Pushing or Pulling? Quantitative Easing, Quantitative Tightening, and International Capital Flows*

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Abstract

This paper analyzes the relationship between international capital flows and conventional and unconventional monetary policies implemented by the Federal Reserve, European Central Bank, Bank of England, and Bank of Japan since the start of the Global Financial Crisis. We measure monetary policy shocks using intraday changes in sovereign yields, which allows us to separately examine the effects of announcements which are more versus less accommodative than expected. Our results therefore provide insights into the flow effects of both quantitative easing and tightening. Using daily data on flows into investment funds, we measure the immediate effects of the identified policy shocks on flows as well as active portfolio reallocations between regions and asset types. We find that the response of flows to surprise policy easings and tightenings is not symmetric, and that responses differ across developed economy central banks. Surprise policy easings and tightenings by the Federal Reserve are both associated with reallocation into U.S. equities and out of other assets, while the response to policy surprises by the other central banks varies. In contrast to several earlier studies, we do not find that quantitative easing by the Federal Reserve increased investor flows into emerging market assets during the 2010s. At the same time, we do find evidence that the effects of DM monetary policy changed significantly during the pandemic period.

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1 Introduction

The relationship between international capital flows and the monetary policies implemented by developed market (DM) central banks over the past fifteen years is an important and still open question. In this paper, we analyze this relationship with a simple and straightforward methodology. We zoom in on the question of whether unconventional monetary policy including asset purchases ("quantitative easing") and the subsequent policy normalization including the unwind of balance sheet purchases ("quantitative tightening") had an impact on international capital flows and whether this impact is symmetric, a question that is of particular interest for two reasons. First, several easing announcements which lowered interest rates were, in fact, less accommodative than expected and resulted in an increase in government bond yields. The response of capital flows to these "hawkish cut" types of announcements cannot be used to identify the effects of policy easing on flows if the relationship between changes in monetary policy and flows is not symmetric. Second, as DM central banks continue to shrink their balance sheets, it is important to understand and monitor the possible effects of this quantitative tightening. The transmission of DM monetary policies to emerging market (EM) economies is of particular interest. Our goal is thus narrower than studying the determinants of capital flows more generally (e.g. Forbes and Warnock 2012, Fratzscher 2012, or Ahmed and Zlate 2014). However, in another dimension, ours is a significant effort because we simultaneously analyze the impact of the policies of all the major central banks, namely the Federal Reserve (Fed), the European Central Bank (ECB), the Bank of England (BoE), and the Bank of Japan (BoJ).

Unconventional monetary policy works through several channels, some of which have conflicting implications for capital flows. In the *portfolio balance channel*, purchases of long-term bonds by the central bank compress the term premium, which drives up demand for substitute risky assets such as emerging market equities (Gagnon *et al* 2011; D'Amico and King 2013; Hamilton and Wu 2012). The central bank is then effectively committed to keep the prices of these assets elevated, which is a *signaling channel* through which investors take these purchases as a commitment to keep yields low, a ripe environment to boost carry-induced demand for emerging market bonds and equity.[1] In addition there is the *confidence channel*, whereby an easing announcement by a central bank is interpreted as a commitment to do, in the words of ECB President Mario Draghi, "whatever it takes" to support growth, which can draw investment to the country. There are additional channels discussed in the literature which more directly affect banking flows or asset prices, and multiple channels

[1]Bauer and Rudebusch (2014) stress the importance of the signaling channel for Federal Reserve announcements since 2008, and show that this channel was as important as the portfolio balance channel.

may interact simultaneously.[2]

We offer a new perspective on the effect of monetary policy on financial flows using a state-of-the-art methodology and carefully constructed data to assess whether DM unconventional policies and their subsequent removal created substantial capital movements across countries. In contrast to existing studies, we also investigate whether the impact of monetary policy easings on capital flows is different than policy tightenings, an issue that has become important as central banks are contemplating the end of the recent tightening cycle. We use information on fund flows and assets obtained from the commercial data provider EPFR Global, a frequently-used source in event-type studies because of the availability of daily data.[3] In particular, we study the response to monetary policy shocks of flows and portfolio allocations to equity and bond funds targeting three distinct investment destinations–the U.S., other development markets, and emerging markets–forming six region-asset groups.

Flow-based measures of capital movements provide only a partial picture of investor behavior. For example, investors may pull funds out of an asset class following higher-than-expected returns which push the total share invested in that asset class above a target amount—so-called rebalancing flows. Similarly, we may observe flows out of *all* asset classes simultaneously if investor wealth decreases. In both of these examples we would observe fund outflows even though investors' desired global asset allocation did not change. Because we are interested in understanding how investors' respond to shifts in monetary policy, we explicitly examine changes in asset allocations using a portfolio-based flow measure discussed in Tille and van Wincoop (2010) and Ahmed *et al* (2015). This measure isolates active portfolio reallocations which shift portfolio shares from passive portfolio reallocations arising from relative returns.

The additional portfolio-based measure is an important innovation of our work because each of the channels through which monetary policy operates involves portfolio rebalancing. An analysis of bilateral fund flows or even a system of flows will not accurately capture this rebalancing unless there is a robust control for wealth, because a sometimes-sizable portion of flows is attributable to the allocation of new savings across assets, rather than a change in portfolio weights.

We use an event study technique similar to Chen *et al* (2012) (among others), which examines

[2]Fratzscher et al. (2018), Chen et al. (2012), Kozicki et al. (2011), and Santor and Suchanek (2013) also provide summaries of the various channels of transmission.

[3]Fratzscher *et al* (2018), for example, use fund-level daily bond and equity flow data from EPFR to study the effect of unconventional monetary policy announcements and operations by the Federal Reserve on asset prices and portfolio allocations for a set of individual countries. In related work, Koepke (2018) uses EPFR monthly equity and bond fund flows to study the effect of market expectations of future Fed monetary policy moves on portfolio allocations to emerging markets.

the cross-border impacts of quantitative easing on capital flows to emerging economies. However, we augment this analysis with intraday data to measure monetary policy shocks as in Curcuru *et al* (2018) and Rogers *et al* (2014, 2018). This is in contrast to other studies, which generally use indicator dummies on policy announcement dates to capture the effect of announcements on flows. Our measure of monetary policy shocks uses the movement in bond yields implied by movements in bond futures prices in a window around the policy announcement, which allows us to control for both the magnitude and direction of the policy surprises.

When we use standard measures of flows and a symmetric model that does not allow for different effects of more-accommodative-than-expected monetary policy announcement surprises (henceforth "easing surprises") versus less-accommodative-than-expected surprises ("tightening surprises"), our results generally conform to the standard narrative that DM policy easing is associated with increased flows to EMs (see, for example, Cho and Rhee 2014, Lim *et al* 2014, Fratzscher *et al* 2018). But the results from an asymmetric model paint a different picture. Spillovers from easing surprises are not the mirror images of spillovers tightening surprises. Most notably, Fed policy surprises significantly affect flows to EM funds when they are tighter than expected, but not when they are more accommodative than expected. This is consistent with Koepke (2018), which finds that expectations of tighter Fed monetary policy are associated with relatively large outflows from EM assets. Similarly, it is policy tightening by the ECB and the BoJ that affects flows to other regions, while policy easing has no significant effect.

We get a substantially different picture of the investor response to monetary policy announcements when we examine active changes in portfolio allocations. Using this measure it appears that investors reallocate their portfolios toward U.S. equities and out of everything else following easing surprises. Remarkably, Fed tightening surprises prompt reallocation *in the same direction* as easing surprises. ECB easing surprises are also associated with inflows into U.S. equities and outflows from DM bonds. However, ECB policy easing does not seem to prompt any significant reallocation, in contrast to the findings in earlier work and to the results using more traditional measures of surprises and flows. So for both Fed and ECB policies, we find evidence consistent with the presence of central bank information shocks (Jarocinski and Karadi 2020), with tightening revealing positive information about the state of the economy.

Splitting the sample into four sub-periods (QE, post-QE, COVID, and post-COVID), we find significant time variation in the effect of Fed policy surprises on portfolio allocations. Prior to the pandemic, surprise easings and tightenings by the Fed were associated with a shift into U.S. equity and out of other assets, and this drives our results for the full sample. After March 2020, however, the sign of this relationship flips for some fund groups, so that Fed easings and tightenings are both associated with reallocation towards EM and non-U.S. DM equity. We find tentative evidence that this change occurs for all fund groups, but the small size of the post-COVID sample limits our inference.

Finally, we also explore whether the effect of policy surprises on allocations across fund groups varies with the policy instrument by separating conventional policy surprises from quantitative easing and quantitative tightening surprises. We classify a surprise as quantitative easing or tightening if the relevant communication contains information about large scale asset purchases (LSAPs). The effects of Federal Reserve policy surprises are generally similar for conventional and LSAP announcements, and we find no evidence that LSAP surprises generate larger spillovers. For the ECB, we find that ECB policy affects allocation almost entirely through conventional policy.

Related Literature

Our finding of no evidence of increased flows to EM funds following Fed easing surprises is consistent with Ahmed *et al* (2015). That study found that while on the surface it appears that flows into EM assets increased coincident with DM easings, the increased EM flows were almost entirely the result of allocations of new savings rather than an active reallocation toward EM assets. In contrast, our results differ from Fratzscher *et al* (2018), Burns *et al* (2014), and Koepke (2018), who find that flows into EM assets picked up following QE announcements. In the robustness checks we show that the different results is attributable to different monetary policy surprise measures and estimation methods.

This paper contributes to three areas of research. First, we complement the literature on the drivers of international capital flows by employing an identification strategy that has been little-used in the flows literature and by considering separately the effects of four major central banks' policies. Existing work on the drivers of flows does consider the role of U.S. monetary policy (Ahmed and Zlate 2014, Koepke 2018), or of developed market interest rates more broadly (Forbes and Warnock 2012, Fratzscher 2012), but does not take into account the endogenous nature of monetary policy, which responds to real economic conditions that also directly affect international capital flows. By measuring monetary policy shocks using intraday changes in bond yields and studying the response of flows in the two days following policy announcements, we are able to isolate the effect of monetary policy on flows in a way that most previous work has not. As previously noted, Fratscher *et al* (2018) also examine the response of flows in the days following U.S. QE announcements, but use dummy variables for announcement days as their measure of unconventional policy in their baseline analysis. Our methodology improves on the existing literature along three dimensions.[4] First, by identifying whether announcements represented tightening or easing relative to market expectations: some of the QE announcements studied in the literature were less accommodative than expected, while others were more accommodative than expected. Second, we allow the response of flows to vary according to the direction of the policy move. And third, we study the effect of ECB, Bank of England, and Bank of Japan policies in addition to the policies of the Fed.

