Mutual Fund Flows, Monetary Policy and Financial Stability*

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Abstract

We study the links between monetary policy and mutual fund flows, and the potential risks to financial stability that might arise from such flows, using data over the 2000–14 period. We find that monetary policy can have a direct influence on the allocation decisions of mutual fund investors. In particular, we show that monetary policy shocks explain mutual fund flow dynamics and that the effect of these shocks differs by investment strategy. Results suggest that positive shocks to the path of monetary policy (unexpected tightening) are associated with persistent outflows from bond mutual funds. Conversely, a tighter-than-expected monetary policy path will cause net inflows into equity funds. In an industry that "mutualizes" redemption costs and where many funds may engage in liquidity transformation, our flow-performance analysis provides evidence of the potential existence of a first-mover advantage in less liquid segments of the market.

Keywords: Mutual fund flows, monetary policy, first-mover advantage
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*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.

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1 Introduction

In response to the recent crisis that emerged during the summer of 2007, the Federal Reserve has been actively implementing policies to support economic growth by lowering yields across the curve and making financial conditions more accommodative. For instance, immediately after the burst of the crisis, the Fed launched a series of credit and liquidity facilities and began aggressively cutting the fed funds target rate, reaching the zero lower bound 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 (quantitative easing), a maturity extension program, and a more active communication strategy involving forward guidance about the future path of the federal funds rate (FFR).[1] In particular, the Fed's asset purchase programs were intended to work largely through the portfolio balance channel by reducing longer-term rates and term premiums, therefore creating more favorable financial conditions such as lower financing costs for firms and households.

As bond yields declined and the stock market recovered in the United States, the bond market surged by 41 percent and equity markets rose by 112 percent during the period from October 2008 to the end of 2014. In this context, the U.S. mutual fund industry saw massive inflows in the years following the onset of the financial crisis, with net new cash flows into long-term mutual funds reaching \$1.1 trillion by the end of 2014 and total assets under management increasing to \$13 trillion, an additional \$7.4 trillion relative to the level observed at the end of 2008.[2]

This dramatic growth in assets under management, together with the recent selloff

[1]Several studies review the programs implemented by the Fed during the past years. See Engen, Laubach, and Reifschneider (2015) for more details.

[2]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. Including money market mutual funds, total net assets reached \$15.8 trillion by the end of 2014.

episodes that took place in 2013 and 2014, brought mutual funds to the center of the debate on the potential disruptions to financial markets that might arise from the mutual fund industry once the Fed normalizes the stance of monetary policy. In particular, there is concern among policymakers and some market participants about how mutual fund investors and asset managers will respond to monetary policy normalization and, ultimately, the effect of their behavior on household wealth and financial stability.

Specific to fund investors, the debate has focused on the risks to run-like dynamics and, therefore, whether mutual fund flows could be an important source of financial instability if an event, potentially the rise in interest rates, were to trigger large redemptions from mutual funds that could result in disruptions in the underlying asset markets.[3] In particular, the recent "taper tantrum" in 2013 and the emerging markets selloff in 2014 centered the debate primarily on bond mutual funds and the potential implications for financial stability of massive redemptions affecting less liquid segments of the bond market.

By offering investors the possibility of daily redemption of their shares, mutual funds investing in illiquid assets engage in liquidity transformation and may face liquidity risk in the event investors massively redeem shares of their funds. In this scenario, as fund managers need to liquidate less liquid positions to meet redemptions, they might generate downward price pressure on the underlying assets, which in turn decreases the value of the fund's shares. In other words, in the case that massive redemptions create disruptions in the underlying assets of the fund, the cost will be borne by those who remained invested in the fund. In an extreme scenario, this "mutualization" of redemption costs could potentially lead to fire sales, as investors will have economic incentives to redeem ahead of the anticipated outflows, also referred to as "first-mover advantage."[4]

[3] See the *Monetary Policy Report* submitted to the Congress by the Federal Reserve in February 2015 (www.federalreserve.gov/monetarypolicy/files/20150224_mprfullreport.pdf).

[4] This concept has been largely study in the literature on bank runs.

From the fund manager side, key questions relate to how asset managers are positioning their portfolios for interest rate hikes, more stringent liquidity conditions, and more volatile rate environments, as well as whether they have liquidity strategies in place that will allow them to manage large and sudden redemptions without creating or amplifying disruptions in financial markets.[5]

In this paper, we focus on fund investors and build on the mutual fund literature on the flow-performance relationship and on the macro-finance literature on monetary policy and asset prices to shed some light on the effect of monetary policy on investors' allocation decisions, as evidenced by mutual fund flows, and the risks to financial stability that fund investors might create. More specifically, using a unified framework that allows us to study the effect of monetary policy on fund flows and the flow impact on fund performance, we ask whether monetary policy shocks in the United States can help explain aggregate fund flows across different asset classes and investment styles, and whether these flows can generate negative price effects that could trigger run-like dynamics in the mutual fund industry. Intuitively, because monetary policy is ultimately expected to affect economic growth, changes in investors' expectations about the stance of monetary policy can be expected to have a direct effect on investors' portfolio allocations and, therefore, related fund flows. 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 on investment vehicles such as mutual funds remains a largely unexplored area of research.[6] We also evaluate the

[5]Reportedly, fixed-income managers have been improving their liquidity management practices in recent years. For example, funds may try to manage liquidity through internal portfolio construction by holding a larger share of their portfolios on highly liquid assets, managing liquidity at the firm level, or expanding their credit lines, among other tools. Furthermore, the Securities and Exchange Commission recently proposed a new rule on liquidity management affecting open-end mutual funds that includes the development of liquidity risk-management programs, the need for liquidity buffers, classification of portfolio holdings based on the level of liquidity of the position, and the possibility of implementing swing pricing.

[6]There is a large literature on the effects of monetary policy on asset prices using high-frequency data in the context of event studies to avoid the widely known omitted variables and endogeneity issues. These studies include Kuttner (2001); Bernanke and Kuttner (2005); Gurkaynak, Sack, and Swanson (2005); and

relation between macroeconomic and financial conditions and the investment behavior of mutual fund investors. To this end, we analyze whether mutual fund flows react to information on macroeconomic fundamentals and financial conditions as summarized by market volatility, consumer sentiment, liquidity, the term spread, financial market returns, inflation, economic activity measures, and changes in the size of the Fed's balance sheet.

The second part of this paper evaluates the price effect of fund flows on performance and its implication for run-like behavior. Our analysis is related to recent studies that find mixed results about the existence of a first-mover advantage. For instance, using a recursive vector autoregression (VAR), Feroli, Kashyap, Schoenholtz, and Shin (2014) find evidence of what they define as a "feedback loop" between flows and returns in some fund categories such as emerging market bonds, mortgage-backed securities (MBS), and investment-grade bonds; they argue that financial stability risks can arise from unlevered fund managers. In contrast, Plantier and Collins (2014) find little evidence of a feedback effect from fund flows to fund returns (bond prices) when altering the order of the endogenous variables in a recursive VAR model. More recently, and focusing on corporate bond funds, Goldstein, Jiang, and Ng (2015) show that fund flows are more sensitive to poor performance than good performance and that this relationship is stronger when market liquidity is limited. They argue that an illiquid corporate bond market may generate a first-mover advantage in mutual funds investing in this segment of the market. Chen, Goldstein, and Jiang (2010) introduce a global-game model that formalizes the mechanisms through which large and sudden redemptions from illiquid funds can effectively transform into costs faced by those investors who remained invested in the fund. This mechanism implies strategic complementarities in

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Lucca and Moench (2015). More recently, many papers have focused on the effects of the Feds quantitative programs on asset prices, including Gagnon, Raskin, Remache, and Sack (2011); Hamilton and Wu (2012); Rosa (2012); DAmico, English, Salido, and Nelson (2012); DAmico and King (2013); and Rogers, Scotti, and Wright (2014), among others.

the redemption decisionmaking that can lead to run-like behavior.[7] They provide evidence of this effect by analyzing equity funds for the 1995-2005 period. In this setting, our findings can be interpreted as a quantitative assessment of the risk that monetary policy may have on triggering this type of mechanism.

