The Effects of U.S. Monetary Policy Shocks on Mutual Fund I nvesting*

Ayelen Banegas† Gabriel Montes-Rojas‡ Lucas Siga§

February 4, 2022

Abstract

We study the effects of unexpected changes in the stance of U.S. monetary policy on the performance and flows of mutual funds investing in domestic and international financial markets over the recent period of unconventional monetary policy. Taking an agnostic approach on the transmission mechanism of monetary policy, we find that monetary policy shocks have a direct effect on fund performance and flow dynamics, and that the effect of these surprises differs by investment strategy. Results show that an unexpected tightening of the stance of policy is associated with negative performance and outflows from fixed-income funds, in particular those investing in international, government and investment grade bond markets. Results also point to a negative relationship between equity fund performance and policy tightening. Moreover, our findings indicate that Federal Reserve's expansionary balance sheet policy (i.e. large-scale asset purchases) has a strong positive effect on the performance and flows of equity funds, especially on those investing in emerging markets.

Keywords: Mutual fund performance and flows, monetary policy shocks
JEL Classification: G20, G23, E52

*The views expressed in this paper are solely the responsibility of the authors and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System. We are grateful to the Associate Editor, one anonymous referee, James Hamilton, Egon Zakrajšek and Jason Wu for helpful comments. We also thank seminar participants at the 2017 American Economic Association annual meeting, the 2017 Latin American Econometric Society annual meetings, and the Federal Reserve Board. An earlier version was released as a FEDS paper under the title "Mutual Fund Flows, Monetary Policy and Financial Stability."

†Federal Reserve Board, Division of Monetary Affairs. Email: ayelen.banegas@frb.gov

‡CONICET-Universidad de Buenos Aires. Email: gabriel.montes@fce.uba.ar

§Department of Economics, University of Essex. Email: lucas.siga@essex.ac.uk

1 Introduction

In the years following the financial crisis, assets of long-term U.S. mutual funds grew substantially, with total assets under management increasing to about $15.9 trillion by the end of 2017, an additional $10 trillion relative to 2008.[1] This growth in assets was driven by both the post-crisis rally in equity and bond markets, as well as by massive inflows into the U.S. mutual fund industry. In particular, in a context of a massive monetary stimulus, there were substantial flows into mutual funds investing in investment-grade and high-yield bond and international equity markets. These inflows were in part triggered by investors reaching for yield during a period characterized by ample liquidity in financial markets and a sustained low-interest rate environment.

This dramatic growth in assets together with sell-off episodes, such as the Taper Tantrum in 2013, brought mutual funds to the center of the debate on the potential disruptions to financial markets that might arise from this industry in the event of a sudden run by mutual fund investors.[2] Our paper is motivated by this debate and brings new evidence to the study of the effects of monetary policy on mutual fund investing and the risks to financial stability that fund investors might generate. Understanding monetary policy transmission through financial intermediaries such as mutual funds, as well as the financial stability effect this sector can have on asset markets, is of particular relevance in the current environment of unprecedented and massive monetary stimulus by central banks in response to the Covid-19 crisis.

From the perspective of U.S. investors, our analysis focuses on the effects of exogenous monetary policy shocks on the performance and flows of U.S. domiciled mutual funds in-

[1] Long-term mutual funds refer to funds investing in either equity, bond or hybrid funds as defined by the Investment Company Institute (ICI). These statistics exclude mutual funds investing in money markets.

[2] During the Taper Tantrum, emerging markets and corporate bond funds experienced large redemptions and negative performance following the Federal Reserve chairman's remarks that were interpreted as a signal that the central bank would begin cutting the pace of bond purchases earlier than expected by market participants.

vesting both in domestic and international financial markets. We ask whether unexpected changes in the stance of monetary policy, such as an unanticipated rise in interest rates, could compress mutual fund performance and/or trigger large outflows that, in an industry that mutualizes redemption costs, could then generate run-like dynamics.[3]

In addressing this question, our empirical strategy is built on the assumption that there might be various not mutually exclusive channels through which U.S. monetary policy shocks may affect mutual fund investing. This agnostic prior is reflected in the set up of our econometric framework which allows for the possibility that exogenous monetary policy surprises may have a direct effect on returns and flows of U.S. domiciled mutual funds investing in both domestic and international financial markets. In this set up, two not mutually exclusive hypothesis are in place: First, the hypothesis that positive monetary policy shocks (i.e. tightening of the policy path) can create downward pressure on asset prices of the portfolio, compressing fund performance and triggering outflows. Second, the hypothesis that these shocks can change investors' expectations about the economic outlook, triggering fund outflows that, in stress events, can have negative price effects on the underlying portfolio holdings, therefore depressing fund performance.[4]

In the spirit of Gertler and Karadi (2015), Jarociski and Karadi (2020), and others, our approach combines high frequency identification methodologies to measure exogenous monetary policy shocks and a vector autorregression (VAR) framework to study the dynamic responses of mutual fund returns and flows to such shocks. Specific to the measurement of exogenous monetary policy surprises, since a large part of our sample covers the zero lower bound (ZLB) period, during which the Federal Reserve (Fed) has been primarily

[3]Note that our study focuses on the effects of monetary policy on investor fund flows, a not on the effects on asset managers' portfolio allocation decisions. For instance, from the perspective of asset managers, and beyond the scope of our work, questions can relate to how fund managers position their portfolios following unexpected changes in the stance of policy, or more volatile rate environments, among other factors that can influence asset managers' allocation decisions.

[4]The monetary economics literature on transmission channels is vast. See Boivin, Kiley, and Mishkin (2010) for a detailed review of channels of policy transmission. Also, and related to the Fed's large-scale asset purchases (LSAPs), many studies focused on the portfolio balance, risk taking, and signaling channels (i.e., Hamilton and Wu (2012a), Borio and Zhu (2012), and Bauer and Rudebusch (2014)).

implementing monetary policy through unconventional policy tools, we build on Hanson and Stein (2015) in our attempt to capture the unanticipated variation in monetary policy that is reflected in the path of the federal funds rate over the medium term (including surprises about future policy inferred from forward guidance and/or other communications by Board members). In addition, to capture shocks that arise from tools that target longer-term rates, such as those related to large-scale asset purchases (LSAPs), we follow Gilchrist, López-Salido, and Zakrajšek (2015).[5] Capturing shocks that target the longer end of the yield curve has become of particular relevance again since March 2020, when the Federal Reserve resumed its asset purchase programs in response to the Covid-19 crisis.

Several results stand out from our analysis. First, monetary policy shocks have a direct effect on bond mutual fund performance and flows. At the asset class level, an unexpected tightening of the policy path is associated with negative returns and net outflows from bond funds. Furthermore, while the initial effect of an unexpected policy tightening on fund flows expands at a decreasing rate over the subsequent year, the effect on returns partially reverts over time. At the investment strategy level, the effect of policy surprises on returns are economically and statistically significant not only for the more policy rate-sensitive categories such as government funds, but also for corporate bond funds (both investment grade and high yield bond funds) and world bond mutual funds. Similarly, results show that an unexpected tightening of the policy path can trigger outflows across bond fund categories. Second, results suggest that the direct effect of monetary policy shocks on equity mutual funds appears to be primarily through its impact on fund returns, with the initial underperformance of equity funds following a policy tightening persisting over the following periods, although its magnitude retraces somewhat following the shock. Furthermore, the negative effect of

[5]Immediately after the burst of the financial crisis, the Fed launched a series of credit and liquidity facilities and began aggressively cutting the fed funds target rate, reaching the ZLB by the end of 2008. Thereafter, the Fed turned to unconventional policy tools to provide additional downward pressure on longer-term interest rates. These tools included a series of asset purchase programs, a maturity extension program, and a more active communication strategy involving forward guidance about the future path of the federal funds rate (FFR). See Engen, Laubach, and Reifschneider (2015) for more details on these programs.

a tighter monetary policy path on equity fund performance is confirmed at the strategy level, with domestic, international developed and emerging market equity funds showing strong economically and statistically significant results. Of note, within the equity space, the strongest results are from U.S. funds investing in emerging equity markets, providing evidence of the spillovers of U.S. monetary policy on international equity prices.[6] Finally, we show that balance sheet policy implementation can also have a strong economic effect on fund performance and investor flows. In particular, results at the strategy level point to a positive relationship between increases in the size of the Fed's balance sheet, measured by changes in the System Open Market Account (SOMA) Portfolio, and performance and flows of equity and corporate bond mutual funds. Of note, within these two asset classes results are the strongest for emerging market equity and high yield bond mutual funds. These findings can be interpreted in the context of the transmission of monetary policy through the portfolio balance channel. As the Fed absorbed large quantities of long-term Treasuries and mortgage-backed securities and changed the quantities and mix of financial assets available to the public, investors shifted allocations into riskier assets, depressing their yields and pushing up their prices.

Our analysis is at the intersection of the macro-finance literature on monetary policy and asset prices, and the mutual fund literature on the flow-performance relationship. Related to the former, although in recent years there has been a vast body of work on the response of asset prices around monetary policy announcements, the study of the effects of monetary policy shocks on mutual fund investing remains relatively unexplored.[7] Our study contributes to this literature by providing novel evidence on the effects of unexpected changes in the

[6]There is a related literature on the impact of U.S. LSAPs on global asset prices. See Rogers, Scotti, and Wright (2014), Neely (2015) and Bowman, Londono, and Sapriza (2015), among others.

[7]There is a large literature on the effects of monetary policy on asset prices using high-frequency data in the context of event studies. These studies include Kuttner (2001); Bernanke and Kuttner (2005); Gurkaynak, Sack, and Swanson (2005); and Lucca and Moench (2015). Also, many papers have focused on the effects of the Fed's LSAPs on asset prices, including Gagnon, Raskin, Remache, and Sack (2011); Hamilton and Wu (2012b); Rosa (2012); D'Amico and King (2013); and Rogers, Scotti, and Wright (2014). Recent and more related work includes Brooks, Katz, and Lustig (2018), Lian, Ma, and Wang (2019), Daniel, Garlappi, and Xiao (2020) and Jiang, Li, Sun, and Wang (2020).

stance of U.S. monetary policy on the performance and flows of U.S. domiciled mutual funds investing in domestic and international markets during the recent period of unconventional monetary policy.

With respect to the risks to financial stability that mutual funds might generate, our analysis relates to recent studies that focus on the fund flow-performance relationship and its implication for run-like behavior.[8] Our work contributes to this literature by taking a step back in the flow-performance discussion, and asking whether these "feedback loops" between flows and returns of mutual funds could be triggered by unanticipated changes in the stance of monetary policy, and if these shocks can produce large, persistent dynamics close to non-stationary behavior. Our findings can be interpreted as a quantitative assessment of the effect that monetary policy shocks may have on triggering mutual fund redemptions and compressing fund performance in the U.S., which are necessary conditions for the existence of run-like dynamics in the mutual fund industry.

Finally, our paper is also related to the international finance literature on the spillovers from central banks' asset purchase programs on global portfolio flows, such as the work of Kaufmann (2020), Fratzscher, Lo Duca, and Straub (2018), Bubeck, Habib, and Manganelli (2018), Cenedese and Elard (2018), Hau and Lai (2016) and Kroencke, Schmeling, and Schrimpf (2015). However, we differ from these studies in that our paper drills down into the investment strategy level as we recognize that, for example, funds investing in high yield corporate bonds might react differently to unexpected changes in the stance of monetary policy than government bond mutual funds. This distinction is also important from a financial stability perspective since funds investing in different asset markets might not engage in maturity transformation in the same way, and therefore their reaction function to monetary policy shocks might differ. For instance, our results also suggest that for funds

[8]These studies focus mostly on the existence of a first-mover advantage.See Feroli, Kashyap, Schoenholtz, and Shin (2014), Goldstein, Jiang, and Ng (2017),Chen, Goldstein, and Jiang (2010), Feroli, Kashyap, Schoenholtz, and Shin (2014), among others.

investing in riskier and less liquid markets, such as emerging equity markets and high yield bonds, liquidity can have an impact on the effect of monetary policy shocks on fund flows and performance. Also, we differ from these studies in that our analysis is from the perspective of U.S. investors and our focus is on the effects of monetary policy shocks on both the performance and flows of U.S. domiciled mutual funds investing both in domestic and international financial markets.

The paper is organized as follows. Section 2 describes the mutual fund data, the monetary policy shocks and the macroeconomic and financial factors used in our analysis. Section 3 describes the econometric model. Section 4 presents our empirical findings. Section 5 discusses the implications of our results.

2 Data

2.1 Mutual funds

We use monthly data on net new flows and total net assets on ICI investment categories on long-term mutual funds (bond and equity funds) domiciled in the United States over the 2009–2017 period. Our decision to use aggregated data at the investment strategy level is motivated by our interest in studying the aggregate effect of unexpected monetary policy changes on mutual fund flows and performance and the potential implications for financial stability, rather than the specific feedback effects of particular funds that might cancel out at the aggregate level.

ICI flow data account for dividends and income gains to correctly identify investors' allocation decisions through new money in an investment strategy. Specifically, flows for

each investment category are calculated as follows:

$$c_{i,t} = s_{i,t} - re_{i,t} + e_{i,t} - d_{i,t}, \tag{1}$$

where $c_{i,t}$ is net new cash flows into fund category i during month t, $s_{i,t}$ is total sales, $re_{i,t}$ accounts for monthly redemptions, $e_{i,t}$ stands for net exchanges, defined as the dollar amount of net shareholder switches into or out of funds in the same complex during month t, and $d_{i,t}$ is all reinvested dividends during the current month. While many data vendors use reinvested dividends estimates and treat them as new cash, we use ICI's data that exclude them from the calculation of flows, as in these cases investors are not consciously making a decision to buy more shares of the fund.

Relevant to the analysis of flow and performance dynamics is understanding who holds mutual fund shares (retail versus institutional investors), where these funds are invested, how sticky these investments are expected to be, as well as whether funds are actively or passively managed. In this section, we describe our mutual fund data set to address some of these questions.

[INSERT TABLE 1 HERE]

As shown in panel A of Table 1 U.S. long-term mutual fund assets have grown dramatically since the 2008 financial crisis, with total net assets increasing from \$5.8 trillion at the end of 2008 to \$15.9 trillion by the end of 2017. Equity mutual funds experienced the largest increases as underlying markets recovered, jumping from \$3.6 trillion to \$10.3 trillion. Similarly, total assets of bond funds more than doubled over the same period, reaching \$4 trillion by the end of 2017. Within the bond segment, funds investing in investment-grade instruments account for the largest share of the universe at \$1.8 trillion; high-yield and world bond funds, which experienced the largest growth rates during the post-crisis period, reached

close to $0.4 trillion and $0.5 trillion, respectively, by the end of 2017.[9]

In terms of the investor base of the U.S. mutual fund industry, individuals are the largest investors, holding about 90 percent of the assets, and institutional investors account for the remaining 10 percent, according to ICI. As depicted in Panel B of Table 1, these shares moved in a very tight range over the sample period.[10] Moreover, as shown in Panel C of the same table, about 50 percent of total assets are retirement-related assets, which are sometimes referred to as "sticky assets" as they tend to be stable long-term investment allocations. Furthermore, retirement accounts generally receive periodic and stable inflows from investors payrolls and can be expected to be less reactive to changes in market conditions than nonretirement assets. Understanding the investor base is an important factor when analyzing flow dynamics and the potential risk for run-like behavior of mutual funds. For instance, focusing on corporate bond mutual funds, Goldstein, Jiang, and Ng (2017) address the differences in the reaction functions of institutional and retail investors to information about past performance, as evidenced by their fund flows. They show that institutional investors tend to react more strongly to information about past performance than retail investors. Also, work by Schmidt, Timmermann, and Wermers (2016) on money market mutual funds point in a similar direction.

