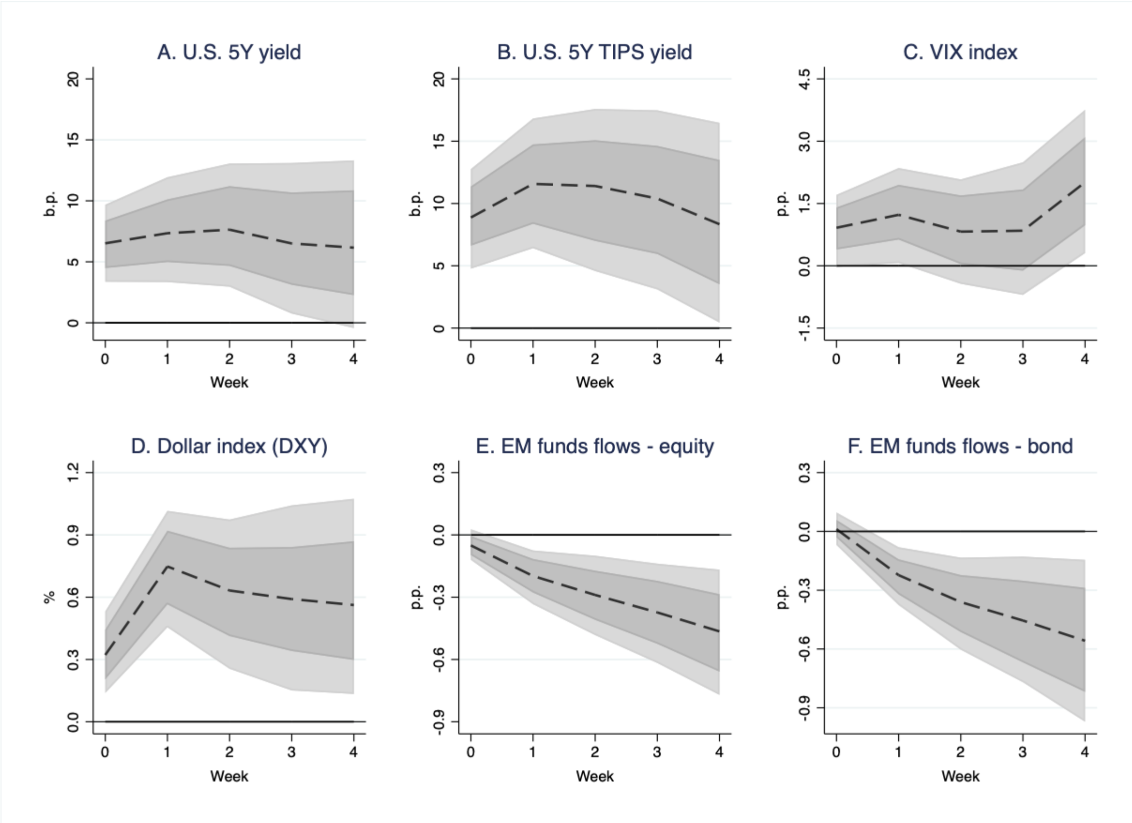
monetary policy shocks by rebalancing their portfolios away from EMs assets, while the same does not happen following information shocks.

Another possibility is that pure monetary policy and information shocks affect investors' appetite for risk differently. While an increase in interest rates that is due to a change in, say, the monetary policy reaction function may well increase risk aversion, a "benign" increase in interest rates due to higher growth expectations should not affect risk appetite. Bruno & Shin (2015) formalize the risk-taking channel of monetary policy in the context of cross-border bank lending flows through changes in the interest rate, which affect banks' leverage. Forbes & Warnock (2012) find that global factors, especially global risk, are significantly associated with extreme capital flow episodes. Ahmed & Zlate (2014) find an important role of global risk appetite, proxied through the VIX index, in driving portfolio flows to EMs. Here, we investigate how Fed shocks affect the VIX and whether that could explain our results. Moreover, since relying on the VIX alone does not allow distinguishing between changes in the price of risk (risk aversion) from changes in the quantity of risk, we also explore the effect of Fed shocks on the risk aversion and the uncertainty indexes constructed by Bekaert et al. (2021).

We also consider the response of the USD exchange rate as another possible channel. To the extent that Fed policy affects the international price of the USD, this may have implications for investment decisions as they would induce a mechanical change in the dollar price of foreign assets. Bruno & Shin (2015) find that a contractionary U.S. monetary policy shock leads to a drop in cross-border banking capital flows through an appreciation of the USD.

To empirically investigate these potential transmission channels, we opt for a vector autoregression (VAR) approach. The advantage of the VAR is that we can estimate the responses of several financial variables to our shock series, as well as the feedback effects that such responses have on fund flows, within a unified framework. We consider the nominal and real (TIPS) interest rate on U.S. 5-year government bonds, the VIX index and the USD exchange rate (measured through the DXY index). As for fund flows, we only include those to EM equity and bond funds in order to keep the VAR parsimonious. Exploiting the fact that our monetary policy variables are exogenous shocks, we identify the VAR through a Cholesky decomposition, ordering the pure monetary policy and information shocks first and second respectively.[19] Figures 5 and 6 show IRFs to the pure monetary policy and information shocks, respectively.

**Figure 5: Financial variables and EM funds flows after a pure monetary policy shock**

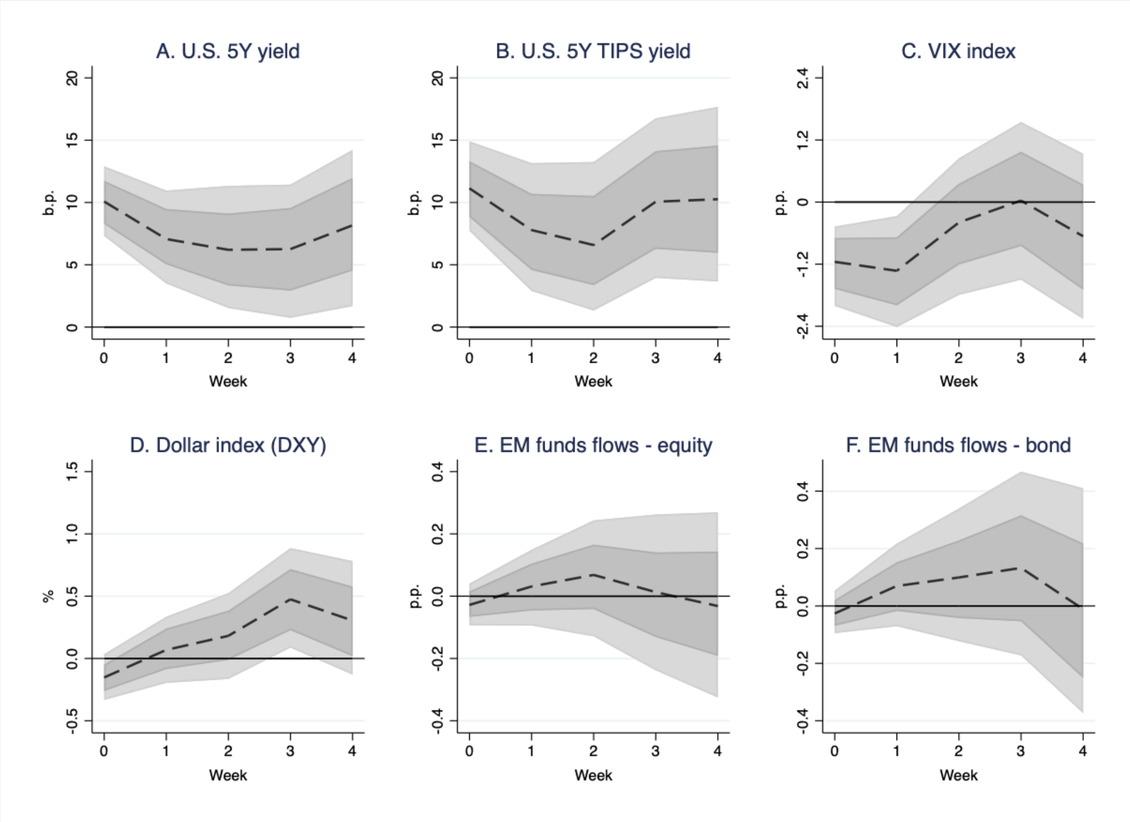



*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Estimates are obtained estimating a VAR specification including the monetary policy and information shock variables, ordered first and second respectively, the 5-year nominal and real rates and the VIX, all in first differences, the dollar index (DXY), in log first-differences and EMs equity and bond flows, in percent of assets. The VAR includes 5 lags of the endogenous variables. Confidence bands are obtained through bootstrapping (500 replications). Estimates are normalized so as to show responses to a 10 b.p. shock.

The VAR results confirm the finding that pure monetary policy shocks lead to negative flows to EM bond and equity funds, while information shocks do not. Looking at the response of the other variables, we find that pure monetary policy and information shocks alike drive up both nominal and real interest rates. This suggests that the main driver of our baseline results is unlikely to be the portfolio rebalancing channel. The importance of the exchange rate channel can instead be examined by looking at the response of the DXY. Both monetary and information shocks lead to an increase in the index (appreciation of the USD), although the response to information shocks is

[19] The identifying assumption is that the shock variables can have contemporaneous effects on the other variables in the VAR but that the opposite does not hold. As shown by Christiano et al. (1999), the ordering of the variables *after* the shock does not matter. Changing the ordering of the shock variables among themselves (information shock first and pure monetary policy shock second) does not affect the results. The VAR is estimated at the weekly frequency, including 5 lags of the endogenous variables. Confidence bands are obtained through bootstrapping (500 repetitions).

**Figure 6: Financial variables and EM funds flows after an information shock**



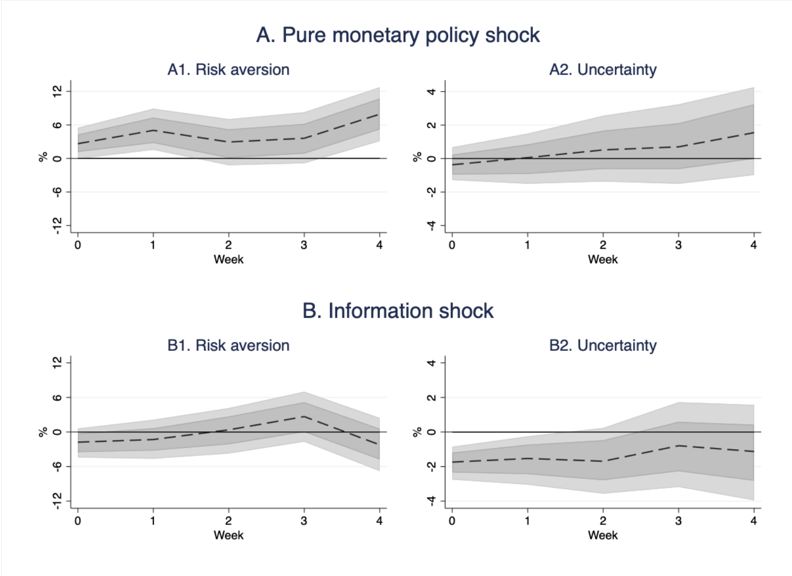

*Notes:* See notes to Figure 5.

sluggish and less precisely estimated. This may suggest that the exchange rate channel can explain some of our baseline results.[20]

What is really striking, however, is the differential response of the VIX index, which tightens after a pure monetary policy shock and eases following an information shock. The magnitude of the impact responses are comparable, but the decrease following information shocks is short-lived, while the increase following monetary policy shocks is more persistent. We check whether these effects are driven by changes in the price or the quantity of risk by estimating another VAR specification where the VIX index is replaced by the risk aversion and the uncertainty indexes of Bekaert et al. (2021). The IRFs derived for EMs fund flows, bond yields and the DXY are very close to those estimated above, hence Figure 7 only reports IRFs for the risk aversion and uncertainty indexes. In line with the theory of the risk-taking channel of monetary policy, the price of risk (risk aversion) jumps by 3-5% after a 10 b.p. pure monetary policy shock, while the uncertainty index (the quantity of risk) is flat. On the other hand, the price of risk is broadly unchanged but uncertainty sharply decreases, by about 2% on impact, after a 10 b.p. information shock.

[20] On the other hand, however, the differential response of the exchange rate may be the flip side of the different effects of pure monetary policy and information shocks on fund flows, thus caution is warranted.

**Figure 7: Effects of Fed's shocks on risk aversion and uncertainty**




*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percent). Estimates are obtained estimating a VAR specification including the monetary policy and information shock variables, ordered first and second respectively, the 5-year nominal and real rates, all in first differences, the dollar index (DXY), the risk aversion and the uncertainty indexes of Bekaert et al. (2021), in log first differences, and EMs equity and bond flows, in percent of assets. The VAR includes 5 lags of the endogenous variables. Confidence bands are obtained through bootstrapping (500 replications). Estimates are normalized to show responses to a 10 b.p. shock.

These dynamics strongly suggest that the differences in responses to pure monetary policy and information shocks may be due to the risk-taking channel of monetary policy. In Appendix D, we substantiate the link between changes in the VIX and EM fund flows by showing the feedback effects of an increase in the VIX index (and of the DXY index) on flows to EM funds (Figure D1). The results echo the literature in that we find an increase in the VIX to sharply decrease flows to bond and to a lesser extent equity funds ([see Bruno & Shin, 2015, for example).

As a further extension, we estimate the response of bond fund flows to pure monetary policy shocks, separately for sovereign and corporate bonds (Figure D2). A tightening shock leads to negative flows from both sovereign and corporate EMs funds as well as corporate U.S. and Global funds. The response of flows to sovereign Global funds is flat, while flows to U.S. sovereign funds increase, in a further signal that pure monetary policy shocks increase risk aversion, eliciting outflows from riskier funds and inflows into those that invest in safe haven assets (U.S. government bonds).