The second area of research related to this paper is work on the international spillovers of monetary policy. The cross-border effects of monetary policy on asset prices has been extensively documented (by Rogers *et al* 2014, 2018, Curcuru *et al* 2018, and Dilts Stedman 2019, among many others). We complement this previous work by studying the role of mutual fund investors in transmitting monetary policy shocks internationally. Fratzcher *et al* (2016) analyze spillovers from a variety of different ECB unconventional monetary policy programs through 2012 via mutual fund flows. In addition to extending the period of analysis through 2018, this paper provides a more general assessment of spillovers from ECB policy by using a uniform policy measure across the various ECB programs. Chari *et al* (2020) use a similar methodology to ours in order to identify U.S. monetary policy surprises and examine their effects on both asset prices and purchases of EM securities by U.S. investors, the latter of which they analyze at the monthly frequency. Our examination of active reallocation by investors, as opposed to the flows and changes in positions studied by Chari *et al* (2020) provide us with additional insights into the investor behavior that generates cross-border spillovers. In particular, we show that flows into EM assets during the QE period did not shift portfolios toward EM assets, because flows into DM assets were even greater.

Third and finally, our paper contributes to the large literature on the channels through which monetary policy and in particular unconventional monetary policy acts on the economy. As mentioned above, the portfolio balance channel (Gagnon *et al* 2010, D'Amico and King 2010, Hamilton and Wu 2012) and the signalling channel (Bauer and Rudebusch 2013) have been extensively explored in the literature. We provide further evidence of a confidence channel, as discussed by Fratscher *et al* (2018) and Chen *et al* (2012). Relatedly, Jarocinski and Karadi (2020) disentangle the information component of monetary policy shocks ("central bank information shocks") from the policy content of those shocks. Our results regarding active

[4] In Section 4.4 we provide a detailed reconciliation between our results and other results in the literature.

portfolio reallocation by fund investors in response to policy shocks suggest an important role for such information shocks.

The remainder of the paper is organized as follows: Section 2 describes the data, Section 3 outlines our empirical model, Section 4 presents the results of our estimation, and Section 5 concludes.

2 Data

2.1 Monetary Policy Surprises

Our surprise data covers regular meetings and unconventional monetary policy announcements by the Fed, ECB, BoE, and BoJ over the period January 2008 to March 2023. The monetary policy surprise (MPS) is based on changes in the prices of government bond futures around monetary policy announcement times. We use the corresponding change in yields from 15 minutes before the announcement to 1 hour and 45 minutes after the announcement.[5]. The futures prices are converted to yields using the method in Curcuru *et al* (2018).[6] We use changes in U.S. 10-year Treasury note futures for the United States, 10-year German bund futures for the euro area, long gilt futures for the United Kingdom, and 10-year Japanese government bond futures for Japan.

The MPS, shown in Figure 1, are roughly equally split between positive and negative values, especially during the period associated with extraordinary policy easing. This highlights a potential problem with using an indicator dummy as a proxy for monetary policy action, as the indicator will not differentiate between policy actions which are more versus less accommodative than expected. The U.S. policy normalization period from 2015 to February 2020 is also characterized by a mix of positive and negative surprises, though the number of positive surprises seems to be slightly larger, indicating that many Fed announcements were interpreted as more accommodative than expected. For the BoE, the mix of positive and negative surprises is present throughout the entire period, but the variance of the shocks increased considerably after the referendum to leave the European Union in 2016. In contrast, the magnitude of the ECB shocks decreased in size in the second half of the sample. BoJ shocks are smaller than those of the other central banks, and are particularly small from

[5]This is the same as the wide window from Rogers *et al* (2014)

[6]Rogers *et al* (2014, 2018), Gilchrist *et al* (2014) and Bowman *et al* (2015) use similar methodologies to compute QE shocks.

2016, when the BoJ introduced its Yield Curve Control (YCC) policy, until 2022. For all four central banks, the magnitude of policy surprises increased dramatically as inflation rose above target during 2021 and 2022. While Figure 1 plots the policy surprises in basis points, when we run the regressions we normalize so that a 25-basis point easing is equal to one, and a 25-basis point hike is equal to negative one.

Other studies including Rogers *et al* (2014) find that QE effects vary depending on the type of policy action. For this reason, we separately identify announcements associated with large scale asset purchase rograms (LSAPs). In contrast to studies like Bauer and Neeley (2014), which focus exclusively on events that constitute an expansionary monetary policy surprise, we include policy tightenings.

2.2 Fund flows

Our data on investor flows to mutual funds and exchange-traded funds (ETFs) comes from EPFR Global, a commercial data provider that collects data directly from funds.[7] About half of the funds are sold to retail investors and the rest are institutional funds. In aggregate these funds hold $15 trillion in assets in over 130 countries, and the total equity holdings reported to EPFR represent up to 20 percent of the float-adjusted market capitalization of individual markets. Approximately 40 percent of the funds are domiciled in the United States and a further 50 percent are domiciled in other advanced economies, so flows in and out of EM funds will generate cross-border flows when fund managers respond to the flows by buying or selling EM securities.[8] EPFR reports asset type, asset values, net fund flows, returns, and country and other asset allocation details. Our sample starts on January 1, 2008 and ends on March 31, 2023.

We use daily frequency data to match as closely as possible the windows over which the monetary policy surprises and investor reactions are measured. We divide the world into three geographic regions for our analysis: United States, other developed markets, and emerging markets. For each region we separately consider equity- and bond-dedicated funds. We use flows and portfolio shares associated with these six region-asset groups in our analysis. In order to ensure that we accurately measure the daily geographic distribution of flows and assets, we exclude from our analysis funds that invest in more than one of the three regions

[7]Funds also report this data to regulators and information aggregators including Bloomberg and Morningstar.

[8]Fund flows do not generate cross border flows if managers use inflows to bolster their cash cushion or meet redemptions using that cushion, or if managers replicate a position in the underlying EM asset using derivatives.

that we analyze. In practice, this means dropping "global" funds that invest in both emerging and developed markets.[9]

We use both flow-based and portfolio-based measures of fund investors' behavior following monetary policy shocks. Our flows-based measure uses flows scaled by initial assets to control for variation in fund size and to make coefficient estimates comparable across asset classes. Because announcement times vary across central banks, we follow existing literature and measure the response of flows over a two-day period in order to ensure that we allow sufficient time to capture investors' reaction to monetary policy announcements.[10] This is important because Fed announcements occur in the afternoon in the U.S. eastern time zone after foreign markets have closed, while the daily flows data we use are reported as of close of business in the domicile of each fund. That is, day t data on flows into European- and Japanese-domiciled funds will not capture the reaction to a Federal Reserve announcement that happened on day t. Thus our measure of flows to asset class i, in region j, on day t is:

$$FF_t^{i,j} = F_t^{i,j} + F_{t+1}^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., DM, EM\}$, $F_t^{i,j}$ is the flows on day t, and $FF_t^{i,j}$ represents the cumulative inflows from the day of the announcement and the business day following the announcement, which we refer to as the "2-day flows".

We focus on the *change* in flows around monetary policy announcements because it is well documented in the literature that fund flows are persistent (Froot *et al* 2001). While researchers working with panel data typically deal with this by including lagged flows or lagged returns, in our event study setting it is more appropriate to look at first differences in flows. So our main variable of interest is the change in 2-day flows:

$$\Delta FF_t^{i,j} = FF_t^{i,j} - FF_{t-2}^{i,j}.\text{[11]} \quad (1)$$

[9]For multi-country funds, EPFR reports country allocations only on a monthly basis. However, EPFR makes available a daily frequency "country flows" dataset comprised of estimates of total fund flows to individual countries. Because revised country allocations are not available every day, for multi-country funds EPFR allocates new flows across the countries in the fund's portfolio based on the country allocations reported by the fund for the previous month-end. As a result, for funds investing in multiple countries EPFR's daily country flows data will not capture cross-country reallocations. Thus the reported daily flows for multi-country funds will be either into all countries or out of all countries depending on whether the fund had aggregate inflows or outflows. This will create excess correlation between the country-level flows, skewing the results. Although not always clear, related papers appear to use daily frequency estimates of country-level flows, not just the country- or region-dedicated funds we analyze in this paper.

[10]This is quite common in this literature, see Chen *et al* (2012), Mishra *et al* (2014).

[11]In other words, the change in the 2-day flow following a monetary policy announcement on day t is $\Delta FF_t^{i,j} = FF_t^{i,j} - FF_{t-2}^{i,j} = \left(F_t^{i,j} + F_{t+1}^{i,j}\right) - \left(F_{t-2}^{i,j} + F_{t-1}^{i,j}\right)$.

Our portfolio-based measure captures changes in the share of the investor fund portfolio allocated to each of the ten region-asset pairs.[12] Portfolio-based measures provide a more robust control for wealth effects than flow-based measures. For example, consider an increase in the wealth of a fund investor which is not accompanied by any change in the desired allocation of assets across the ten region-asset groups. Such a change would generate simultaneous flows into all groups even though there is no shift in the investor's asset allocation. In this situation a measure based on portfolio weights would be unchanged.

We focus our analysis primarily on the active component of portfolio reallocation discussed in Tille and van Wincoop (2010).[13] That paper decomposes the total change in portfolio weights into active and passive components. The passive component is the change in weights arising from relative differences in asset returns. The active component is the change in the weights arising from flows which rebalance the weights in the overall portfolio.[14] The active portfolio reallocation in Tille and van Wincoop (2010) is computed as the residual change in the weight between two periods after accounting for passive shifts in portfolio weights. The active component of reallocation is given by:

$$A_t^{i,j} = w_t^{i,j} - w_{t-1}^{i,j} \frac{1 + r_t^{i,j}}{1 + r_t^{TOT}} \tag{2}$$

with portfolio weight:

$$w_t^{i,j} = \frac{NAV_t^{i,j}}{NAV_t^{TOT}}$$

where $NAV_t^{i,j}$ is the aggregate net asset value (NAV) of all funds investing in region-asset group of funds (i, j) on day t, $r_t^{i,j}$ is the return on each region-asset group from time $t-1$ to t. The second part of equation 2 is the passive component of reallocation. Because of the growth in EPFR coverage over the sample period, we adjust the NAV and weights by the change attributable to the change in fund coverage. Similar to the flow measure, our main variable of interest is the cumulative active component of the portfolio reallocation from close of business of the day before the monetary policy announcement to close of business of

[12] Again, the fund investor aggregate portfolio also includes assets invested in developed markets other than the four regions in our study, which constitute up to 15 percent of holdings. We include these assets in the denominator but do not analyze movements in this segment of the portfolio.

[13] The distinction between active and passive reallocation is closely related to Kraay and Ventura's (2000) "new rule for the current account."

[14] Flows can create changes in the value of the funds' assets so some of the change in the weights which we are attributing to the passive component could be the result of active investment changes. However, the same-day correlation between fund returns and flows in our sample is quite low, ranging from -0.08 to 0.25 for equity funds and -0.03 and -0.19 for bond funds. So very little of the change in portfolio weights we have attributed to passive reallocation is the result of active changes in investment strategy.

day following the announcement:

$$AA_t^{i,j} = A_t^{i,j} + A_{t+1}^{i,j}. \tag{3}$$

The portfolio share changes are measured in basis points rather than percentage points to make the coefficient estimates easier to interpret.