Panel D presents a breakdown of the share of actively versus passively managed long-term mutual fund assets over time.[11] Overall, while assets of U.S. long-term mutual funds are still largely actively managed, the growth of passive mutual fund assets has been notable over the past years, with the share of passive assets increasing from 11 percent in 2008 to 21 percent at the end of our sample.[12] The change in the composition of mutual fund

[9]Of note, money market mutual fund assets, not shown, contracted significantly over the same period. This asset class was particularly hurt by the prolonged low interest rate environment that compressed returns in money markets.

[10]Conversely, the share of institutional investors in money market funds is significantly larger than in long-term funds, at about 40 percent.

[11]Our data set includes both actively and passively managed mutual funds, but excludes funds that invest primarily in other mutual funds.

[12]This trend is very much in line with the growth seen in other pooled investment vehicles such as ETFs and collective investment trusts (CITs).

assets (i.e. the increase of passive relative to active investments) could have implications for monetary policy transmission and financial stability. For instance, index funds have different portfolio rebalance mechanisms than active funds as they track closely a market benchmark. Therefore, the impact of a monetary policy shock on fund performance will depend largely on price movements of the underlying portfolio holdings rather than on the asset manager's allocation decisions, altering the magnitude of the shock effect on fund performance and potentially changing the flow-performance relationship.

Panel E of table 1, indicates that the level of concentration in the mutual fund industry has been trending up, with the largest five complexes accounting for about 50 percent of total assets, as of end of 2017.

In terms of flows, bond mutual funds experienced the largest net inflows over the sample period. Specifically, as shown in Figure 1, bond funds saw massive post-crisis inflows, with net new cash flows close to $1 trillion for the 2009–2014 period. Furthermore, inflows into investment-grade bond funds reached close to $384 billion over the same period, followed by world bond funds at $186 billion and multisector bond funds at $195 billion. Meanwhile, inflows into funds investing in high-yield bonds reached $109 billion over that period.

[INSERT TABLE 2 HERE]

[INSERT FIGURE 1 HERE]

Table 2 (Panel A) presents flows summary statistics for the broader mutual fund categories (total equity and bond funds) and selected equity and bond categories for the period 2009-2017. As shown in Panel A, while total bond mutual funds experienced net monthly inflows in the order of $10 billion dollars on average, equity funds saw net outflows close to $6 billion per month during the post-crisis period. In particular, positive net flows into emerging markets and world equity funds were more than offset by net outflows from domestic

equity funds.[13] Of note, volatility of monthly flows increased significantly from the pre- to post-crisis periods across investment categories.[14] This increase in volatility is particularly remarkable for bond mutual funds, where monthly volatility jumped from $7.9 billion in the 2000–2008 period to $20 billion in the post-crisis period. Meanwhile, volatility of total equity flows was little changed at about $17 billion.

With respect to performance, we estimate price returns for the i fund category as follows:

$$r_{i,t} = \frac{a_{i,t} - (c_{i,t} + d_{i,t}) - a_{i,t-1}}{a_{i,t-1}}, \tag{2}$$

where $r_{i,t}$ is monthly price returns, $a_{i,t}$ is total net assets at the end of month t, and $(c_{i,t}+d_{i,t})$ is total net flows including distributions.[15]

Table 2 (Panel B) presents performance statistics for the different investment categories during the post-crisis period. As expected, averaged monthly returns for equity funds were larger than those of their bond counterparts. These higher equity returns were associated with higher volatility. For instance, while equity fund volatility was at about 4.8%, monthly volatility of total bond funds was close to 1.2 % during the sample period. Within asset classes, high yield funds reported the highest average return volatility levels across bond fund categories. In addition, high yield funds had the largest negatively skewed returns, consistent with the potential tail risks associated with this investment category. Meanwhile, for the equity space, volatility was the highest for emerging market returns. Relative to the pre-crisis period, return volatility increased in the post-crisis for equity and bond mutual

[13] While domestic equity mutual funds experienced large outflows during the post-crisis period, net inflows into domestic equity ETFs were substantial over the period.

[14] For comparison, Table A.1 (Panel A) in the Appendix presents flows summary statistics for the pre-crisis period 2000-08.

[15] As ICI category returns are not aggregating individual fund level returns, entry and/or exit of large funds in a month could bias the fund category return for that month. In evaluating this issue and in order to understand how close are ICI return calculations from a bias-free return dataset, we used return data from Morningstar Direct (MD), which do not suffer from this bias, for a set of the broadest ICI fund categories we study, and compare them against the ICI series. Overall, correlations and summary statistics for the distribution of the return series show that ICI and MD return series track each other very closely over the period of our study. Also, note that under certain settings, some methods can be used to correct for this bias, such as in Kroencke, Schmeling, and Schrimpf (2015).

funds.[16] Within equity funds, the increase in volatility of emerging market equity funds was remarkable (from 5.6 to 8.5 percent) over the period. In bond markets, volatility rose consistently across categories, with high yield funds experiencing the largest increase (from 1.9 percent in the pre-crisis to 4.8 percent in the post-crisis period).

Of note, return correlations of equities and bond funds increased at the broader asset class level following the financial crisis and stand at about 0.6 for the 2009–2017 period.[17] At the investment strategy level, correlations of investment-grade and government funds decreased significantly from 0.85 to 0.37, while correlation of investment-grade and high yield funds rose from 0.25 to 0.66 over the same period. Meanwhile, correlations among equity categories were little changed relative to the pre-crisis period and stand at or above 0.9.

2.2 Monetary policy shocks

A critical aspect of our analysis is the measurement of monetary policy shocks. Since Bernanke and Blinder (1992) and Sims (1992), a considerable literature has employed VAR methods to identify and measure these shocks. The canonical methodology is that of Christiano, Eichenbaum, and Evans (1996), who propose to measure exogenous monetary policy surprises using orthogonalized shocks to the Federal funds rate in a structural VAR model. The system is identified by assuming that Fed behavior has no contemporaneous effect on other "real" economic variables but takes them into account for policy actions. These structural VAR methods were, however, criticized on several dimensions, such as the time-invariant parameter issue and omitted-variable bias. There is also a large literature on the effects of monetary policy on asset prices that addresses the omitted variables and endogeneity issues using high-frequency data in the context of event studies. These studies include Kuttner (2001); Bernanke and Kuttner (2005); Gurkaynak, Sack, and Swanson (2005); and

[16] Table A.1 (Panel B) in the Appendix presents the summary statistics for the pre-crisis period 2000-08.

[17] See Tables A.2 and A.3 in the Appendix for a detailed comparison of pre- and post-crisis flow and return correlations.

Lucca and Moench (2015), among others.

The literature also emphasizes that monetary policy is multidimensional. Gurkaynak, Sack, and Swanson (2005) make an important distinction between measures of surprises on the target rate (*target shocks*) and on the monetary policy path (*path shocks*). Shocks that capture the unanticipated variation in monetary policy that is reflected in the current reaction of the policy instrument (i.e., the FFR) are known as "target" shocks, while "path" shocks intend to capture shocks to the path of monetary policy and not only the policy instrument. For instance, a path shock can reflect surprises about future policy that can be inferred from forward guidance and/or other communications by Board members. In this paper, we focus in the post-crisis period of "unconventional" monetary policy, a period in which the Fed reached the ZLB and provided additional downward pressure on longer-term interest rates through balance sheet policy. Therefore, we rely on the *path shocks* introduced by Hanson and Stein (2015) and Gilchrist, López-Salido, and Zakrajšek (2015) to fully capture the impact of unconventional monetary policy on mutual fund investing.

Specifically, we build a proxy of policy shocks using intra-day data on the two-year nominal Treasury yield as proposed by Hanson and Stein (2015). They argue that, since the mid-nineties when the Fed began releasing a statement including information about the federal funds target rate and the economic and policy outlook after its FOMC meetings, news in FOMC announcements are largely about the expected path of the FFR over the following quarters, rather than about surprise changes in the current policy rate, and use the change in the two-year nominal Treasury yield (ΔTY_{2yr}) on FOMC announcement dates as proxy for monetary policy surprises. The underlying idea is to capture unanticipated changes about the expected medium-term path of interest rates, which would correspond to both target and path surprises. To avoid the well known omitted variable bias due to changes in the ΔTY_{2yr} on FOMC days not reflecting monetary policy surprises but rather other

macroeconomic news, Hanson and Stein (2015), HS hereafter, propose a high-frequency intra-day identification and proxy for monetary surprises with the change in two-year nominal Treasury yield in a narrow 60-minute window (15 minutes before and 45 minutes after) around FOMC announcements.

We use this procedure as exogenous monetary policy surprises. This measure, however, can not fully capture monetary policy actions during the post-crisis period of analysis given that following the burst of the financial crisis the Fed began aggressively cutting the fed funds target rate, reaching the ZLB by the end of 2008 and turning to unconventional policy tools to provide additional downward pressure on longer-term interest rates. These tools included a series of asset purchase programs (i.e. LSAPs) and a maturity extension program that resulted in the purchase of more than $4 trillion dollars in Treasury and mortgage-back securities. In addition, the Fed began to implement a more active communication strategy involving forward guidance about the future path of the Federal funds rate.[18]

Because many of these unconventional policy measures during the period of our analysis were intended to directly influence longer-term interest rates, we argue that changes in the two-year Treasury yield around policy announcements during the ZLB period are insufficient to fully summarize the impact of unconventional monetary policy. To address this issue, we follow Gilchrist, López-Salido, and Zakrajšek (2015) and decompose the observed change in the ten-year nominal Treasury yield over a narrow window surrounding a policy announcement into two components: first, an anticipated component that reflects the effects of changes in the two-year Treasury yield on longer-term yields within that narrow window. Second, a surprise component that is orthogonal to the changes in the two-year Treasury yield within the narrow window and is intended to capture the direct effect of unconventional

[18]Forward guidance refers to communications about the likely future course of monetary policy. The Fed began using forward guidance in its statements in the early 2000s. In particular, the structure of the FOMC statements has been modified to include: (i) an economic outlook, in January 2000; (ii) qualitative statements about future policy inclinations, in August 2003; (iii) calendar based-guidance, in August 2011; (iv) outcome-based guidance, in December 2012.

policy measures on longer-term interest rates. Summing up, we measure monetary shocks on the long-end of the yield curve as follows:

$$\Delta TY_{10yr_t} = const. + \lambda \Delta TY_{2yr_t} + \Delta MP_{long_t}$$

where ΔTY_{10yr_t} is the change in the ten-year nominal Treasury yield on FOMC announcement dates and ΔMP_{long_t} is the residual from the above model; which, together with HS, correspond to our preferred measure of monetary policy surprises during the ZLB period. This shock will be denoted as GLZ. To compute the full effect of unexpected changes to the monetary policy path on fund returns and flows during the ZLB period, we will consider both HS and GLZ.

[INSERT TABLE 3 HERE]

[INSERT FIGURE 2 HERE]

We aggregate monetary policy shocks into a monthly frequency. If the Fed made no announcements on a given month we loose that particular observation.[19] For robustness, we also evaluate the shocks imputing a value 0 to months without announcements. Overall, as discussed in section 4.4, regression results hold under this alternative way of constructing shock series.

Figure 2 depicts the estimated monetary policy shocks, and Table 3 reports the corresponding summary statistics. Both HS and GLZ shocks have negative skewness, pointing to a less accommodative than anticipated interpretation of monetary decisions by market participants. In terms of size, the largest observations are in the order of 15 bps. and 30 bsp. for HS and GLZ shocks, respectively, which occurred following the March 2009 FOMC meeting when the Fed announced additional asset purchases as part of its LSAP 1. Also, with respect to dispersion, GLZ exhibits greater variation than HS during our sample period.

[19] During our sample period there were no months with multiple announcements on a given month. As a result, our shock series fully match those of Hanson and Stein (2015) and Gilchrist, López-Salido, and Zakrajšek (2015).

Finally, note that correlation between HS and GLZ is close to zero by construction.

Following Fratzscher, Lo Duca, and Straub (2018), we also control for changes in the size of the System Open Market Account, referred as the *SOMA portfolio*, that were particularly significant during the post-crisis period as the Fed purchased large quantities of long term U.S. Treasuries and mortgage-backed securities as part of its LSAPs to support economic recovery. In particular, we use the first difference of the logarithm of *SOMA portfolio* to account for changes in the Fed's balance sheet policy, an active monetary policy tool during the ZLB period, which intended to ease financial conditions through the portfolio balance channel. Figure 3 provides an illustration of the evolution of the SOMA portfolio and highlights the change and the unprecedented magnitude of the Fed's balance sheet policy during our sample period.

[INSERT FIGURE 3 HERE]

2.3 Macroeconomic and financial factors

Our analysis also considers a set of control variables that intend to capture macroeconomic and financial conditions. These may affect investors' allocation decisions or have a direct impact on asset prices. For instance, information about the economy is likely to influence investors' expectations about future corporate earnings and therefore expected equity and corporate bond returns. More broadly, investors' risk appetite is expected to be shaped by the economic outlook. Specific to real macroeconomic conditions, we include the ADS business conditions index (Aruoba, Diebold, and Scotti (2009)) that tracks real business conditions based on high and low frequency economic indicators. The index has mean zero and therefore positive (negative) values can be interpreted as macroeconomic conditions being better (worse) than average. This variable is referred through out the paper as *Macro conditions*. In addition, we capture *Inflation* with the core personal consumption expenditures

price index which tracks price changes in good and services excluding food and energy, as the goal is to control for inflation trends. Broad financial conditions are controlled by a group of financial indicators including the *VIX*, a measure of implied equity market volatility to proxy for investor sentiment; a measure of *Credit Spread* defined as the difference between the yield from the ICE BofAML 7-to-10-year BBB-rated corporate bond index and U.S. Treasury yields of the same maturity; and a proxy for the *Term Spread* calculated as the difference between the 10 year U.S. Treasury yield and the yield on 3-month Treasury bills.

3 Econometric model

There are various channels through which policy may impact financial markets and the economy, and therefore investors' decisions, and the monetary economics literature on this topic is vast.[20] Closer to our work, and specific to the post-crisis period and the Fed's LSAPs, many studies have focused on the portfolio balance, risk-taking, and signaling channels as the monetary transmission mechanisms (i.e., Hamilton and Wu (2012a), Borio and Zhu (2012), and Bauer and Rudebusch (2014)). More recently, Fratzscher, Lo Duca, and Straub (2016, 2018) provide an extensive discussion on the transmission channels through which the Fed's quantitative easing (QE) programs affected global portfolio flows during the ZLB. In this paper, we take an agnostic view about the mechanism through which monetary policy affects mutual funds, which is consistent with the not mutually exclusive argument of Fratzscher, Lo Duca, and Straub (2018). Our prior is reflected in the set up of our econometric framework, which allows for the possibility that monetary policy shocks have a direct effect on both returns and flows of mutual funds. In this set up, two non-exclusive hypothesis are in place: First, the hypothesis that contractionary monetary policy shocks (i.e. tightening) can create downward pressure on asset prices of the portfolio, hurting fund

[20] See Boivin, Kiley, and Mishkin (2010) for a detailed review of this literature.

performance and triggering outflows. Second, the hypothesis that these shocks can change investors' expectations about the economic outlook, triggering large fund outflows that, in stress events, can have large negative price effects on the underlying portfolio holdings, therefore depressing fund performance.