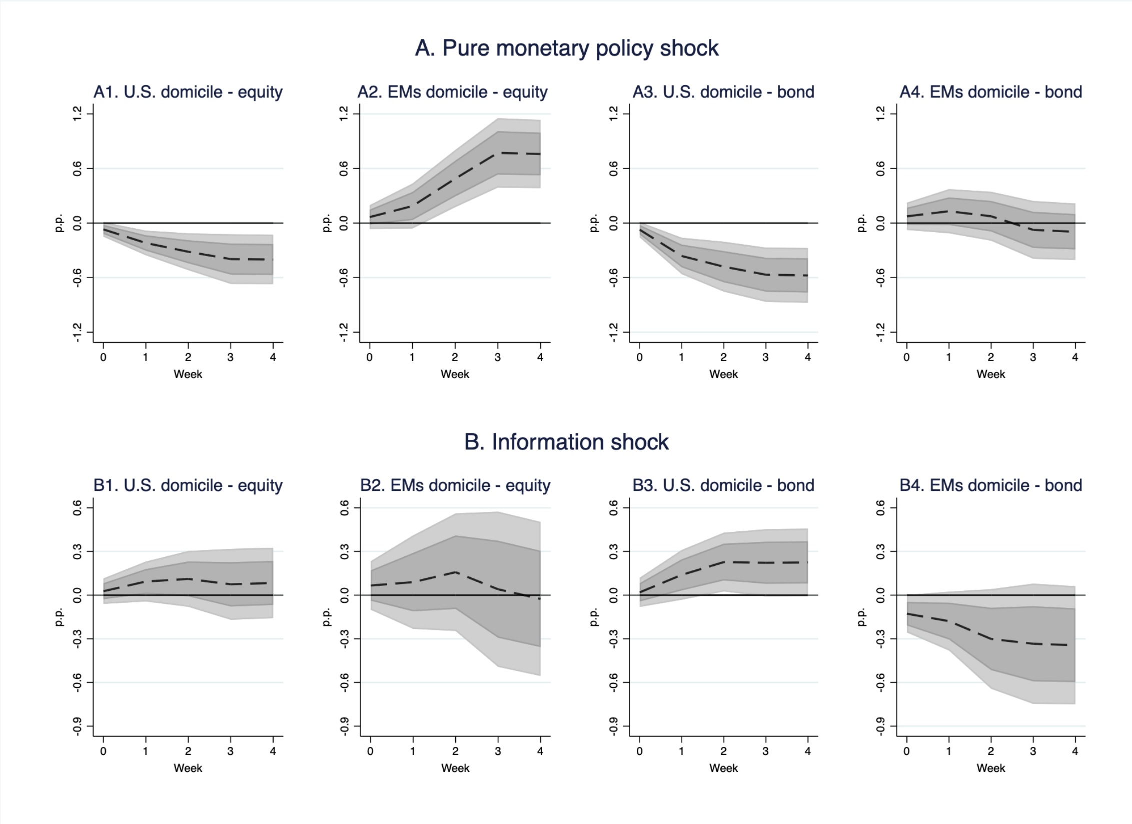
We conclude this section by positing the following transmission channel. An increase in interest rates that is unpredictable from changes in economic fundamentals (pure monetary policy shock) increases risk aversion and lead investors to shed high-risk assets. On the other hand, an increase in interest rates that reflects the Fed's perception of improved U.S. fundamentals tends to decrease uncertainty, neutralizing the detrimental effect of higher interest rates for EMs fund flows.

# 5. Extensions

## 5.1. Home bias: asymmetric behavior of U.S. and EM investors

Previous literature has shown that when investors become more risk averse they tend to rebalance their portfolios away from foreign and into domestic assets.[21] Here, we test whether domestic and foreign investors respond differently to Fed shocks exploiting information on funds' domiciles, which we see as a proxy for the country of origin of the underlying investors. We focus on funds investing in EMs and compare the response of flows to those domiciled in the U.S. versus domiciled in EMs themselves. For the estimation, we go back to local projections, which, absent feedback effects to be explored, is preferred on the grounds of greater flexibility relative to the VAR approach (see discussion in Section 2.4)

**Figure 8: Effect of Fed's shocks on EMs fund flows accounting for fund domicile**




*Notes:* See notes to Figures 2 and 3. Estimates are obtained on the subsample of funds domiciled in the U.S. (Panels A1, A3, B1 and B3) and EMs (Panels A2, A4, B2 and B4).

Results are shown in Figure 8. While U.S. investors dis-invest from EM equity funds after a pure monetary policy shock (Panel A1), EM investors sharply increase flows to the same type of funds (Panel A2), therefore mitigating the reduction in foreign capital. We find a similar tendency for bond funds, although the response of EM investors is much weaker and less persistent (Panels A3

[21] See Coeurdacier & Rey (2013) for a comprehensive review of the early literature.

and A4). In contrast, after an information shock, U.S. investors increase flows to EM bond funds, while EM investors decrease them (Panels B3 and B4). Flows to EM equity funds do not exhibit significant responses to information shocks.

We then perform a similar exercise on flows to U.S. funds (Figure D3 in Appendix D). We find that flows to funds investing in U.S. equities that are domiciled abroad increase sharply after a positive information shock. This increase is much larger than the increase in U.S. equity funds domiciled domestically (likely to be used by domestic investors). In the next section, we explore what these results imply for cross-border flows.

## 5.2. Implications for capital flows

Our fund-level analysis so far suggests that pure monetary policy shocks lead to a decline in foreign capital, while information shocks may increase it. In this sub-section (only), we use the *country-level* dataset of Emerging Portfolio Fund Research, which provides information on the amount of new purchases of country $y$'s assets made by funds domiciled in foreign countries as well as overall country $y$'s assets owned by these same funds we have been examining. We use this aggregated cut at the data to estimate the response to our shock series of cross-border flows from foreign countries into country $y$. The focus is on gross foreign inflows.

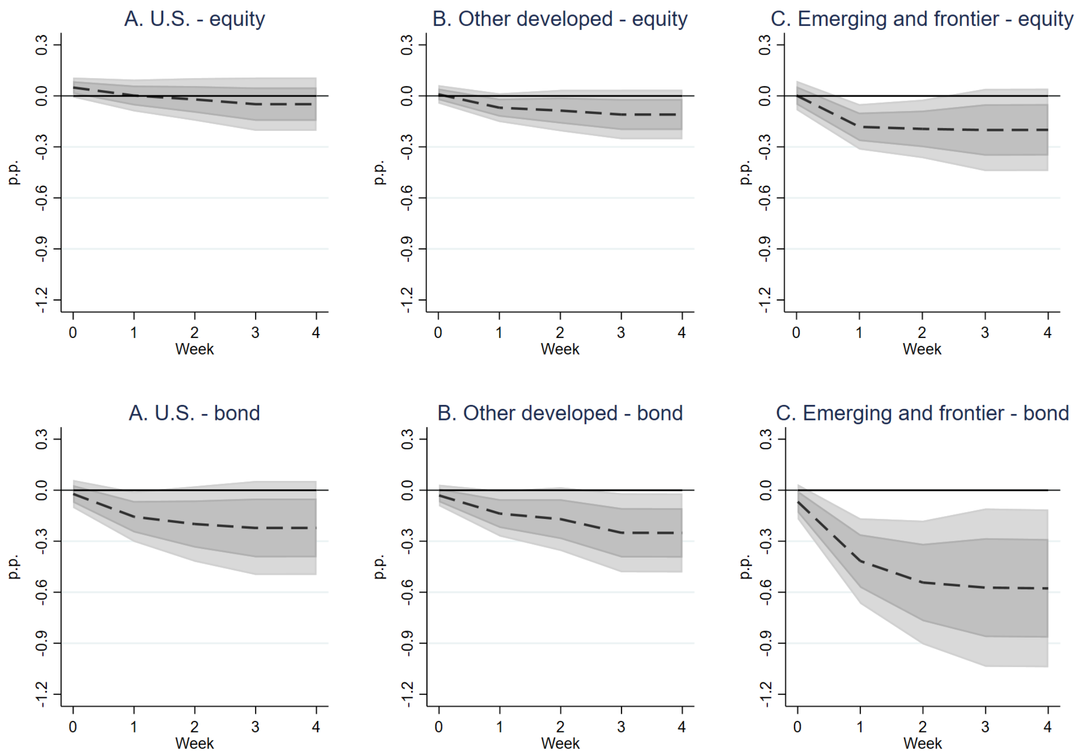
Figures 9 and 10 report responses to pure monetary policy and information shocks respectively. Countries are divided in three groups: (i) the U.S., (ii) other developed markets, and (iii) emerging and frontier markets (according to the MSCI definition). The new results confirm that pure tightening U.S. monetary policy shocks generally lead to a decline of foreign capital. When we look at bond flows, such decline is not limited to emerging and frontier markets. Foreign capital also decline in the U.S. and in other developed markets. Looking at equity flows, the decrease in foreign capital is instead smaller and does not involve the U.S.

The new estimates for information shocks offer strong evidence that an increase in U.S. interest rates on the back of a stronger economy leads to sharp inflows of foreign capital into U.S. equity assets, while it slightly decrease foreign capital inflows to other countries' equity assets. Responses of foreign inflows into bond assets tends to be negative but are not statistically significant.

## 5.3. Zooming in on EM bond funds: investment mandate matters

Here, we zoom in on flows to EM bond funds and investigate heterogeneities in responses to Fed shocks across different types of funds, exploiting the richness of the Emerging Portfolio Fund Research fund-level dataset. Besides the geographical focus, bond funds differ in several dimensions. Some can invest in any type of bond, but others are constrained to invest only in certain bonds.

**Figure 9: Country-level results: cross-border flows after a monetary policy shock**



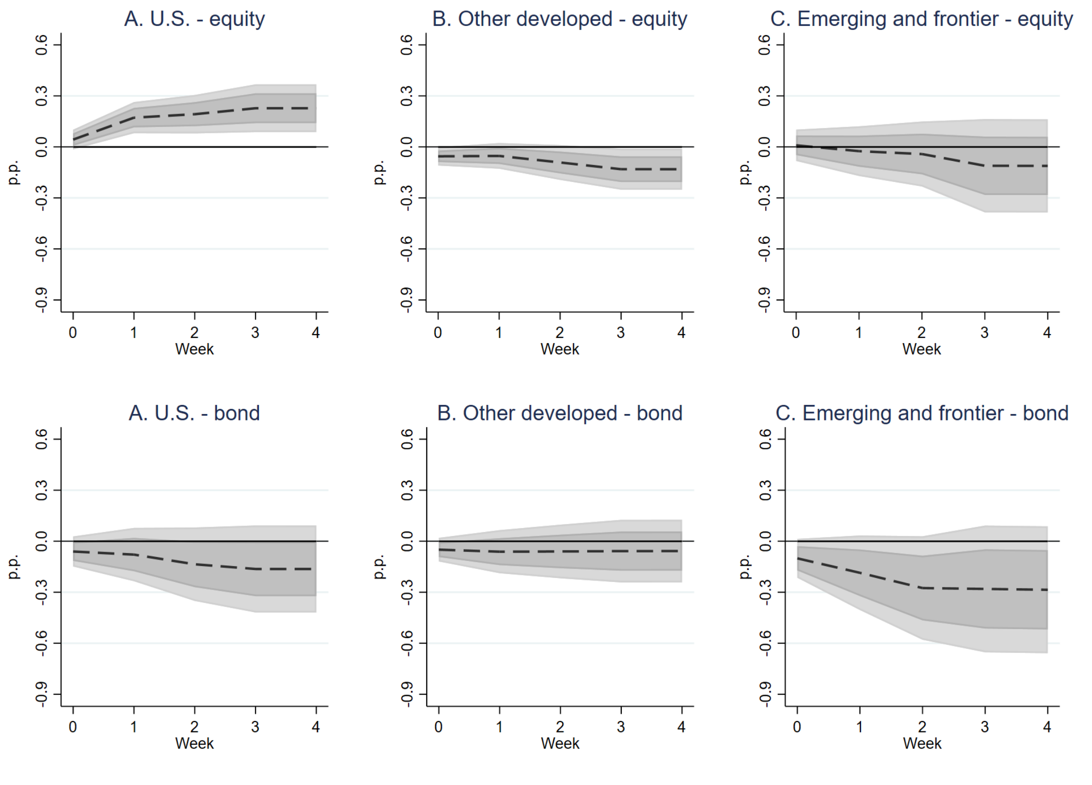

*Notes:* See notes to Figure 2. Estimates are obtained estimating the $\beta^k$ coefficients from am alternative, country-level, specification of Equation 4 in which the dependent variable is new purchases of country $y$'s assets made by funds domiciled in foreign countries as a share of assets already owned.

Here, we consider three key dimensions that may impact how bond investors respond to U.S. monetary policy news: the issuer of the bond, its credit quality, and the currency of denomination – whether "hard" (USD, GBP, EUR, CHF or YEN) or local (any EM currency).

If changes in risk aversion are the main factor driving the effect of pure monetary policy shocks on EM bond fund flows, responses may be stronger for funds investing in bonds considered to be riskier. Credit quality is a direct indication of risk, but other factors may also matter. For instance, corporate bonds may be considered to be riskier than sovereign bonds, even when they have the same credit rating. Similarly, although foreign investors holding a bond denominated in hard currency are shielded from exchange rate fluctuations, hard currency bonds may be perceived to be riskier than local currency ones given the currency mismatch between the income and liability of the bond issuer. Hence, they may be more exposed to changes in risk aversion.

To investigate whether bond characteristics matter, we define funds that are restricted to invest in bonds that (i) are issued by the government, (ii) have a credit rating of BBB- or above (investment-grade bonds), and (iii) are denominated in hard currency to be our baseline group and compare flows to this group to those to other groups having different characteristics. Empirically, we estimate

**Figure 10: Country-level results: cross-border flows after an information shock**




*Notes:* See notes to Figure 9. Estimates are obtained estimating the $\gamma^k$ coefficients.