A critical aspect of our analysis is the measurement of monetary policy shocks. In a period characterized by unconventional monetary policy actions, there is no consensus about the optimal approach to measuring monetary policy shocks. We thus take an agnostic approach and evaluate a set of alternative measures, including target and path shock factors. First, we follow Christiano, Eichenbaum, and Evans (1996) (CEE hereafter), who propose to measure exogenous monetary shocks using orthogonalized shocks to the FFR in a structural VAR model. Second, we build a proxy of policy shocks using federal funds futures data to construct a measure of "surprise" target rate changes as proposed by Bernanke and Kuttner (2005) (BK hereafter). Although these two measures have been widely used in the empirical macro-finance literature, they fail to fully capture shocks to monetary policy that arise from tools other than the policy rate. This limitation is an important issue in our analysis because a large part of our sample covers the zero lower bound, a period during which the Fed has been actively implementing monetary policy through unconventional policy tools. To address this issue, we build a third proxy for monetary shocks using monthly data from the Blue Chip Financial Forecasts (BCFF) and the Blue Chip Economic Indicators (BCEI) surveys as introduced by Buraschi, Carnelli, and Whelan (2014) (BCW hereafter). More specifically, we identify the shocks through a Taylor rule using survey data on expectations about future GDP growth, inflation, and the FFR. Intuitively, by using this approach, we intend to capture shocks to the path of monetary policy. For example, this monetary shock measure

[7] Using a similar global-game modeling approach, Feroli, Kashyap, Schoenholtz, and Shin (2014) propose an alternative destabilization channel for mutual funds. In their framework, the strategic asset managers are averse to being ranked last, and, in certain economic environments, this motive may lead to large asset sales.

reflects the surprises about future policy that can be inferred from forward guidance or other communications by Board members. Interestingly, and as in BCW, we find a negative correlation between target and path shocks. BK and CEE shocks tend to be pro-cyclical, and BCW path shocks are countercyclical. BCW argue that these patterns are consistent with a yield curve with a pro-cyclical short-end and a countercyclical long-end, with the former driven by target shocks and the latter related to path shocks, which BCW find to be correlated to risk premiums. We argue that BCW shocks are better suited to capture unexpected shocks to monetary policy in a dynamic and changing environment in which the Fed has intervened with different tools.

Using a structural VAR identification strategy and ICI data on mutual fund flows and total net assets aggregated by investment strategy, we find that monetary policy shocks, past fund returns, and a set of macroeconomic and financial aggregates can help explain mutual fund flow dynamics and that drivers of flows differ by investment strategy. Interestingly, we find a clear asymmetry in the effect of these shocks on mutual funds flows. That is, a positive target shock corresponds to a negative path shock in terms of its effect on mutual funds flows, and this finding is robust across different mutual fund strategies. Given our analysis of target versus path monetary shocks, we conclude that the BCW method provides a more suitable picture of the effect of monetary policy on mutual fund flows and, therefore, we build our economic interpretation on path shocks.

More specifically, for the bond market, results show that a tightening of monetary policy (that is, a positive target shock) will translate into a 0.4 to 0.5 standard deviation increase in the flow-to-assets ratio, and a positive path shock will produce outflows on the order of 0.8 standard deviation. Within the bond fund universe, results are mainly driven by the taxable bond segment of the market, including government, high-yield, investment-grade, multisector, and world bond funds. For equity, the effect of monetary path shocks on flow of funds investing in equity markets is negative for target shocks (0.2 to 0.4 standard deviation) and positive for path shocks (0.5 standard deviation). Thus, these findings are consistent with the argument that as the economy improves, investors will shift their portfolio allocations from safe-haven to riskier assets. Furthermore, although flow of funds investing in the government, municipal, investment-grade, and multisector bond markets exhibit a countercyclical relationship with macro conditions, high-yield bond flows show a cyclical pattern, similar to equity flows. Interestingly , we document strong co-movements between high-yield and equity fund flows throughout the analysis.

In turn, our flow-performance analysis shows that outflows can have an effect on the performance of funds investing in bonds and in less liquid segments of the equity market. As a result, under the current regulatory framework in which redemption costs are mutualized and mutual funds engage in liquidity transformation, our findings suggest that there are economic incentives that may generate a first-mover advantage. However, we argue that adequate liquidity-management practices and policy guidelines can help mitigate these incentives.

In summary, the main contributions of this paper to the mutual fund literature are twofold. First, we document that monetary policy has a direct influence on the behavior of mutual fund investors. Specifically, our results show that positive monetary policy shocks (tightening) can trigger outflows in funds investing in fixed-income securities and inflows into international equity funds. Second, we evaluate the price effect of fund flows on performance and its implication for run-like behavior. We show that mutual fund investors may have economic incentives that can generate a first-mover advantage in funds investing in less liquid asset classes.

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

2 Data and monetary policy shocks estimation

2.1 Mutual funds

We use monthly data on net new flows and total net assets on the 51 ICI investment categories on long-term mutual funds (namely bond, equity, and hybrid funds) domiciled in the United States over the 2000–14 period.[8] Our flow data account for dividends and income gains to correctly identify new money in an investment strategy. Specifically, ICI calculates flows for each investment category as follows:

$$f_t = s_t - re_t + e_t - d_t, \tag{1}$$

where f_t is net new cash flows during month t, s_t is total sales, re_t accounts for monthly redemptions, e_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_t is all reinvested dividends during the current month.[9]

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

As shown in table 1, after declining by about 35 percent in 2008, U.S. long-term mutual fund assets have grown dramatically, with total net assets increasing from $5.7 trillion to

[8] Our decision to use aggregated data at the investment strategy level is motivated by our interest in studying the effect of mutual fund flows on financial markets and the potential implications for financial stability, rather than the specific feedback effects of particular funds that might cancel out at the aggregate level.

[9] Although many asset managers treat reinvested dividends as new cash, ICI excludes them from estimated flows, as in these cases investors are not consciously making a decision to buy more shares of the fund.

$13.1 trillion by the end of 2014. Equity mutual funds experienced the largest increases as underlying markets recovered, jumping from $3.6 trillion to $8.3 trillion. Similarly, total assets of bond funds more than doubled over the same period, reaching $3.4 trillion by the end of 2014. Within the bond segment, funds investing in investment-grade instruments account for the largest share of the universe at $1.5 trillion; high-yield and world bond funds, which experienced the largest growth rates during the 2008–14 period, reached close to $0.4 trillion and $0.5 trillion, respectively, by the end of 2014. Conversely, money market mutual fund assets, not shown, contracted around 30 percent over the same period. This asset class was particularly hurt by the prolonged low interest rate environment that compressed returns in money markets.

In terms of long-term mutual fund ownership, individuals are the largest investors, holding about 92 percent of the assets, and institutional investors account for the remaining 8 percent. Note that these shares moved in a very tight range over the sample period.[10] Within asset classes, although institutional investors share of total assets was steady throughout the sample period at around 10 percent for bond funds, their share of total assets in equity funds increased from 5 percent to 8 percent over the same period. In turn, as shown in panel C of table 1, about 46 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 are expected to receive periodic and stable inflows from investors payrolls and tend to be less reactive to changes in market conditions than nonretirement assets. This fact is important when analyzing flow dynamics and the potential risk for run-like behavior in the mutual fund industry.

As shown in panel D of table 1, ICI data indicate that the level of concentration in the mutual fund industry has remained stable over time, with the largest five complexes

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

accounting for about 40 percent of total assets.

[INSERT TABLE 1 HERE]

In terms of flows, bond mutual funds experienced the largest net inflows over the sample period. In particular, as shown in figures 1 and 3, bond funds saw massive post-crisis inflows, with net new cash flows close to $1 trillion for the 2009 –14 period. Furthermore, as presented in figure 2,inflows into investment-grade bond funds reached close to $384 billion over the post-crisis 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 the same period. Table 2 presents summary statistics for the broader mutual fund categories (equity, bond, and hybrid funds) and selected equity and bond categories. As shown in panels B and C of table 2, volatility of flows increased significantly from the pre- to post-crisis periods across investment categories. This increase in volatility is particularly remarkable for bond mutual funds, where monthly volatility jumped from $7.9 billion in the earlier part of the sample to $20 billion in the post-crisis period. As presented in table 2,these jumps in flow volatility were significant across bond investment categories. Similarly, volatility in hybrid flows rose from $2.7 billion to $4.6 billion over the same period. Meanwhile, volatility of total equity flows was little changed at about $17 billion.

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 3 HERE]

[INSERT FIGURE 2 HERE]

[INSERT TABLE 2 HERE]

As described in table 3, flow correlations changed significantly over the sample period for some asset classes. For instance, the negative correlation between total equity and bond flows reverted from close to negative 0.5 in the pre-crisis period to 0.1 in the post-crisis years. Interestingly, this change in correlations of new mutual fund cash flows is similar to the changes in correlations observed in the returns of the underlying equity and bond markets. Correlation between flows into equity and hybrid funds rose from 0.1 to 0.7, and that of equity and high-yield flows doubled to around 0.4. In particular, correlation of high-yield and domestic equities increased from 0.2 to 0.5 over the two sample periods.