Tables 1 and 2 provide summary statistics for our flow and portfolio measures, respectively. The tables present the mean, median, and standard deviation of 2-day flows $FF_t^{i,j}$, change in 2-day flows $\Delta FF_t^{i,j}$, and active reallocation $AA_t^{i,j}$ for the six region-asset fund groups, computed over days with and without central bank announcement events.[15] The tables suggests that changes in flows during announcement days are notably larger—in absolute value —or otherwise different from those for non-event days. For example, while on non-event days the median change in 2-day flows into U.S. equity funds is 0.16 percent, the mean change in 2-day flows following a Fed announcement is an order of magnitude larger, at -1.42 percent. Similarly, there are active allocations toward U.S. equity funds on Fed announcement days, and away from these funds on other days.

Figure 2 plots the cumulative flows into the funds in our sample for the six region-asset groups. In Panel A, flows are measured in billions of U.S. dollars, while in Panel B flows are scaled by net asset value. Flows into DM funds generally behave quite differently from flows into EM funds. Investors pulled money out of U.S. and other DM equity funds as the U.S. financial crisis escalated. These asset classes remained out of favor with investors until late 2012, and instead investors poured money into EM funds. The direction of flows turned sharply in 2013, and investors moved money out of EM equity funds until 2016. Flows to U.S. equity funds were muted during the 2010s and only revived late in the COVID pandemic. Other DM funds equity funds have received steady inflows since 2013.

Flows into U.S. bond funds recovered quickly in mid-2009 and grew steadily through 2022, with only a small dip at the start of the pandemic, but turned negative in the last two years of the sample. EM bond funds received substantial inflows from 2009 through the so-called Taper Tantrum in mid-2013; indeed, measured as a share of initial assets flows to EM bonds were at least as large as those to U.S. bond funds. Flows recovered from the Taper Tantrum

[15] For Federal Reserve announcements, flows summed over the announcement and following day are noticeably more than double the flows on the announcement day, though the standard deviation of flows is so large the difference is not statistically significant. For announcements by the BoE and ECB, for some series the 2-day flows are noticeably less than twice the 1-day flows, suggesting that all the action is on the announcement day. The BoJ event day flows are too volatile to draw any conclusions. For non-event days, the 2-day flows are close to twice the 1-day flows, as expected.

beginning in 2016 and remained substantial through the start of the pandemic. Since early 2022, however, investors have withdrawn substantial amounts from EM bond funds.

The top panel of Figure 2 shows how the assets managed by the funds in our sample have grown over the last 15 years, and how the dollar amounts allocated to each asset class has changed. The bottom panel plots the resulting changes in the share of fund investors' portfolio allocated to each fund group. The portfolio shares of U.S. equity and bonds increased in the early days of QE. U.S. asset shares then trended lower until 2011 as investment in other funds increased. The U.S. portfolio share then remained relatively flat until after the pandemic, when it turned up again. By contrast, the EM share of fund investors' portfolios has declined over the last 15 years.

3 Model

To assess the impact of monetary policy announcements on bond and equity flows we use the following event-study regression:

$$\Delta FF_t^{i,j} = \alpha + \beta^{i,j,b} MPS_t^b + \varepsilon_t^{i,j} \tag{4}$$

where MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$ on day t (though the surprise, as explained in Section 2.1, is computed with intradaily data) and the coefficients $\beta^{i,j,b}$ represents the impact of monetary policy surprises from central bank b on flows to funds investing in each region-asset group. When running these regressions, we normalize the policy surprises so that a 25-basis point easing is equal to one and an equally sized tightening is equal to negative one. This makes interpreting the coefficients easier, with a positive $\beta^{i,j,b}$ indicating that policy easing has a positive effect on flows. We also estimate equation (4) with the dependent variable equal to the portfolio-based 2-day active reallocation $AA_t^{i,j}$.

A number of papers have investigated the possibility that the price impact of easing monetary policies might be different than that of tightening policies, both in the context of conventional monetary policy (Kuttner 2001) and unconventional policy (Rogers *et al* 2014). To explore a potential asymmetric response of flows to announcements that were easier versus tighter than expected, we also estimate the regression:

$$\Delta FF_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b \mathbb{1}\left(MPS_t^b < 0\right) + \beta_2^{i.j,b} MPS_t^b \, \mathbb{1}\left(MPS_t^b > 0\right) + \varepsilon_t^{i,j} \tag{5}$$

where the coefficients $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$measure the impact of monetary policy tightening (MPS<0) and easing (MPS>0) from central bank b, respectively. Our normalization of the shocks means that a positive value of $\beta_1^{i,j,b}$ indicates that tighter policy is accompanied by an increase in net outflows, while a positive value of $\beta_2^{i.j,b}$ indicates that monetary easing is accompanied by an increase in net inflows.[16] As before, we also run regressions with the dependent variable in equation (5) constructed using the portfolio-based measure $AA_t^{i,j}$. Similarly, surprise easing is associated with a positive active reallocation when $\beta_1^{i.j,b} > 0$ and vice versa. The relationship between the sign of the coefficients in equation (5) and the estimated direction of net flows (or allocation) is:

	Implied direction of flows	
Direction of monetary policy shock	Inflows	Outflows
Tightening (MPS < 0)	$\beta_1 < 0$	$\beta_1 > 0$
Easing (MPS > 0)	$\beta_2 > 0$	$\beta_2 < 0$

As mentioned earlier, the monetary policy shocks are normalized so that a one unit increase corresponds to a 25-basis point decrease in the relevant 10-year government bond yield. This approach differs from other event studies that employ indicator variables to represent the announcement, and represents the monetary policy surprise net of market expectations embedded in market prices. Thus, QE and conventional policy announcements will have a negative sign if they are interpreted as less accommodative than the market expected. In our view, both the magnitude and direction of the surprise matter in order to study the effect of an announcement. Because we are only interested in the impact of monetary policy surprises on capital flows, and not on all the determinants of flows, we do not include additional covariates. We implicitly rely on the identifying assumption that the only thing causing interest rates to move in a small window around central bank policy announcements is news about monetary policy. By regressing daily capital flows on exogenous MPS, we identify the immediate casual effect of monetary policy surprises on flows. Following Rogers *et al* (2014), we estimate equations (4) and (5) using robust regression to avoid excessive influence of outliers.[17]

[16] A positive value of $\beta_1^{i.j,b}$ could alternatively indicate that tighter policy is accompanied by an decrease in net inflows, while a positive value of $\beta_2^{i.j,b}$ could indicate that monetary easing is accompanied by an decrease in net outflows.

[17] We use the robust regression M-estimator of Huber (1981) with the bisquare weighting function.

4 Results

We find the impact of tightening and easing is generally not symmetric. And while our results show some variation depending on the flow measure, neither in the QE period nor in the subsequent 2015-2020 normalization period do we find that easing announcements by the Federal Reserve are associated with inflows into EM equity funds. In particular, when using a measure of flows that accounts for active reallocation, investors reallocate their portfolio toward DM equity investments and out of other assets following easing surprises by DM central banks. We also find evidence, however, that this relationship changed significantly during the COVID and post-COVID period, with Fed easing prompting reallocation into EM equity.

4.1 Flow Regressions

The results for the symmetric model, where the positive and negative monetary policy surprises are pooled together as in equation (4), are shown in Table 3. The dependent variable is the change in 2-day flows scaled by initial NAV. Positive coefficients mean that flows to the fund group increase when yields decline following a monetary policy announcement (an easing surprise) or flows to the fund group slow when yields increase following an announcement (a tightening surprise).[18] Fed policy surprises are not significantly related to flows to U.S. funds, but there is evidence of spillovers across regions. The coefficients on Fed policy shocks is positive and significant for EM bond funds, suggesting that Fed easing surprises drive inflows to funds dedicated to that asset class. By contrast, ECB easing surprises are associated with a fall in flows to U.S. and EM equity funds. Similarly, BoE easing surprises are associated with lower flows to EM equity funds. BoJ easing has a weakly significant and positive effect on flows to EM bond funds.

The coefficient of -0.128 on U.S. equity flows following ECB surprises indicates that a 25 basis point easing surprise is associated with a fall in flows into U.S. equity funds slightly larger than the median change on non-event days, so it is relatively modest. The estimated effects (of U.S. and BoJ policy) on flows to EM bond funds are also below the non-even day median. Effects of ECB and BoE policy surprises are substantially larger than the very small median change in flows on non-event days.

[18] Note what we refer to as an increase in flows could be an acceleration of net inflows or a slowing of net outflows.

As discussed earlier, because investor reaction to easing surprises could be different from the reaction to tightening surprises, we split the policy shocks according to their sign and estimate equation (5). Table 4 reports the results, where estimates of β_1 are reported in the "Tightening" rows and capture the responses to tightening surprises, and β_2 are reported in the "Easing" rows and capture the response to easing surprises. A significantly positive value of β_1 indicates that tightening surprises are accompanied by an acceleration in net outflows from (or a slowdown in net inflows to) the fund group in question, and a significant positive value of β_2 indicates that easing surprises are accompanied by an increase in net inflows (or a slowdown in net outflows).[19]

Consistent with previous work, we find evidence of important asymmetries in the effects of tightening and easing surprises. As was the case with the symmetric model, central bank policy shocks are not associated with significant changes in flows to most fund groups. However, when we do find significant effects, they are almost all asymmetric. Importantly, our results regarding the effect of monetary policy shocks on fund flows are at odds with the view that *easing* policies of DM central banks have generated large capital flows to emerging markets. For the Fed and the BoJ, only *tightening* shocks dampen flows to EM funds; easing shocks have no significant effect.[20] By contrast, ECB and BoE tightening are associated with an increase in flows to EM equity, and while BoE easing does have a significant effect, the coefficient is negative, meaning that flows to EMs decelerate when the UK central bank loosens. The relationship between ECB and BoE shocks and EM flows is consistent with a role for central bank information shocks (Jarocinski and Karadi 2020), with investors interpreting less accommodative monetary policy as a signal that central banks are optimistic and moving into risky assets.

We also find asymmetric effects on flows to U.S.-focused funds. Fed tightening is associated with a slowdown in flows to U.S. bond funds, while BOJ tightening generates a pickup in flows to U.S. bond and equity funds.

[19]Alternatively, a significantly negative value of β_1 indicates that tightening surprises are accompanied by increased net inflows or a slowdown in net outflows, and a significant negative value of β_2 indicates that an easing surprises are accompanied by increased net outflows or a slowdown in net inflows.