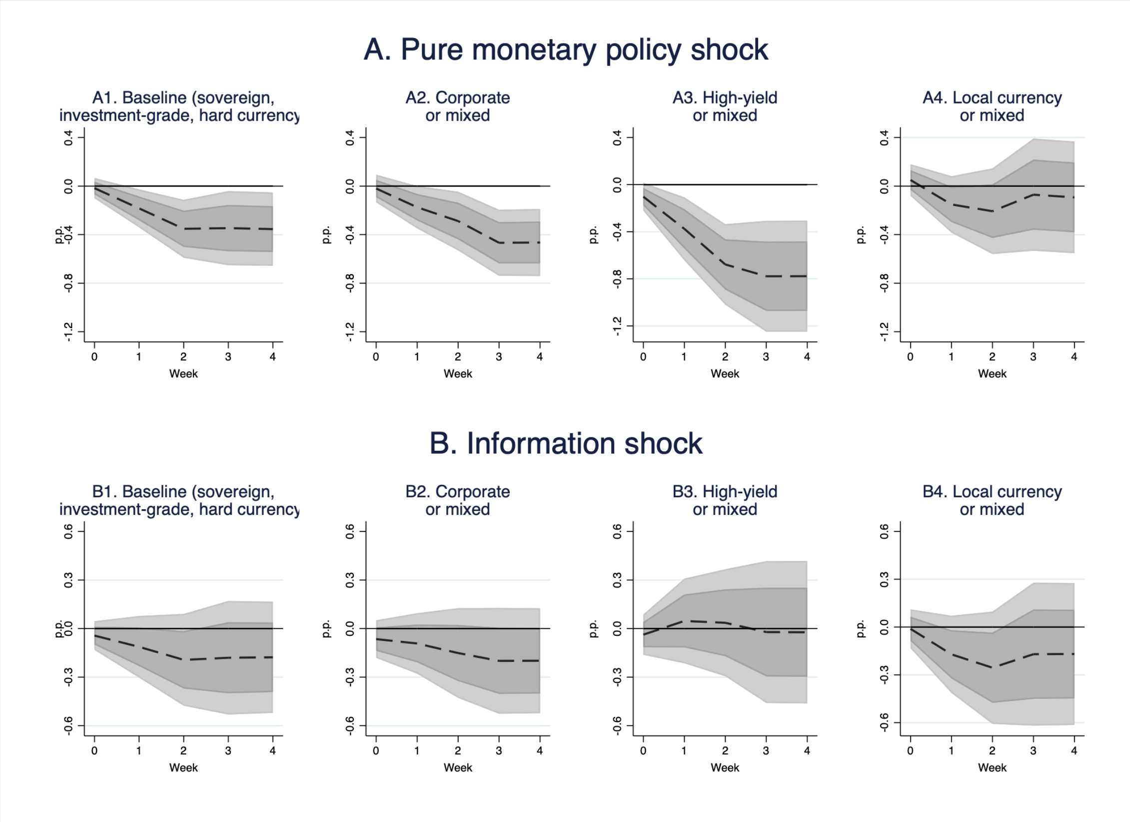
the following equation:

$$\frac{\sum_{j=0}^{k} F_{i,t+j}}{A_{i,t}} = \beta^k e_t + \gamma^k i_t + \sum_{c=1}^{3} (\zeta^{c,k} x_i^c * e_t + \pi^{c,k} x_i^c * i_t) + \sum_{l=1}^{24} \left( \sigma_l^k \frac{F_{i,t-l}}{A_{i,t-l}} + \phi_l^k n_{i,t-l} \right) + \delta_i + \varepsilon_{i,t} \quad (5)$$

where the $x_i^c$s are three dummy variables for funds investing in, respectively: (i) either both sovereign and corporate bonds or corporate bonds only ($c = 1$), (ii) either both investment grade and high-yield bonds or high-yield bonds only ($c = 2$), (iii) either both hard and local currency bonds or hard currency bonds only ($c = 3$), and the rest is as in Equation 4.

Figure 11 shows the new estimates. Panels A1 and B1 show responses of flows into our baseline group of funds. Such responses are simply given by the $\beta^k$ and $\gamma^k$ coefficients. Panels A2 and B2 show flows to funds that do not necessarily have to invest in sovereign bonds, but are still constrained to invest in investment-grade and hard currency bonds (estimates obtained as $\beta^k + \zeta^{1,k}$ and $\gamma^k + \pi^{1,k}$ respectively). Panels A3 and B3 focus on funds that must invest in bonds that are issued by the sovereign and are denominated in hard currency but either do not have a credit quality restriction or can only invest in high-yield bonds (those with credit rating below BBB-, estimates given by $\beta^k + \zeta^{2,k}$ and $\gamma^k + \pi^{2,k}$). Finally, Panels A4 and B4 show responses when the currency denomination constraint is relaxed ($\beta^k + \zeta^{3,k}$ and $\gamma^k + \pi^{3,k}$).

**Figure 11: Effect of Fed shocks on EM fund flows accounting for fund characteristics**



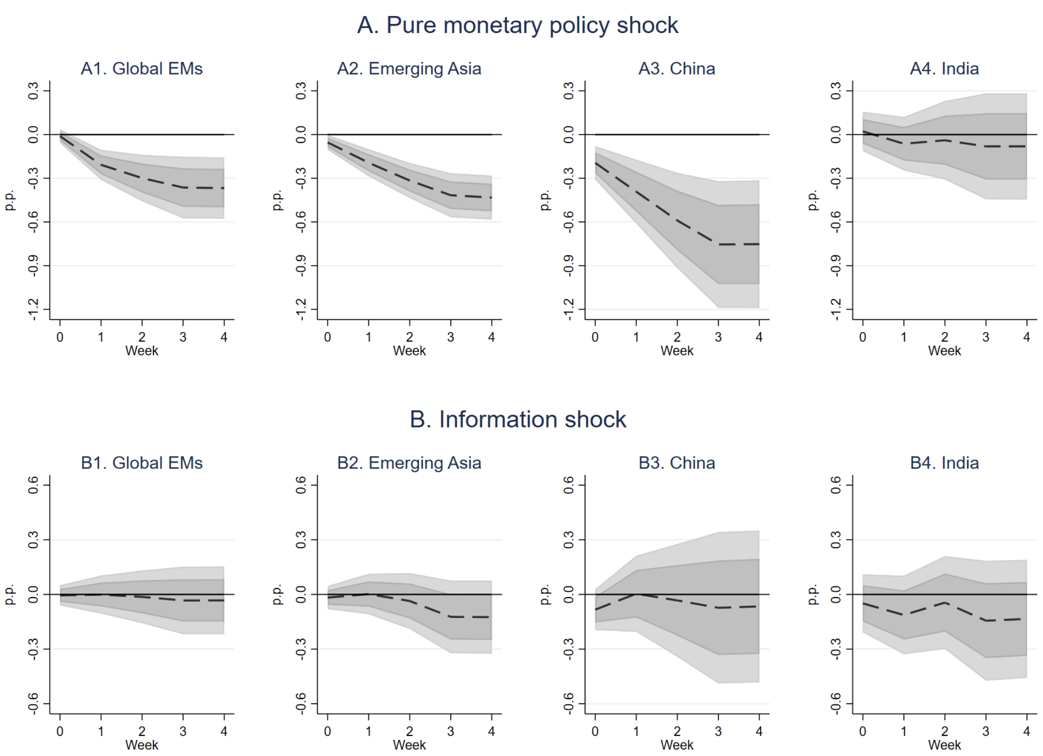

*Notes:* Panels A1 and B1 report responses of flows into funds with mandate to invest only in (i) sovereign, (ii) investment-grade, and (iii) hard currency bonds (obtained estimating the $\beta^k$ and $\gamma^k$ coefficients from Equation 5). Panels A2-A4 (B2-B4) report responses when each of the investment mandates (i)-(iii) is relaxed one at a time (obtained as linear combinations of the $\beta^k$ and $\zeta^{i,k}$ ($\gamma^k$ and $\pi^{1,k}$) coefficients). Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Estimates are normalized to show responses to a 10 b.p. shock.

This analysis points to **credit quality** and **currency denomination** as having an important role in determining the response of investors to pure monetary policy shocks. Outflows from funds investing in our baseline group of bonds (sovereign, investment-grade and hard currency) are half as large as those from funds having the same characteristics but that are not constrained to invest in investment grade bonds. By contrast, outflows from funds that are not constrained to invest in hard currency bonds are not significant, suggesting that local currency bonds may be less exposed to monetary policy shocks in the U.S. This has important policy implications since local currency bonds also have the advantage that they shield the issuer from currency mismatches and therefore may be a good instrument to attract foreign capital while at the same time reducing risks stemming from exchange rate fluctuations and changes in risk aversion. Looking at responses to information shocks, we do not find significant differences across funds based on investment mandate.

### 5.4. Regional heterogeneity: zooming in on Asia

We explore responses to Fed policy of flows to EM funds that invest in Asia. We look in particular at funds investing in (i) all Asian countries except Japan, (ii) China and (iii) India. For comparison, we also show responses of flows to funds that invest in the ensemble of EMs. We exclude funds that are domiciled in EMs, as we have seen that EM investors tend to respond differently from foreign investors to U.S. monetary policy news, which may confound the results. Since flows to EM bond and equity funds tend to be qualitatively similar, we group them together (separate results are available upon request).

**Figure 12: Effect of Fed's shocks on Global EMs and Asia funds flows**




*Notes:* See notes to Figures 2 and 3. Estimates are obtained on the subsample of (i) Global EM funds (Panels A1, B1), (ii) Asia ex-Japan funds (Panels A2, B2), (iii) China funds (Panels A3, B3), and (iv) India funds (Panel A4, B4). Funds domiciled in EMs are excluded from the sample.

Funds investing in China suffer sharp outflows after a tightening monetary policy shock. Global EMs and Asian regional funds also suffer outflows, but they are about half as large as outflows from China-focused funds. Funds investing in India instead do not suffer outflows on average. In line with previous results, responses to information shocks are not significant.

Figures D4 and D5 in Appendix D show results for other regional (non-Asia) funds and individual BRIC countries funds respectively. Flows to African, Emerging Europe and Latin American regional funds respond to pure monetary policy surprises similarly to global EM funds, while funds investing

BRIC countries exhibit larger responses, in line with the response of China-focused funds. Among single BRIC countries funds, we confirm that China funds suffer by far the largest outflows. Looking at information shocks, African and Emerging Europe regional funds, as well as Russia funds receive inflows following a positive information shock.

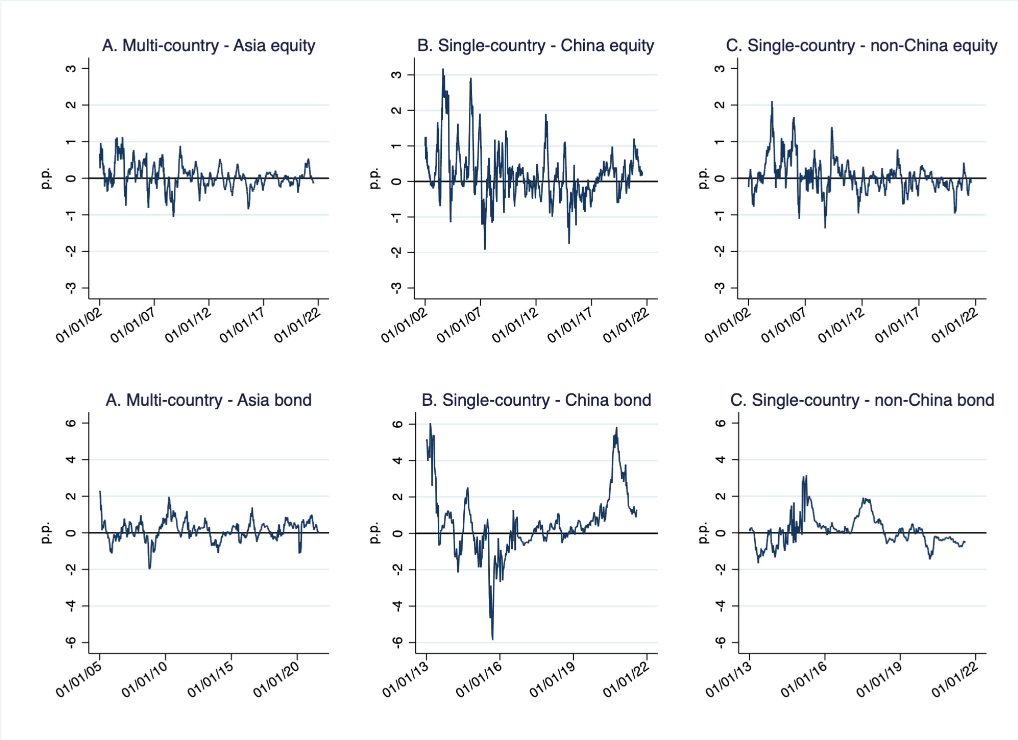
### Flows to Asia-focused funds: Covid resilient

Here, we present descriptive statistics on flows to Asia-focused funds, restricting attention to funds domiciled in advanced countries. We distinguish between equity and bond funds as well as between multi-country and single-country funds. Among the latter, we consider flows to funds investing in China and other (non-China) countries separately. These data are displayed in Figure 13. Two stylized facts emerge strongly. First, flows to China-focused funds are far more volatile than flows to multi-country and non-China single-country funds. Second, bond investors proactively shift between China and non-China funds in response to shocks. For instance, flows to China bond funds were sharply negative during the Chinese financial market turbulence of 2015-2016, as foreign investors rebalanced their investments away from China and into non-China bond funds. On the other hand, non-China bond funds suffered outflows during the COVID-19 epidemic, while China bond funds received large inflows. This suggests that China may be perceived as a safe haven within Asia. Remarkably, China bond funds did not suffer any outflows even at the height of the COVID-19 epidemic in China. Such rebalancing is less evident for flows to equity funds. We further describe U.S. monetary policy and flows during the Covid pandemic in Appendix E.