Consistent with our prior and the main goal of the paper (i.e. studying the effect of monetary policy shocks on the dynamics of mutual fund flows and returns), our econometric framework can be defined as follows. Let $f_{i,t} = \frac{c_{it}}{a_{i,t-1}}$ be the ratio of net new cash flows at month t to total net assets at month $t-1$ for investment strategy i, $r_{i,t}$ the return for investment strategy i at month t, mp_t an exogenous monetary policy shock, and X_t a vector of control variables including the financial and macroeconomic indicators introduced in section 2.3. Also, and given the many-fold nature of the relation between mutual fund flows and returns, we do not impose a structural causal contemporaneous relationship between $f_{i,t}$ and $r_{i,t}$.[21] Rather we estimate a reduced form VAR model for each i investment strategy of interest, where mp_t and X_t are assumed to be exogenous variables. More specifically, we consider the following two-variables (i.e. flows and returns) VAR$(2, p)$ model:

$$f_{i,t} = \alpha_{i,f0} + \sum_{j=1}^{p}(\alpha_{i,pff} f_{i,t-j} + \alpha_{i,pfr} r_{i,t-j}) + \beta_{i,f} mp_t + \gamma'_{i,f} X_t + u_{i,t}, \tag{3}$$

$$r_{i,t} = \alpha_{i,r0} + \sum_{j=1}^{p}(\alpha_{i,prf} f_{i,t-j} + \alpha_{i,prr} r_{i,t-j}) + \beta_{i,r} mp_t + \gamma'_{i,r} X_t + v_{i,t}, \tag{4}$$

where $(v_{i,t}, u_{i,t})$ are mutual fund strategy-specific innovations. Using the BIC procedure we select two lags, i.e., $p = 2$.

[21] There is a large finance literature that investigates the relationship between mutual fund flows and performance. Earlier papers include Ippolito (1992) who finds evidence suggesting that mutual fund flows chase returns. Sirri and Tufano (1998) argue that the fund sensitivity to the performance-fund relationship is asymmetric, with investors reacting more strongly to good than bad performance. There are a number of more recent studies on the convexity of the flow-performance relationship, including Musto and Lynch (2003); Huang, Wei, and Yan (2007); Ferreira, Keswani, Miguel, and Ramos (2012); Goldstein, Jiang, and Ng (2017); and Chen and Qin (2017). There is also work supporting the opposite directional effect. For instance, Zheng (1999) finds evidence of a positive effect of flows on returns. However, the persistence in performance appears to be transitory. Lou (2012) and Coval and Stafford (2007) argue that the flow effect on performance through the stocks held in the fund portfolio is also present in the case of extreme outflows, where there is a negative effect on the price of the portfolio holding, depressing overall fund performance. Christoffersen, Musto, and Wermers (2014) present a detailed survey on the literature on the mutual fund flow-performance relationship.

This set up accommodates our agnostic approach about the direct effect of monetary policy on mutual fund investing. It allows monetary shocks to have an impact on fund performance through its effect on asset prices, while it also allows for other mechanisms that might influence investors' allocation decisions, as reflected by fund flows, to transmit monetary policy decisions (e.g. signaling channel).

Related to financial stability, we test whether there is empirical evidence that monetary policy shocks can cause large effects on mutual fund flows and returns, whether these effects are temporary or persist over time, and how this evidence varies across fund strategies that are exposed to different levels of liquidity mismatch. In other words, we evaluate if a positive monetary policy shock (i.e. tightening) can have a large negative effect on returns and flows, and whether these initial effects are amplified over time, potentially creating feedback loops between flows and returns that could trigger more redemptions and disruptions in the prices of the underlying assets, especially in the less liquid segments of the market, as fund managers might be forced to sell at a discount to meet redemptions.

We thus construct impulse response functions (IRFs) following an exogenous monetary policy shock and its effect on mutual fund flows and performance over time.

4 Results

The econometric results are presented by mutual fund investment strategy in tables 4-6. For each category the tables show the regression results for HS and GLZ monetary policy (MP) shocks on both mutual fund flows and returns. The period of analysis covers the post-crisis, starting in January 2009, through March 2017. The baseline regressions include only observations in which FOMC announcements were made.[22]

[22]For robustness, in section 4.4, we present results where all observations, with and without announcements, are considered in the regressions.

As discussed above, the HS shock is intended to capture surprises in the expected medium-term path of interest rates, while the GLZ shock, orthogonal to HS by construction, focuses on targeting the longer end of the yield curve. The dynamic effects are constructed using the implied accumulated IRFs from the previous tables, and are reported in tables 7 and 8.

To ease exposition of the results we consider MP shocks in the order of 100 basis points (bp) throughout the analysis, which are significantly large relative to the magnitudes observed since the crisis. However, given the symmetry and linearity of the framework, the size of the shocks can be easily scale to accommodate different magnitudes.

4.1 Aggregate effects

Table 4 reports the regression results for aggregate Bond and Equity mutual funds. For bond funds, positive monetary policy shocks (a tightening of the stance of MP) have a negative effect on both flows and returns. Results show that a surprised tightening of MP as measured by a 100 bp increase in the HS shock results in net outflows of 2.5 percentage points (pp) relative to assets under management, and reduces returns by 9.6 pp. Similarly, a GLZ shock, which targets longer term yields, results in outflows in the order of 3.6 pp and a decline of 4.5 pp on bond fund returns. Moreover, the cumulative IRFs, which also take into account the effect of lagged flows and returns and the set of controls introduced in the previous section, show that the initial effect of an unexpected MP tightening on bond flows expands at a decreasing rate over the subsequent year. Specifically, as shown in Table 7, the long-term effect (12-months ahead) of a positive 100 bp MP shock on bond fund flows is a decline of 9.4 pp and 9.1 pp in the flow-to-asset ratio for the HS and GLZ case, respectively. Conversely, the effect of HS and GLZ shocks on bond fund returns partially revert over the subsequent 12 months, decreasing from negative 9.6 pp and negative 4.5 pp on impact, respectively, to

negative 7.5 pp and negative 2.9 pp. Also, Figure 4 plots the cumulative dynamic multiplier effects of monetary policy shocks on total bond funds flows and returns.

For total equity mutual funds, the direct effect of MP surprises on flows and returns is less consistent than in the case of bond mutual funds. As shown in panel B of Table 4, only the effect of the HS shock on returns is economically and statistically significant, with a positive 100 bp shock pointing to a 23 pp decline in equity fund returns. This effect remains statistically different from zero 12 months later, as depicted in Table 8 and Figure 5, although its magnitude declines to negative 13.4 pp by the end of the first year.

[INSERT TABLE 4 HERE]

[INSERT FIGURE 4 HERE]

[INSERT FIGURE 5 HERE]

It is also worth noticing the large positive and significant effect of changes in the size of the *SOMA Portfolio*, our measure of balance sheet policy implementation, on equity fund returns: a 1% increment in this variable produces a contemporaneous change in equity fund returns of 0.45 pp and 0.58 pp for the HS and GLZ specification models, respectively, and a positive net inflow of 0.023 pp for the GLZ shock model. Note that for bonds the effect is much smaller than for equities, with a 1% increase in the *SOMA Portfolio* increasing returns between 0.052 and 0.073 pp, only statistically significant for the latter. These results can be interpreted in the context of the ZLB and the Fed's LSAPs which through the so-called portfolio balance channel, the Fed created a more favorable financial conditions (such as lower financing costs) by changing the quantity and mix of financial assets held by investors. As a result, as the Fed absorbed large quantities of long term Treasury and MBS securities, investors shifted their allocations to riskier assets, pushing up prices and flows of these assets (mostly equities). Moreover, results at the strategy level also support these findings as we find a positive relationship between increases in the size of the *Soma Portfolio* and performance

and flows of domestic, international developed and emerging market equity funds (shown in table 6). Also, results for high yield bond funds present similar patterns.

4.2 Bond Mutual Funds

[INSERT TABLE 5 HERE]

The mutual fund data used in section 4.1 aggregate different investment categories at the asset-class level. For example, bond mutual funds include different strategies such as government, high-yield (HY), investment-grade (IG), municipal and international bond funds. However, it is important to recognize that strategies within the same asset class have distinct investment goals, different liquidity and risk profiles, and therefore might respond differently to unexpected changes in the stance of MP. For instance, and consistent with the risk-taking channel of monetary policy, changes in the stance of policy may affect fund investors willingness to take on risk exposures, thus influencing the level of risk in their portfolios, which in the context of mutual funds and the unconventional post-crisis monetary policy period, could translate into larger inflows into higher risk fund categories, such as corporate bond funds, relative to lower risk fund categories.[23]

To this end, we next examine the effect of MP shocks on flows and returns at the investment-strategy level. Table 5 reports the regression models for the five bond mutual fund strategies mentioned above, and table 7 reports their implied IRFs. Across strategies, we find strong evidence of the negative effect of unexpected tightening of MP, as proxied by both HS and GLZ shocks, on bond fund returns. Moreover, these effects are not only present in what we expect to be more policy-sensitive fund categories such as government bond mutual funds, but the effect of a positive monetary shock on returns is economically and statistically significant in the corporate bond categories. For instance, a positive 100 bp

[23]Note that, as argued by Borio and Zhu (2012), the effect of monetary policy changes on risk-tolerance may influence not only the risk profile of portfolios but also asset prices, as well as overall funding conditions, and therefore also affecting the real economy.

HS shock results in a decline in HY and IG fund performance in the order of 10 pp. IRFs of MP shocks on bond fund performance, summarized in Panel B of table 7, show that the initial negative effects on performance revert somewhat in the subsequent months, except for municipal funds that experienced a temporary increase in the magnitude of the initial effect before reverting after the third month. Of note, although both measures of monetary surprises appear to be useful in explaining fund returns during the period of unconventional monetary policy, HS consistently depicts the largest effects on bond fund performance.

Despite there are various channels through which MP can be transmitted, our performance results can be interpreted in the context of the asset prices channel as this part of our analysis focuses on the direct effect that unexpected changes in MP have on the prices of financial assets, such as fixed income securities. In this set up, our results support the hypothesis that an unexpected tightening of the stance of MP would negatively impact bond prices of portfolio holdings, which in turn hurt fund performance.

With respect to bond flows, estimates presented in Table 5 also point to a negative relationship between monetary surprises and flows across bond fund strategies. Specifically, results for IG corporate bond funds are economically and statistically significant under both HS and GLZ shocks, pointing to net outflows close to 2.3 pp and 3 pp, respectively, due to a 100 bp unexpected tightening of the policy path. As shown in panel A of Table 7, these IG fund net outflows continue to increase over the subsequent months, with the flow-to-asset ratio declining close to 14 pp (HS) and 13 pp (GLZ) by the end of the first year. Results also provide evidence of the negative effect of U.S. monetary policy tightening shocks, as defined by HS, on international bond flows, suggesting that a higher than anticipated monetary policy path in the U.S. is associated with large net outflows from mutual funds investing in international bond markets (Table 5) that amplify somewhat over time (Table 7). Similarly, positive shocks capturing the long-end of the yield curve (a 100 bp tightening of the policy

path as defined by GLZ) translate into a 7 pp decline on impact of the flow-to-asset ratio of Government mutual funds, reaching close to 20 pp by the end of the first year. Overall, these results support the hypothesis that MP shocks can change fund investors' expectations about the economic outlook, influencing their allocation decisions as proxied by fund flows.

Of note, despite the negative relationship between bond fund flows and MP shocks across fund categories, there is some heterogeneity in these results. For instance, the effect of surprises to the expected medium term path of interest rates (i.e. HS) on fund flows is only statistically significant for riskier funds such as international and corporate bond funds (i.e. IG bond funds), while lack statistical significance for less risky government bond funds. In the context of the post-crisis period of unconventional expansionary monetary policy, and given the symmetry of our framework, these results are in line with the argument that expansionary changes in the path of policy can positively impact investors' risk-tolerance, influencing mutual fund investors' allocations, and triggering fund inflows into riskier funds such as corporate and international bond funds, consistent with the risk-taking channel of monetary policy.[24] In contrast, for MP shocks targeting the path of longer-term rates (i.e. GLZ) the effect on fund flows appear somewhat stronger for government bond funds than other bond fund categories.

4.3 Equity Mutual Funds

[INSERT TABLE 6 HERE]

For equity mutual funds, results in Table 6 provide strong evidence of the transmission of unexpected monetary policy actions on fund performance across different equity investment strategies. For domestic equity funds, a 100 bps. positive shock affecting the medium-term policy path (HS) is associated with a decline in performance in the order of 21 pp.

[24] Of note, bond flow patterns based on ICI data also point to larger net inflows into riskier bond categories relative to less risky government funds during this period.

meanwhile, funds investing primarily in international developed equity markets show an economically and statistically significant decline in performance, close to 33 pp, following a positive (tightening) HS shock. Moreover, the effect of monetary surprises appears the largest in the less liquid segments of the equity market, in particular for the universe of U.S. funds investing in emerging market equity securities, for which the effect of an unexpected upward shift of the policy path in the order of 100 bps. is associated with a decline in performance of 44 pp. Of note, as depicted in table 8 these effects partially retraced over the subsequent months, reverting to half their initial sizes by the end of the first quarter. Overall, the directional effect of these findings is broadly consistent with many studies that have looked at the impact of monetary policy surprises on equity prices (Bernanke and Kuttner (2005), Gurkaynak, Sack, and Swanson (2005), Kiley (2014)), which find that an unexpected decline (increase) in the policy rate is associated with an increase (decline) in domestic equity prices, which in the context of mutual funds translates into fund positive performance.[25]

Conversely, as shown in Table 6, results for equity flows generally lack statistical significance, with the exception of the international category for which a 100 bps. positive monetary shock to the long-end of the yield curve (GLZ), which can be interpreted as a better-than-expected economic outlook, results in net inflows in the order of 2.5 pp in the flow-to-asset ratio. This finding, together with the negative GLZ effects on bond fund flows depicted in table 5, are consistent with the argument that as expectations about the economy improve, investors will shift their portfolio allocations from safe-haven into riskier assets. Moreover, the IRFs results in table 8 indicate that the cumulative effect of the GLZ shock on these equity flows continues to increase over the subsequent months, reaching close to 4 pp. by the end of the first year following the shock.

[25]For instance, using data on fed funds futures Bernanke and Kuttner (2005) argue that monetary policy tightening is negatively correlated with equity prices, and that its effect on stocks is through its impact on expected future excess returns.