[20]These results are consistent with those of Koepke (2018), which finds that shifts in expectations towards easier Fed policy do not significantly affect flows to EM funds, while a change in expectations toward tighter policy has a large and significant dampening effect on flows to EM funds. Similarly, Burns *et al* (2014) estimate that EM inflows will decline in response to expectations for future policy normalization.

4.2 Portfolio Allocation Regressions

We get a different perspective on investor responses to monetary policy surprises when we shift our focus from fund flows to the portfolio reallocation decisions of fund investors. Table 5 presents results from estimating equation (5) when the dependent variable is the cumulative active portfolio reallocation on the day of the announcement and the subsequent day $AA_t^{i,j}$.[21] In Section 2.2 we discussed in detail the advantages of measuring fund investors' response to policy shocks using active reallocations. The results presented in Table 5 show that Fed policy has a significant effect on reallocation for 10 of the 12 fund group-shock type combinations that we study. We similarly find more significant effects of ECB and BoE policy, while the effects of BoJ policy appear less significant than was the case in the flow regressions.

In striking contrast to previous work, we find that following Fed easing surprises, investors reallocate their portfolio *away from* EM bonds as well as from U.S. bonds and non-U.S. DM assets. This shift is accompanied by a large active increase in the share of the portfolio invested in U.S. equity. This suggests that Fed policy easing works primarily through the confidence channel.[22]

Active reallocation in response to Fed policy shocks is asymmetric across the board, with the coefficients on Fed tightening and Fed easing carrying opposite signs, which implies that both types of policy shocks move flows in the *same direction*. Thus, Fed tightening shocks—like Fed easing shocks—spark a reallocation into U.S. equity and out of U.S. bonds, non-U.S. DM assets, and EM bonds. As in the previous section, this is consistent with a role for central bank information shocks (Jarocinski and Karadi 2020), with hawkish policy surprises revealing positive news about the underlying state of the economy.

Turning to the other central banks, ECB tightening surprises have an effect similar to Fed tightening: a reallocation into U.S. equity and away from U.S. and other DM bonds. ECB easing surprises, by contrast, do not have significant effects. BoE easing does prompt significant reallocation, with investors moving out of U.S. equity and EM bond funds into U.S. bonds.

[21]While portfolio weights themselves are extremely persistent, investors adjustments to those weights are much less so. This is particularly true of our active reallocation measure, which removes the effects of price momentum on portfolio shares. For this reason, we do not analyze changes in active reallocation.

[22]Our results are consistent with Rai and Suchanek (2014), which finds evidence of outflows from many EM funds reported by EPFR following QE tapering announcements in 2013.

Time Variation in the Effects of Policy Shocks

Because the conduct of monetary policy has varied substantially over the last 15 years, we next examine whether the effects of policy shocks on fund flows have have changed over time. We divide the sample into four periods: QE (from November 2008 to November 2014), Post-QE (December 2014 to February 2020), COVID (March 2020 to February 2022), and post-COVID (March 2022 to March 2023). For this exercise, we analyze only the effects of Fed policy shocks; the appropriate subperiods would be different for other central banks. We then estimate equation (5) separately for each subperiod.

In Figure 4, we plot how our estimates of the effects of Fed policy shocks vary over time for each of the six fund groups we are studying.[23] It is once again striking how the the coefficients on tightening and easing shocks carry opposite signs, often significantly so. This is true not only across fund groups but also across time, even when the coefficients themselves change.

We find significant evidence that the effects of tightening and easing shocks on active reallocation have changed over time, while remaining very asymmetric. The pattern of effects that we found in column 1 of Table 5, in which both easing and tightening spark reallocation into U.S. equity and out of U.S. bonds and non-U.S. assets, is driven by the post-GFC QE period and the subsequent post-QE period. Moreover, the effects of U.S. monetary policy on reallocation are striking similar across the two periods, despite the major shifts in both the stance of monetary policy and the tools used to implement it.

During and after the COVID pandemic, however, the signs of this relationship flip for DM and EM equity funds, with Fed easing sparking reallocation *into* these fund groups. Coefficient estimates for the post-COVID period have very wide standard error bands, because this period contains only nine observations, of which only two are tightening surprises (see Figure 1). We nonetheless keep this period separate in our estimation because nearly all the point estimates differ notably from earlier periods, for example, changing sign for four out of six fund groups. This suggestive evidence and the statistically significant sign changes we find in the COVID period, indicates that the effects of Fed policy shocks changed quite dramatically during and after the pandemic.

Conventional versus Unconventional Monetary Policy

Finally, we separately examine the effects of conventional and unconventional monetary policy, focusing on the Fed and the ECB. This allows us to assess whether the effects of

[23] Table A1 in the Appendix provides full regression results.

quantitative easing and quantitative tightening are significantly different from those of interest cuts or hikes. To do this, we estimate the following modified version of equation (5):

$$\Delta FF_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b \mathbb{1}\left(MPS_t^b < 0\right) + \beta_2^{i,j,b} MPS_t^b\, \mathbb{1}\left(MPS_t^b > 0\right) + LSAP_t^b \left[\beta_3^{i,j,b} MPS_t^b \mathbb{1}\left(MPS_t^b < 0\right) + \beta_4^{i,j,b} MPS_t^b\, \mathbb{1}\left(MPS_t^b > 0\right)\right] + \varepsilon_t^{i,j} \quad (6)$$

Where $LSAP_t^b$ is a dummy equal to one if policy shock b, t contains information about asset purchases or sales. In Table 6, column 1 presents estimates of $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$, column 2 provides estimates of $(\beta_1^{i,j,b} + \beta_3^{i,j,b})$ and $(\beta_2^{i,j,b} + \beta_4^{i,j,b})$, while $\beta_3^{i,j,b}$ and $\beta_4^{i,j,b}$ appear in column 3.

As shown in the first three columns of for the Federal Reserve, conventional policy and LSAPs have generally similar effects. The coefficient estimates have the same sign in all but case, and differences are statistically significant for only three of the twelve fund group-shock type combinations. Moreover, whether conventional versus unconventional policy has a larger effect varies across fund group. The reallocation into U.S. equity in response to Fed easing shocks is larger for LSAPs, but spillovers to funds investing in non-U.S. assets are larger for conventional policy. In particular, investors' shift out of EM bond funds in response to tightening shocks is larger for conventional policy, and there is reallocation out of DM bonds in response to Fed tightening via conventional policy but not via LSAPs. Overall then, our results are not consistent with the view that quantitative easing and quantitative tightening have larger spillovers than conventional monetary policy.

For the ECB, we find that the size and significance of the effects that we found in Table 5 are driven by conventional policy shocks rather than by asset purchases. Indeed, we find little significant reallocation in response to ECB asset purchases. The only exception to this pattern is for the effect of ECB tightening shocks, which are significantly associated with reallocation *into* non-U.S. DM bond funds when they occur via LSAPs, but have no significant effect on DM bond fund via conventional policy. This pushing effect of quantitative tightening is again consistent with a central bank information effect.

Taken together, the results of Tables 4-6 suggest that the inflows into EM funds during the QE period were not the result of the extraordinary easing measures implemented by DM central banks. In fact, our results suggest that both easing and tightening surprises led to a pickup in outflows from EM funds throughout the 2010s. Other factors, such as the relatively good growth prospects of EM economies could be responsible for solid investor appetite for EM funds during the sample period. In the robustness checks we do a careful comparison of our results with studies which find evidence that DM monetary policy during the QE era lead to sizable EM asset inflows. In the post-QE period, however, we find support for the claims of EM policy makers that DM monetary policy was contributing to a retreat from EM assets by investors.

4.3 Comparison with Earlier Work

Our results show no evidence of increased flows or reallocation into EM funds in response to Fed policy easings during the post-GFC period of QE, in contrast to the findings of Fratzscher *et al* (2018) and others. This could be attributable to differences in the construction of the dataset, the flow measure, monetary policy surprises, model specification, or some combination of factors. In this subsection, we assess the effect of each of these differences, focusing specifically on the QE period in order to make an apples-to-apples comparison.

To perform a reconciliation of our results with other literature, we use an alternative model setup, which separates the surprise variables by phase of QE, but does not distinguish between easing and tightening announcements:

$$F_{t+1}^{i,j} = \alpha + \beta_1^{i,j} QE1 + \beta_2^{i,j} QE2 + \beta_3^{i,j} QE3 + \varepsilon_t^{i,j}. \tag{7}$$

The QE variables in the model are alternatively an indicator variable, as used by other papers in the literature, or MPS_t^{Fed} as measured in Curcuru *et al* (2018). The regression is fitted to every daily observation, with the indicator variable or MPS_t^{Fed} set to 0 on non-event days. We estimate equation (7) using flows as a share of the initial NAV as the dependent variable, following the literature, and also our active portfolio reallocation variable. The results are shown in Tables 7 and 8. Differences between the first two columns in Tables 7 and 8 capture how much of the discrepancy between our results and others could be attributable to the use of a dummy to indicate a QE event (first column) rather than the MPS_t^{Fed} variable (second column). The difference between the last two columns suggests how much can be attributed to the flow measures–traditional flow measures are used in the estimation in the second column, the active portfolio reallocation in the third column. There are also differences in the QE dates in this paper and others. In Table 7, we use the QE dates listed in Appendix Table A1; in Table 8, we use the QE dates from Fratzscher *et al* (2018).

Using an indicator variable to specify QE events and using flows/NAV as the dependent variable (the first column in Tables 7 and 8), the results are similar to other papers. The estimates point to significant flows into both DM and EM equities during QE1, flows into all asset types in QE2, and flows into EM equities during QE3. This suggests that differences in the data sample are not responsible for the different conclusions reached in our paper. When comparing across Tables 7 and 8, there are some differences in the magnitude and significance of the coefficients in the first columns, where an indicator dummy is used for the MPS. Results with MPS_t^{Fed} and active portfolio allocations are more consistent across the two tables. Thus, the policy surprise measure or model setup appear to be responsible for the differences between our results and others in the literature.

Some of the differences between our results and others can be attributed to the policy shock measure. When instead of an indicator dummy (column 1) we use MPS_t^{Fed} as the policy shock (column 2), some of the coefficients change in magnitude, sign and/or significance. We still find significant flows into both DM and EM equities during QE1. However, the coefficients on DM equity and EM equity during QE2 are not significant or become negative, and most notably, there are significant outflows from EM equity during QE3. The change in sign can probably be attributed to the tightening actions captured by the MPS_t^{Fed} variable, as many of the QE events were less accommodative than expected.[24] Thus, some of the differences can be attributed to the use of a QE indicator variable in other papers, which suggests that the use of indicator variables in this type of event study framework could potentially lead to misleading results.