[INSERT TABLE 3 HERE]

We also use data on total net assets to estimate price returns as follows:

$$r_t = \frac{a_t - fi_t - a_{t-1}}{a_{t-1}}, \tag{2}$$

where r_t is monthly price returns, a_t is total net assets at the end of month t, and fi_t is total net flows including distributions. Table 4 presents performance statistics for the different investment categories. In contrast with the patterns observed in mutual fund flows, return volatility declined in the post-crisis period relative to the pre-crisis period for equity and hybrid mutual funds but remained little changed for total bonds. Within equity funds, the decline in monthly volatility of emerging market equity funds was remarkable (from 8.2 to 4.3 percent) over the period. In bond markets, although the overall volatility was stable, world bond and multisector funds experienced large increases in return volatility, jumping from 30 and 2.5 percent to 8.3 and 10.0 percent, respectively. Figure 4 plots monthly returns for our main mutual fund aggregates.

[INSERT FIGURE 4 HERE]

[INSERT TABLE 4 HERE]

Although return correlations increased somewhat at the broader asset class level, there are some interesting patterns within the different categories. For instance, as shown in panels A and B of table 5, over the pre- and post-crisis periods, correlations of investment-grade returns to the different bond categories decreased significantly, but investment-grade correlations to equity categories increased somewhat. Meanwhile, correlations within bond strategies such as high-yield, government, multisector, world, and municipal bonds also declined over the same period. Conversely, correlations of equity categories did not change much. [INSERT TABLE 5 HERE]

2.2 Macroeconomic and financial factors

Investors are expected to factor in changes in macroeconomic and financial conditions when deciding on their investment allocations. For instance, information about the economy is likely to influence their expectations about future corporate earnings and therefore expected equity returns. More broadly, investors' risk appetite is expected to be shaped by the economic outlook. To account for these elements, we build macroeconomic factors using principal component analysis to summarize the information of a large set of economic indicators. We include series for industrial production, retail sales, housing indicators, IS manufacturing survey indicators (new orders, inventories, and export orders), and consumer surveys (current conditions, consumer sentiment, and expected labor conditions). Time series for these macro factors are shown in figure 5. We also consider a series for inflation, as measured by the consumer price index, and a set of financial variables. These variables include equity market volatility (VIX), the term spread, changes in the size of the Federal Reserve's balance sheet, global bond index returns, and returns for the S&P 500 index.

[INSERT FIGURE 5 HERE]

2.3 Monetary policy shocks

Financial and nonfinancial markets are unlikely to respond to policy actions that were already anticipated. That is, if the Fed's actions are systematically related to economic variables (such as inflation or the output gap) that are observed by the Fed and economic agents, then the anticipatory responses occur before the actual change happens (such as a tightening of monetary policy or increment of the interest rate). In those cases, it is difficult to identify the causal effect of monetary policy on financial markets. Distinguishing thus between expected and unexpected policy actions has been a key fundamental challenge in the literature and, as a result, the definition of a shock and how it is constructed varies. We follow a skeptical approach and construct different measures of monetary shocks. As argued later, these measures differ not only on the identifying assumptions, but also on what type of shock they are intended to capture.

First, we consider the orthogonalized shocks from a VAR model with identifying restrictions. Since Bernanke and Blinder (1992) and Sims (1992), a considerable literature has employed VAR methods to identify and measure these shocks. The canonical methodology that we follow is that of CEE, who propose to measure exogenous monetary shocks using orthogonalized shocks to the FFR in a structural VAR model. The system is identified by assuming that Fed behavior has no contemporary effect on other "real" economic variables but takes them into account for policy actions.

Second, we construct shocks as in BK, who follow Kuttner (2001) in using FFR futures data to construct a measure of "surprise" rate changes. They use the event-study analysis of comparing the one-month future contract with the actual target rate set by the Fed. The economic rationale is that future interest rates reflect expectations about monetary policies, and, thus, deviations of the actual rate from the predicted one by the futures market represent a shock. Their approach overcomes some of the problems encountered by CEE's VAR, such as the time-invariant parameter issue and omitted-variable bias.

These two surprise measures of monetary policy are based only on the actual/observed policy rate and might not fully capture monetary policy shocks for two reasons. First, agents might be able to anticipate changes in the policy rate but might be surprised about the path of monetary policy. Second, recent changes in monetary policy, such as reaching the zero lower bound and the use of unconventional monetary policy, might make FFR-based measures superfluous.

The literature emphasizes that monetary policy is multidimensional. GSS and BCW, among others, make an important distinction between measures of surprises on the target rate (*target shocks*) and surprises on the path of monetary policy (*path shocks*). BK and CEE shocks fall within the category of target shocks, as they capture the unanticipated variation in monetary policy that is reflected in the current reaction of the policy instrument; path shocks intend to capture shocks to the path of monetary policy. More specifically, BCW define a path shock as reflecting the surprises about future policy that can be inferred from forward guidance and/or other communications by Board members. Intuitively, BCW path shocks allow assessing agents' expectations about the evolution of monetary policy. BCW use survey data to learn directly about agents' expectations/forecasts about different measures of economic activity and financial aggregates without imposing assumptions about the underlying data-generating process. These shocks are based on expectations about the path of the FFR controlling for forecasts about the evolution of inflation and the output gap.

Next, we discuss in more detail the monetary policy shocks considered in our analysis.

Christiano, Epelbaum and Evans (1996, 2000)

CEE propose to measure exogenous monetary shocks using orthogonalized shocks to the FFR in a structural VAR model. Consider a data vector Z_t given by $Z_t = [EMP_t, CPI_t, PCOM_t, FFR_t]$, where EMP_t is the logarithm of nonfarm payroll employment, CPI_t is the logarithm of the consumer price index, $PCOM_t$ is the growth rate in the S&P GSCI commodity price index, and FFR_t is the FFR. Moreover, consider the following VAR model:

$$BZ_t = A(L)Z_{t-1} + \Sigma\eta_t. \tag{3}$$

The system is identified by orthogonalizing the shocks η_t using the order in Z_t. This implies that the FFR has no contemporaneous effect on the other economic variables and that the "real" variables inflation and employment precede the Fed decisions:

$$\nu_t^{cee} = \iota_4\Sigma^{-1}[BZ_t - A(L)Z_{t-1}], \tag{4}$$

with $\iota_4 = [0, 0, 0, 1]$.

Following CEE, we compute the model using six lags with data from January 1995 to December 2014.

Bernanke and Kuttner (2005)

In an event-study setting, BK compare the one-month futures contract with the actual target rate set by the Fed. This methodology can be adapted to construct a monthly series using BK (equation 5):

$$\nu_t^{BK} = \frac{1}{D}\sum_{d=1}^{D} i_{d,t} - f_{t-1,D}^{1},$$

where $i_{d,t}$ is the FFR target on day d of month t (with D days) and $f_{t-1,D}^{1}$ is the rate of the one-month futures contract on the last (Dth) day of month $t-1$.

Note that these monthly shock variables may lack some of the properties of a daily-based surprise one. BK argue that monthly averages tend to attenuate the size of monetary surprises and that endogeneity issues might still be present.

Buraschi, Carnelli and Whelan (2014)

BCW consider residuals obtained from the reaction function of a Taylor rule model of Clarida, Gali, and Gertler (2000).

Let r_t^* denote the target FFR in period t, r^* the desired nominal rate when both inflation and output are at their target level, $\pi_{t,k}$ the percent change in the price level (inflation) between periods t and $t+k$ (in annual rates), π^* a target for inflation, and $x_{t,q}$ the average output gap between periods t and $t+q$, with the output gap being defined as the percent deviation between actual and target GDP ($x_{t,q} \equiv (Y_t/Y_t^* - 1)$). Let Σ_t denote the σ-algebra containing all the information available at period t and $E(.|\Sigma_t)$ the conditional expectation operator. Then, the proposed reaction function is as follows:

$$r_t^* = r^* + \beta(E(\pi_{t,k}|\Omega_t) - \pi^*) + \gamma E(x_{t,q}|\Omega_t). \tag{5}$$

The observed rate, r_t, may, however differ from r_t^*, and the former can be decomposed into two orthogonal components:

$$r_t = r_t^* + u_t, \tag{6}$$

where $r_t^* \perp u_t$. u_t represents the exogenous monetary shocks, a nonsystematic component of monetary policy. The orthogonality assumption between u_t and the arguments of the Taylor rule imply that it can be estimated as a time-series regression.

The Fed policy rule may be unknown but can be estimated from informed agents. Consider the h-period-ahead conditional expectation,

$$E(r_{t+h}|\Omega_t) = r^* + \beta(E(\pi_{t+h,k}|\Omega_t) - \pi^*) + \gamma E(x_{t+h,q}|\Omega_t) + E(u_{t+h}|\Omega_t). \tag{7}$$

BCW infer that the assumption that agents believe in a Taylor rule implies that the monetary shocks can be recovered from financial forecasts. These forecast data allow the measurement of market participants' expected path for monetary policy.