As in the aggregate level results, changes in size of the Fed's SOMA portfolio, which we include to capture the effect of LSAPs during the post-crisis period, consistently point to a positive economically and statistically significant relationship between the expansion of the Fed's balance sheet, through which the Fed injected large amount of liquidity into the financial system, and the returns and flows of mutual fund investing in domestic and international equity markets. These results are in line with recent work by Fratzscher, Lo Duca, and Straub (2016) that studies the effects of U.S. quantitative easing (QE) on international mutual fund flows. Specifically, using an international panel of fund flows, dummies to identify the day of QE announcements and data on purchases of Treasury bonds and liquidity operations by the Fed over the period 2008 to 2012, they find evidence of portfolio rebalancing into risky assets during QE: inflows into equity mutual funds, outflows from bond funds. They also argue that inflows into U.S. equity funds were the strongest in QE1, while in QE2 and QE3 the Fed's announcements and operations had the strongest effects on emerging market fund flows.

In addition, the set of control variables prove helpful in explaining flows and returns across equity mutual funds. As shown in table 6, improving macroeconomic conditions are positively related to equity mutual fund performance; while higher inflation, implied market volatility (a proxy for risk sentiment) and wider term spreads are associated with declines in equity prices, that translate into negative fund returns.

4.4 Robustness

In this section we perform a series of robustness checks to see how sensitive the baseline findings are to the macroeconomic and financial variables used, the construction of the monetary policy shock series, and liquidity conditions.

To avoid concerns related to possible data mining, our baseline specification considers a

single set of control variables across investment strategies and regressions. Going one step further, we evaluate whether the set of controls drive the results. In doing so, we compute the coefficients of the model with no covariates other than the monetary policy shocks, assumed exogenous. Panels A of tables 9 and 10 present results for bond and equity mutual fund strategies with (baseline) and without the set of control variables. Overall, as shown in columns 3-4 and 7-8 of Panels A, results hold when excluding the set of covariates used in the baseline setting. Similar results (not shown) are found for the IRFs effects. However, results depart somewhat from the baseline when looking at the effect of the GLZ shock on the returns of equity funds. As shown in column 8 of Panel A of table 10, the effect of the GLZ monetary shock becomes statitistically significant when excluding the set of covariates used in the baseline specification.

With respect to the construction of the monetary policy shock series, in the baseline analysis the HS and GLZ shocks were computed for the months with FOMC announcements and observations with no announcements were dropped, resulting in 66 out of 103 observations. In panels B of tables 9 and 10 we take an alternative approach and compute the VAR model imputing the shock variables a zero value for months in which there were no FOMC announcements. Overall, the results show estimates similar in magnitude and sign to our baseline results.

We also explore the sensitivity of our results to different levels of fund liquidity. In particular, we test whether the impact of MP shocks on fund flows and performance can depend on liquidity conditions of each mutual fund category.[26] Let liq_{it} be the liquidity ratio for mutual fund category i in month t.[27] Then we construct a simple index that compares the actual value with the in-sample values. For this we define,

[26] We thank an anonymous referee for suggesting this analysis.

[27] We use the ICI Liquidity ratio defined as the percentage of liquid assets over total net assets; where liquid assets include certificates of deposit, commercial paper, US government agency issues (one year maturity or less), repurchase agreements, cash reserves, other securities (one year maturity or less), and receivables minus liabilities.

$$liqindex_{it} = \frac{liq_{it} - liqmin_i}{liqmax_i - liqmin_i},$$

where $liqmin_i = min_t\{liqindex_{it}\}$ and $liqmax_i = max_t\{liqindex_{it}\}$. $liqindex$ is a number that is between 0 and 1, where 0 corresponds to the minimum liquidity value in the sample and 1 to the maximum, separately for each i mutual fund category. Then we can recover the minimum and the maximum value just by imputing a 0 or 1 in this index.

We then consider adding $liqindex_{it}$ and $mp_t \times liqindex_{it}$ to both eqs. (3) and (4). This simple extension allows us to evaluate whether MP shocks may have a differential effect that depends on the value of $liqindex_{it}$, our liquidity proxy. The results are presented in Tables 11 and 12 where we only report the coefficients of mp_t and $mp_t \times liqindex_{it}$. For less liquid states (i.e. $liqindex$ close to 0) we should interpret the tightening effect as the coefficient of MP shock only; while for more liquid states (i.e. $liqindex$ close to 1) we should consider the sum of the two coefficients. Note that the average effect which appears in Tables 5 and 6 corresponds to imputing the average in-sample value of $liqindex$, which varies across mutual funds categories.

Overall, as shown in Tables 11 and 12, most of the interaction coefficients are non statistically significant for our sample period, except for some of the riskiest mutual funds categories that invest in the less liquid segments of financial markets.[28] For instance, for high-yield bonds (see Table 11) there is a consistent positive and significant effect of the interaction term on both flows and performance. The average effect in Table 5 was negative, thus the positive interaction coefficient suggests that the higher the illiquidity of high yield bond funds (i.e. $liqindex$ closer to cero), the larger and more negative effect of a MP tightening shock on fund flows and performance.[29]

[28] Note the liquidity ratio is a category level proxy for fund liquidity.

[29] In other words, the higher the liquidity ratio, the less negative the impact of a monetary policy tightening shock on fund flows and returns.

Results also point to a statistically significant effect for international and emerging equity market funds under the HS shock, though the interaction is negative (see Table 12). These results suggest that a higher than expected stance of monetary policy in the U.S. in the context of ample liquidity (i.e. *liqindex* closer to one) is associated with investors' outflows from funds investing in emerging and international equity markets. These results can be interpreted in the context of the risk channel of monetary policy transmission, consistent with the argument that a surprise monetary policy tightening can negatively impact investors' risk appetite for riskier investments, and ultimately financing conditions in emerging and international markets. For example, during the Taper Tantrum episode in 2013, in a context of ample liquidity, in response to the Federal Reserve chairman's remarks that were interpreted as a signal that the Federal Reserve would begin cutting the pace of its asset purchases earlier than expected, emerging markets mutual funds experienced large outflows and negative performance.

5 Implications of the empirical results

Focusing on the post-crisis period of unconventional monetary policy, this paper investigates the effects of exogenous monetary policy surprises on the performance and flows of U.S. domiciled mutual funds investing in a large set of domestic and international financial markets. Using a unified framework and under the prior that not-mutually exclusive monetary policy transmission mechanisms can be at place, our framework allows us to take an agnostic approach on the monetary policy transmission channel by allowing monetary policy shocks to have a direct effect on both investor flows and returns of mutual funds.

Overall, our empirical results show that a positive shock to the path of monetary policy (i.e. a tightening of the stance of monetary policy) is associated with negative performance and outflows from funds investing primarily in bond and equity markets. At the investment

strategy level, we find that this evidence is particularly strong for government, investment-grade corporate, and international bond funds. That said, results also point to a negative relationship between tighter than expected monetary policy and high yield bond fund performance. In addition, we find empirical evidence of a positive price effect of balance sheet policy, proxied by changes in the size of the Fed's SOMA portfolio, on high yield bond fund performance. This positive relationship between the size of the Fed's portfolio and corporate bond fund performance is consistent with the argument of the portfolio balance channel, an active mechanism associated with the Fed's LSAPs that generated positive spillovers to prices of risky assets, such as corporate bonds and equity securities.

For equity mutual funds, results provide strong evidence of the effect of monetary policy shocks on fund performance. Specifically, results are economically and statistically significant across investment strategies, indicating that a surprise tightening of the policy path is associated with a decline in performance for the universe of equity mutual funds. Of note, the effect of monetary shocks appears the largest in the less liquid segments of the equity market, in particular the universe of U.S. funds investing in emerging equity markets. Results also indicate that expansion in central bank balance sheet boosts fund performance across the equity space, and triggers fund inflows into these risky categories.[30]

With respect to the dynamic responses of mutual fund flows and performance to monetary policy surprises, results show that the effects triggered by these shocks appear to persist over the subsequent periods, although expanding at a decreasing rate for bond flows, remaining about unchanged in the case of equity flows, and partially reverting the initial effect on performance for most equity and bond fund categories. Overall, the response functions provide little support to the argument that unanticipated changes in the stance of policy could trigger destabilizing effects on mutual fund flows and returns, on aggregate. Nonetheless,

[30]Note that changes in fund performance may be driven by both a valuation effect (i.e. changes in the price of the underlying holdings of the portfolio) as well as a portfolio allocation effect (i.e. buying and selling of portfolio holdings by asset managers). Disentangling the effect of monetary policy on these two factors is a topic for future research.

taken together, our findings show that monetary policy can have a direct effect on the U.S. mutual fund industry, and because under the current regulatory set-up mutual funds may engage in liquidity transformation while mutualizing redemption costs, there could be economic incentives for run-like behavior.[31] Therefore, the potential risks to financial stability that funds investing in less liquid segments of the market might generate under stressed conditions should be weighted in the formulation of monetary policy.

[31] Also, it is important to note that other types of shocks, such as credit shocks, could trigger different investor behavior or have a different effect on performance and flow dynamics than monetary policy surprises.

References

Aruoba, S. B., F. X. Diebold, and C. Scotti (2009): "Real-Time Measurement of Business Conditions," *Journal of Business & Economic Statistics*, 27(4), 417–427.

Bauer, M. D., and G. D. Rudebusch (2014): "The Signaling Channel for Federal Reserve Bond Purchases," *International Journal of Central Banking*, 10(3), 233–289.

Bernanke, B. S., and A. S. Blinder (1992): "The Federal Funds Rate and the Channels of Monetary Transmission," *American Economic Review*, 82(4), 901–21.

Bernanke, B. S., and K. N. Kuttner (2005): "What Explains the Stock Market's Reaction to Federal Reserve Policy?," *Journal of Finance*, 60(3), 1221–1257.

Boivin, J., M. T. Kiley, and F. S. Mishkin (2010): "Chapter 8 - How Has the Monetary Transmission Mechanism Evolved Over Time?," in *Handbook of Monetary Economics*, ed. by B. M. Friedman, and M. Woodford, vol. 3, pp. 369 – 422. Elsevier.

Borio, C., and H. Zhu (2012): "Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism?," *Journal of Financial Stability*, 8(4), 236–251.

Bowman, D., J. M. Londono, and H. Sapriza (2015): "U.S. unconventional monetary policy and transmission to emerging market economies," *Journal of International Money and Finance*, 55(C), 27–59.

Brooks, J., M. Katz, and H. Lustig (2018): "Post-FOMC Announcement Drift in U.S. Bond Markets," *NBER Working Papers*, No 25127.

Bubeck, J., M. M. Habib, and S. Manganelli (2018): "The portfolio of euro area fund

investors and ECB monetary policy announcements," *Journal of International Money and Finance*, 89(2), 103–126.

Cenedese, G., and I. Elard (2018): "Unconventional monetary policy and the portfolio choice of international mutual funds," *Bank of England WP No. 705*.

Chen, Q., I. Goldstein, and W. Jiang (2010): "Payoff complementarities and financial fragility: Evidence from mutual fund outflows," *Journal of Financial Economics*, 97(2), 239–262.

Chen, Y., and N. Qin (2017): "The Behavior of Investor Flows in Corporate Bond Mutual Funds," *Management Science*, 63(5), 1271–1656.

Christiano, L. J., M. Eichenbaum, and C. Evans (1996): "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds," *Review of Economics and Statistics*, 78(1), 16–34.

Christoffersen, S. E., D. K. Musto, and R. Wermers (2014): "Investor Flows to Asset Managers: Causes and Consequences," *Annual Review of Financial Economics*, 6(1), 289–310.

Coval, J., and E. Stafford (2007): "Asset fire sales (and purchases) in equity markets," *Journal of Financial Economics*, 86(2), 479–512.

D'Amico, S., and T. B. King (2013): "Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply," *Journal of Financial Economics*, 108(2), 425 – 448.

Daniel, K. D., L. Garlappi, and K. Xiao (2020): "Monetary Policy and Reaching for Income," *Journal of Finance*, forthcoming.

Engen, E. M., T. Laubach, and D. L. Reifschneider (2015): "The Macroeconomic Effects of the Federal Reserve's Unconventional Monetary Policies," *Federal Reserve Working Paper*, 2015-5.

Feroli, M., A. K. Kashyap, K. L. Schoenholtz, and H. S. Shin (2014): "Market Tantrums and Monetary Policy," Research Paper 14-09, Chicago Booth.

Ferreira, M. A., A. Keswani, A. F. Miguel, and S. B. Ramos (2012): "The flow-performance relationship around the world," *Journal of Banking & Finance*, 36(6), 1759–1780.

Fratzscher, M., M. Lo Duca, and R. Straub (2016): "ECB Unconventional Monetary Policy Actions: Market Impact, International Spillovers and Transmission Channels," *IMF Economic Review , 3674*, 64(1), 36–74.

——— (2018): "On the international spillovers of US quantitative easing," *Economic Journal*, 128(608), 330–377.

Gagnon, J., M. Raskin, J. Remache, and B. Sack (2011): "The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases," *International Journal of Central Banking*, 7(1), 3–43.

Gertler, M., and P. Karadi (2015): "Monetary policy surprises, credit costs, and economic activity," *American Economic Journal: Macroeconomics*, 7(1), 44–76.

Gilchrist, S., D. López-Salido, and E. Zakrajšek (2015): "Monetary Policy and Real Borrowing Costs at the Zero Lower Bound," *American Economic Journal: Macroeconomics*, 7(1), 77–109.

Goldstein, I., H. Jiang, and D. T. Ng (2017): "Investor Flows and Fragility in Corporate Bond Funds," *Journal of Financial Economics*, 126(3), 592 – 613.

Gurkaynak, R. S., B. P. Sack, and E. T. Swanson (2005): "Do actions speak louder than words? The response of asset prices to monetary policy actions and statements," *International Journal of Central Banking*.

Hamilton, J. D., and C. Wu (2012a): "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment," *Journal of Money, Credit and Banking*, 44(s1), 3–46.

Hamilton, J. D., and J. C. Wu (2012b): "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment," *Journal of Money, Credit and Banking*, 44, 3–46.

Hanson, S. G., and J. C. Stein (2015): "Monetary policy and long-term real rates," *Journal of Financial Economics*, 115, 429–448.

Hau, H., and S. Lai (2016): "Asset Allocation and Monetary Policy: Evidence from the Eurozone," *Journal of Financial Economics*, 120(2), 309–329.

Huang, J., K. D. Wei, and H. Yan (2007): "Participation Costs and the Sensitivity of Fund Flows to Past Performance," *The Journal of Finance*, 62(3), 1273–1311.

Ippolito, R. A. (1992): "Consumer reaction to measures of poor quality: Evidence from the mutual fund industry," *Journal of Law and Economics*, pp. 45–70.

Jarociski, M., and P. Karadi (2020): "Deconstructing Monetary Policy SurprisesThe Role of Information Shocks," *American Economic Journal: Macroeconomics*, 12(2), 1–43.

Jiang, H., Y. Li, Z. Sun, and A. Wang (2020): "Does Mutual Fund Illiquidity Introduce Fragility into Asset Prices? Evidence from the Corporate Bond Market," *Available at SSRN: https://ssrn.com/abstract=3501969*.

Kaufmann, C. (2020): "Investment funds, monetary policy, and the global financial cycle," *European Central Bank Working Paper 2489*.