The use of the portfolio flow measure also plays a role. Using the active portfolio reallocation as the flow measure (column 3), there is no evidence of a reallocation toward EM assets. Instead, our estimation finds significant inflows into U.S. equity and significant outflows from all other asset types during QE1, including EM equity funds. The results are similar when using the alternative QE dates in Table 8.[25]

In sum, after the switch from a dummy variable to MPS_t^{Fed} to identify QE events, we find at best mixed evidence of flows into EM equities. An additional shift to the active portfolio reallocation measure of flows switches the signs on flows for DM and EM equity and bonds funds to outflows. In other words, the net effect of QE was increased investor holdings of

[24]For example, 8 of the 20 QE events listed in Fratzscher *et al* (2018) Table 1C were accompanied by an increase in 10-year Treasury yields, shown in in Table 1B.

[25]Another important difference between the results in Tables 7 and 8, and related tables in Fratzscher *et al* (2018) are in the relative size of the standard errors – our regression coefficients are similar, but our standard errors are generally larger, leading to fewer statistically significant regression coefficients. As noted earlier, we only use regional aggregates, and limit our analysis to flows into dedicated country or regional funds to get an accurate reading of the geography. In contrast, Fratzscher *et al* (2018) and similar studies use daily country-level flows, which are estimated based on country allocations reported by the fund for the previous month-end. This will create excessive correlation between the country-level flows, making the regression errors and coefficients difficult to interpret.

U.S. equities, and decreased holdings of other assets. Taken together, our results suggest that the observed inflows into EM equities during DM QE were driven by an increase in overall financial wealth. While investors did purchase EM equities in the first phase of QE, these purchases did not shift their portfolio weights toward EM assets because the increases in investor purchases of other assets, particularly U.S. equities, were even greater.

5 Conclusions

In this paper, we find that the main effect of Federal Reserve monetary policy, both conventional and unconventional, was to increase investment allocations of U.S. equity funds and decrease allocations of DM and EM bonds, and EM and non-U.S. DM equities. This finding differs from other studies that use EPFR data, largely due to differences in the flow measure and the identification of monetary policy surprises, in particular surprises that are less accommodative-than-expected. Our results are consistent with work by Ahmed *et al* (2015), which suggests that a wealth effects might be responsible for most of the inflows into EM assets. This has the broad implication that the pro-cyclicality of flows to emerging economies documented by many authors is a wealth effect rather than a QE effect. Although we find only slim evidence of spillovers to EM assets during the 2010s, our results also suggest that this may have changed during and after the COVD pandemic. Thus, EMs and non-U.S. DMs may not be insulated from spillovers if and when the Federal Reserve loosens policy.

In future work we will follow Jarocinski and Karadi (2020) and disentangle the information component of monetary policy shocks ("central bank information shocks") from the policy content of those shocks, to separately examine the flow effects. These results should provide additional evidence on the channels through which monetary policy is operating.

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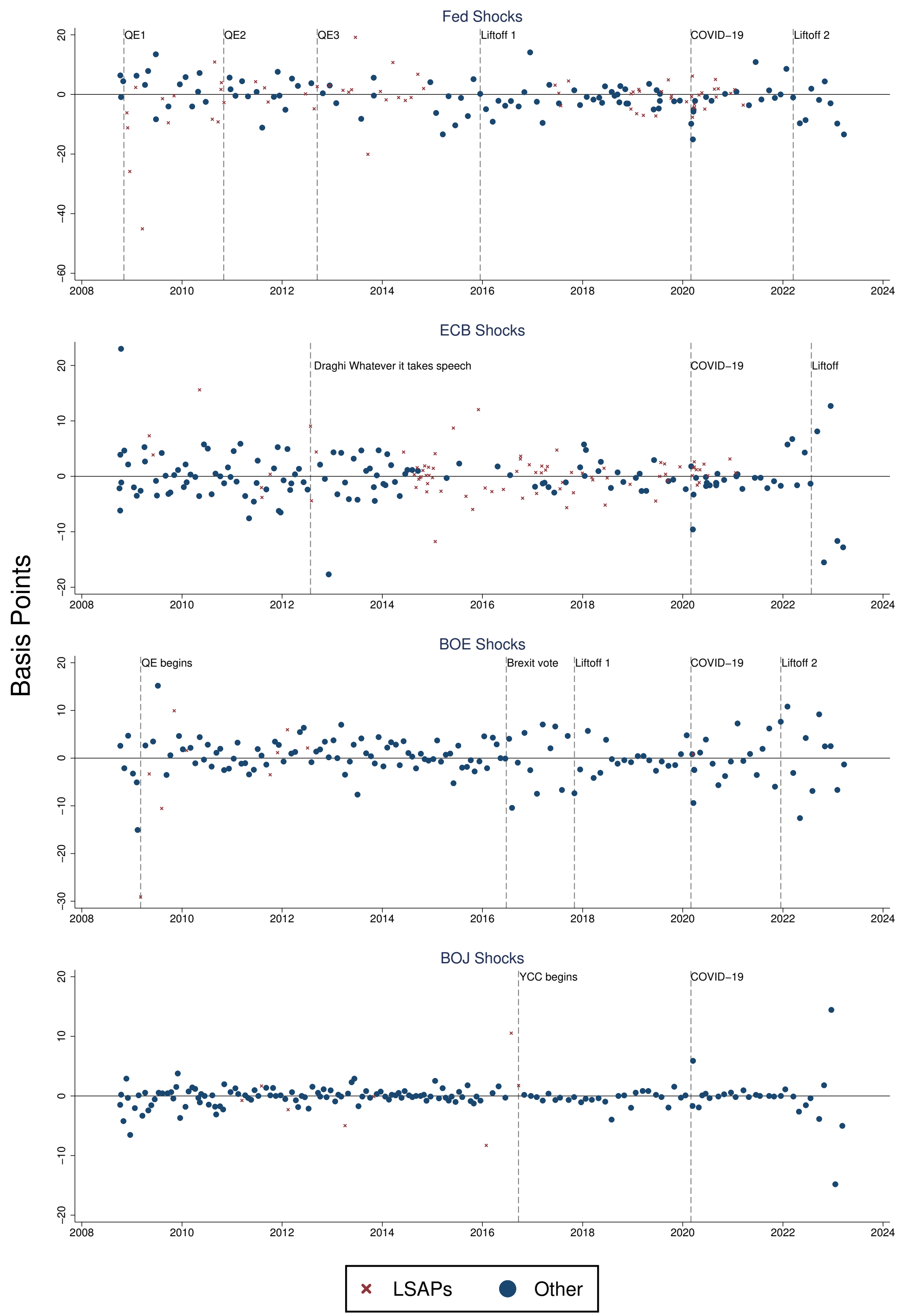
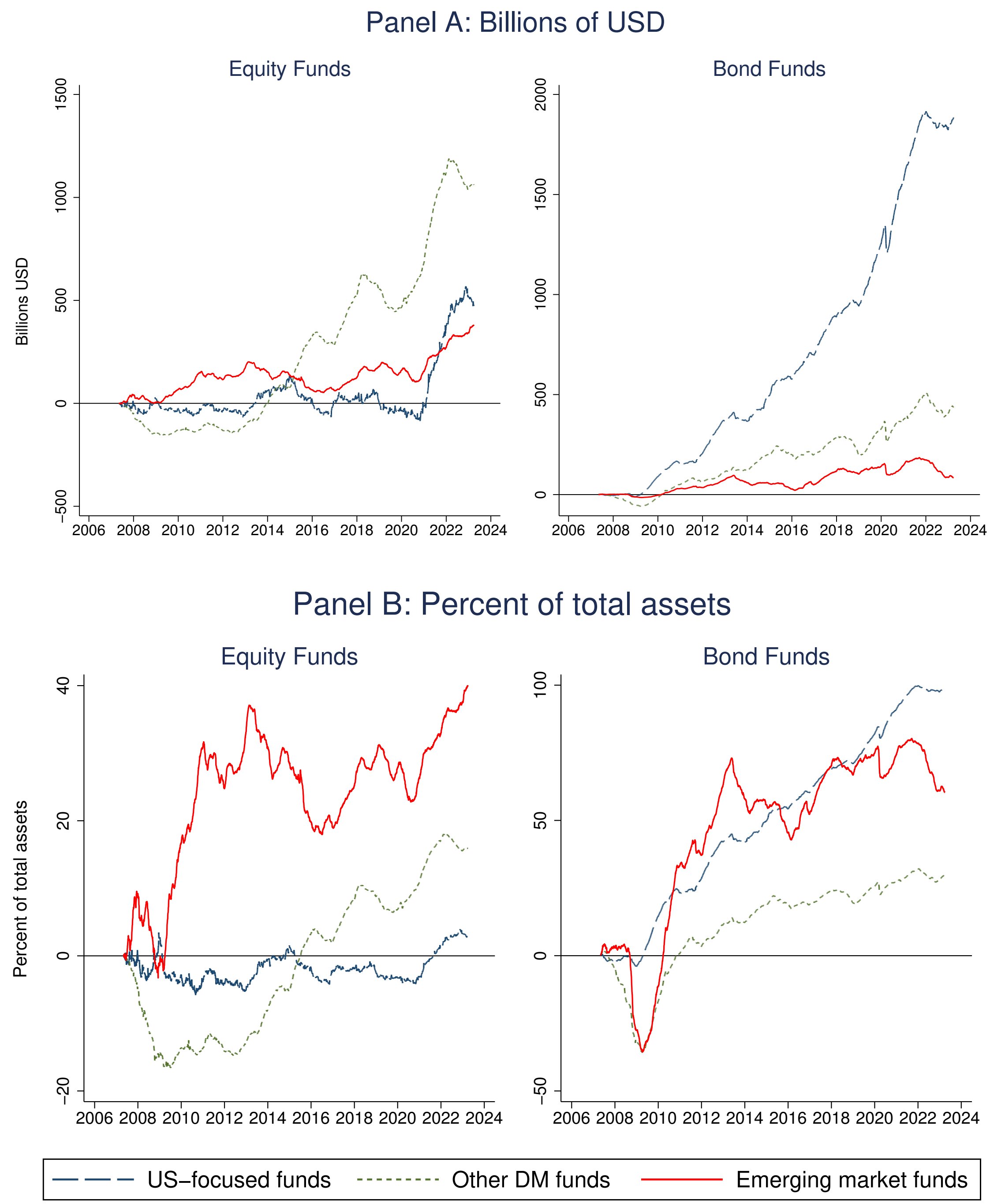
Figures