## 6. Conclusions

We contribute to the vast literature on the effects of U.S. monetary policy on international capital flows, employing a novel identification procedure to decompose observed U.S. monetary policy surprises into pure monetary policy shock and information shock components. We find that an increase in interest rates driven by a pure monetary policy shock leads to persistent outflows from EMs and to a lesser extent global and U.S. mutual funds. On the other hand, when rates increase following a positive information shock investors reallocate capital out of U.S. bonds and into riskier mutual funds. We also show that failing to make this decomposition of monetary policy surprises would lead to the incorrect conclusion that U.S. monetary policy has essentially zero effect on international mutual fund flows. We attribute our main results to the risk-taking channel of monetary policy. Pure monetary policy shocks tend to tighten financial conditions, while information shocks lower the VIX. We furthermore find heterogeneity in regional responses to these shocks, with Global, EM, and Asia-focused funds suffering sharp outflows after tightening U.S. monetary policy shocks.

**Figure 13: Aggregate flows to Asia-focused funds**




*Notes:* the figure shows aggregate flows (flows across all funds) as a share of aggregate assets, distinguishing by investment mandate. Only funds domiciled in advanced economies are included. Flows are shown as 8-week moving averages. X-axes denote the time period. Y-axes denote the magnitude (in percentage points).

## References

Ahmed, S., & Zlate, A. (2014). Capital flows to emerging market economies: A brave new world? *Journal of International Money and Finance*, *48*, 221–248.

Auerbach, A. J., & Gorodnichenko, Y. (2012). Measuring the output responses to fiscal policy. *American Economic Journal: Economic Policy*, *4*, 1–27.

Bauer, M., & Swanson, E. T. (2021). An alternative explanation of the "fed information effect". *http://www.socsci.uci.edu/ swanson2/index.html*, .

Beber, A., & Brandt, M. W. (2009). When it cannot get better or worse: The asymmetric impact of good and bad news on bond returns in expansions and recessions. *Review of Finance*, *14*, 119–155.

Bekaert, G., Engstrom, E. C., & Xu, N. R. (2021). The time variation in risk appetite and uncertainty. *Management Science*, .

Bloomberg (). Bloomberg financial services.

Boyd, J. H., Hu, J., & Jagannathan, R. (2005). The stock market's reaction to unemployment news: Why bad news is usually good for stocks. *The Journal of Finance*, *60*, 649–672.

Bruno, V., & Shin, H. S. (2015). Capital flows and the risk-taking channel of monetary policy. *Journal of Monetary Economics*, *71*, 119–132.

Bu, C., Rogers, J. H., & Wu, W. (2020). A unified measure of fed monetary policy shocks. *Journal of Monetary Economics*, *Forthcoming*.

Burger, J., Warnock, F., & Warnock, V. (2018). The effects of u.s. monetary policy on emerging market economies' sovereign and corporate bond markets. In *Monetary Policy and Global Spillovers: Mechanisms, Effects, and Policy Measures* (pp. 49–96). Central Bank of Chile volume 25.

Calvo, G. A., Leiderman, L., & Reinhart, C. M. (1993). Capital inflows and real exchange rate appreciation in latin america: the role of external factors. *Staff Papers*, *40*, 108–151.

Campbell, J. R., Evans, C. L., Fisher, J. D., Justiniano, A., Calomiris, C. W., & Woodford, M. (2012). Macroeconomic effects of federal reserve forward guidance [with comments and discussion]. *Brookings Papers on Economic Activity*, (pp. 1–80).

Chari, A., Stedman, K. D., & Lundblad, C. (2020). Taper tantrums: Quantitative easing, its aftermath, and emerging market capital flows. *The Review of Financial Studies*, .

Christiano, L. J., Eichenbaum, M., & Evans, C. L. (1999). Monetary policy shocks: What have we learned and to what end? *Handbook of macroeconomics*, *1*, 65–148.

Cieslak, A., & Schrimpf, A. (2019). Non-monetary news in central bank communication. *Journal of International Economics*, *118*, 293–315.

Coeurdacier, N., & Rey, H. (2013). Home bias in open economy financial macroeconomics. *Journal of Economic Literature*, *51*, 63–115.

Converse, N., Levy-Yeyati, E., & Williams, T. (2018). How etfs amplify the global financial cycle in emerging markets. IIEP-WP.

Dahlhaus, T., & Vasishtha, G. (2020). Monetary policy news in the us: Effects on emerging market capital flows. *Journal of International Money and Finance*, *109*, 102251.

Driscoll, J., & Kraay, A. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *Review of Economics and Statistics*, *80*, 549–560.

Emerging Portfolio Fund Research (). Fund and country flows databases. Data retrieved on June 10, 2018, `https://next.epfrglobal.com`.

Faust, J., Rogers, J. H., Wang, S.-Y. B., & Wright, J. H. (2007). The high-frequency response of exchange rates and interest rates to macroeconomic announcements. *Journal of Monetary Economics*, *54*, 1051–1068.

Forbes, K., & Warnock, F. E. (2012). Capital flow waves: Surges, stops, flight, and retrenchment. *Journal of International Economics*, *88*, 235–251.

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

Fratzscher, M., Lo Duca, M., & Straub, R. (2018). On the international spillovers of us quantitative easing. *The Economic Journal*, *128*, 330–377.

Gilbert, T., Scotti, C., Strasser, G., & Vega, C. (2017). Is the intrinsic value of macroeconomic news announcements related to their asset price impact? *Journal of Monetary Economics*, *92*, 78–95.

Gürkaynak, R. S., Sack, B., & Swanson, E. (2005). The sensitivity of long-term interest rates to economic news: Evidence and implications for macroeconomic models. *American economic review*, *95*, 425–436.

Hansen, S., McMahon, M., & Tong, M. (2019). The long-run information effect of central bank communication. *Journal of Monetary Economics*, *108*, 185–202.

Hoek, J., Kamin, S. B., & Yoldas, E. (forthcoming). When is bad news good news? u.s. monetary policy, macroeconomic news, and financial conditions in emerging markets. *Journal of International Economics*, .

Iacoviello, M., & Navarro, G. (2019). Foreign effects of higher us interest rates. *Journal of International Money and Finance*, *95*, 232–250.

Jarociński, M., & Karadi, P. (2020). Deconstructing monetary policy surprises—the role of information shocks. *American Economic Journal: Macroeconomics*, *12*, 1–43.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American economic review*, *95*, 161–182.

Jordà, Ò., & Taylor, A. M. (2016). The time for austerity: estimating the average treatment effect of fiscal policy. *The Economic Journal*, *126*, 219–255.

Krishnamurthy, A., & Vissing-Jorgensen, A. (2011). *The effects of quantitative easing on interest rates: channels and implications for policy*. Technical Report National Bureau of Economic Research.

Liu, Z., Spiegel, M., & Zhang, J. (2020). Capital controls and income inequality. *Federal Reserve Bank of San Francisco Working Paper 2020-14*, .

Lunsford, K. (2020). Policy language and information effects in the early days of federal reserve forward guidance. *American Economic Review*, (pp. 2899–2934).

Miranda-Agrippino, S. (2016). Unsurprising shocks: information, premia, and the monetary transmission. *Bank of England Working Paper*, .

Miranda-Agrippino, S., & Nenova, T. (2021). A tale of two global monetary policies. *CEPR Working Paper DP16485*, .

Nakamura, E., & Steinsson, J. (2018). High-frequency identification of monetary non-neutrality: the information effect. *The Quarterly Journal of Economics*, *133*, 1283–1330.

Neely, C. J. et al. (2010). *The large scale asset purchases had large international effects*. Federal Reserve Bank of St. Louis, Research Division St Louis.

Paul, P. (2019). The time-varying effect of monetary policy on asset prices. *Review of Economics and Statistics*, (pp. 1–44).

Pinchetti, M., & Szczepaniak, A. (2021). Global spillovers of the fed information effect, .

Ramey, V. A., & Zubairy, S. (2018). Government spending multipliers in good times and in bad: evidence from us historical data. *Journal of Political Economy*, *126*, 850–901.

Romer, C. D., & Romer, D. H. (2000). Federal reserve information and the behavior of interest rates. *American Economic Review*, *90*, 429–457.

Romer, C. D., & Romer, D. H. (2004). A new measure of monetary shocks: Derivation and implications. *American Economic Review*, *94*, 1055–1084.

Romer, C. D., & Romer, D. H. (2017). New evidence on the aftermath of financial crises in advanced countries. *American Economic Review*, *107*, 3072–3118.

Swanson, E. T., & Williams, J. C. (2014). Measuring the effect of the zero lower bound on medium-and longer-term interest rates. *American Economic Review*, *104*, 3154–85.

Teulings, C. N., & Zubanov, N. (2014). Is economic recovery a myth? robust estimation of impulse responses. *Journal of Applied Econometrics*, *29*, 497–514.

Thomson Reuters Datastream (). Economic analysis.

Warnock, F., & Warnock, V. C. (2009). International capital flows and u.s. interest rates. *Journal of International Money and Finance*, *28*, 903–919.

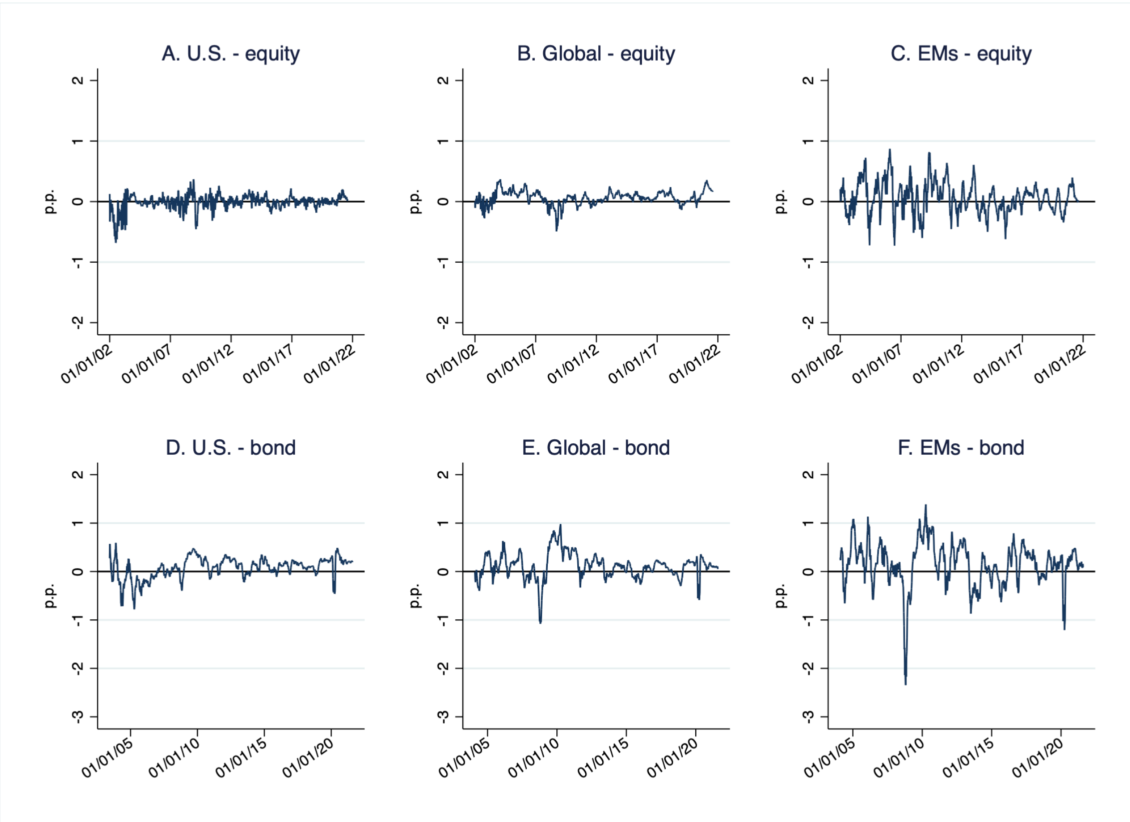
# Appendix

## A. Dataset coverage and descriptive statistics

**Table A1: Monetary policy shock and information shock test**

| | **Avg. Blue Chip GDP forecasts next 3Q** | | | |
|---|---|---|---|---|
| | 1994-2017 | 2009-2017 | 1994-2017 | 2009-2017 |
| Monetary Shock (BRW) | 0.0732 | 0.0588 | | |
| | (0.21) | (0.25) | | |
| Information Shock | | | 0.384** | 0.630** |
| | | | (0.19) | (0.25) |
| Constant | -0.0165* | -0.0201 | -0.0164* | -0.0204* |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Observations | 150 | 59 | 150 | 59 |
| R-squared | 0.001 | 0.001 | 0.038 | 0.183 |

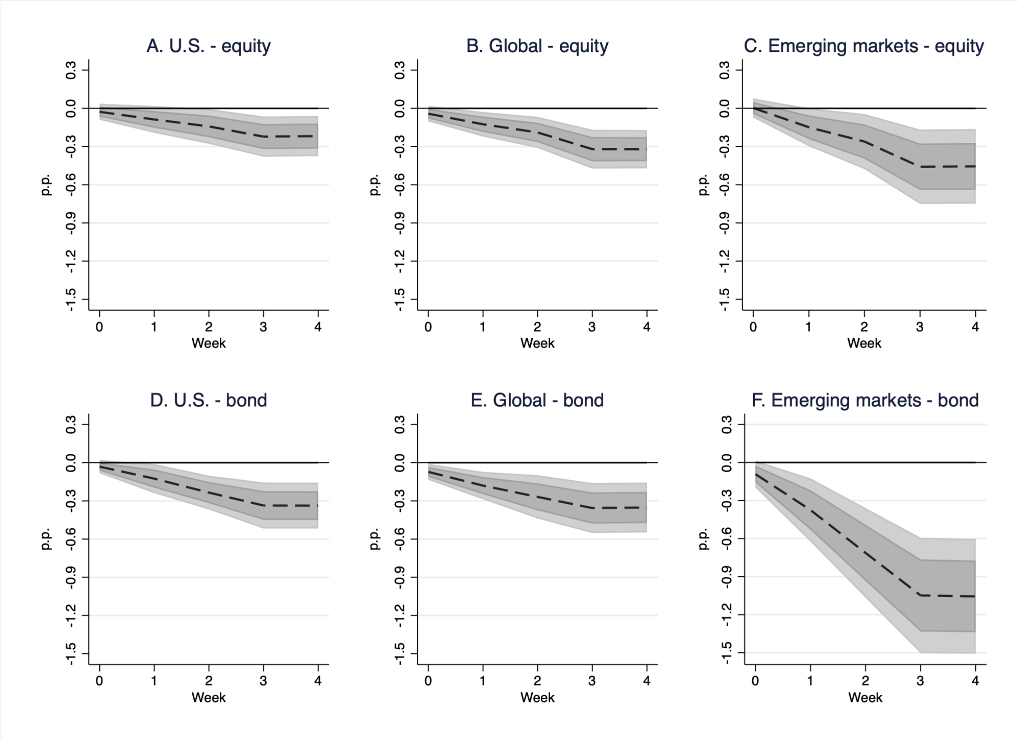
**Figure A1: Investment fund flows over time**




*Notes:* the figure shows aggregate flows (flows across all funds) as a share of aggregate assets. Flows are shown as 8-week moving averages. X-axes denote the time period. Y-axes denote the magnitude (in percentage points).