Furthermore, following BCW, if the monetary rule is implemented with frictions, a lagged structure is better suited to capture both the monetary rule and the monetary shocks. That is, consider now

$$r_t = \rho(L)r_{t-1} + \rho(1)r_t^* + u_t, \tag{8}$$

where $\rho(L) = \rho_1 + \rho_2 L + ... + \rho_m L^{m-1}$ and L is the lag operator.

Thus, the estimated model is

$$\begin{aligned} E(r_{t+h}|\Omega_t) &= \rho_1 + \rho_2 E(r_{t+h-1}|\Omega_t) + ... + \rho_m E(r_{t+h-m+1}|\Omega_t) + \\ & r^* + \beta(E(\pi_{t+h,k}|\Omega_t) - \pi^*) + \gamma E(x_{t+h,q}|\Omega_t) + E(u_{t+h}|\Omega_t). \end{aligned} \tag{9}$$

Finally, define $\{\nu_t^{bcw} = E(u_{t+h}|\Omega_t)\}$ as the constructed series of exogenous monetary policy shocks. These shocks are then defined as orthogonal to the arguments of the feedback rule, and therefore the shocks can be estimated as the residuals from the Taylor regression that account for the systematic component of monetary policy.

The estimation is implemented using monthly survey data from January 1995 to December 2014 from the BCEI and the BCFF. More specifically, we consider consensus series for the FFR, real GDP, and the consumer price Index. For FFR, we use the one-year-ahead forecast `rate_ff4` (thus $h = 12$) and a lag structure with `rate_ff3` and `rate_ff2` (that is, $h - 3 = 9$ and $h - 6 = 6$, respectively). For inflation and the output gap, we use the one-year-ahead forecast (`pi_ff4` and `x4_e`). The output gap is constructed as in BCW, p.7.

Estimated FFR-based shocks

Figure 7 reports the estimated shocks for different methods (the shocks are standardized by their corresponding in-sample standard deviations) for the 2000–14 period. The figure clearly shows that ν^{cee} and ν^{bk} are highly correlated (in-sample 2000–14 correlation of 0.67). Both series show that the 2005–07 period was marked by consistent positive shocks; starting in 2008, considerable negative shocks appeared. By 2011, however, shocks decreased to almost zero. For the 2000–14 period, ν^{bcw} is negatively correlated with the former two—$corr(\nu^{bcw}, \nu^{cee}) = -0.12$ and $corr(\nu^{bcw}, \nu^{bk}) = -0.42$. Note that contrary to the other two measures, the BCW measure shows positive shock values from the burst of the financial crisis through 2010, after which it turns negative.[11]

[INSERT FIGURE 7 HERE]

One particular feature that stands out from the figure is that the shocks are highly autocorrelated for ν^{bk} and ν^{bcw}, with an autoregressive parameter greater than 0.65. By construction, the autocorrelation is absent in ν^{cee}, but a visual inspection reveals that there are periods of negative shocks and periods of positive shocks. This demonstrates that shocks can be anticipated by using their own lags and, therefore, the exogeneity or "surprise" feature is put into question. In order to analyze this further, we use the Hodrick-Prescott filter to decompose the series into trend and cycle, with a smoothing parameter of 1000, such that $\nu_t^{\cdot} = \nu_t^{\cdot}(trend) + \nu_t^{\cdot}(cycle)$. Figures 8 and 9 plot the trend and cycle component of the series. The former figure clearly shows the marked differences between the path factor (BCW) and the target factors (BK, CEE) over the entire 2000–14 period. These differences stand out as very significant for the latest financial crisis post-2008 period, as they provide an opposite interpretation of the monetary shocks.

[11] Although not reported we also consider proxies for target and path shocks as defined by GSS. These shocks are positively correlated with BCW.

[INSERT FIGURE 8 HERE]

[INSERT FIGURE 9 HERE]

As in BCW, we find a negative correlation between the *target* and *path* shocks; more specifically, BK and CEE shocks tend to be pro-cyclical, and BCW path shocks are countercyclical. [12] Both CEE and BK shocks are constructed as deviations from the observed FFR, and BCW shocks are constructed as deviations from the forecasted FFR as reflected in survey data. We argue that they measure different features of monetary policy. For instance, if a positive CEE-BK shock shows an unexpected tightening of monetary policy, a BCW shock represents agents' consensus about the path or evolution of that rate into the future, conditional on the current tightening. The negative correlation between CEE-BK and BCW thus reflects the fact that agents expect that the FFR will be reduced in the future if the Fed currently increases it. This argument is consistent with the fact that markets anticipate that current monetary policy, as given by *target* shocks, will be successful in achieving its objectives, and the future path will have the opposite effect, as given by *path* shocks.

As argued by the macro literature, there is no single optimal indicator of monetary policy surprises. For instance, the FFR lost its flexibility and effectiveness as it reached the zero lower bound at the end of 2008. Both BK and CEE measures reflect this fact by displaying minimal fluctuation around zero since then. In addition, the effect of the Fed's forward guidance used to communicate likely future monetary policy and the large-scale asset purchase (LSAP) programs that created unprecedented amounts of liquidity in the financial system (see figure 6 for a quick inspection of the magnitude of this change) are not captured by BK or CEE. In other words, both the nature and magnitude of the Fed's intervention reveal that these target factors might not be suitable for properly capturing monetary shocks

[12] BCW argue that these patterns are consistent with a yield curve with a pro-cyclical short end and a countercyclical long end, where the former is driven by target shocks, and the latter is related to path shocks, which BCW find to be correlated to risk premia.

during this period of unconventional monetary policy, i.e., unexpected changes in monetary policy driven by alternative tools other than the FFR. For this reason, BCW is our preferred measure of monetary policy shock.

3 Structural VAR estimates

We estimate the effect of monetary policy shocks on mutual fund flows under a structural VAR framework. Consider a data vector Z_t given by $Z_t = [SHOCK_t, f_t, r_t]$, where $SHOCK_t$ is the different measures of monetary shocks introduced in section 2, f_t is the mutual fund flows-to-asset ratio, and r_t represents the proxy for mutual fund price returns. We consider a different vector of Z_t for each type of investment strategy. These endogenous variables are included with four lags.[13]

The system is identified by orthogonalizing the shocks imposing a pre-specified contemporaneous effects structure. First, we assume that the measure for monetary policy shocks is not contemporaneously affected by mutual fund flows and returns but may influence them. Second, we assume that flows are not contemporaneously affected by returns. Note, however, that the lag structure allows for past returns to affect flows and vice versa. Finally, we assume that returns may be contemporaneously influenced by both monetary policy shocks and flows. The rationale for the assumed contemporaneous relationship between flows and returns is based on the finance literature on the flow-performance relation that suggests that flows affect and predict performance. In particular, a large literature investigates the effect of fund flows on performance driven by momentum. The underlying idea is that flows into winner funds may prompt portfolio managers to trade on the same assets, leading to higher asset prices of these funds and therefore resulting in higher performance. This effect is likely

[13]The lag structure differs depending on the model implemented. For instance, AIC criteria suggested between three and four lags, and SIC criteria suggested one to three lags.

to be larger in the case of extreme flows into less liquid and smaller segments of the financial markets, such as the high-yield bond market, where price pressures could be significant.[14] Earlier work by 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 is also present in the case of extreme outflows where there is a negative effect on the price of the stock in the fund, depressing overall fund performance.[15]

For robustness, we check whether results are sensitive to an alternative ordering of the endogenous variables that assumes that flows are contemporaneously affected by returns, but not the reverse. Overall, our main findings on the effect of monetary policy shocks on fund flows are validated under this alternative identifying assumption.[16]

The VAR model considers exogenous covariates in order to control for potential factors that affect Z_t. These covariates are included with a contemporary value and with one lag. First, we include inflation as a measure of nominal distortions in the economy. Second, two macroeconomic factors constructed form the principal component analysis previously outlined (denoted as $F1$ and $F2$). Third, we include the first difference in the logarithm of the Fed balance sheet assets as a measure of liquidity (denoted as $Dlfed$). In particular, this variable intends to control for the large amounts of liquidity injected by the Fed through the recent large-scale asset purchases (or LSAP) programs. Finally, we include measures

[14] Also note that although flows could take place any time within the month, monthly returns are calculated using end-of-the-month total net assets. Therefore, it is reasonable to assume that, for a given month, flows taking place in the days prior to month-end but aggregated to the monthly level may have an effect on end-of-the-month returns.

[15] Another strand of the literature focuses on the relation of flows to past performance. For example, earlier papers include Ippolito (1992) who finds 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); and Goldstein, Jiang, and Ng (2015). Christoffersen, Musto, and Wermers (2014) present a detailed survey on the literature on the flow-performance relation.