Figure 1: Monetary Policy Shocks



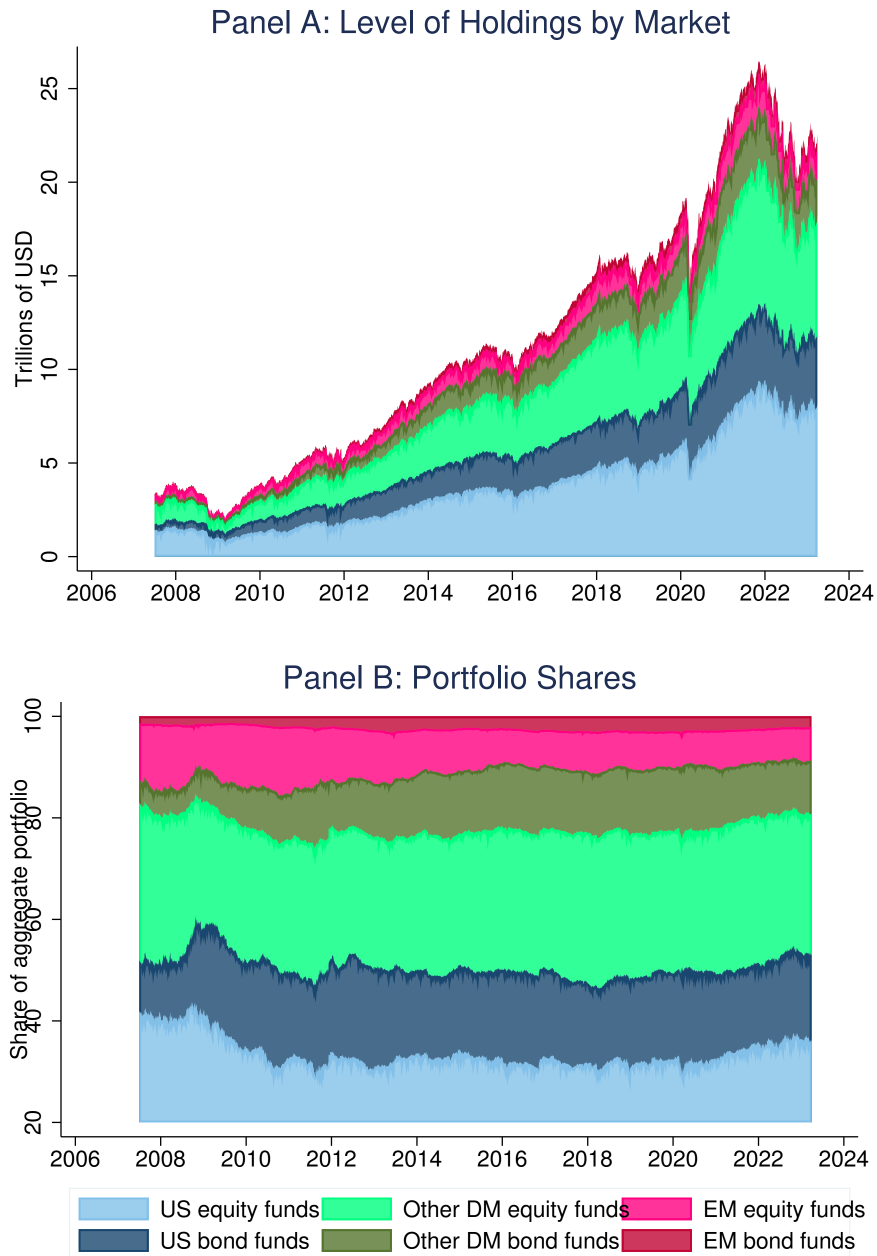
Monetary policy shocks are measured using the method in Curcuru et al. (2018).

Figure 2: Cummulative Fund Flows



Source: EPFR. Series constructed using daily frequency data on flows to dedicated country or regional funds. Panel B scaled by net asset values of each fund group.

Figure 3: Fund Investors' Aggregate Portfolio



Source: EPFR. Series constructed using daily frequency data on holdings of dedicated country or regional funds. Allocations to developed markets outside of the U.S. Europe, U.K, and Japan such as Canada or Australia are not included in our fund portfolio but are included in the aggregate portfolio totals.

Figure 4: Time Varying Effects of Fed Policy on Active Reallocation

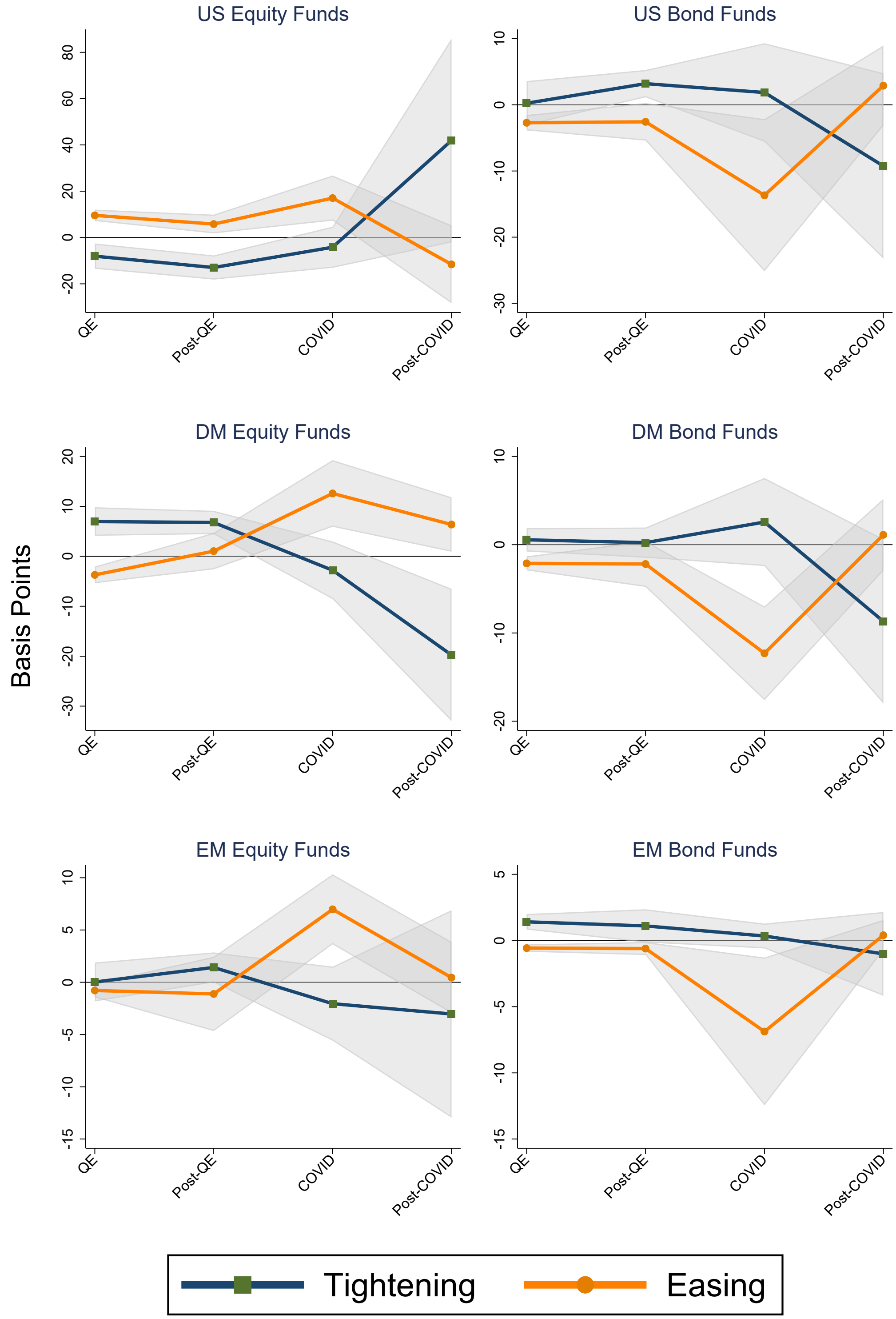


Figure plots coefficients from estimating equation (5) separately for each period. Shaded areas indicate 2-standard error bands. QE period runs from 11/3/2008 to 10/29/2014. Post-QE is from 12/17/2014 through 3/2/2020. COVID period is 3/3/2020 to 3/15/2022. Post-COVID period is 3/16/2022 to 3/31/2023.

Tables

Table 1: Summary Statistics, Fund Flows

	2-day flows (Millions USD)			**Change in 2-day flows** (Basis points)		
	Mean	Median	St. Dev.	Mean	Median	St. Dev.
NON Event Days: 3485						
US Equity	281.4	58.9	5020.4	0.51	0.16	23.93
US Bond	971.3	764.0	1988.1	0.03	-0.30	10.07
DM Equity	544.8	350.7	2138.2	-0.02	-0.10	10.63
DM Bond	259.4	319.6	1227.6	0.15	0.01	11.26
EM Equity	204.6	168.2	1247.6	0.09	-0.04	15.83
EM Bond	55.6	85.9	627.8	-0.27	-0.72	21.44
FED Event Days: 171						
US Equity	1229.7	262.7	7458.1	0.07	-1.42	18.90
US Bond	148.1	884.1	5485.1	1.57	1.09	13.26
DM Equity	110.1	283.7	2868.5	-0.58	0.29	18.57
DM Bond	-560.7	198.4	3478.9	-2.21	-0.15	14.57
EM Equity	57.1	27.3	1159.9	0.37	-0.19	14.90
EM Bond	-244.4	35.8	1545.7	-1.52	-1.08	23.16
BOE Event Days: 154						
US Equity	-1328.8	-1206.4	5913.1	-5.89	-3.05	24.36
US Bond	242.4	752.5	4206.3	-0.91	-1.17	12.24
DM Equity	556.1	368.8	2456.3	-0.43	0.30	17.43
DM Bond	-107.6	301.5	2661.0	-0.85	-0.67	10.33
EM Equity	60.5	81.6	1292.3	-0.88	-0.63	15.04
EM Bond	-84.8	114.9	1291.0	2.62	3.36	23.36
ECB Event Days: 241						
US Equity	-366.7	-424.3	5436.1	-1.43	-1.26	24.11
US Bond	785.1	868.9	3750.8	-0.21	-0.94	11.84
DM Equity	404.6	233.0	2420.7	0.69	-0.51	11.88
DM Bond	22.2	217.8	2141.3	-1.99	-1.64	10.60
EM Equity	68.2	137.9	1261.9	0.04	-0.78	17.14
EM Bond	27.1	66.5	1021.8	1.62	2.61	26.02
BOJ Event Days: 186						
US Equity	-612.3	-592.4	6799.9	-5.82	-4.76	37.34
US Bond	482.6	490.1	2864.4	-1.48	-2.02	10.47
DM Equity	355.6	166.4	2359.3	0.26	-0.11	15.96
DM Bond	81.9	333.5	2458.8	0.51	0.70	14.09
EM Equity	184.3	244.6	1325.3	-0.73	-0.85	18.43
EM Bond	-9.9	78.5	1073.1	1.12	0.96	22.92