Kiley, M. T. (2014): "The Response of Equity Prices to Movements in Long-Term Interest Rates Associated with Monetary Policy Statements: Before and After the Zero Lower Bound," *Journal of Money, Credit and Banking*, 46(5), 1057–1071.

Kroencke, T. A., M. Schmeling, and A. Schrimpf (2015): "Global Asset Allocation Shifts," *BIS Working Paper No. 497*.

Kuttner, K. N. (2001): "Monetary policy surprises and interest rates: Evidence from the Fed funds futures market," *Journal of Monetary Economics*, 47(3), 523–544.

Lian, C., Y. Ma, and C. Wang (2019): "Low Interest Rates and Risk-Taking: Evidence from Individual Investment Decisions," *Review of Financial Studies*, 32(6), 2107–2148.

Lou, D. (2012): "A flow-based explanation for return predictability," *Review of Financial Studies*, 25(12), 3457–3489.

Lucca, D. O., and E. Moench (2015): "The Pre-FOMC Announcement Drift," *Journal of Finance*, 70(1), 329–371.

Musto, D. K., and A. W. Lynch (2003): "How Investors Interpret Past Fund Returns," *Journal of Finance*, 58(5), 2033–2058.

Neely, C. (2015): "Unconventional monetary policy had large international effects," *Journal of Banking and Finance*, 52(C), 101–111.

Rogers, J. H., C. Scotti, and J. H. Wright (2014): "Evaluating asset-market effects of unconventional monetary policy: a multi-country review," *Economic Policy*, 29(80), 749–799.

Rosa, C. (2012): "How "unconventional" are large-scale asset purchases? The impact of monetary policy on asset prices," Staff Reports 560, Federal Reserve Bank of New York.

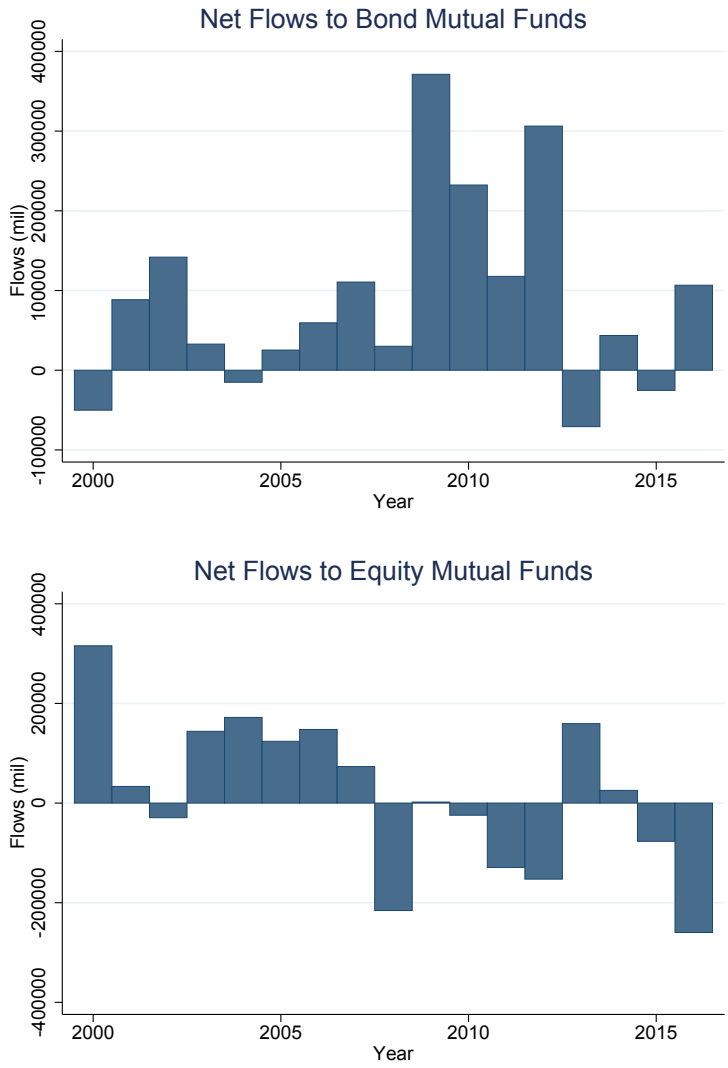
Schmidt, L., A. Timmermann, and R. Wermers (2016): "Runs on Money Market Mutual Funds," *American Economic Review*, 106(9), 2625–57.

Sims, C. A. (1992): "Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy," *European Economic Review*, 36(5), 975–1000.

Sirri, E. R., and P. Tufano (1998): "Costly search and mutual fund flows," *Journal of Finance*, pp. 1589–1622.

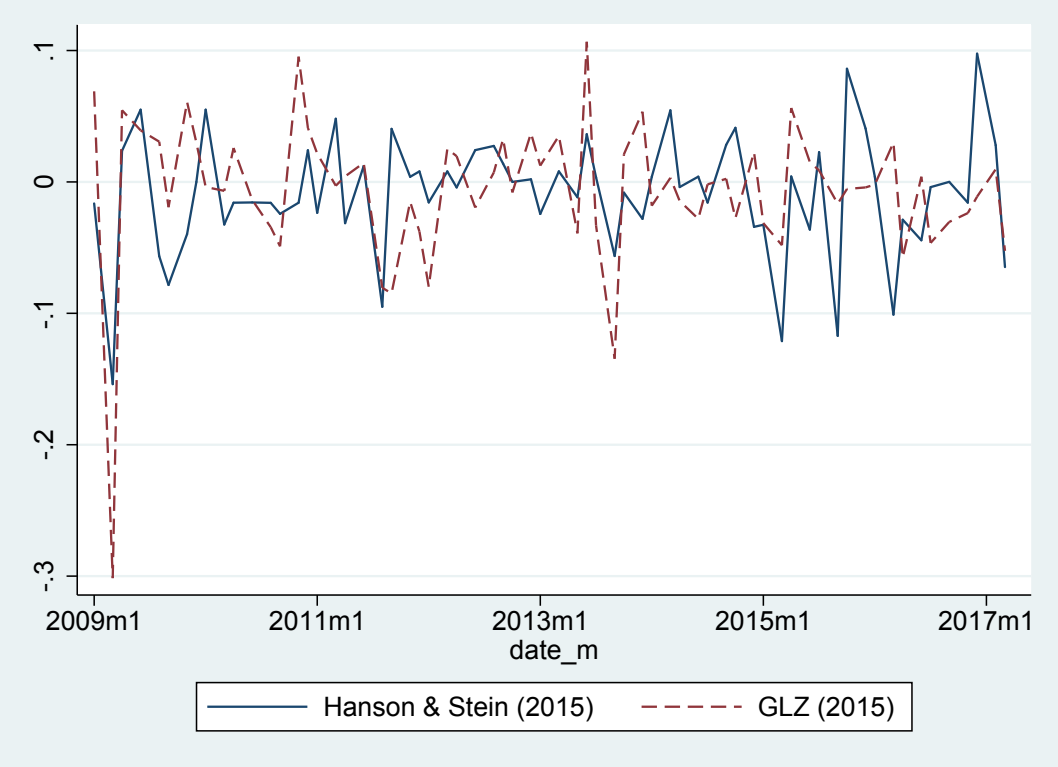
Zheng, L. (1999): "Is money smart? A study of mutual fund investors' fund selection ability," *Journal of Finance*, 54(3), 901–933.

Figure 1: Mutual Fund Flows by Asset Class



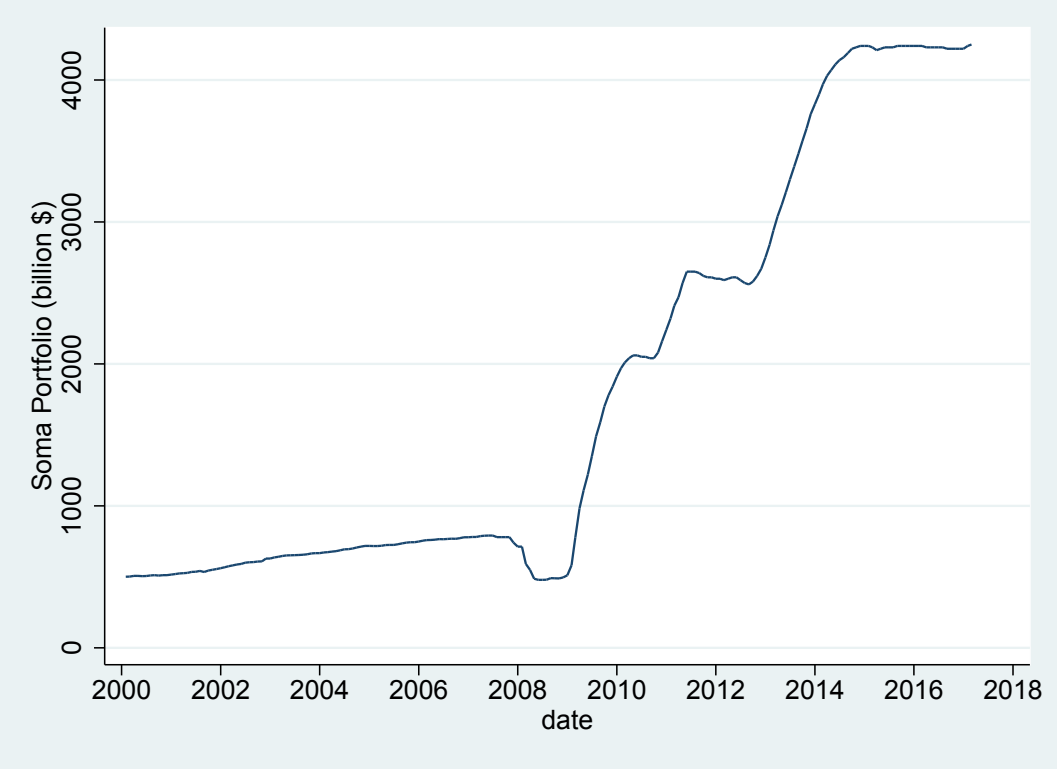
Source: Investment Company Institute (http://www.ici.org)

Figure 2: Monetary Policy Shocks



Note: HS refers to monetary policy shocks as defined by Hanson and Stein (2015) and GLZ capture monetary shocks based on Gilchrist, López-Salido, and Zakrajšek (2015).

Figure 3: Fed's SOMA Portfolio

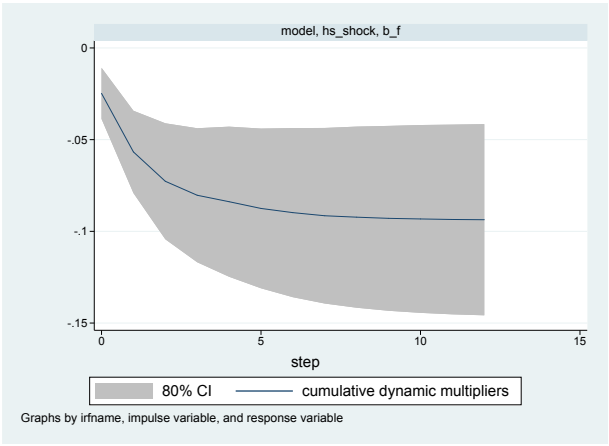


Notes: This figure displays the evolution of the Federal Reserve's SOMA portfolio over the period 2000–2017.

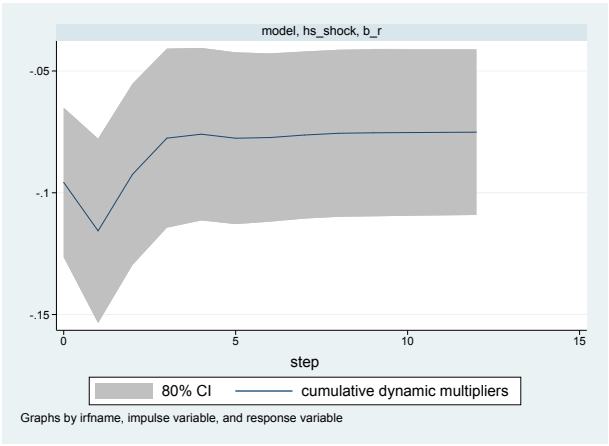
Figure 4: Monetary Policy Shocks on Bonds MF, impulse-response functions

HS shock

Flows

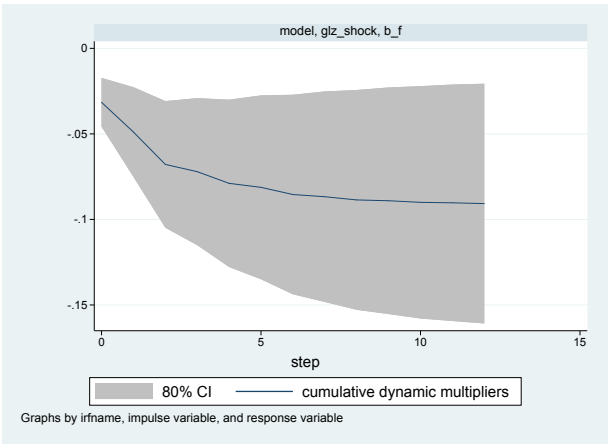


Returns

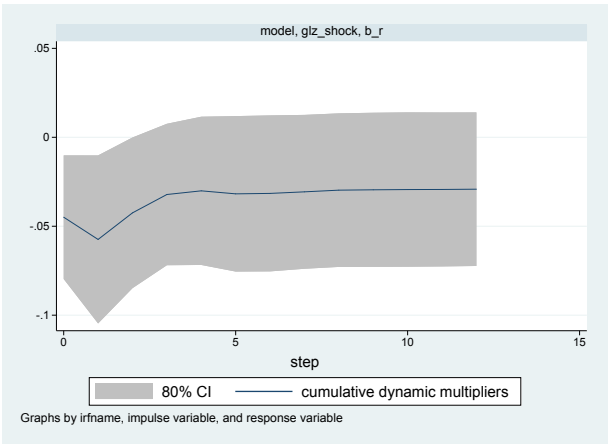


GLZ shock

Flows



Returns

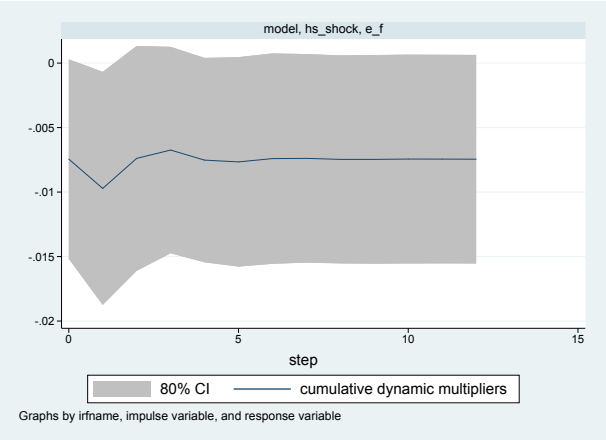


Note: HS refers to monetary policy shocks as defined by Hanson and Stein (2015) and GLZ capture monetary shocks based on Gilchrist, López-Salido, and Zakrajšek (2015).