[16] These results are available from the authors upon request.

for market volatility (change in the logarithm of the VIX index, denoted *Dlvix*), domestic equity market returns (S&P500) and global bond returns (Barclays' global bond index).

4 Results

4.1 Shocks to aggregate equity and bond mutual funds

Consider the effect of FFR-based monetary policy shocks on mutual fund aggregates. Figure 10 reports the cumulative orthogonalized impulse response function (COIRF) to a positive 1 standard deviation unexpected change to the monetary shock measure (that is, monetary policy tightening) on equity and bond mutual fund flows for the entire period of analysis, spanning from January 2000 to December 2014.

First, note that at the aggregate level, unexpected changes arising from monetary policy decisions appear to have a significant effect on long-term mutual fund flows. This finding is in line with Feroli, Kashyap, Schoenholtz, and Shin (2014) who find that "changes in the stance of monetary policy can trigger heavy fund inflows and outflows." Second, BCW produce *path* shocks on flows that are of the opposite sign of CEE and BK *target* shocks. The negative correlation between CEE-BK and BCW is reflected in these exact opposite effects on mutual fund aggregates. Third, there are marked differences on the effect of monetary policy shocks on flows across asset classes, with equity fund flows showing opposite directional effects than those experienced by bond fund flows.

For equities, an unexpected tightening in the policy rate, as measured by CEE and BK target shocks, will cause investors to pull out from equity funds, as shown by the COIRF in figure 10. An unanticipated 1 standard deviation increase in BK will trigger persistent outflows on the order of 0.4 standard deviation over outstanding total net assets in equity mutual funds. The dynamics from CEE shocks point in a similar direction, with an unanticipated 1 standard deviation increase in CEE triggering outflows on the order of 0.3 standard deviation over total net assets in equity funds. However, estimates for these target shocks are generally not statistically significant. Conversely, an unexpected tightening of the expectations about future monetary policy as given by BCW's path factor, which can be interpreted as a better-than-expected economic outlook, will cause cumulative inflows into equity funds of about 0.5 standard deviation, and they will persist over the subsequent months.[17]

For bond mutual funds, an unexpected tightening in the policy rate, as measured by the target shocks, CEE and BK, will cause investors to add to bond funds, as shown by the middle-left and middle panels in figure 10. As before, BCW shocks have the opposite effect on flows than monetary policy measures capturing unexpected changes to the target rate. In particular, an unanticipated 1 standard deviation increase in BCW will trigger cumulative outflows on the order of 0.8 standard deviation over total assets. This effect on bond flows is statistically significant and persistent.

In addition to the analysis on the effect of monetary policy on fund flows, we evaluate the effect of a set of exogenous financial and macroeconomic variables that can be expected to influence investors' allocation decisions. First, we consider changes in our measure of liquidity introduced by the Fed through unconventional monetary policy implementation. Second, building on the literature that links demand for market liquidity and uncertainty, we evaluate the effect of equity volatility shocks as proxied by the S&P 500 volatility index (VIX) on mutual fund flows.[18] Finally, we also compute the estimated effect of unexpected changes in macro conditions, as captured by the first factor of the principal component analysis (F1) introduced in section 2. The results are summarized in figure 11. The bottom

[17] Hau and Lai (2016) show that declines in the local real short-term interest rates in eight countries from the Eurozone are associated with inflows into equity mutual funds and outflows into money market funds.

[18] Recent work by Huang (2015) argues that volatility can signal future equity fund flows and that periods of higher expected market volatility can be associated with higher demand for liquidity, as managers are more concerned with potential redemptions.

panels show the response functions of bond fund flows to unexpected changes in liquidity, market volatility, and macroeconomic conditions. We find that shocks to $Dlfed$ and $Dlvix$ produce large negative flows on bond mutual funds. Conversely, liquidity, volatility, and macroeconomic shocks are initially followed by equity fund outflows that fully revert over the subsequent two months.

4.2 Mutual fund flows by investment strategy

The flow series used in the previous analysis aggregate flows from different investment categories at the asset-class level. For example, bond mutual funds include flows from different strategies such as high-yield, investment-grade, and international bond funds. However, it is important to recognize that strategies within the same asset class but with different risk profiles and distinct investment goals might respond differently to unexpected changes in the variables of interest. To this end, we next examine the effect of monetary, economic, and financial shocks on flows at the investment-strategy level. As shown in figure 12, we find that the negative relationship between bond flows at the aggregate level and shocks to the path of monetary policy, as summarized by BCW, is also present at the investment-strategy level for most taxable bond categories. In turn, a positive shock to the size of the Federal Reserve's balance sheet is associated with persistent outflows from most bond fund categories, with high yield being the only exception. As shown in figure 12, an unexpected increase in liquidity will cause persistent large inflows into high-yield bond funds. In the context of monetary policy easing, where the central bank is putting downward pressure on market rates, these positive relationships could be associated with investors reaching for yield and therefore shifting allocations to riskier assets. This result is similar to those observed across equity strategies (figure 13). Interestingly, as depicted by column 3 in figure 12, shocks to equity market volatility appear to have a large and persistent negative effect on high-yield bonds. Conversely, the effect of equity market volatility on government bond fund flows is slightly positive, although it lacks statistical significance.

For most of the fixed-income categories, positive shocks to macroeconomic conditions are associated with initial inflows on the order of up to 0.5 standard deviation. However, these initial positive effects revert over the following months, turning negative by the end of the first half of the year. An exception to this pattern is high-yield funds, which experience an initial outflow at the time of the shock but partially recover immediately after the shock. Flows from equity strategies follow a similar pattern as high-yield flows (figure 13); however, they manage to more than offset the initial outflows over the six months following the shock.

4.3 Flow-performance relationship

Over recent years, fixed-income investors have been pointing to a deterioration of market liquidity conditions, particularly in the growing corporate bond market. Among the factors explaining this new environment, asset managers frequently argue that new regulations on liquidity and capital requirements have altered the willingness and capacity of dealers' market making. In this context, policymakers have been expressing concerns over potential risks to financial stability that might arise in the event of a sudden run by mutual fund investors. The underlying argument is that large redemptions in illiquid segments of the market can add pressure to the performance of funds, as asset managers might be forced to sell less liquid assets at a discount to meet redemptions. In the current regulatory setup, this decline in the value of the fund portfolio will be borne by those who remain invested in the fund. As a result, this "mutualization" of redemption costs could generate a first-mover advantage, as investors have the economic incentive to redeem ahead of large outflows in order to avoid large declines in the value of their fund shares. Policymakers are concerned about the amplifying effects of large and sudden outflows on the underlying asset markets and the potential risks to financial stability of such flows. In this context, a central question we explore in this section is whether there is empirical evidence of a first-mover advantage in mutual fund investing and how this evidence varies across fund strategies that are exposed to different levels of liquidity mismatch. To address these questions, we build on the large and growing literature on the flow-performance relationship and evaluate whether unexpected fund flows have an effect on the value of the fund portfolio, as evidenced by performance.[19] Recent studies show mixed results about the existence of a first-mover advantage. For instance, using a recursive VAR that orders first flows and then returns, Feroli, Kashyap, Schoenholtz, and Shin (2014) find evidence of a first-mover advantage in some fund categories, such as those investing in emerging market bonds, MBS, and investment-grade bonds for the 1998–2013 period. However, they find no evidence for U.S. Treasuries and domestic equities. Building on Feroli, Kashyap, Schoenholtz, and Shin (2014), Plantier and Collins (2014) argue that there is little evidence of a feedback effect from fund flows to fund returns (bond prices) when the order of the endogenous variables in their VAR is altered. More recently, and focusing on corporate bond funds, Goldstein, Jiang, and Ng (2015) show that fund flows are more sensitive to poor performance than good performance and that this relationship is stronger when market liquidity is limited. They argue that an illiquid corporate bond market may give place to a first-mover advantage among mutual funds investing in this segment of the market.[20]

Our baseline VAR model allows us to tackle this question in a unified manner, evaluating the effect of monetary policy shocks on flows and the impact of these flows on performance, therefore providing evidence on necessary conditions for the existence of a first-mover ad-

[19] See Christoffersen, Musto, and Wermers (2014) for a review of the related literature.