Table 2: Summary Statistics, Active Reallocation

	(Basis points)		
	Mean	Median	St. Dev.
NON Event Days: 3485			
US Equity	-0.535	-0.580	4.322
US Bond	0.598	0.534	1.840
DM Equity	-0.218	-0.083	2.859
DM Bond	0.047	0.087	1.056
EM Equity	0.077	-0.019	1.722
EM Bond	0.032	0.057	0.530
FED Event Days: 171			
US Equity	0.708	-0.078	4.353
US Bond	0.130	0.441	2.651
DM Equity	-0.236	-0.332	3.114
DM Bond	-0.423	-0.197	1.648
EM Equity	0.001	-0.050	1.311
EM Bond	-0.180	-0.043	0.899
BOE Event Days: 154			
US Equity	-0.837	-1.167	4.269
US Bond	0.545	0.646	2.267
DM Equity	0.124	0.266	3.014
DM Bond	0.037	0.159	1.419
EM Equity	0.110	0.016	1.488
EM Bond	0.021	0.056	0.818
ECB Event Days: 241			
US Equity	-0.432	-0.800	4.222
US Bond	0.613	0.731	2.203
DM Equity	-0.107	-0.103	3.337
DM Bond	-0.126	0.004	1.284
EM Equity	0.045	0.021	1.594
EM Bond	0.008	0.047	0.713
BOJ Event Days: 186			
US Equity	-0.437	-1.153	6.206
US Bond	0.454	0.571	2.142
DM Equity	0.108	0.155	3.407
DM Bond	-0.005	0.104	1.641
EM Equity	-0.143	0.066	3.500
EM Bond	0.023	0.132	0.749

Table 3: Fund flows and monetary policy shocks, symmetric model

Dependent Variable: **Change in 2-day flows, (percent of initial NAV)**	Fed	ECB	BoE	BoJ
US Equity	0.081 (0.098)	-0.128 (0.063)**	-0.045 (0.098)	-0.065 (0.107)
US Bond	0.019 (0.034)	0.024 (0.042)	0.007 (0.041)	-0.092 (0.130)
DM Equity	-0.018 (0.026)	-0.018 (0.038)	0.014 (0.070)	-0.047 (0.037)
DM Bond	-0.016 (0.023)	-0.030 (0.041)	0.008 (0.028)	0.020 (0.072)
EM Equity	0.022 (0.033)	-0.138 (0.069)**	-0.217 (0.049)***	0.002 (0.087)
EM Bond	0.124 (0.052)**	-0.014 (0.120)	-0.029 (0.068)	0.215 (0.111)*
Observations	(171)	(241)	(154)	(186)

This table reports the coefficients $\beta^{i,j,b}$ from a regression of the 2-day change in fund flows $\Delta FF_t^{i,j}$ on monetary policy shocks using the model:

$$\Delta FF_t^{i,j} = \alpha + \beta^{i,j,b} MPS_t^b + \varepsilon_t^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., DM, EM\}$, MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$. The 2-day change in fund flows is the sum of flows on the day of and the day following a central bank policy announcement, normalized by initial fund assets, less the sum of flows on the 2 days prior to the policy announcement, again normalized by initial fund assets. Monetary policy shocks are measured using the method in Curcuru et al. (2018) and normalized so that a 25bps easing surprise is equal to one. Coefficients are estimated using the robust regression M-estimator of Huber (1981) with bisquare weighting function. Fed and BoE samples begin October 2008. ECB sample begins August 2007. BoJ sample begins May 2007. All samples end March 2023.

Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.

Table 4: Fund flows and monetary policy shocks, asymmetric model

Dependent Variable: Change in 2-day flows, (share of initial NAV)		Fed	ECB	BoE	BoJ
US Equity	Tightening	0.012 (0.115)	-0.138 (0.118)	-0.222 (0.181)	-0.320 (0.155)**
	Easing	0.130 (0.161)	-0.118 (0.086)	0.065 (0.110)	0.180 (0.130)
US Bond	Tightening	0.150 (0.059)**	0.059 (0.095)	0.078 (0.118)	-0.260 (0.088)***
	Easing	-0.037 (0.027)	-0.009 (0.056)	-0.034 (0.074)	0.055 (0.108)
DM Equity	Tightening	0.040 (0.037)	-0.010 (0.133)	-0.028 (0.054)	-0.099 (0.041)**
	Easing	-0.048 (0.059)	-0.022 (0.044)	0.112 (0.089)	0.001 (0.057)
DM Bond	Tightening	-0.064 (0.041)	-0.047 (0.056)	-0.034 (0.057)	-0.071 (0.112)
	Easing	0.008 (0.023)	-0.007 (0.081)	0.035 (0.038)	0.099 (0.107)
EM Equity	Tightening	-0.050 (0.062)	-0.201 (0.085)**	-0.236 (0.070)***	-0.005 (0.132)
	Easing	0.053 (0.050)	-0.060 (0.116)	-0.194 (0.089)**	0.004 (0.132)
EM Bond	Tightening	0.362 (0.079)***	-0.077 (0.378)	-0.046 (0.164)	0.312 (0.182)*
	Easing	0.021 (0.035)	0.026 (0.152)	-0.021 (0.086)	0.136 (0.133)
Observations		(171)	(241)	(154)	(186)

This table reports the coefficients $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$ from a regression of the 2-day change in fund flows $\Delta FF_t^{i,j}$ on monetary policy shocks using the model:

$$\Delta FF_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b 1\left(MPS_t^b < 0\right) + \beta_2^{i,j,b} MPS_t^b\ 1\left(MPS_t^b > 0\right) + \varepsilon_t^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., DM, EM\}$, MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$. The values of β_1 are reported in the "Tightening" rows and capture the responses to tightening surprises, and β_2 are reported in the "Easing" rows and capture the responses to easing surprises. The 2-day change in fund flows is the sum of flows on the day of and the day following a central bank policy announcement, normalized by initial fund assets, less the sum of flows on the 2 days prior to the policy announcement, again normalized by initial fund assets. Monetary policy shocks are measured using the method in Curcuru et al. (2018) and normalized so that a 25bps easing surprise is equal to one. Coefficients are estimated using the robust regression M-estimator of Huber (1981) with bisquare weighting function. Fed and BoE samples begin October 2008. ECB sample begins August 2007. BoJ sample begins May 2007. All samples end March 2023.
Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.

Table 5: Active portfolio reallocation and monetary policy shocks, asymmetric model

Dependent Variable: 2-day active reallocation (basis points)		Fed	ECB	BoE	BoJ
US Equity	Tightening	-10.76 (2.34)***	-5.76 (2.64)**	-2.80 (4.28)	-3.25 (4.76)
	Easing	8.41 (1.43)***	-0.79 (1.91)	-3.65 (1.93)*	-0.43 (2.29)
US Bond	Tightening	1.91 (0.90)**	2.59 (0.74)***	-0.50 (1.81)	1.55 (2.18)
	Easing	-2.60 (0.60)***	0.84 (0.86)	2.94 (1.23)**	0.20 (1.37)
DM Equity	Tightening	8.16 (1.48)***	-0.28 (1.37)	3.79 (1.87)**	-0.54 (2.14)
	Easing	-2.76 (1.36)**	-1.20 (1.06)	1.00 (1.77)	-2.06 (1.69)
DM Bond	Tightening	0.83 (0.72)	2.86 (1.09)***	0.46 (1.09)	-0.79 (0.68)
	Easing	-1.93 (0.38)***	-0.43 (0.84)	-0.40 (0.62)	1.24 (1.05)
EM Equity	Tightening	0.80 (0.78)	-0.25 (0.87)	-0.56 (0.82)	-0.51 (1.09)
	Easing	-0.34 (0.45)	0.73 (0.57)	1.76 (0.96)*	3.61 (1.35)***
EM Bond	Tightening	0.80 (0.37)**	0.33 (0.59)	0.27 (0.39)	0.43 (0.79)
	Easing	-0.55 (0.15)***	-0.09 (0.73)	-0.51 (0.19)***	-0.28 (0.77)
Observations		(194)	(241)	(154)	(186)

This table reports the coefficients $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$ from a regression of the 2-day sum of the active component of the portfolio reallocation $AA_t^{i,j}$ on monetary policy shocks using the model:

$$AA_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b 1\left(MPS_t^b < 0\right) + \beta_2^{i,j,b} MPS_t^b \ 1\left(MPS_t^b > 0\right) + \varepsilon_t^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., Europe, DM, EM\}$, MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$. The values of β_1 are reported in the "Tightening" rows and capture the responses to tightening surprises, and β_2 are reported in the "Easing" rows and capture the responses to easing surprises. Active reallocation is the sum of the active changes in portfolio weights on the day of and the day following central bank policy announcements (see Section 3 of the text for details of the calculation of active reallocation). Monetary policy shocks are measured using the method in Curcuru et al. (2018) and normalized so that a 25bps easing surprise is equal to one. Coefficients are estimated using the robust regression M-estimator of Huber (1981) with bisquare weighting function. Fed and BoE samples begin October 2008. ECB sample begins August 2007. BoJ sample begins May 2007. All samples end March 2023.
Standard errors are in parenthesis. *** $p< 0.01$, ** $p< 0.05$, *$p< 0.10$.

Table 6: Active portfolio reallocation and Federal Reserve policy shocks, Conventional vs LSAP announcements, asymmetric model

Dependent Variable: 2-day active reallocation (basis points)		Fed			ECB		
		Conventional	LSAP	Diff	Conventional	LSAP	Diff
US Equity	Tightening	-10.89 (4.44)**	-9.38 (1.84)***	1.52 (4.50)	-7.71 (1.92)***	0.18 (3.22)	7.89 (3.56)**
	Easing	5.08 (2.24)**	9.14 (1.26)***	4.07 (2.47)*	-1.25 (2.00)	-1.45 (3.70)	-0.20 (3.94)
US Bond	Tightening	1.59 (1.30)	1.64 (0.94)*	0.04 (1.42)	2.98 (0.94)***	1.19 (1.32)	-1.79 (1.49)
	Easing	-1.37 (1.33)	-2.77 (0.56)***	-1.40 (1.39)	0.83 (0.89)	1.88 (1.70)	1.05 (1.81)
DM Equity	Tightening	8.14 (2.24)***	7.16 (1.26)***	-0.98 (2.39)	0.79 (1.86)	-3.59 (2.07)*	-4.38 (2.61)*
	Easing	-0.51 (2.18)	-3.50 (0.89)***	-3.00 (2.25)	-1.32 (1.03)	-0.56 (2.62)	0.76 (2.59)
DM Bond	Tightening	1.79 (0.94)*	-0.66 (0.44)	-2.45 (0.87)***	3.67 (0.65)***	0.59 (1.00)	-3.09 (1.10)***
	Easing	-2.48 (0.93)***	-1.82 (0.36)***	0.66 (0.95)	-0.37 (1.01)	0.13 (0.77)	0.50 (1.13)
EM Equity	Tightening	1.83 (1.55)	0.13 (0.65)	-1.70 (1.62)	-0.49 (1.10)	0.44 (1.46)	0.92 (1.76)
	Easing	-0.63 (0.99)	-0.41 (0.41)	0.21 (1.03)	1.05 (0.63)*	-0.61 (1.03)	-1.66 (1.16)
EM Bond	Tightening	0.84 (0.45)*	0.85 (0.53)	0.01 (0.64)	0.80 (2.69)	-0.08 (0.60)	-0.88 (2.25)
	Easing	-0.97 (0.32)***	-0.42 (0.11)***	0.55 (0.32)*	0.03 (1.11)	-0.33 (0.82)	-0.36 (0.92)
Observations		(125)	(67)		(164)	(75)	