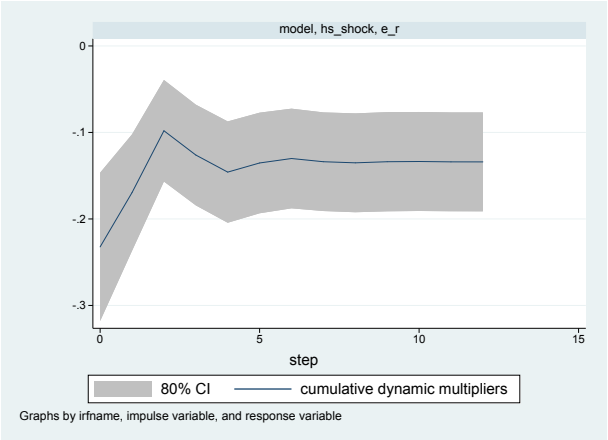
Figure 5: Monetary Policy Shocks on Equity MF, impulse-response functions

HS shock

Flows

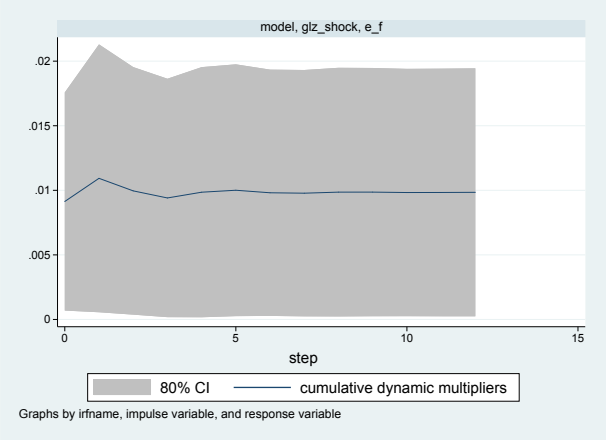


Returns

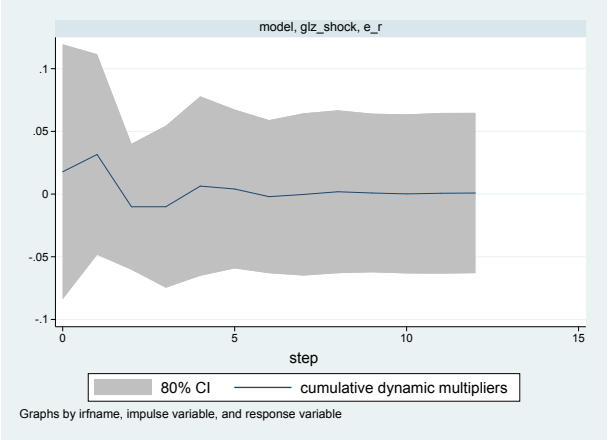


GLZ shock

Flows



Returns



Note: HS refers to monetary policy shocks as defined by Hanson and Stein (2015) and GLZ capture monetary shocks based on Gilchrist, López-Salido, and Zakrajšek (2015).

Table 1: Total Net Assets by Asset classes (Billions of dollars, year-end)

	2000	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Panel A: Investment Strategy											
Equity Funds											
Capital Appreciation	1,434	809	1,086	1,247	1,177	1,318	1,724	1,855	1,843	1,779	2,093
World	565	916	1,308	1,543	1,358	1,614	2,036	2,081	2,104	2,163	2,824
Total Return	1,936	1,929	2,478	2,807	2,678	3,007	4,003	4,378	4,202	4,635	5,389
Bond Funds											
Investment Grade	246	738	1,051	1,242	1,365	1,570	1,449	1,522	1,512	1,640	1,840
High Yield	110	118	198	244	271	342	419	378	327	373	375
World	33	106	159	246	294	369	431	467	432	420	491
Government	125	188	210	225	242	298	239	254	266	281	290
Multisector	32	84	130	160	174	231	248	273	284	321	405
State Muni	132	135	159	156	159	177	145	156	160	161	165
National Muni	146	203	299	318	339	403	354	410	434	453	500
Hybrid Funds	361	562	718	842	884	1,032	1,283	1,374	1,334	1,389	1,526
Total Long-term MFs	5,120	5,788	7,797	9,030	8,942	10,361	12,331	13,149	12,897	13,616	15,899
Panel B: Investor Type (ex. MMF)											
Individual Investors	94%	93%	92%	92%	92%	92%	92%	92%	92%	92%	90%
Institutional Investors	6%	7%	8%	8%	8%	8%	8%	8%	8%	8%	10%
Panel C: Retirement-related Assets											
Share over total assets	37%	36%	39%	42%	42%	43%	45%	46%	49%	49%	49%
Panel D: Active vs. Passive											
Active funds	92%	89%	89%	89%	88%	87%	86%	84%	83%	81%	79%
Passive funds	8%	11%	11%	11%	12%	13%	14%	16%	17%	19%	21%
Panel E: Mutual Fund Concentration											
	1995	2000	2005	2010	2015	2017					
Largest 5 complexes	34%	32%	37%	40%	45%	50%					
Largest 10 complexes	47%	44%	48%	53%	56%	60%					
Largest 25 complexes	70%	68%	70%	74%	75%	77%					

Notes: This table shows the evolution of total net assets of long-term mutual funds for the year 2000 and from 2008 to 2017, by asset class. Panel A reports assets by investment strategy. Panel B presents the share of individual and institutional assets over total assets over time. Panel C shows the share of retirement-related assets to total assets. Panel D splits fund universe between actively and passively managed funds. Panel E describes the concentration of the largest mutual fund complexes. Panels B through E are based on industry level statistics from the Investment Company Institute.

Table 2: Mutual Fund Flows and Returns Summary Statistics

	Equity	Bond	Investment Grade	High Yield	Government	Multisector	World Bond Bond	Municipal	Domestic	World Equity	EME Equity
Panel A: Flows											
Mean	-6,169	10,595	4,461	790	467	1,594	2,115	1,170	-9,390	3,221	995
Max	37,084	47,252	24,228	11,801	5,383	8,289	21,022	10,323	18,092	18,992	6,184
Min	-70,518	-59,257	-24,939	-15,602	-8,235	-4,700	-12,855	-17,644	-44,055	-26,463	-4,155
p25	-18,968	-1,576	256	-1,789	-969	587	-1,298	-631	-16,725	-2,390	-183
p50	-3,815	13,196	4,936	1,438	1,115	1,860	2,905	2,482	-10,561	4,112	1,192
p75	6,201	24,762	10,950	4,147	2,429	2,860	5,722	4,796	-1,318	8,215	2,193
Std Dev.	17,388	19,132	9,762	4,986	2,888	2,078	4,837	5,396	11,371	8,020	1,880
Skewness	-0.56	-0.84	-0.61	-0.95	-0.98	-0.54	-0.04	-1.48	-0.10	-0.70	-0.26
Kurtosis	3.90	3.88	3.41	4.35	3.85	4.74	4.74	5.09	2.93	4.27	3.52
Panel B: Returns											
Mean	0.60%	0.09%	0.13%	0.09%	0.07%	0.19%	0.11%	0.03%	0.70%	0.33%	0.34%
Max	11.18%	2.60%	2.97%	8.27%	6.71%	3.88%	4.70%	4.22%	11.50%	12.92%	19.52%
Min	-19.22%	-5.54%	-4.79%	-16.45%	-2.38%	-8.78%	-8.27%	-5.44%	-18.35%	-21.79%	-28.12%
p25	-1.92%	-0.45%	-0.41%	-0.62%	-0.41%	-0.41%	-0.66%	-0.51%	-1.68%	-1.98%	-2.62%
p50	1.13%	0.18%	0.17%	0.39%	-0.04%	0.25%	0.39%	0.15%	1.16%	0.46%	0.41%
p75	3.41%	0.78%	0.83%	1.29%	0.55%	0.93%	1.27%	0.78%	3.53%	3.68%	3.60%
Std Dev.	4.79%	1.18%	1.13%	2.81%	1.03%	1.50%	1.88%	1.34%	4.69%	5.30%	6.53%
Skewness	-0.82	-1.57	-1.28	-2.25	2.37	-1.79	-0.94	-0.71	-0.81	-0.69	-0.57
Kurtosis	5.19	9.12	7.40	15.18	18.21	14.28	6.21	6.37	4.96	5.34	6.26

Notes: This table shows summary statistics for monthly mutual fund flows (Panel A) and returns (Panel B), by asset class (equity and bond funds) and by investment strategy. These descriptive statistics are calculated using monthly data from the Investment Company Institute for the period 2009-2017.

Table 3: HS and GLZ Shocks Summary Statistics

Variable	Obs	Mean	Std Dev	Min	Max
HS shock (ΔTY_{2yr})	66	-.0087	.0460	-.1539	.0976
ΔTY_{10yr}	66	-.0075	.0744	-.4033	.1362
GLZ shock	66	-.0060	.0558	-.3015	.1067

Notes: ΔTY_{2yr} and ΔTY_{10yr} are the changes in a 60-minute window (15 minutes before and 45 minutes after) around FOMC announcements of the corresponding Treasury yields. The number of observations indicates months with FOMC announcements during the 2009-17 period. HS and GLZ shocks are the monetary policy surprises as defined by Hanson and Stein (2015) and Gilchrist, López-Salido, and Zakrajšek (2015), respectively.

Table 4: Aggregate Bond and Equity MFs

	Panel A: Bond MF				Panel B: Equity MF			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
HS shock	-0.025**	-0.096***			-0.007	-0.232***		
	(0.011)	(0.024)			(0.006)	(0.067)		
GLZ shock			-0.036***	-0.045*			0.009	0.018
			(0.011)	(0.027)			(0.007)	(0.079)
Soma Portfolio	0.007	0.052	-0.001	0.073*	0.014	0.453***	0.023**	0.579***
	(0.017)	(0.037)	(0.017)	(0.042)	(0.010)	(0.108)	(0.010)	(0.120)
Flows L1	-0.057	-0.344	0.068	0.023	0.122	0.189	0.197	2.147
	(0.171)	(0.377)	(0.166)	(0.404)	(0.201)	(2.224)	(0.194)	(2.332)
Flows L2	0.535***	0.047	0.494***	-0.192	-0.127	-3.583**	-0.124	-3.843**
	(0.152)	(0.334)	(0.146)	(0.356)	(0.163)	(1.802)	(0.162)	(1.951)
Returns L1	0.348***	0.297*	0.339***	0.262	0.006	-0.276***	0.000	-0.327***
	(0.071)	(0.157)	(0.070)	(0.171)	(0.008)	(0.093)	(0.009)	(0.108)
Returns L2	-0.024	-0.201	-0.046	-0.280*	-0.006	-0.269***	-0.010	-0.334***
	(0.069)	(0.153)	(0.068)	(0.165)	(0.008)	(0.089)	(0.008)	(0.097)
Macro conditions	0.001	0.009**	0.001	0.008*	-0.001	0.028***	-0.001	0.028***
	(0.002)	(0.004)	(0.002)	(0.004)	(0.001)	(0.009)	(0.001)	(0.010)
Inflation	0.000	-0.001*	0.000	-0.001	0.000	-0.005***	0.000	-0.005***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)
Credit Spread	0.004*	0.008*	0.003	0.004	-0.002	0.036***	-0.002*	0.027*
	(0.002)	(0.005)	(0.002)	(0.005)	(0.001)	(0.013)	(0.001)	(0.014)
Term Spread	-0.004**	-0.010**	-0.003	-0.007	0.003**	-0.033***	0.002**	-0.034**
	(0.002)	(0.004)	(0.002)	(0.005)	(0.001)	(0.012)	(0.001)	(0.013)
VIX	-0.000**	-0.001*	-0.000*	0.000	0.000	-0.007***	0.000	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)

Notes: Panel A reports estimates of baseline VAR estimates for bond mutual fund flows and returns over the 2009-2017 period based on equation 3, while Panel B presents results for equity mutual fund flows and returns. Number of observations is 66 (only those observations with FOMC announcements).

* p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 5: Bond Mutual Funds

	Government Bonds				Investment Grade				High Yield			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
HS shock	0.015	-0.0571**			-0.0233*	-0.106***			-0.002	-0.105**		
	(0.020)	(0.024)			(0.012)	(0.023)			(0.030)	(0.046)		
GLZ shock			-0.071***	-0.091***			-0.030**	-0.051*			-0.002	0.010
			(0.020)	(0.025)			(0.013)	(0.027)			(0.031)	(0.048)
Soma Portfolio	0.023	-0.041	-0.026	-0.064*	0.013	0.041	0.005	0.062	0.060	0.280***	0.059	0.352***
	(0.031)	(0.038)	(0.030)	(0.037)	(0.019)	(0.036)	(0.020)	(0.042)	(0.049)	(0.074)	(0.050)	(0.078)
Flows L1	0.598***	-0.124	0.770***	0.035	0.372**	0.231	0.374**	0.324	0.057	-0.495**	0.058	-0.407*
	(0.149)	(0.181)	(0.145)	(0.181)	(0.151)	(0.285)	(0.149)	(0.317)	(0.146)	(0.220)	(0.144)	(0.225)
Flows L2	-0.064	0.046	-0.131	0.014	0.286**	-0.211	0.298**	-0.332	0.337**	0.470*	0.336**	0.456*
	(0.129)	(0.157)	(0.120)	(0.150)	(0.134)	(0.253)	(0.132)	(0.282)	(0.168)	(0.253)	(0.168)	(0.262)
Returns L1	0.112	-0.189	0.076	-0.150	0.319***	0.107	0.344***	0.177	-0.108	0.370***	-0.107	0.337**
	(0.136)	(0.165)	(0.124)	(0.156)	(0.062)	(0.118)	(0.062)	(0.132)	(0.094)	(0.141)	(0.095)	(0.148)
Returns L2	-0.012	-0.198	-0.016	-0.186	-0.042	-0.349**	-0.029	-0.343**	-0.259***	-0.595***	-0.259***	-0.654***
	(0.106)	(0.129)	(0.098)	(0.123)	(0.080)	(0.151)	(0.079)	(0.169)	(0.087)	(0.131)	(0.085)	(0.133)
Macro conditions	0.000	0.008**	-0.002	0.006*	0.000	0.007**	-0.001	0.006	0.010**	0.017**	0.010**	0.018**
	(0.003)	(0.004)	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)	(0.007)	(0.004)	(0.007)
Inflation	-0.001	-0.001**	-0.001	-0.001**	0.000	-0.001	0.000	0.000	-0.003***	-0.003***	-0.003***	-0.003***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Credit Spread	-0.001	0.007	0.000	0.005	0.001	0.003	0.001	-0.001	0.017***	0.019**	0.017***	0.015*
	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)	(0.005)	(0.002)	(0.005)	(0.006)	(0.009)	(0.006)	(0.009)
Term Spread	-0.005	-0.013***	-0.003	-0.009**	0.000	-0.005	0.001	-0.002	-0.018***	-0.024***	-0.018***	-0.023***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.002)	(0.004)	(0.002)	(0.005)	(0.005)	(0.008)	(0.005)	(0.008)
VIX	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.002***	-0.003***	-0.002***	-0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)

Notes: This table reports estimates of baseline VAR estimates for Government, investment grade, and high yield mutual fund flows and returns over the 2009-2017 period period based on equation 3. Number of observations is 66 (only those observations with FOMC announcements). * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 4: Bond Mutual Funds (cont.)