[20] Related work by Chen, Goldstein, and Jiang (2010) find that equity fund outflows are more sensitive to underperformance in funds investing in illiquid assets than in funds investing in more liquid assets. They argue that strategic complementarities in mutual fund investing can be a source of financial fragility.

vantage. Again, we report results at the asset-class and investment-strategy levels.[21] This decision is guided by our interest in the aggregate price effect of mutual fund flows on financial markets and the potential threat of such flows to financial stability.[22] Figures 14 and 15 show the response functions of fund performance to a positive 1 standard deviation shock to the flow-to-assets ratio for bond and equity investment strategies. At the asset-class level, results suggest that the price response to a positive shock to flows is substantially different for bond and equity funds. Figure 14 shows that an unexpected inflow (outflow) of 1 standard deviation would have initially increased (decreased) bonds' risk-adjusted return by about 0.2 standard deviation and partially reverted this effect in the subsequent months, but the price response of equity funds to a shock to flows of similar relative magnitude is smaller and not statistically significant (figure 15). Results for equity funds are largely driven by funds investing in domestic equities. However, a disaggregation by investment strategy shows that the price effect of flows in emerging and international equity markets is economically and statistically significant. In particular, a positive (negative) shock to flows increases (decreases) performance by about 0.2 standard deviation in funds investing in emerging equity markets. Response functions for international equity funds point in a similar direction, although the effect on performance appears to be somewhat smaller than in emerging markets funds. Overall, these results suggest that for less liquid segments of the equity market, fund flows have an effect on performance that could potentially generate a first-mover advantage and that under certain market conditions, large redemptions that require asset managers to liquidate positions could amplify price pressures in underlying

[21] Note that the baseline setup also includes contemporaneous and lagged equity and bond market returns to control for changes in performance associated with developments in the underlying markets.

[22] Ideally, we would prefer higher-frequency data for the analysis of the price effect of fund flows. Nevertheless, monthly data allow us to explore this question. Also, investments decisions in bond and equity mutual funds are considered long-term investments, and in general, their associated entering and exiting costs contribute to longer investment horizons. For example, as shown in table 1, a large fraction of mutual fund assets correspond to retirement assets, which are known to be stickier and can be expected to be less sensitive to current market conditions.

asset markets.[23]

For bond mutual funds, results are generally economically and statistically significant across investment strategies. As shown in figure 14, unexpected inflows on the order of 1 standard deviation over total assets have a positive effect on risk-adjusted returns on the order of 0.15 standard deviation for investment-grade and government bond funds. In particular, government bond funds have a slighter higher initial effect at around 0.2 standard deviation that partially reverts over the subsequent months. Meanwhile, the price effect of unexpected inflows into high-yield bond funds is also positive and statistically significant. However, the risk-adjusted effect is slightly higher, at about 0.3 standard deviation, than those experienced by the less risky government and investment-grade funds.[24] International and multisector bond funds present similar directional effects. However, their initial price responses partially revert over the months following the shock. Interestingly, municipal bond funds experience the strongest price effect, reaching 0.5 after the shock, retracing somewhat after the fourth month, and stabilizing at around 0.3 standard deviation thereafter.[25]

Overall, although not conclusive, our findings provide empirical evidence of one of the necessary conditions for the existence of run-like incentives for mutual fund investors, namely the effect of fund flows on performance.

Another crucial aspect for a first-mover advantage to materialize is related to how portfolio managers meet redemptions. In other words, investors' incentives to redeem ahead of large expected outflows also depend on the liquidity management practices of asset managers, particularly, their tools and procedures to meet demand for liquidity that can arise

[23]Note that results are symmetric by construction.

[24]Performance is presented in risk-adjusted terms, accounting for the return volatility of the different investment categories.

[25]Note that, as shown in table 6, the magnitudes of these price effects are consistenly smaller than the underlying return volalitlity experienced by fund investors across investment strategies. For instance, while the initial response to outflows in the high yield universe is equivalent to a decline in performance in the order of 64 basis points, the monthly return volatility of high yield mutual funds is about 355 basis points over the sample period spanning from January 2000 to December 2014.

from both investors' outflows and portfolio rebalancing. For instance, funds investing in illiquid markets might build liquidity buffers at the fund or firm level to protect the value of their portfolio from the need to liquidate assets at a discount in the case of large and sudden redemptions by investors.[26] Appropriate liquidity buffers can then help mitigate the economic incentives that could trigger a first-mover advantage.

More recently, liquidity management practices also include a closer and more frequent monitoring of the liquidity of the underlying assets in the portfolio (i.e. scoring), stress testing and active communication strategies, among others. These new tools can help alleviate the costs associated with traditional portfolio level liquidity buffers such as holding more cash and liquid assets, which can be costly during normal times as they might hurt both absolute and relative performance.

5 Conclusion

This paper investigates the effect of monetary policy shocks on mutual fund flows and the risk to financial stability that might arise from these flows using a unified framework that allows us to connect monetary policy, investors' allocation decisions and performance. Empirical results show that positive shocks to the path of monetary policy are associated with persistent outflows from funds investing in the bond market. Specifically, a positive 1 standard deviation shock to the expectations about future monetary policy will translate to a 0.8 standard deviation increase in the flow-to-assets ratio. Conversely, the effect of monetary path shocks on flow of funds investing in equity markets is positive, suggesting that a tighter-than-expected monetary policy path, which could be interpreted as a better-than-expected economic outlook, will cause net inflows into equity mutual funds. Within the bond fund universe, results are mainly driven by the taxable bond segment of the market, including

[26] An alternative source of liquidity at the firm level might also include lines of credit from banks.

government, high-yield, investment-grade, multisector, and world bond funds.

Our flow-performance results show that outflows can have an effect on the performance of funds investing in bonds and in less liquid segments of the equity market. In the current regulatory environment, where redemption costs are mutualized and mutual funds engage in liquidity transformation, our findings show that there are economic incentives that may generate a first-mover advantage. However, adequate liquidity management practices and policy guidelines can help mitigate these incentives.

Taken together, our findings show that monetary policy can have a direct effect on mutual fund investors' behavior, as evidenced by their fund flows, and that, under the current regulatory set-up, there could be economic incentives for run-like behavior. As a result, the potential risks to financial stability that mutual fund investors might generate under stressed conditions should be weighed in the formulation of monetary policy.

References

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?," *The Journal of Finance*, 60(3), 1221–1257.

Buraschi, A., A. Carnelli, and P. Whelan (2014): "Monetary Policy and Treasury Risk Premia," .

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.

Christiano, L. J., M. Eichenbaum, and C. Evans (1996): "The Effects of Monetary Policy Shocks: Evidence from the Flow of Funds," *The 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," *Annu. Rev. Financ. Econ.*, 6(1), 289–310.

Clarida, R., J. Gali, and M. Gertler (2000): "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory," *The Quarterly Journal of Economics*, 115(1), pp. 147–180.

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

DAmico, S., W. English, D. L. Salido, and E. Nelson (2012): "The Federal Reserve's Large?scale Asset Purchase Programmes: Rationale and Effects," *Economic Journal*, 122(564), F415–F446.

DAmico, 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.

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

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.

Goldstein, I., H. Jiang, and D. T. Ng (2015): "Investor Flows and Fragility in Corporate Bond Funds," *Available at SSRN 2596948*.

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 J. C. Wu (2012): "The Effectiveness of Alternative Monetary Policy

Tools in a Zero Lower Bound Environment," *Journal of Money, Credit and Banking*, 44, 3–46.

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

Huang, J. (2015): "Dynamic liquidity preferences of mutual funds," in *AFA 2009 San Francisco Meetings Paper*.

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.

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.

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," *The Journal of Finance*, 70(1), 329–371.

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

Plantier, L. C., and S. Collins (2014): "Are Bond Mutual Fund Flows Destabilizing? Examining the Evidence from the Taper Tantrum," *Examining the Evidence from the Taper Tantrum(September 1, 2014)*.

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.