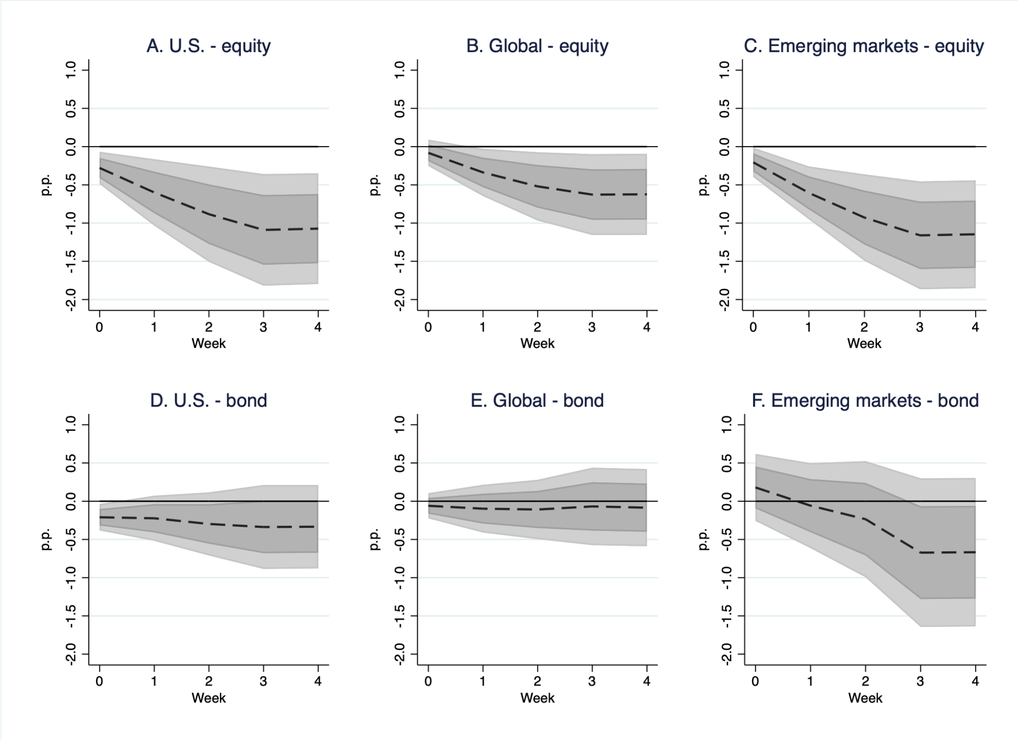
## B. Results using alternative identification strategies

**Figure B1: Jarociński & Karadi (2020) identification - pure monetary policy shock**




*Notes:* Dashed black lines report point estimates. Deep and shallow gray areas are 90% and 67% confidence bands. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Responses are obtained estimating the $\beta^k$ coefficients from an alternative specification of Equation 4, in which $e_t$ and $i_t$ are replaced with Jarociński & Karadi (2020) monetary policy and information shock series (poor man restriction). Estimates are normalized to show responses to a 10 b.p. shock.

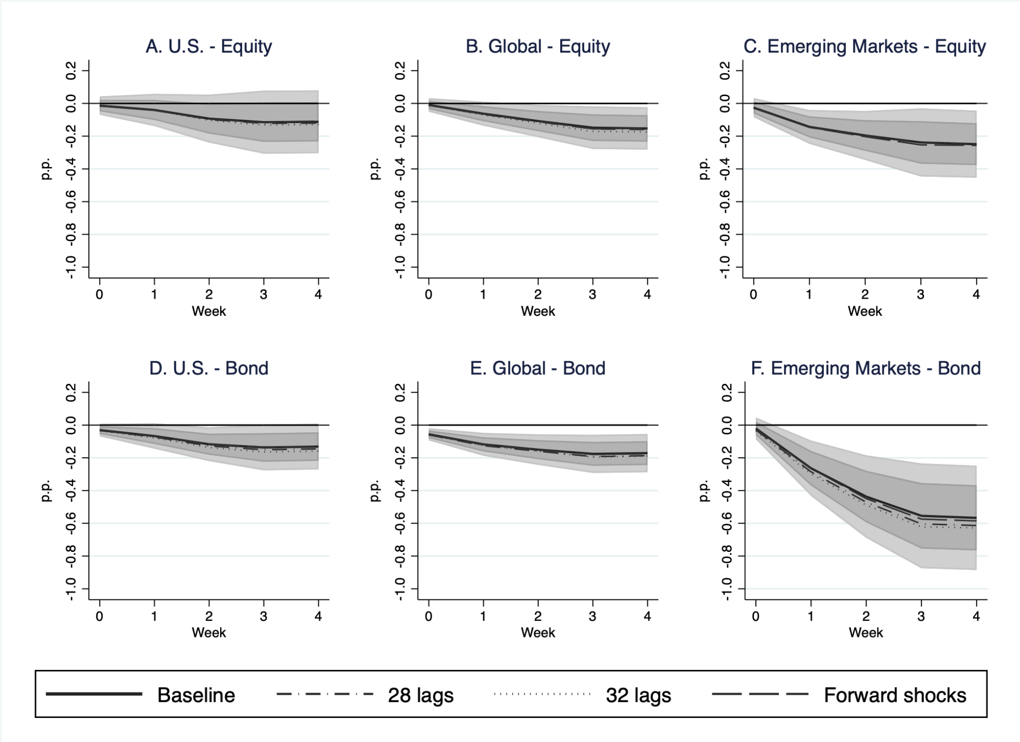
**Figure B2: Jarociński & Karadi (2020) identification - information shock**




*Notes:* See notes to Figure B1. Point estimates and confidence bands refer to the $\gamma^k$ coefficients.

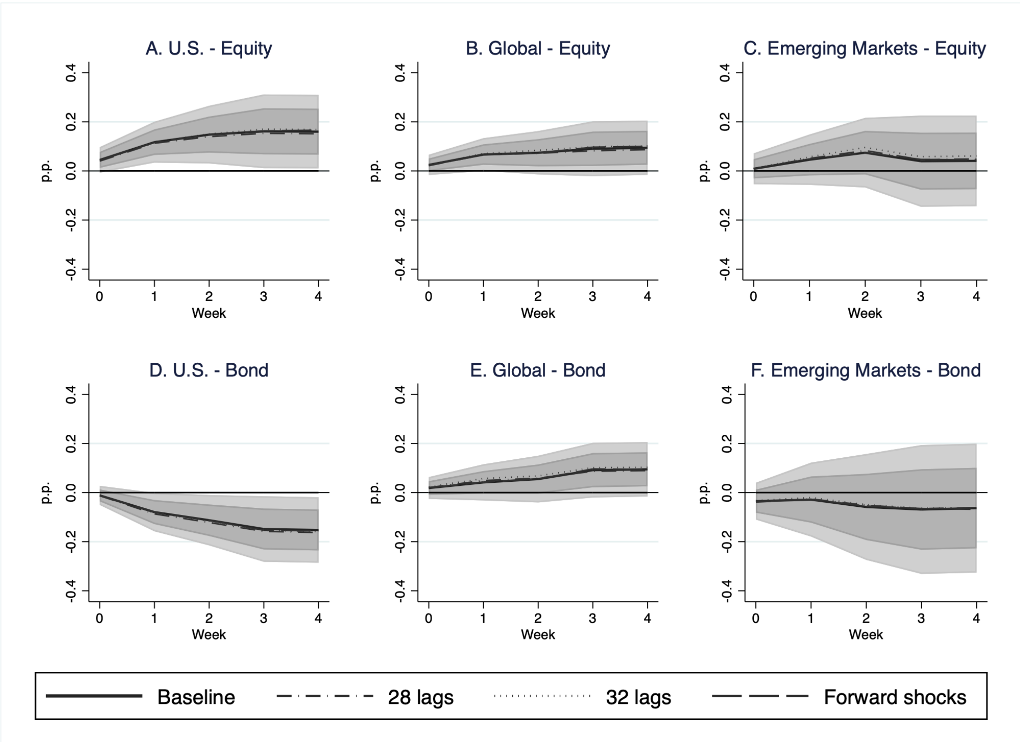
## C. Robustness checks on baseline results

**Figure C1: Alternative lag structure - pure monetary policy shock**



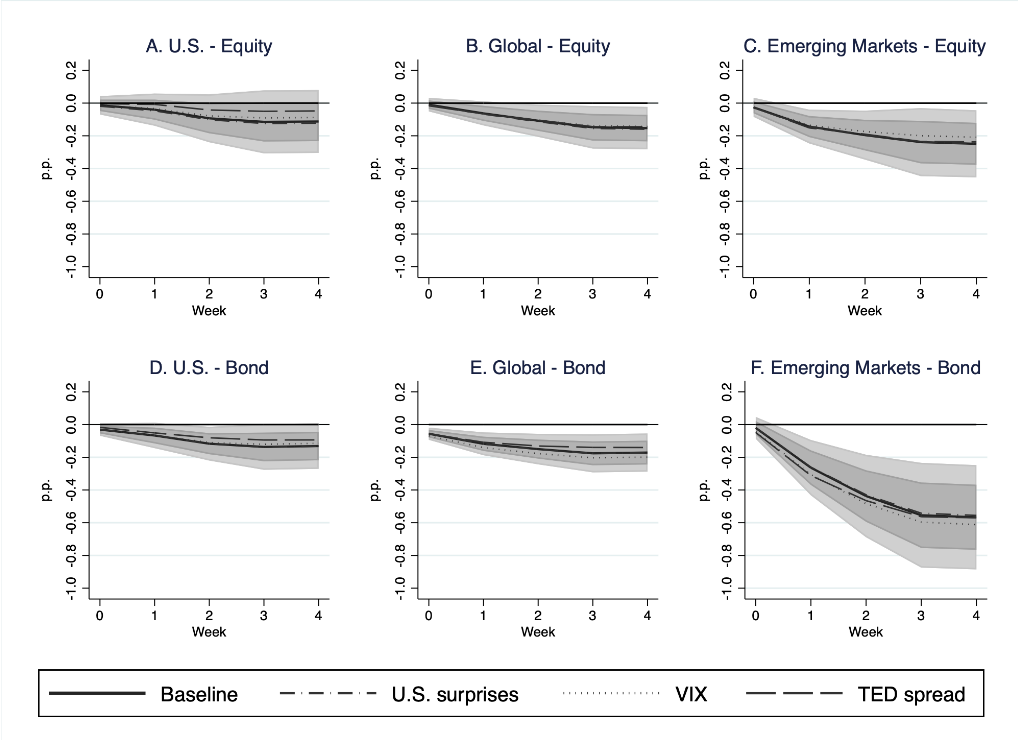

*Notes:* Black solid lines report baseline point estimates, while deep and shallow gray areas are their 90% and 67% confidence bands (as in Figure 2). Dashed and dotted lines report point estimates obtained from alternative lag specifications. X-axes denote the response horizon (in weeks). Y-axes denote the magnitude of the response (in percentage points). Estimates are normalized to show responses to a 10 b.p. shock.