	Municipal Bonds				International Bonds			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
HS shock	-0.012	-0.091***			-0.094**	-0.155***		
	(0.039)	(0.024)			(0.043)	(0.049)		
GLZ shock			-0.105***	-0.097***			-0.070	-0.071
			(0.040)	(0.026)			(0.048)	(0.056)
Soma Portfolio	-0.056	-0.017	-0.106*	-0.032	-0.082	0.004	-0.078	0.034
	(0.060)	(0.037)	(0.059)	(0.038)	(0.063)	(0.072)	(0.066)	(0.078)
Flows L1	-0.028	-0.071	0.026	-0.027	0.125	-0.310**	0.175	-0.256*
	(0.112)	(0.069)	(0.109)	(0.070)	(0.114)	(0.130)	(0.120)	(0.141)
Flows L2	0.136	-0.014	0.108	-0.056	0.141	-0.290**	0.118	-0.321**
	(0.101)	(0.062)	(0.096)	(0.062)	(0.117)	(0.132)	(0.119)	(0.140)
Returns L1	-0.082	-0.086	-0.032	-0.014	0.233**	-0.096	0.296***	-0.007
	(0.178)	(0.109)	(0.170)	(0.109)	(0.096)	(0.108)	(0.097)	(0.114)
Returns L2	0.631***	-0.361***	0.654***	-0.373***	0.025	-0.099	0.019	-0.120
	(0.206)	(0.127)	(0.196)	(0.126)	(0.106)	(0.120)	(0.108)	(0.127)
Macro conditions	-0.007	0.002	-0.008	0.001	0.005	0.017**	0.004	0.015**
	(0.005)	(0.003)	(0.005)	(0.003)	(0.006)	(0.007)	(0.006)	(0.007)
Inflation	0.000	-0.001	0.000	-0.001	-0.003***	-0.004***	-0.003**	-0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Credit Spread	0.005	-0.007	0.006	-0.008*	-0.001	0.025***	-0.004	0.020**
	(0.008)	(0.005)	(0.007)	(0.005)	(0.008)	(0.009)	(0.008)	(0.010)
Term Spread	-0.006	0.001	-0.004	0.004	-0.004	-0.027***	-0.001	-0.023**
	(0.007)	(0.004)	(0.007)	(0.004)	(0.007)	(0.008)	(0.008)	(0.009)
VIX	-0.001	0.001	-0.001	0.001*	-0.001	-0.003***	-0.001	-0.003***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)

Notes: This table reports estimates of baseline VAR estimates for Municipal and International bond mutual fund flows and returns over the 2009-2017 period based on equation 3. Number of observations is 66 (only those observations with FOMC announcements). * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 6: Equity Mutual Funds

	Domestic				International Developed				Emerging Markets			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
HS shock	-0.006	-0.206***			-0.008	-0.329***			-0.013	-0.438***		
	(0.005)	(0.066)			(0.010)	(0.083)			(0.014)	(0.109)		
GLZ shock			0.004	0.041			0.025**	-0.062			0.010	-0.132
			(0.006)	(0.078)			(0.011)	(0.099)			(0.015)	(0.128)
Soma Portfolio	0.012	0.425***	0.017*	0.543***	0.013	0.378***	0.030*	0.491***	0.041*	0.691***	0.051**	0.754***
	(0.009)	(0.106)	(0.009)	(0.117)	(0.016)	(0.127)	(0.016)	(0.144)	(0.022)	(0.167)	(0.024)	(0.199)
Flows L1	0.069	-0.353	0.115	1.000	0.282*	-1.430	0.280*	-0.078	0.351**	0.227	0.366***	1.204
	(0.188)	(2.281)	(0.187)	(2.401)	(0.163)	(1.301)	(0.153)	(1.396)	(0.141)	(1.076)	(0.140)	(1.169)
Flows L2	-0.117	-2.925	-0.107	-2.767	-0.003	-0.648	0.027	-0.891	-0.033	-2.635**	-0.024	-2.278*
	(0.150)	(1.821)	(0.151)	(1.946)	(0.142)	(1.136)	(0.138)	(1.259)	(0.141)	(1.073)	(0.141)	(1.178)
Returns L1	0.008	-0.270***	0.004	-0.345***	-0.002	-0.235***	-0.009	-0.194*	0.022	-0.095	0.020	-0.066
	(0.008)	(0.097)	(0.009)	(0.112)	(0.011)	(0.089)	(0.011)	(0.103)	(0.014)	(0.103)	(0.014)	(0.116)
Returns L2	-0.005	-0.258***	-0.008	-0.336***	-0.007	-0.279***	-0.015	-0.302***	0.007	-0.181	0.003	-0.254**
	(0.008)	(0.092)	(0.008)	(0.099)	(0.012)	(0.094)	(0.012)	(0.106)	(0.015)	(0.112)	(0.015)	(0.122)
Macro conditions	-0.001	0.028***	-0.001	0.029***	-0.001	0.021*	-0.001	0.018	0.000	0.039**	0.000	0.031*
	(0.001)	(0.009)	(0.001)	(0.010)	(0.001)	(0.011)	(0.001)	(0.013)	(0.002)	(0.016)	(0.002)	(0.017)
Inflation	(0.000)	-0.005***	(0.000)	-0.005***	0.000	-0.006***	0.000	-0.006***	-0.001***	-0.009***	-0.001***	-0.007**
	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)	(0.002)	(0.000)	(0.003)	(0.000)	(0.003)
Credit Spread	-0.001	0.040***	-0.001	0.033**	-0.003	0.034**	-0.003*	0.024	-0.004	0.038*	-0.005*	0.023
	(0.001)	(0.013)	(0.001)	(0.014)	(0.002)	(0.016)	(0.002)	(0.017)	(0.003)	(0.020)	(0.003)	(0.022)
Term Spread	0.002*	-0.036***	0.002*	-0.037***	0.004**	-0.035**	0.003*	-0.035**	0.001	-0.051***	0.001	-0.042**
	(0.001)	(0.012)	(0.001)	(0.013)	(0.002)	(0.015)	(0.002)	(0.017)	(0.002)	(0.018)	(0.002)	(0.021)
VIX	0.000	-0.007***	0.000	-0.007***	0.000	-0.008***	0.000	-0.006***	0.000	-0.008***	0.000	-0.006***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.002)	(0.000)	(0.002)

Notes: This table reports estimates of baseline VAR estimates for domestic, international developed and emerging market equity mutual fund flows and returns over the 2009-2017 period based on equation 3. Number of observations is 66 (only those observations with FOMC announcements). * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 7: Impulse-response functions: MP->Bond MFs

Periods ahead	t=0			t=3			t=12		
	Effect	Lower	Upper	Effect	Lower	Upper	Effect	Lower	Upper
				HS Monetary Policy shock					
Panel A: Flows									
Total Bond	-0.025*	-0.039	-0.011	-0.080*	-0.117	-0.044	-0.094*	-0.146	-0.042
Government	0.015	-0.010	0.041	0.023	-0.032	0.077	0.024	-0.035	0.082
Inv. Grade	-0.023*	-0.039	-0.008	-0.100*	-0.146	-0.053	-0.136*	-0.220	-0.053
High Yield	-0.002	-0.041	0.037	0.051	-0.010	0.113	0.049	-0.017	0.115
Municipals	-0.020	-0.042	0.001	-0.114*	-0.193	-0.035	-0.169*	-0.309	-0.028
International	-0.094*	-0.149	-0.039	-0.150*	-0.225	-0.074	-0.148*	-0.222	-0.073
Panel B: Returns									
Total Bond	-0.096*	-0.126	-0.065	-0.078*	-0.114	-0.041	-0.075*	-0.109	-0.041
Government	-0.057*	-0.088	-0.026	-0.042*	-0.064	-0.020	-0.042*	-0.064	-0.020
Inv. Grade	-0.106*	-0.136	-0.077	-0.080*	-0.114	-0.046	-0.088*	-0.126	-0.050
High Yield	-0.105*	-0.164	-0.046	-0.073*	-0.131	-0.015	-0.087*	-0.144	-0.029
Municipals	-0.086*	-0.126	-0.047	-0.109*	-0.172	-0.046	-0.102*	-0.170	-0.034
International	-0.155*	-0.217	-0.092	-0.049	-0.115	0.017	-0.055	-0.119	0.008
				GLZ Monetary Policy shock					
Panel C: Flows									
Total Bond	-0.036*	-0.046	-0.017	-0.072*	-0.115	-0.029	-0.091*	-0.161	-0.021
Government	-0.071*	-0.097	-0.045	-0.187*	-0.276	-0.098	-0.209*	-0.336	-0.082
Inv. Grade	-0.030*	-0.046	-0.014	-0.095*	-0.149	-0.041	-0.129*	-0.228	-0.030
High Yield	-0.002	-0.042	0.038	-0.008	-0.061	0.044	-0.008	-0.063	0.047
Municipals	-0.021	-0.045	0.002	-0.052	-0.134	0.030	-0.077	-0.223	0.068
International	-0.070*	-0.131	-0.009	-0.107*	-0.193	-0.021	-0.104*	-0.186	-0.022
Panel D: Returns									
Total Bond	-0.045*	-0.080	-0.010	-0.032	-0.072	0.008	-0.029	-0.072	0.014
Government	-0.091*	-0.123	-0.059	-0.074*	-0.113	-0.035	-0.076*	-0.120	-0.032
Inv. Grade	-0.050*	-0.085	-0.016	-0.044*	-0.084	-0.004	-0.043	-0.089	0.003
High Yield	0.010	-0.052	0.072	0.005	-0.030	0.040	0.007	-0.039	0.054
Municipals	-0.012	-0.058	0.035	-0.011	-0.071	0.049	-0.010	-0.075	0.056
International	-0.071*	-0.143	0.000	-0.003	-0.075	0.069	-0.010	-0.079	0.059

Notes: This table shows the initial effect, the 3-, and 12-months ahead cumulative orthogonalized impulse-response function of bond fund flows and returns by investment strategy to a positive monetary policy shock (i.e. tightening) as defined by either HS and GLZ. The table presents the point estimates (effects) and the 80% confidence intervals (Lower and Upper) columns.

Table 8: Impulse-response functions: MP->Equity MFs

Periods ahead	t=0			t=3			t=12		
	Effect	Lower	Upper	Effect	Lower	Upper	Effect	Lower	Upper
				HS Monetary Policy shock					
Panel A: Flows									
Total Equity	-0.007*	-0.015	0.000	-0.007	-0.015	0.001	-0.007	-0.016	0.001
Domestic	-0.006	-0.013	0.001	-0.005	-0.012	0.002	-0.006	-0.013	0.001
International	-0.008	-0.021	0.006	-0.008	-0.027	0.012	-0.008	-0.028	0.012
EME	-0.013	-0.031	0.006	-0.033	-0.064	-0.002	-0.031	-0.059	-0.002
Panel B: Returns									
Total Equity	-0.232*	-0.318	-0.147	-0.126*	-0.184	-0.068	-0.134*	-0.191	-0.077
Domestic	-0.206*	-0.290	-0.121	-0.117*	-0.173	-0.061	-0.122*	-0.179	-0.065
International	-0.329*	-0.436	-0.222	-0.207*	-0.286	-0.128	-0.206*	-0.284	-0.129
EME	-0.438*	-0.577	-0.298	-0.275*	-0.386	-0.165	-0.285*	-0.386	-0.184
				GLZ Monetary Policy shock					
Panel C: Flows									
Total Equity	0.009*	0.001	0.018	0.009*	0.000	0.019	0.010*	0.000	0.019
Domestic	0.004	-0.004	0.012	0.004	-0.004	0.012	0.004	-0.004	0.012
International	0.025*	0.011	0.039	0.038*	0.016	0.060	0.039*	0.015	0.062
EME	0.010	-0.010	0.029	0.011	-0.022	0.044	0.011	-0.021	0.043
Panel D: Returns									
Total Equity	0.018	-0.084	0.119	-0.010	-0.075	0.054	0.001	-0.063	0.065
Domestic	0.041	-0.059	0.141	0.018	-0.043	0.078	0.020	-0.039	0.078
International	-0.062	-0.188	0.066	-0.067	-0.164	0.030	-0.066	-0.166	0.034
EME	-0.132	-0.296	0.031	-0.108	-0.223	0.006	-0.109	-0.228	0.010

Notes: This table presents the initial effect, the 3-, and 12-months ahead cumulative orthogonalized impulse-response function of equity fund flows and returns by investment strategy to a positive monetary policy shock (i.e. tightening) as defined by either HS and GLZ. The table displays the point estimates (effects) and the 80% confidence intervals (Lower and Upper) columns.

Table 9: Robustness: Bond MFs

Panel A: Obs. with FOMC announcements

	HS shock				GLZ shock			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
Total	-0.0248**	-0.0958***	-0.0228**	-0.0994***	-0.0315***	-0.0449*	-0.0332***	-0.0690***
	(0.0109)	(0.0240)	(0.0107)	(0.0241)	(0.0111)	(0.0271)	(0.0098)	(0.0245)
Government	0.0153	-0.0571**	0.00405	-0.0579**	-0.0708***	-0.0911***	-0.0701***	-0.0908***
	(0.0198)	(0.0241)	(0.0194)	(0.0247)	(0.0202)	(0.0253)	(0.0172)	(0.0228)
Investment Grade	-0.0233*	-0.106***	-0.0240**	-0.114***	-0.0298**	-0.0505*	-0.0280**	-0.0727***
	(0.0122)	(0.0230)	(0.0114)	(0.0225)	(0.0126)	(0.0269)	(0.0110)	(0.0242)
High Yield	-0.00195	-0.105**	0.0033	-0.141***	-0.00215	0.0103	-0.0181	-0.0817
	(0.0303)	(0.0458)	(0.0331)	(0.0537)	(0.0310)	(0.0484)	(0.0321)	(0.0539)
Municipal	-0.0119	-0.0904***	-0.00489	-0.0973***	-0.105***	-0.0971***	-0.0788**	-0.0935***
	(0.0390)	(0.0239)	(0.0392)	(0.0248)	(0.0398)	(0.0256)	(0.0376)	(0.0247)
International	-0.0941**	-0.155***	-0.0806*	-0.128**	-0.0701	-0.0714	-0.067	-0.119**
	(0.0431)	(0.0488)	(0.0442)	(0.0553)	(0.0476)	(0.0560)	(0.0449)	(0.0560)
Covariates	YES	YES	NO	NO	YES	YES	NO	NO

Panel B: Obs. imputed zero with no announcements

	HS shock				GLZ shock			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
Total	-0.0193*	-0.0943***	-0.0212**	-0.0988***	-0.0301***	-0.0493**	-0.0341***	-0.0699***
	(0.0099)	(0.0221)	(0.0099)	(0.0223)	(0.0102)	(0.0247)	(0.0092)	(0.0226)
Government	0.0227	-0.0576***	0.00481	-0.0566***	-0.0527***	-0.0957***	-0.0657***	-0.0900***
	(0.0182)	(0.0207)	(0.0182)	(0.0212)	(0.0188)	(0.0208)	(0.0167)	(0.0197)
Investment Grade	-0.0224**	-0.109***	-0.0241**	-0.114***	-0.0274**	-0.0576**	-0.0283***	-0.0748***
	(0.0106)	(0.0213)	(0.0102)	(0.0209)	(0.0109)	(0.0242)	(0.0099)	(0.0220)
High Yield	0.0106	-0.0919**	0.0108	-0.133**	-0.00248	0.00886	-0.0221	-0.0792
	(0.0299)	(0.0461)	(0.0323)	(0.0526)	(0.0306)	(0.0481)	(0.0315)	(0.0524)
Municipal	0.00438	-0.0925***	0.000518	-0.0963***	-0.105**	-0.100***	-0.0814**	-0.0980***
	(0.0408)	(0.0229)	(0.0395)	(0.0236)	(0.0414)	(0.0238)	(0.0382)	(0.0232)
International	-0.0928**	-0.134***	-0.0780**	-0.119**	-0.0676	-0.0678	-0.06	-0.107**
	(0.0384)	(0.0498)	(0.0395)	(0.0529)	(0.0413)	(0.0541)	(0.0402)	(0.0536)
Covariates	YES	YES	NO	NO	YES	YES	NO	NO