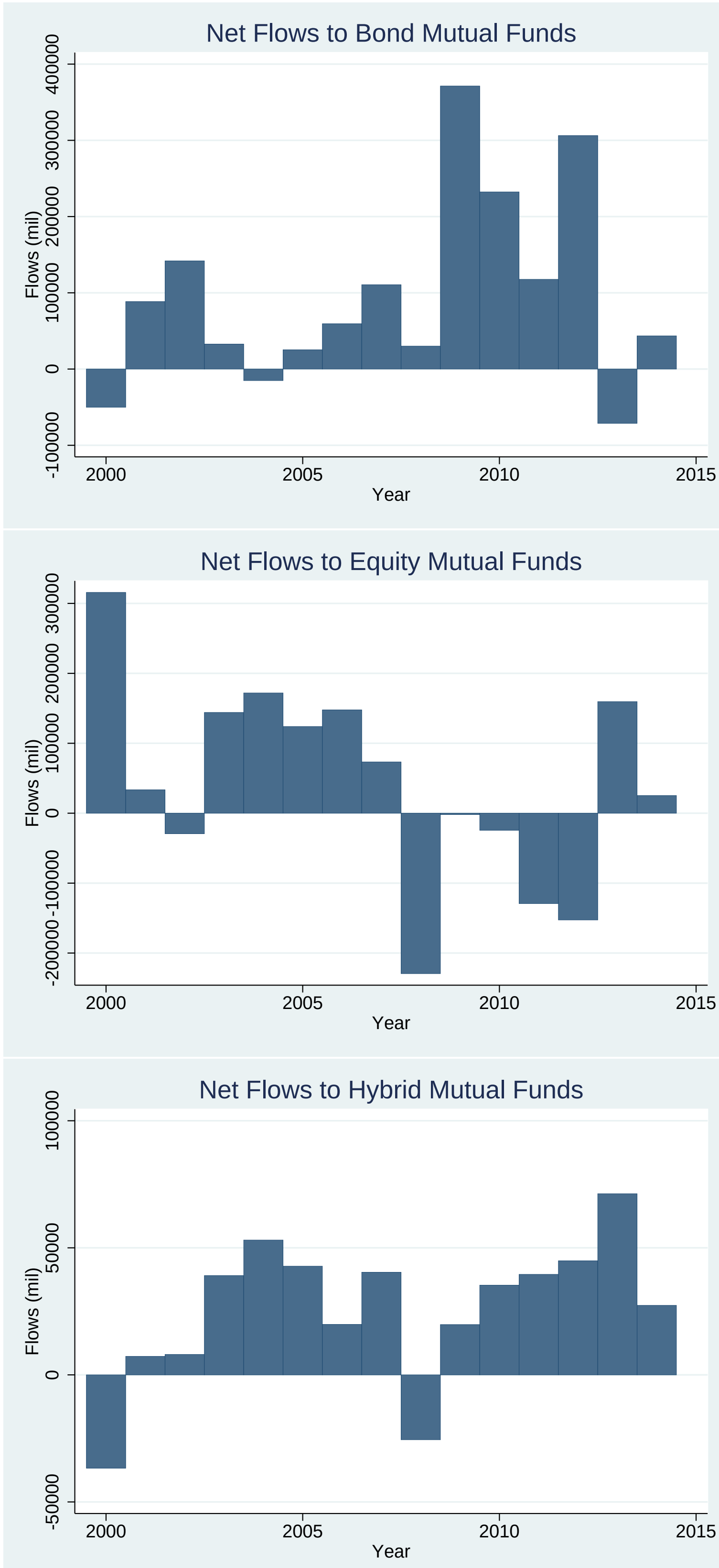
Rosa, C. (2012): “How "unconventional" are large-scale asset purchases? The impact of monetary policy on asset prices,” Discussion paper.

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.

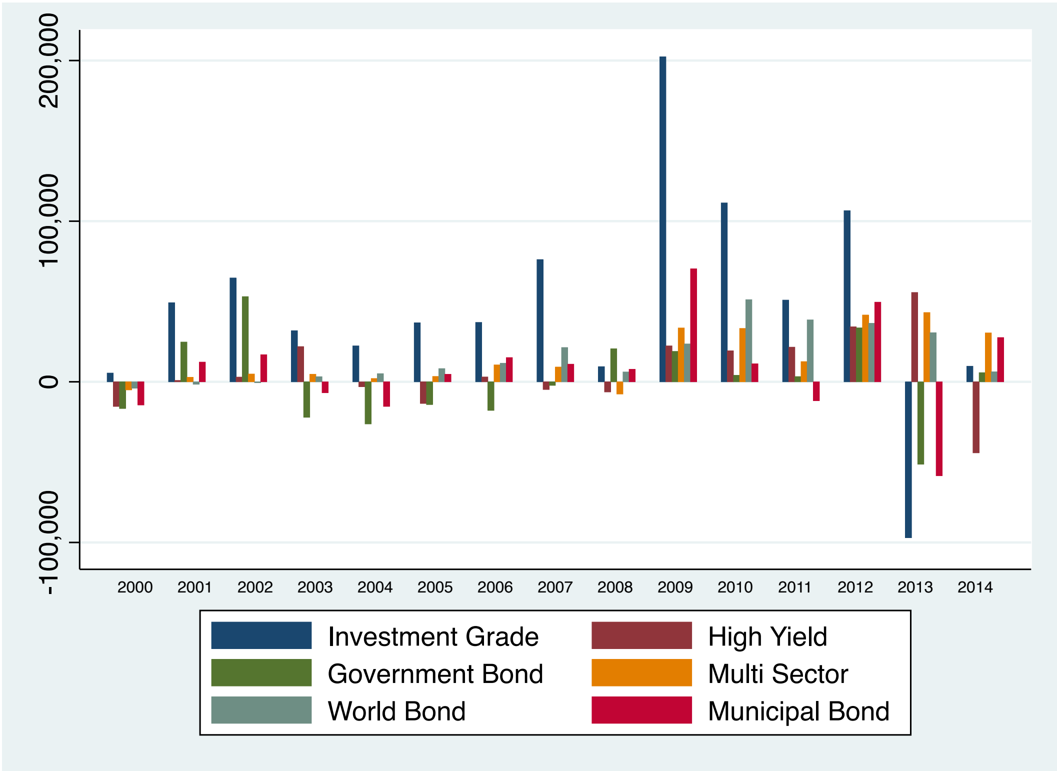
Zheng, L. (1999): “Is money smart? A study of mutual fund investors’ fund selection ability,” *The Journal of Finance*, 54(3), 901–933.

Figure 1: Mutual Fund Flows by Asset Class



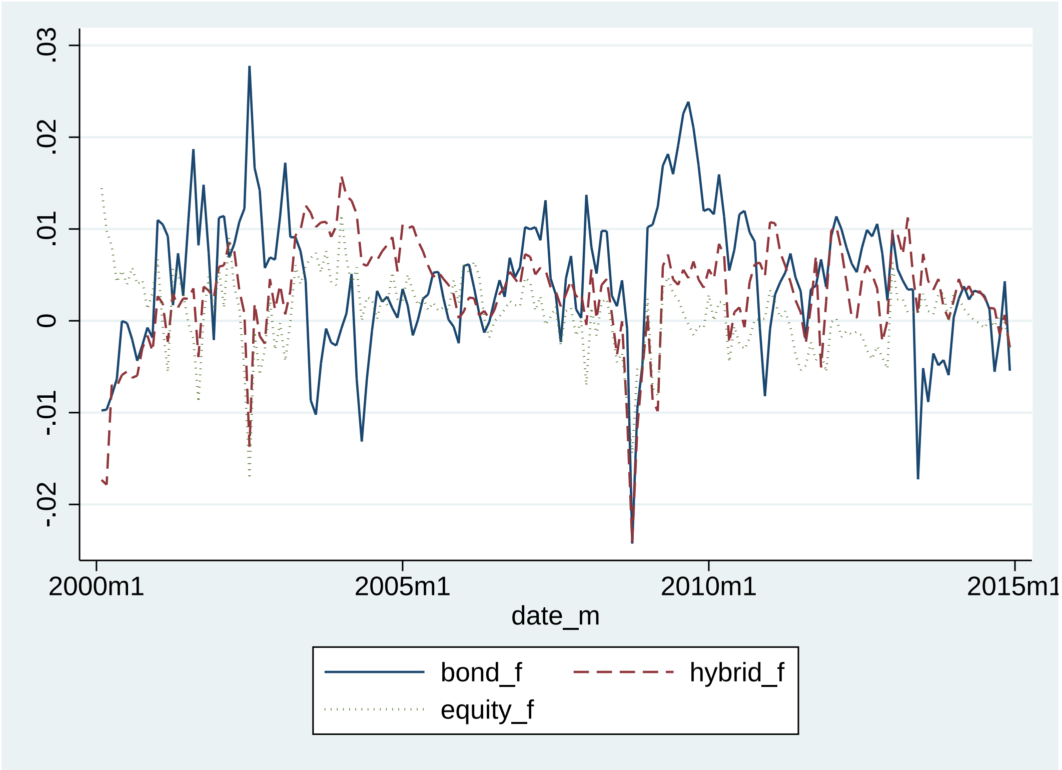
Source: Investment Company Institute (http://www.ici.org)