This table reports the coefficients $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$ from a regression of the 2-day sum of the active component of the portfolio reallocation $AA_t^{i,j}$ on monetary policy shocks using the model:

$$AA_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b \mathbb{1}\left(MPS_t^b < 0\right) + \beta_2^{i,j,b} MPS_t^b\ 1\left(MPS_t^b > 0\right) + LSAP_t\left[\beta_3^{i,j,b} MPS_t^b \mathbb{1}\left(MPS_t^b < 0\right) + \beta_4^{i,j,b} MPS_t^b\ \mathbb{1}\left(MPS_t^b > 0\right)\right] + \varepsilon_t^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., DM, EM\}$, MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$. The values of β_1 are reported in the "Tightening" rows and capture the responses to tightening surprises, and β_2 are reported in the "Easing" rows and capture the responses to easing surprises. Active reallocation is the sum of the active changes in portfolio weights on the day of and the day following central bank policy announcements (see Section 3 of the text for details of the calculation of active reallocation). Monetary policy shocks are measured using the method in Curcuru et al. (2018) and normalized so that a 25bps easing surprise is equal to one. Coefficients are estimated using the robust regression M-estimator of Huber (1981) with bisquare weighting function. Fed sample begins October 2008. ECB sample begins August 2007. The dates of LSAP announcements are listed in the policy announcement Tables A1 and A2.
Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.

Table 7: Alternative Specification

	Dependent Variable:		
	Flows (% of initial assets)	Flows (% of initial assets)	Active portfolio reallocation (bps)
US Equity Funds			
QE1 indicator	0.15*** (0.06)		
QE2 indicator	0.07** (0.03)		
QE3 indicator	-0.01 (0.06)		
QE1 MPS		0.34*** (0.05)	7.65*** (1.20)
QE2 MPS		-0.13 (0.23)	-11.96* (6.39)
QE3 MPS		-0.11 (0.66)	2.47 (3.72)
US Bond Funds			
QE1 indicator	0.01 (0.02)		
QE2 indicator	-0.02 (0.03)		
QE3 indicator	-0.04*** (0.01)		
QE1 MPS		0.02 (0.02)	-2.56*** (0.57)
QE2 MPS		0.41*** (0.11)	3.09 (3.46)
QE3 MPS		0.45*** (0.14)	11.57 (11.75)
DM Equity Funds			
QE1 indicator	0.04* (0.02)		
QE2 indicator	-0.01 (0.03)		
QE3 indicator	-0.02 (0.05)		
QE1 MPS		0.03** (0.01)	-2.88*** (0.66)
QE2 MPS		0.00 (0.21)	8.39 (5.24)
QE3 MPS		0.40 (0.62)	3.07 (22.23)
DM Bond Funds			
QE1 indicator	-0.01 (0.03)		
QE2 indicator	-0.02 (0.03)		
QE3 indicator	0.05** (0.02)		
QE1 MPS		-0.12 (0.07)	-1.77*** (0.43)
QE2 MPS		0.47*** (0.09)	2.33 (1.61)
QE3 MPS		-0.28 (0.23)	-0.86 (5.55)
EM Equity Funds			
QE1 indicator	0.05* (0.03)		
QE2 indicator	-0.00 (0.05)		
QE3 indicator	0.14** (0.06)		
QE1 MPS		0.15*** (0.03)	-0.06 (0.14)
QE2 MPS		0.15 (0.37)	-1.24 (4.66)
QE3 MPS		-1.70*** (0.65)	-15.24*** (1.60)
EM Bond Funds			
QE1 indicator	0.02 (0.05)		
QE2 indicator	0.07*** (0.02)		
QE3 indicator	0.06 (0.05)		
QE1 MPS		-0.10* (0.06)	-0.39*** (0.09)
QE2 MPS		-0.06 (0.22)	-0.61** (0.30)
QE3 MPS		-0.49 (0.64)	-1.02*** (0.39)

This table reports the coefficients from the regression

$$F_{t+1}^{i,j} = \alpha + \beta_1^{i,j} QE1 + \beta_2^{i,j} QE2 + \beta_3^{i,j} QE3 + \varepsilon_t^{i,j}.$$

of single-day fund flows on either indicator variables equal to one on dates of quantitative easing announcements or the Curcuru et al. (2018) measure of U.S. monetary policy shocks (MPS) on those same QE dates. Sample runs from 1 Jan 2007 to 31 December 2013. QE1 is from 11/3/2008 to 6/30/2010. QE2 is from 11/1/2010 to 6/30/2011. QE3 is from 9/13/2012 to the end of the sample. Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.

Table 8: Alternative Specification and Alternate QE Dates

	Dependent Variable:		
	Flows (% of initial assets)	Flows (% of initial assets)	Active portfolio reallocation (bps)
US Equity Funds			
QE1 ind.	0.35*** (0.13)		
QE2 indicator	0.05* (0.03)		
QE3 indicator	-0.04 (0.04)		
QE1 MPS		0.41*** (0.01)	9.18*** (0.31)
QE2 MPS		-0.19*** (0.07)	-3.25* (1.79)
QE3 MPS		-0.24 (0.31)	2.64 (1.98)
US Bond Funds			
QE1 ind.	0.01 (0.02)		
QE2 indicator	0.01 (0.01)		
QE3 indicator	0.03 (0.04)		
QE1 MPS		0.01 (0.01)	-3.13*** (0.30)
QE2 MPS		-0.07*** (0.02)	0.33 (1.19)
QE3 MPS		0.35 (0.32)	12.94 (11.60)
DM Equity Funds			
QE1 ind.	0.05 (0.04)		
QE2 indicator	0.03*** (0.01)		
QE3 indicator	-0.01 (0.03)		
QE1 MPS		0.03** (0.01)	-3.47*** (0.31)
QE2 MPS		-0.05 (0.05)	3.18 (2.34)
QE3 MPS		0.13 (0.26)	-8.60 (18.42)
DM Bond Funds			
QE1 ind.	-0.17** (0.07)		
QE2 indicator	0.07*** (0.02)		
QE3 indicator	-0.03 (0.03)		
QE1 MPS		-0.13 (0.09)	-2.02*** (0.55)
QE2 MPS		-0.12 (0.07)	-0.16 (0.63)
QE3 MPS		-0.53*** (0.15)	-1.85 (4.00)
EM Equity Funds			
QE1 ind.	0.20*** (0.04)		
QE2 indicator	0.07** (0.03)		
QE3 indicator	0.07 (0.06)		
QE1 MPS		0.17*** (0.01)	-0.08 (0.07)
QE2 MPS		-0.05 (0.10)	0.32 (1.27)
QE3 MPS		-0.79* (0.45)	-4.56 (3.89)
EM Bond Funds			
QE1 ind.	-0.23*** (0.04)		
QE2 indicator	0.16*** (0.05)		
QE3 indicator	-0.01 (0.06)		
QE1 MPS		-0.15** (0.07)	-0.48*** (0.09)
QE2 MPS		-0.29 (0.20)	-0.43 (0.40)
QE3 MPS		-0.55 (0.36)	-0.57** (0.22)

Regression specifications are identical to those of Table 7, but use the QE dates taken from Fratzscher et al (2016).
Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.

Appendix Tables

A.1 Additional Results

Table A1: Time varying effects of Federal Reserve policy shocks on active portfolio reallocation

Dependent Variable: 2-day active reallocation (basis points)		QE	Post-QE	COVID	Post-COVID
US Equity	Tightening	-8.05 (2.79)***	-12.96 (2.66)***	-4.20 (4.54)	41.90 (22.46)*
	Easing	9.58 (1.25)***	5.82 (2.07)***	17.05 (4.97)***	-11.58 (8.60)
US Bond	Tightening	0.23 (1.71)	3.19 (1.05)***	1.85 (3.80)	-9.24 (7.15)
	Easing	-2.71 (0.59)***	-2.57 (1.45)*	-13.67 (5.87)**	2.89 (3.09)
DM Equity	Tightening	6.97 (1.46)***	6.78 (1.19)***	-2.79 (2.95)	-19.76 (6.77)***
	Easing	-3.72 (0.85)***	1.04 (1.86)	12.59 (3.41)***	6.37 (2.79)**
DM Bond	Tightening	0.55 (0.68)	0.23 (0.87)	2.57 (2.55)	-8.68 (4.76)*
	Easing	-2.12 (0.40)***	-2.19 (1.32)*	-12.31 (2.71)***	1.12 (2.08)
EM Equity	Tightening	0.03 (0.95)	1.42 (0.73)*	-2.05 (1.81)	-3.03 (5.06)
	Easing	-0.78 (0.34)**	-1.11 (1.81)	6.98 (1.71)***	0.45 (1.74)
EM Bond	Tightening	1.41 (0.30)***	1.10 (0.64)*	0.34 (0.48)	-1.01 (1.62)
	Easing	-0.57 (0.14)***	-0.61 (0.25)**	-6.88 (2.85)**	0.40 (0.59)
Observations		(49)	(61)	(32)	(9)

This table reports the coefficients $\beta_1^{i,j,b}$ and $\beta_2^{i,j,b}$ from a regression of the 2-day sum of the active component of the portfolio reallocation $AA_t^{i,j}$ on monetary policy shocks using the model, estimated separately for each time period:

$$AA_t^{i,j} = \alpha + \beta_1^{i,j,b} MPS_t^b 1\left(MPS_t^b < 0\right) + \beta_2^{i,j,b} MPS_t^b \, 1\left(MPS_t^b > 0\right) + \varepsilon_t^{i,j}$$

where $i = \{equity, bonds\}$, $j = \{U.S., DM, EM\}$, MPS_t^b is the monetary policy surprise of central bank $b = \{Fed, ECB, BoE, BoJ\}$. The values of β_1 are reported in the "Tightening" rows and capture the responses to tightening surprises, and β_2 are reported in the "Easing" rows and capture the responses to easing surprises. Active reallocation is the sum of the active changes in portfolio weights on the day of and the day following central bank policy announcements (see Section 3 of the text for details of the calculation of active reallocation). Monetary policy shocks are measured using the method in Curcuru et al. (2018) and normalized so that a 25bps easing surprise is equal to one. Coefficients are estimated using the robust regression M-estimator of Huber (1981) with bisquare weighting function.
QE period runs from 11/3/2008 to 10/29/2014. Post-QE is from 12/17/2014 through 2/2018. COVID periods is 3/2020 to 2/2022. Post-COVID period is 3/2022 to 3/2023.
Standard errors are in parenthesis. *** p< 0.01, ** p< 0.05, *p< 0.10.