Notes: This table shows monetarty policy shock estimates under alternative settings. In panel A, we estimate the model using observations for which there was an FOMC announcement. Columns 1-2 and 5-6 present baseline results. In columns 3-4 and 7-8 the VAR model excludes the set of covariates used in the baseline specification. For this cases the number of observations is 66 (only those with FOMC announcements). Panel B presents results for the VAR model imputing the shock variables a zero value for months in which there were no FOMC announcements. The number of observations in this case is 103. Standard errors in parenthesis, * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 10: Robustness: Equity MFs

Panel A: Obs. with FOMC announcements

	HS shock				GLZ shock			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
Total	-0.00744	-0.232***	-0.00585	-0.263***	0.00914	0.0178	0.00529	-0.253**
	(0.0060)	(0.0669)	(0.0061)	(0.0986)	(0.0066)	(0.0793)	(0.0063)	(0.1020)
Domestic	-0.0059	-0.206***	-0.005	-0.267***	0.00425	0.0408	0.00247	-0.234**
	(0.0054)	(0.0656)	(0.0055)	(0.0991)	(0.0061)	(0.0781)	(0.0056)	(0.1030)
International Developed	-0.00764	-0.329***	-0.0027	-0.289***	0.0252**	-0.0615	0.0184*	-0.297***
	(0.0104)	(0.0833)	(0.0102)	(0.1100)	(0.0109)	(0.0993)	(0.0103)	(0.1140)
Emerging Markets	-0.0126	-0.438***	-0.013	-0.402***	0.00965	-0.132	-0.00237	-0.394***
	(0.0143)	(0.1090)	(0.0147)	(0.1340)	(0.0152)	(0.1280)	(0.0146)	(0.1320)
Covariates	YES	YES	NO	NO	YES	YES	NO	NO

Panel B: Obs. imputed zero with no announcements

	HS shock				GLZ shock			
	Flows	Returns	Flows	Returns	Flows	Returns	Flows	Returns
Total	-0.00786	-0.228***	-0.00648	-0.254**	0.00652	-0.0239	0.00365	-0.225**
	(0.0054)	(0.0773)	(0.0056)	(0.0987)	(0.0058)	(0.0865)	(0.0057)	(0.1000)
Domestic	-0.00642	-0.193**	-0.00607	-0.247**	0.00245	0.00293	0.000602	-0.195*
	(0.0050)	(0.0765)	(0.0051)	(0.0985)	(0.0054)	(0.0846)	(0.0052)	(0.1000)
International Developed	-0.00846	-0.310***	-0.00323	-0.290***	0.0178*	-0.104	0.0153	-0.296**
	(0.0096)	(0.0950)	(0.0095)	(0.1120)	(0.0103)	(0.1070)	(0.0097)	(0.1150)
Emerging Markets	-0.0135	-0.406***	-0.0152	-0.407***	0.00868	-0.189	-0.00679	-0.408***
	(0.0144)	(0.1180)	(0.0144)	(0.1300)	(0.0152)	(0.1300)	(0.0143)	(0.1280)
Covariates	YES	YES	NO	NO	YES	YES	NO	NO

Notes: This table shows monetary policy shock estimates under alternative settings. In panel A, we estimate the model using observations for which there was an FOMC announcement. Columns 1-2 and 5-6 present baseline results. In columns 3-4 and 7-8 the VAR model excludes the set of covariates used in the baseline specification. For this cases the number of observations is 66 (only those with FOMC announcements). Panel B presents results for the VAR model imputing the shock variables a zero value for months in which there were no FOMC announcements. The number of observations in this case is 103. Standard errors in parenthesis, * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 11: Robustness: Liquidity effects (Bonds)

	Coefficient	HS shock		GLZ shock	
		Flows	Returns	Flows	Returns
Total Bonds					
	MP shock	-0.0710***	-0.174***	-0.0324*	-0.0433
		(0.0243)	(0.0545)	(0.0171)	(0.0417)
	MP × liq	0.0864**	0.150	0.00300	-0.0114
		(0.0422)	(0.0943)	(0.0366)	(0.0890)
Government					
	MP shock	-0.0487	-0.00380	-0.118**	-0.0432
		(0.0687)	(0.0834)	(0.0584)	(0.0723)
	MP × liq	0.116	-0.0876	0.0925	-0.0967
		(0.116)	(0.141)	(0.108)	(0.134)
Inv. Grade					
	MP shock	-0.0614**	-0.190***	-0.0347*	-0.0732*
		(0.0274)	(0.0517)	(0.0194)	(0.0411)
	MP × liq	0.0831	0.193*	0.0176	0.0549
		(0.0564)	(0.107)	(0.0455)	(0.0962)
High Yield					
	MP shock	-0.0686	-0.215***	-0.0994**	-0.199***
		(0.0537)	(0.0695)	(0.0488)	(0.0612)
	MP × liq	0.196*	0.360**	0.200**	0.429***
		(0.113)	(0.146)	(0.0809)	(0.102)
Municipal					
	MP shock	-0.00223	-0.105	0.0109	0.0899
		(0.0359)	(0.0695)	(0.0294)	(0.0587)
	MP × liq	-0.0488	0.0226	-0.0799	-0.279**
		(0.0667)	(0.129)	(0.0694)	(0.138)
International					
	MP shock	-0.0452	0.132	0.0754	0.0481
		(0.133)	(0.137)	(0.111)	(0.123)
	MP × liq	-0.0837	-0.473**	-0.319	-0.242
		(0.227)	(0.235)	(0.224)	(0.247)

Notes: This table shows the effect of monetary policy shocks and its interaction with the liquidity ratio. The regression model is that of eqs. (3)-(4) augmented with $liqindex$ and $MP\ shock \times liqindex$. The reported coefficients are those of $MP\ shock$ and $MP\ shock \times liqindex$ in models eq. (3) (Flows) and eq. (4) (Returns). The number of observations in this case is 66. Standard errors in parenthesis, * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table 12: Robustness: Liquidity effects (Equity)

	Coefficient	HS shock		GLZ shock	
		Flows	Returns	Flows	Returns
Total Equity					
	MP shock	-0.00110	-0.0310	-0.0233	-0.254
		(0.0148)	(0.176)	(0.0171)	(0.218)
	MP × liq	-0.0176	-0.351	0.0515*	0.527
		(0.0254)	(0.304)	(0.0285)	(0.363)
Domestic					
	MP shock	-0.00930	-0.0137	-0.0329**	-0.234
		(0.0132)	(0.178)	(0.0151)	(0.217)
	MP × liq	0.000883	-0.333	0.0540**	0.472
		(0.0221)	(0.297)	(0.0229)	(0.329)
International					
	MP shock	0.0323*	-0.00401	0.0347*	0.114
		(0.0180)	(0.138)	(0.0204)	(0.172)
	MP × liq	-0.0980***	-0.635**	-0.0319	-0.287
		(0.0344)	(0.265)	(0.0482)	(0.405)
EME					
	MP shock	0.0951**	-0.147	-0.0326	0.207
		(0.0478)	(0.386)	(0.0399)	(0.339)
	MP × liq	-0.213**	-0.548	0.0762	-0.624
		(0.0879)	(0.709)	(0.0697)	(0.591)

Notes: This table shows the effect of monetary policy shocks and its interaction with the liquidity ratio. The regression model is that of eqs. (3)-(4) augmented with $liqindex$ and $MP\ shock \times liqindex$. The reported coefficients are those of $MP\ shock$ and $MP\ shock \times liqindex$ in models eq. (3) (Flows) and eq. (4) (Returns). The number of observations in this case is 66. Standard errors in parenthesis, * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01.

Table A.1 Mutual Fund Flows and Returns - Summary Statistics 2000-2008

	Equity	Bond	Investment Grade	High Yield	Government	Multisector Bond	World Bond	Municipal	Domestic Equity	World Equity	EME Equity
Panel A: Flows											
Mean	1,395	7,630	4,000	330	166	982	1,350	802	-2,755	4,150	806
Max	56,710	47,252	24,228	11,801	14,953	8,289	21,022	10,323	34,004	23,929	6,184
Min	-70,518	-59,257	-24,939	-15,602	-8,235	-4,700	-12,855	-17,644	-48,791	-26,463	-4,155
p25	-9,353	-855	897	-1,615	-1,397	123	-189	-648	-13,387	-494	-182
p50	3,620	7,786	3,473	506	66	638	715	1,213	-2,266	4,367	592
p75	13,065	16,484	7,426	2,641	1,935	1,870	3,268	3,137	6,939	8,479	1,808
Std Dev.	18,637	14,897	7,242	3,774	2,931	1,635	3,556	4,035	14,187	7,540	1,614
Skewness	-0.48	-0.47	-0.56	-0.79	0.27	0.29	0.53	-1.55	-0.08	-0.26	0.18
Kurtosis	4.00	4.87	5.44	6.18	5.96	6.03	8.22	7.51	3.27	4.15	4.00
Panel B: Returns											
Mean	0.17%	0.09%	0.21%	-0.18%	0.07%	0.13%	0.30%	0.04%	0.13%	0.36%	1.01%
Max	8.66%	2.06%	2.32%	5.06%	1.46%	4.36%	5.44%	2.16%	8.89%	9.41%	11.42%
Min	-10.19%	-2.31%	-2.42%	-5.90%	-2.35%	-10.04%	-3.40%	-5.07%	-10.81%	-10.69%	-13.75%
p25	-2.28%	-0.45%	-0.48%	-1.18%	-0.41%	-0.48%	-0.63%	-0.66%	-2.26%	-3.12%	-3.07%
p50	0.58%	0.20%	0.33%	0.25%	0.19%	0.28%	0.25%	0.27%	0.83%	0.97%	2.11%
p75	3.02%	0.63%	0.90%	0.88%	0.57%	0.94%	1.19%	0.72%	2.79%	3.44%	5.05%
Std Dev.	4.17%	0.83%	0.91%	1.88%	0.77%	1.51%	1.51%	1.10%	4.18%	4.28%	5.63%
Skewness	-0.50	-0.35	-0.28	-0.31	-0.66	-2.77	0.50	-1.19	-0.48	-0.44	-0.39
Kurtosis	2.94	2.91	2.92	4.17	3.46	21.45	4.16	6.50	3.02	2.68	2.46

Notes: This table shows summary statistics for monthly mutual fund flows (Panel A) and returns (Panel B), by asset class (equity and bond funds) and by investment strategy. These descriptive statistics are calculated using monthly data from the Investment Company Institute for the period 2000-2008.

A.2 Mutual Fund Flow Correlations

	Equity	Bond	IG	HY	Government	Multisector	World Bond	Municipal	Domestic Eq.	World Eq.	EME Eq.
Panel A: Pre-crisis											
Equity	1										
Bond	-0.48	1									
IG	-0.41	0.91	1								
HY	0.19	0.33	0.11	1							
Government	-0.63	0.74	0.60	-0.02	1						
Multisector	-0.15	0.50	0.50	0.22	0.11	1					
World Bond	-0.26	0.44	0.50	-0.05	0.02	0.40	1				
Municipal	-0.36	0.85	0.71	0.23	0.55	0.37	0.42	1			
Domestic Eq.	0.92	-0.52	-0.50	0.23	-0.55	-0.34	-0.43	-0.40	1		
World Eq.	0.61	-0.14	0.00	0.01	-0.46	0.31	0.22	-0.08	0.24	1	
EME Eq.	0.39	0.09	0.19	0.08	-0.24	0.45	0.28	0.10	0.08	0.80	1
Panel B: Post-crisis											
Equity	1										
Bond	0.14	1									
IG	-0.02	0.88	1								
HY	0.35	0.32	0.04	1							
Government	-0.39	0.44	0.40	-0.27	1						
Multisector	0.18	0.66	0.51	0.21	0.07	1					
World Bond	0.44	0.50	0.23	0.39	-0.18	0.46	1				
Municipal	-0.03	0.72	0.66	-0.16	0.68	0.38	0.00	1			
Domestic Eq.	0.93	0.22	0.05	0.42	-0.30	0.14	0.39	0.04	1		
World Eq.	0.85	0.01	-0.11	0.15	-0.42	0.20	0.40	-0.12	0.60	1	
EME Eq.	0.61	0.38	0.17	0.39	-0.18	0.33	0.69	0.03	0.52	0.59	1

Notes: This table presents correlations for equity, hybrid, and bond mutual fund flows. Panel A covers the pre-crisis period, and Panel B the post-crisis period. Correlations are calculated using data from the Investment Company Institute.

A.3 Mutual Fund Return Correlations

	Equity	Bond	IG	HY	Government	Multisector	World Bond	Municipal	Domestic Eq.	World Eq.	EME Eq.
Panel A: Pre-crisis											
Equity	1										
Bond	0.14	1									
IG	-0.02	1									
HY	0.66	1									
Government	-0.27	0.78	0.84	-0.06	1						
Multisector	0.26	0.58	0.40	0.39	0.39	1					
World Bond	0.34	0.71	0.64	0.46	0.43	0.54	1				
Municipal	-0.08	0.83	0.71	0.15	0.68	0.38	0.41	1			
Domestic Eq.	1.00	0.13	-0.03	0.65	-0.27	0.25	0.31	-0.08	1		
World Eq.	0.94	0.19	0.04	0.65	-0.23	0.29	0.47	-0.06	0.92	1	
EME Eq.	0.82	0.25	0.09	0.66	-0.17	0.39	0.51	-0.04	0.79	0.90	1
Panel B: Post-crisis											
Equity	1										
Bond	0.61	1									
IG	0.48	0.95	1								
HY	0.79	0.79	0.63	1							
Government	0.10	0.60	0.67	0.14	1						
Multisector	0.69	0.83	0.72	0.86	0.36	1					
World Bond	0.80	0.88	0.81	0.79	0.45	0.85	1				
Municipal	0.21	0.75	0.67	0.47	0.44	0.46	0.46	1			
Domestic Eq.	0.99	0.57	0.44	0.77	0.07	0.66	0.76	0.18	1		
World Eq.	0.97	0.69	0.56	0.80	0.17	0.74	0.88	0.27	0.93	1	
EME Eq.	0.90	0.72	0.61	0.79	0.22	0.75	0.89	0.33	0.85	0.96	1

Notes: This table presents correlations for equity, hybrid, and bond mutual fund returns. Panel A covers the pre-crisis period, and Panel B the post-crisis period. Correlations are calculated using data from the Investment Company Institute.