**Figure C2: Alternative lag structure - information shock**



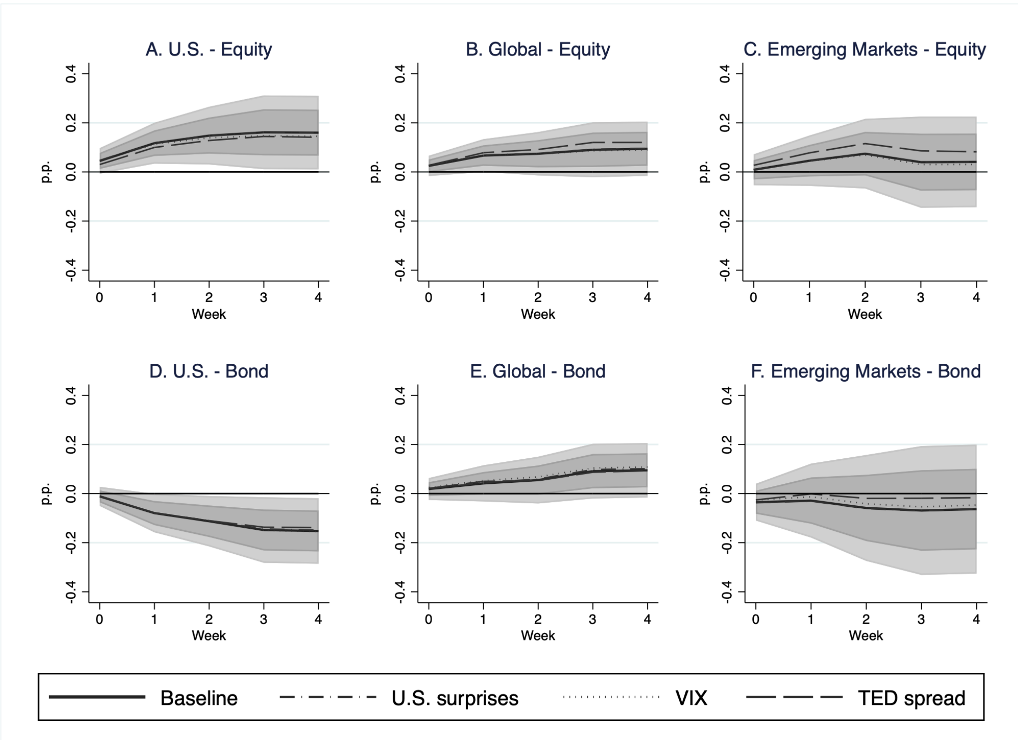

*Notes:* See notes to Figure C1. Baseline point estimates and confidence bands are those of Figure 3.

**Figure C3: Control variables - pure monetary policy shock**



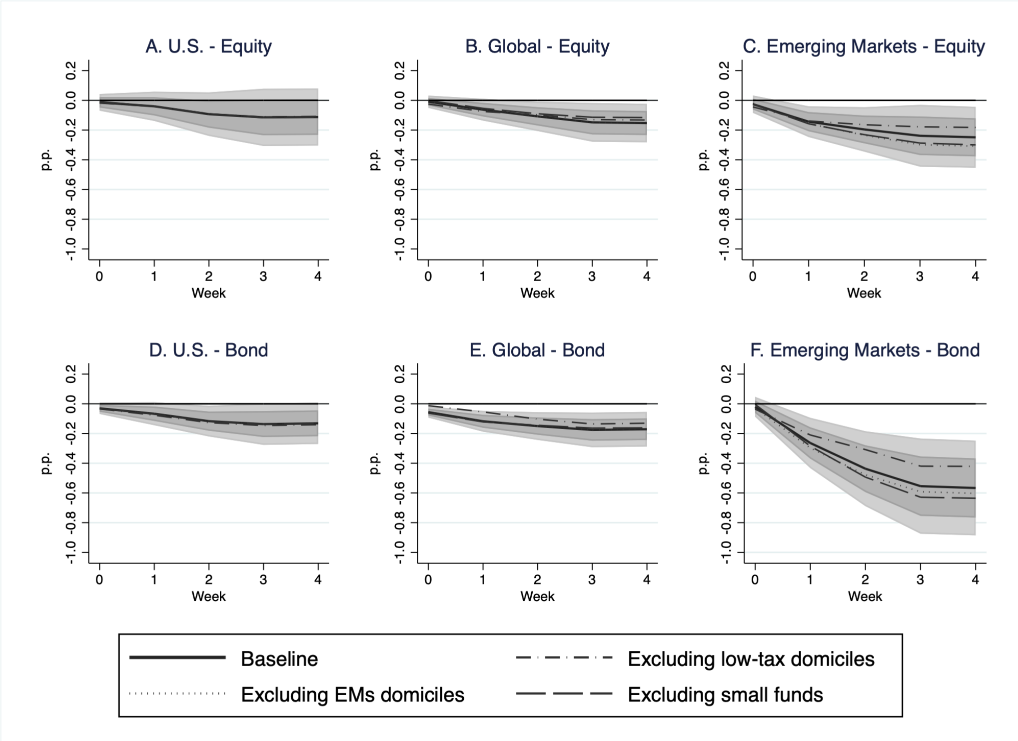

*Notes:* See notes to Figure C1. Dashed and dotted lines report alternative estimates obtained when including different sets of control variables.

**Figure C4: Control variables - information shock**



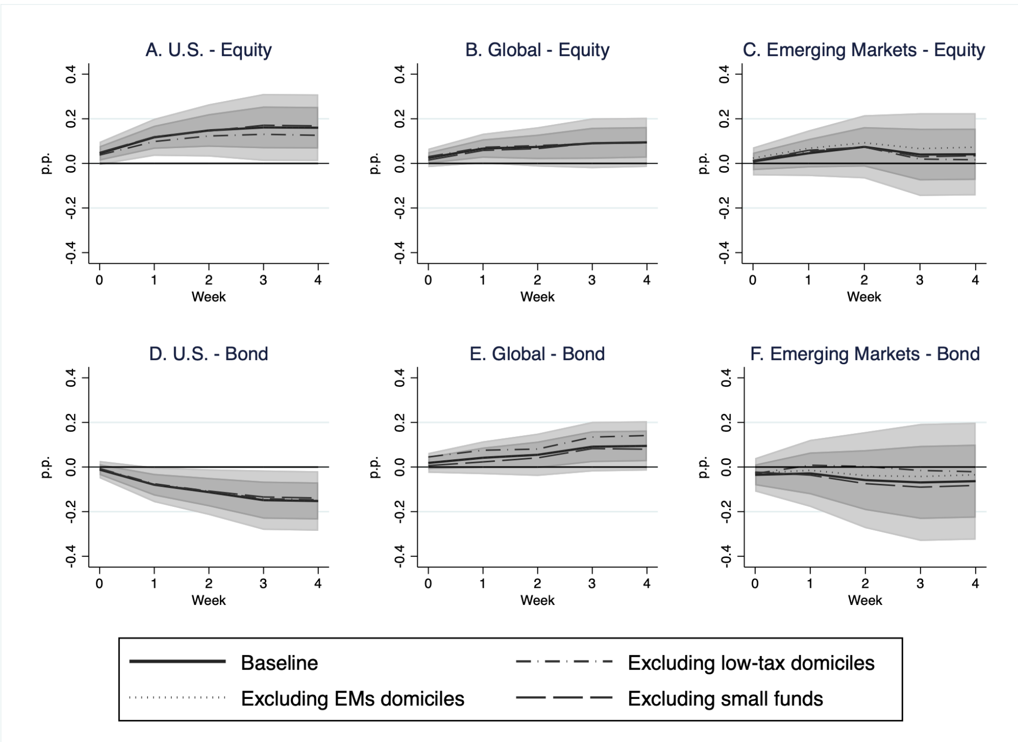

*Notes:* See notes to Figure C2. Dashed and dotted lines report alternative estimates obtained when including different sets of control variables.

**Figure C5: Sample stability - pure monetary policy shock**



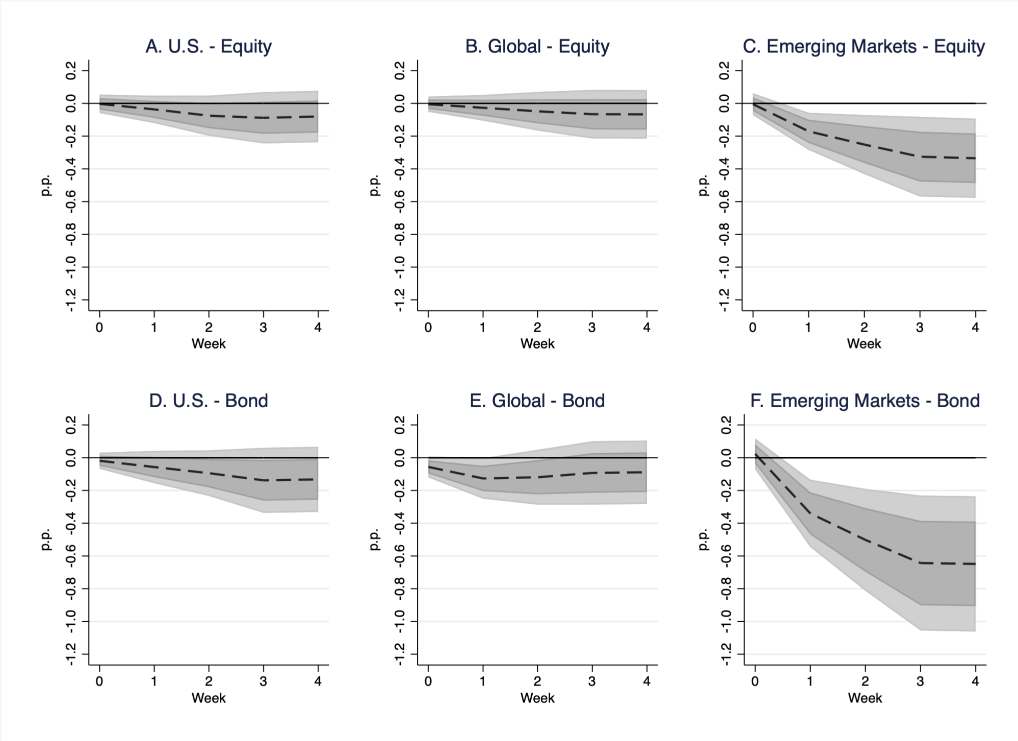

*Notes:* See notes to Figure C1. Dashed and dotted lines report alternative estimates obtained excluding different types of funds.

**Figure C6: Sample stability - information shock**



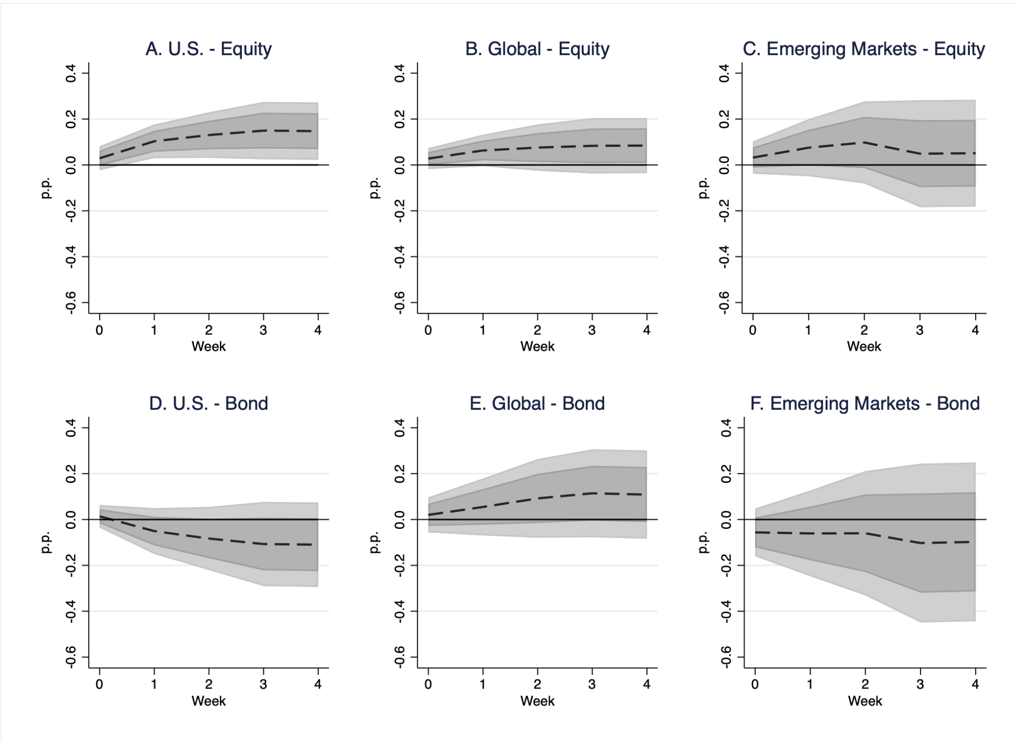

*Notes:* See notes to Figure C2. Dashed and dotted lines report alternative estimates obtained excluding different types of funds.

**Figure C7: Large funds - pure monetary policy shock**



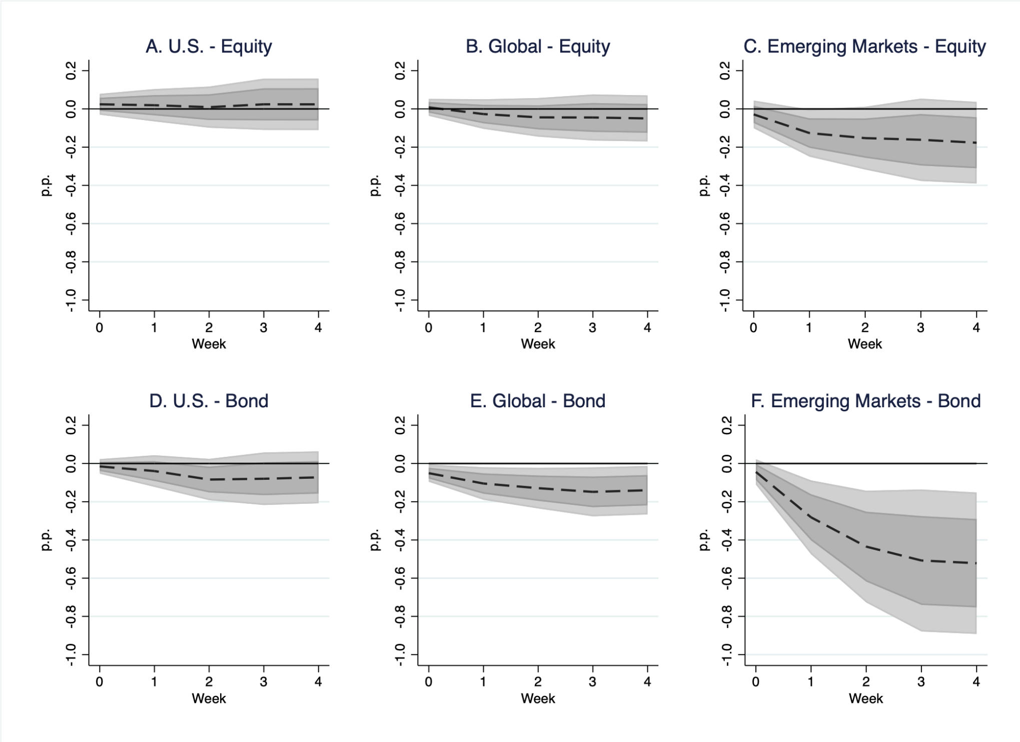

*Notes:* See notes to Figure 2. Estimates are obtained including only funds in the upper quartile of the funds assets distribution in the sample.

**Figure C8: Large funds - information shock**



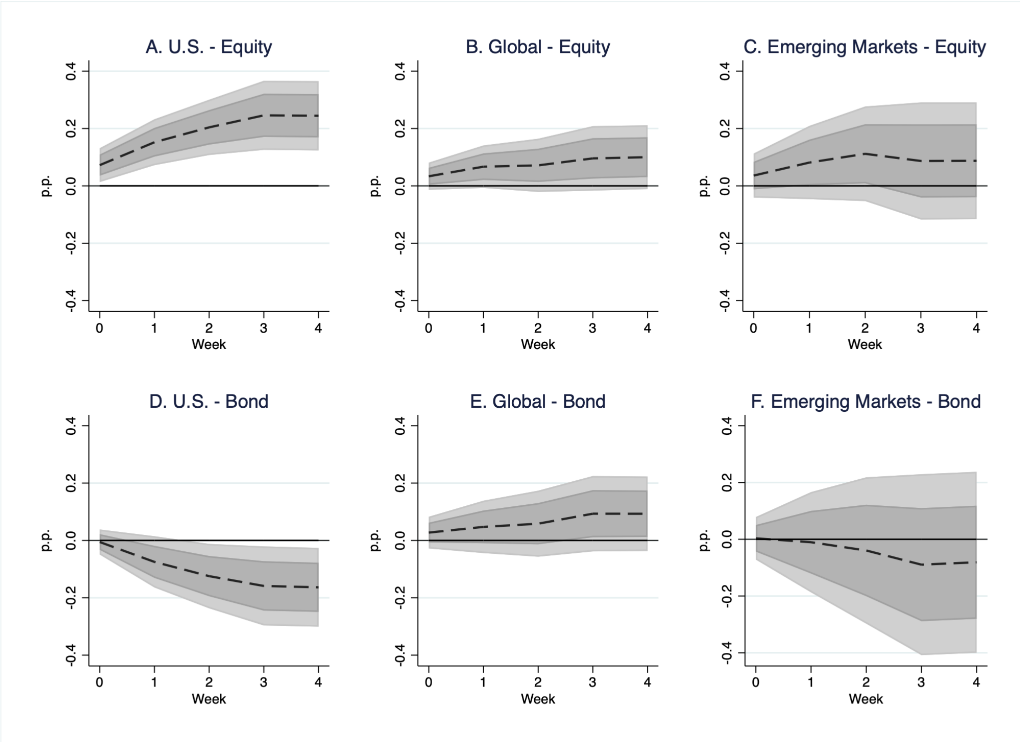

*Notes:* See notes to Figure 3. Estimates are obtained including only funds in the upper quartile of the funds assets distribution in the sample.

**Figure C9: Post-GFC period - pure monetary policy shock**



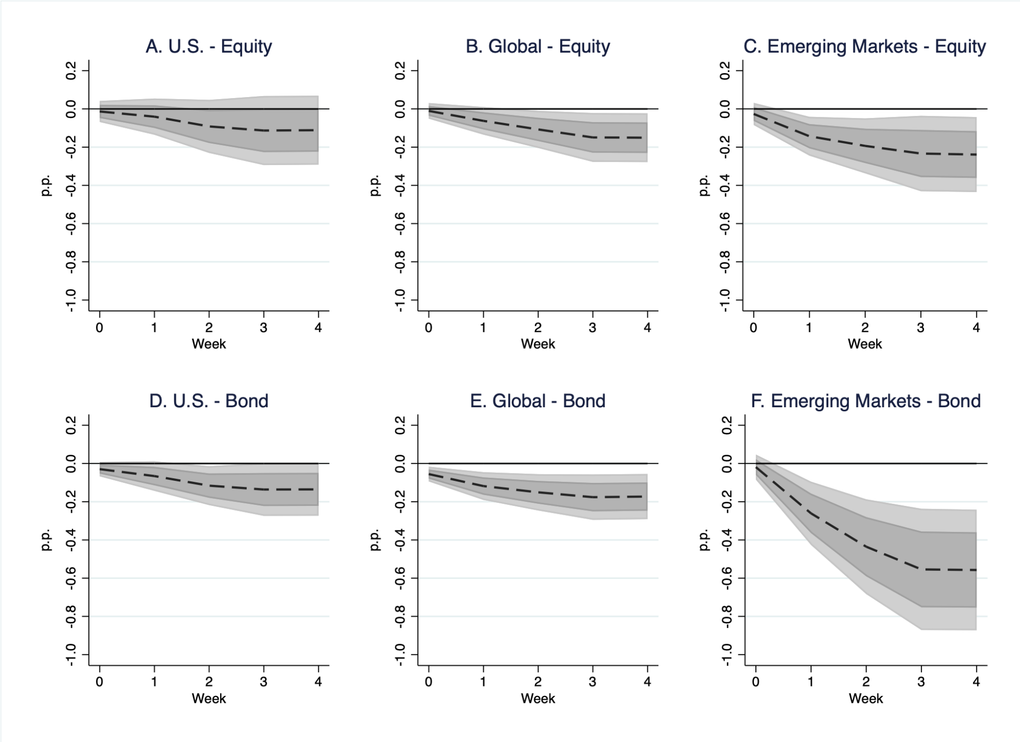

*Notes:* See notes to Figure 2. Estimates are obtained estimating coefficients on the post-2009 sample.

**Figure C10: Post-GFC period - information shock**



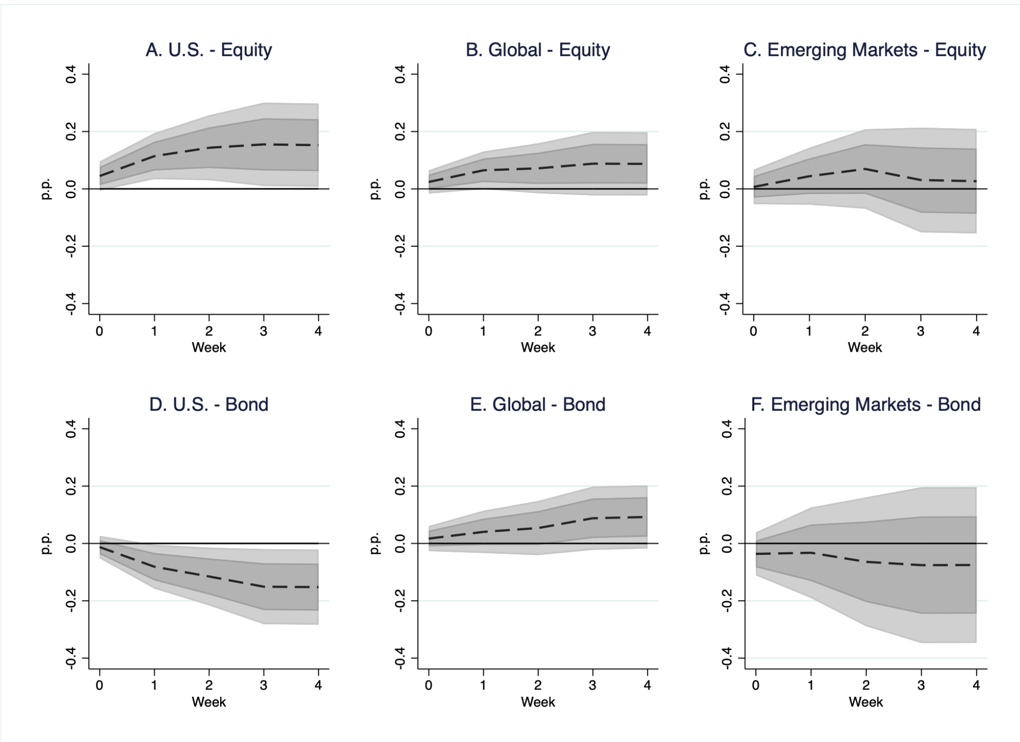

*Notes:* See notes to Figure 3. Estimates are obtained estimating coefficients on the post-2009 sample.

**Figure C11: Driscoll-Kraay standard errors - pure monetary policy shock**




*Notes:* See notes to Figure 2. Confidence bands are obtained using Driscoll-Kraay standard errors.

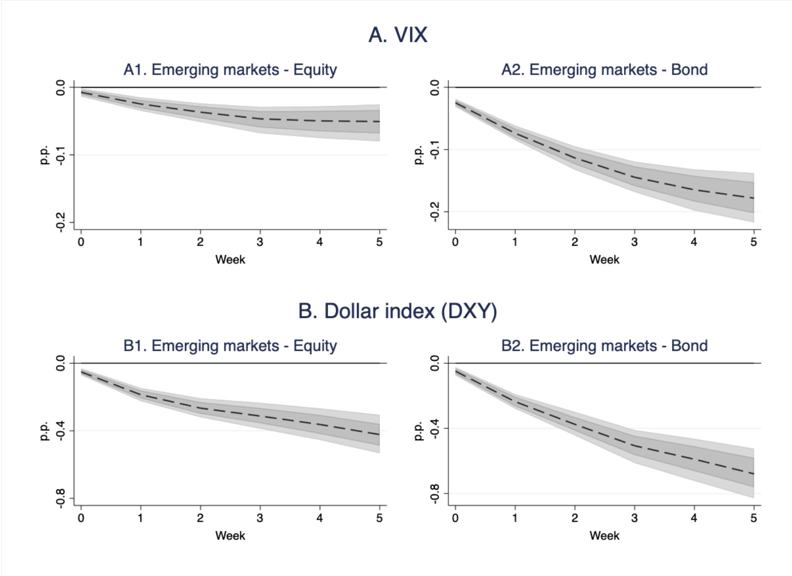
**Figure C12: Driscoll-Kraay standard errors - information shock**




*Notes:* See notes to Figure 3. Confidence bands are obtained using Driscoll-Kraay standard errors.

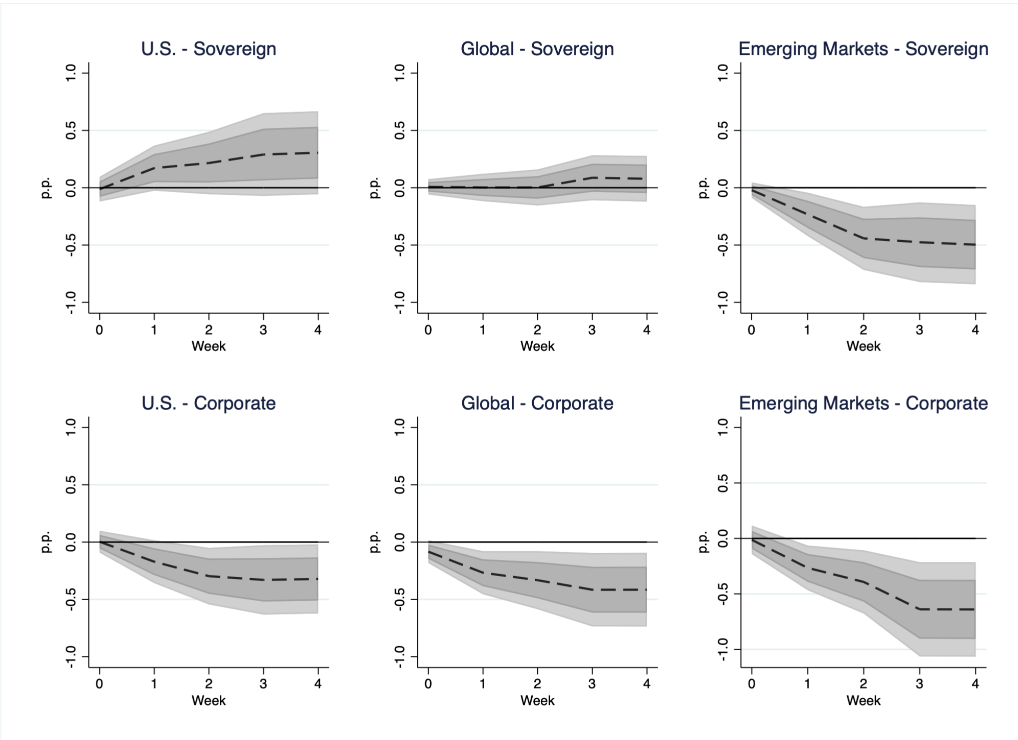
## D. Additional results on transmission channels and extensions

**Figure D1: Effects of VIX and USD exchange rate on flows to EMs funds**



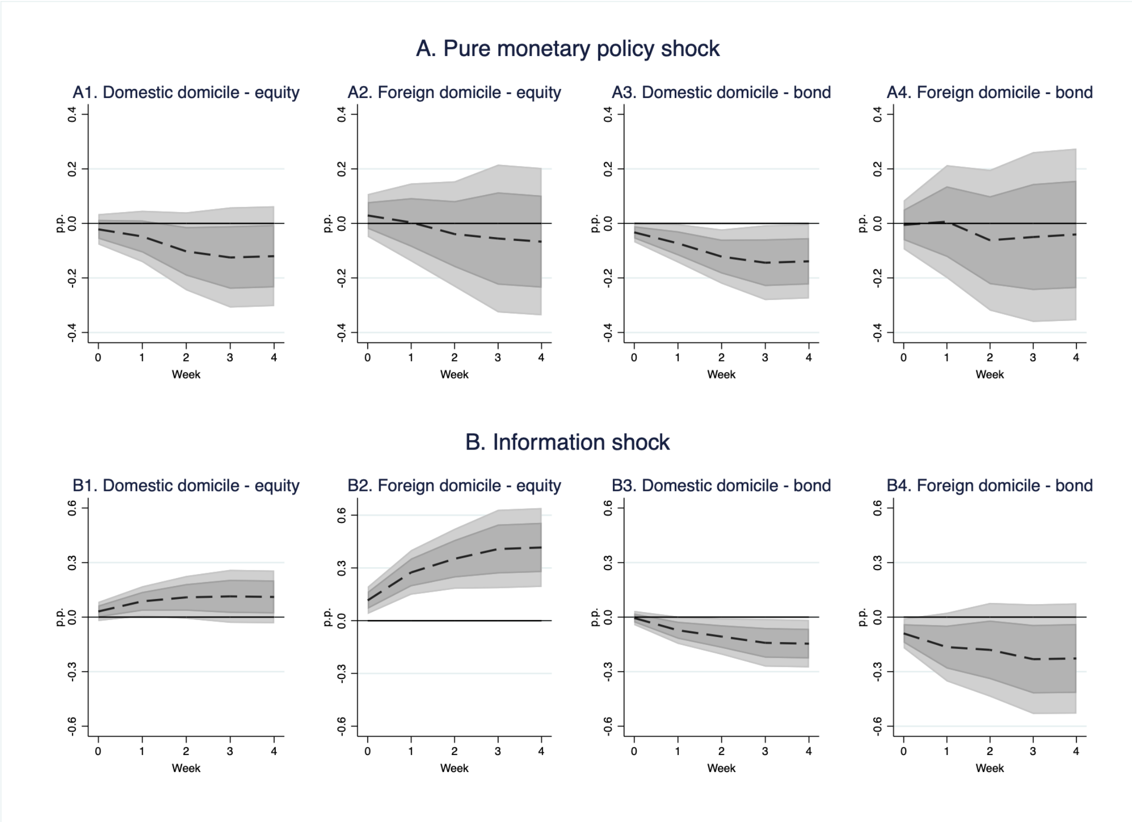

*Notes:* Black solid lines and deep and shallow gray areas respectively denote point estimates and their 67% and 90% confidence intervals. X-axes denote the response horizon (in weeks), with 0 being the week of the FOMC meeting. Y-axes denote the magnitude of the response (in percentage points). Responses are obtained estimating a VAR (see Section 4 for details).

**Figure D2: Sovereign and corporate bond flows after a pure monetary policy shock**



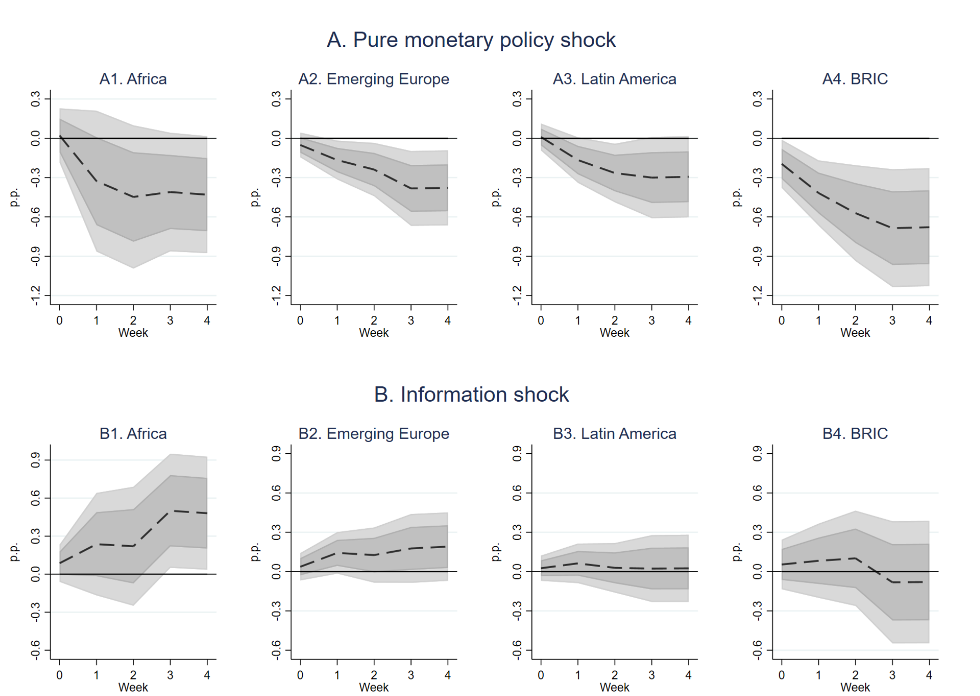

*Notes:* See notes to Figure 2.

**Figure D3: Effects of Fed's shocks on U.S. funds flows accounting for funds domicile**



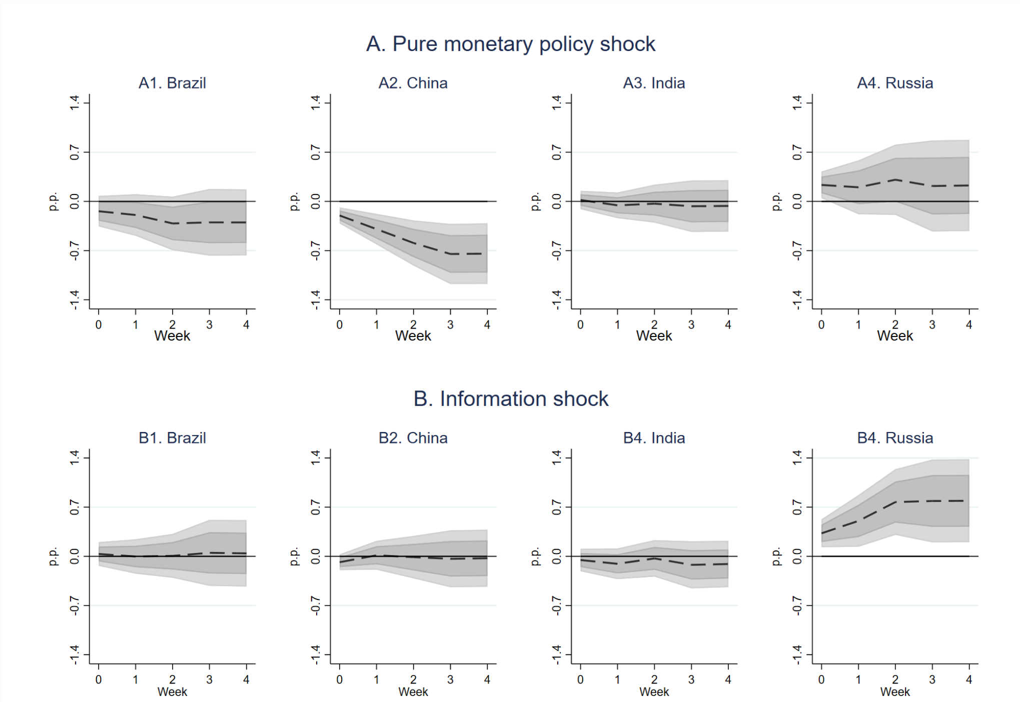

*Notes:* See notes to Figures 2 and 3.

**Figure D4: Effect of Fed's shocks on Global EMs and non-Asia funds flows**




*Notes:* See notes to Figures 2 and 3. Estimates are obtained on the subsample of (i) Africa regional funds (Panels A1, B1), (ii) Emerging Europe regional funds (Panels A2, B2), (iii) Latin America regional funds (Panels A3, B3), and (iv) BRIC funds (Panel A4, B4). Funds domiciled in EMs are excluded from the sample.

**Figure D5: Effect of Fed's shocks on BRIC countries funds flows**




*Notes:* See notes to Figures 2 and 3. Estimates are obtained on the subsample of (i) Brazil funds (Panels A1, B1), (ii) China funds (Panels A2, B2), (iii) India funds (Panels A3, B3), and (iv) Russia funds (Panel A4, B4). Funds domiciled in EMs are excluded from the sample.

## E. Spotlight on Covid

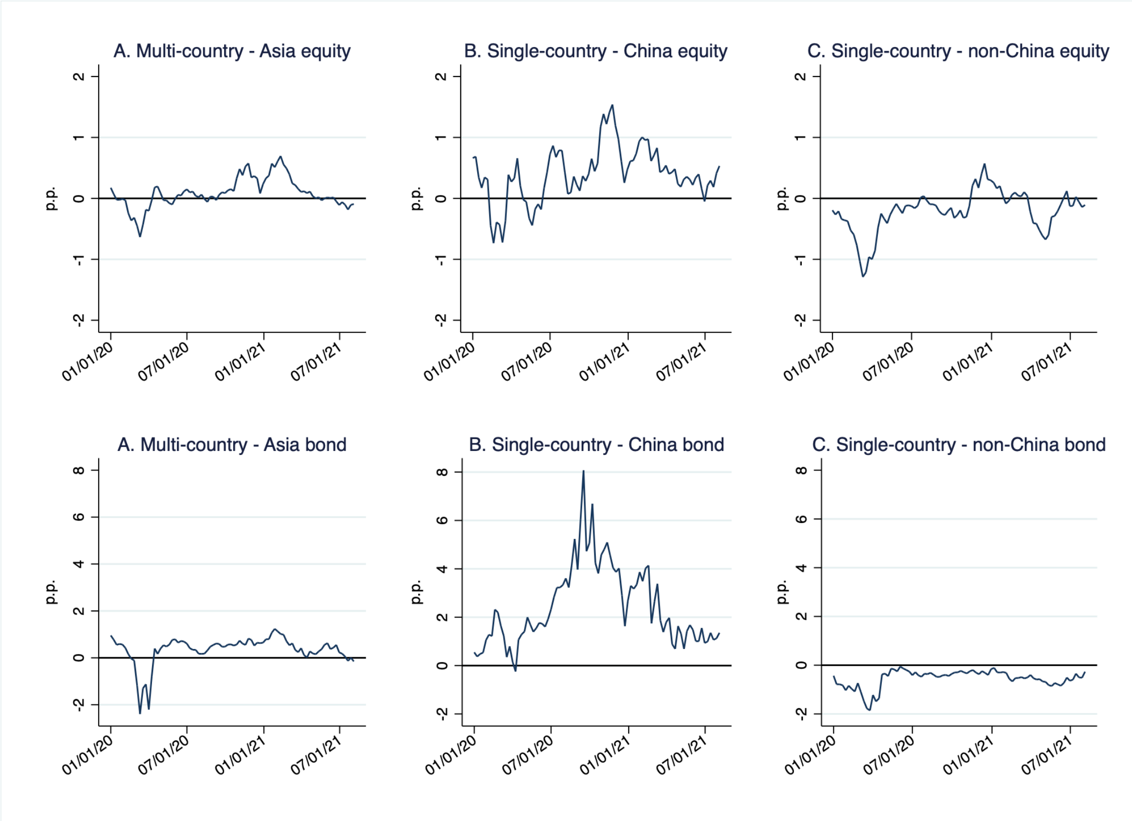
In this Appendix we present descriptive statistics on fund flows and Fed's shocks during the COVID-19 crisis (January 2020 to July 2021). Flows to U.S., Global, and EMs bond funds suffered synchronous outflows in the early stages of the COVID-19 epidemic, from February to April 2020, but were positive throughout the subsequent period (Figure E1). Flows into equity funds developed differently across fund with different investment mandate. Flows into U.S. equity funds did not experience particularly large movements, while global equity funds saw outflows in the early stage of the pandemic but posted a prolonged period of positive flows in the subsequent period, which accelerated following the development of effective COVID-19 vaccines. Flows to EMs equity funds were highly negative for a long period after the first outbreaks of the COVID-19 pandemic and only turned positive after the development of vaccines, recovering most of the previous outflows.

**Figure E1: Aggregate flows during the COVID-19 crisis**


*Notes:* the figure shows aggregate flows (flows across all funds) as a share of aggregate assets, distinguishing by investment mandate. Flows are shown as 4-week moving averages. X-axes denote the time period. Y-axes denote the magnitude of flows (in percentage points).

Next, we turn to flows into Asia-focused funds domiciled in advanced economies (Figure E2). As briefly discussed above, China-focused bond funds experienced large positive flows throughout the COVID-19 pandemic. Quite strikingly, instead, non-China single-country funds experienced outflows throughout the same period. Multi-country bond funds only saw outflows during at the beginning of the pandemic. Turning to equity funds, the evidence again points to a rebalancing away from non-China single country funds and into China-funds throughout most of the pandemic period. Multi-country equity funds suffered outflows in the first phases of the pandemic, but recovered in the period after the development of vaccines.

**Figure E2: Aggregate flows to Asia-focused funds during the COVID-19 crisis**




*Notes:* the figure shows aggregate flows (flows across all funds) to Asia-focused funds as a share of aggregate assets. Only funds domiciled in advanced economies are included. Flows are shown as 4-week moving averages. X-axes denote the time period. Y-axes denote the magnitude of flows (in percentage points).

Turning to the Fed, pure monetary policy shocks were mostly negative in the first part of the pandemic, consistent with the large asset purchases and aggressive interest rate cuts that brought the Fed Funds rate back to the effective lower bound (Figure E3). A large tightening shock happened in June 2021, by our metric, when the Fed first hinted at the possibility of scaling back the unconventional policies initially adopted in response to the crisis. Information shocks were instead mostly positive (tightening policy in the face of an improving economy) especially in the latter part of the period, after the successful rollout of COVID-19 vaccines.

**Figure E3: Fed shocks during the COVID-19 crisis**


*Notes:* X-axes denote the time period. Y-axes denote the magnitude of the shock (in basis points).