Figure 2: Bond Mutual Fund Flows by Investment Strategy



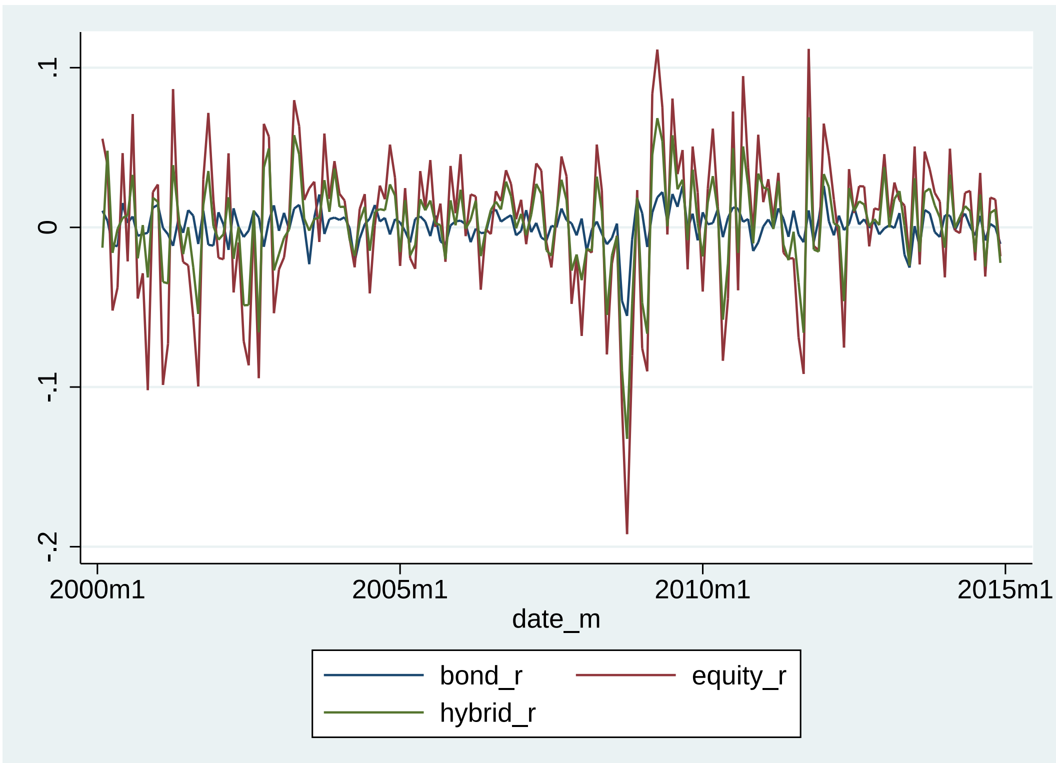
Source: Investment Company Institute (http://www.ici.org)

Figure 3: Net Flows over Total Net Assets, by Asset Class



Notes: This figure shows the ratio of flows (f_t) to total net asset (tna_{t-1}), by asset class. $f_t = s_t - re_t + e_t - d_t$, where f_t is net new cash flows during month t, s_t is total sales, re_t accounts for monthly redemptions, e_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_t is all reinvested dividends during the current month.

Figure 4: Mutual Fund Returns by Asset Class

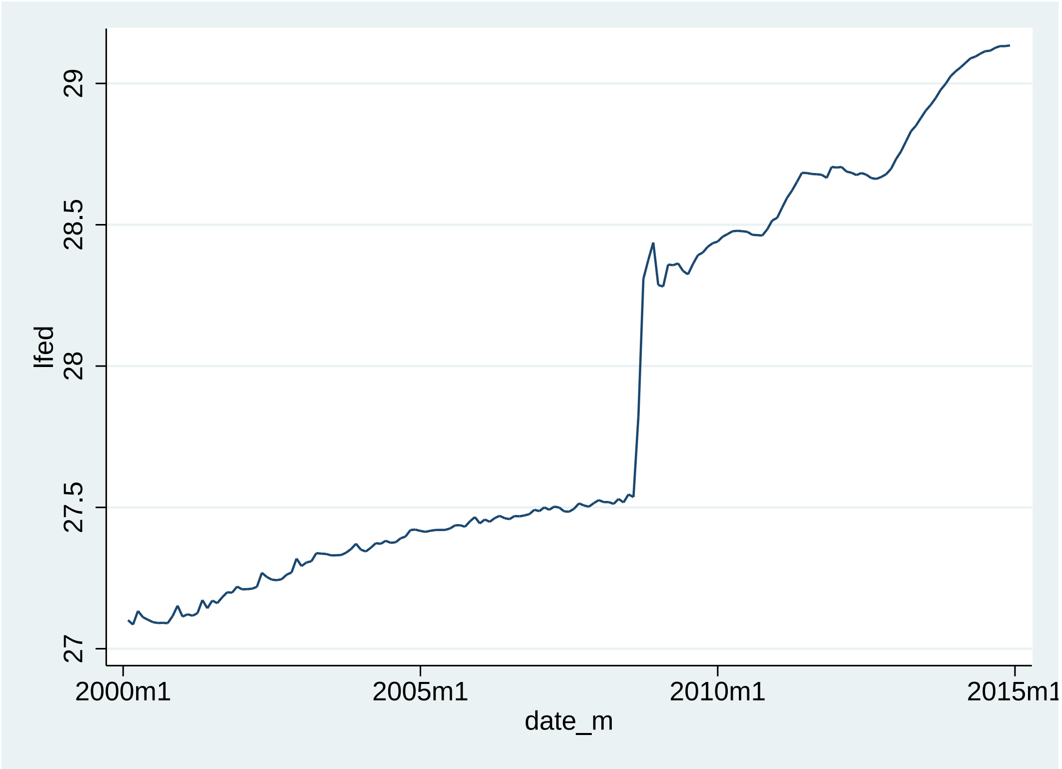


Notes: This figure presents monthly returns (r_t) over the 2000–14 period, by asset class. $r_t = \frac{a_t - fi_t - a_{t-1}}{a_{t-1}}$, where r_t is monthly price returns, a_t is total net assets at the end of month t, and fi_t is total net flows including distributions.

Figure 5: Macro Factors, Principal Components

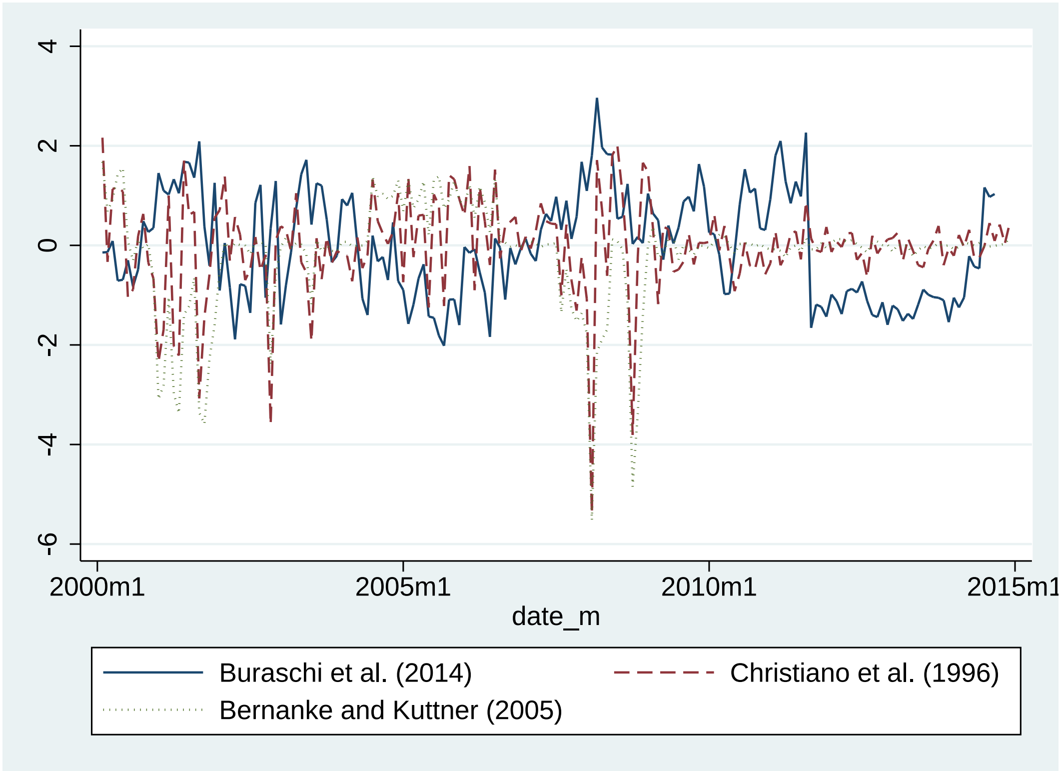
Notes: This figure shows time series for a set of macroeconomic factors built using principal components analysis. The below series are included in the analysis: Industrial Production (currip.B50001.s), Retail Sales (usslv_i02yrf.m); Housing: Single-family Housing Starts, Single-family Housing Permits, Pending Home Sales, Existing Home Sales, CoreLogic Price Index for Single-Family Homes, 30-Year Conforming Fixed-Rate Mortgage; IS Manufacturing Survey: Average Regional New Orders, New Orders, Export Orders, Supplier Deliveries, Inventories; Consumer Surveys: Michigan Survey: Current Conditions, Michigan Survey: Expected Conditions, Consumer Sentiment- Michigan Index, Consumer Sentiment- Conference Board Index, Expected Labor Market Conditions- Michigan Survey.

Figure 6: Fed's Balance Sheet



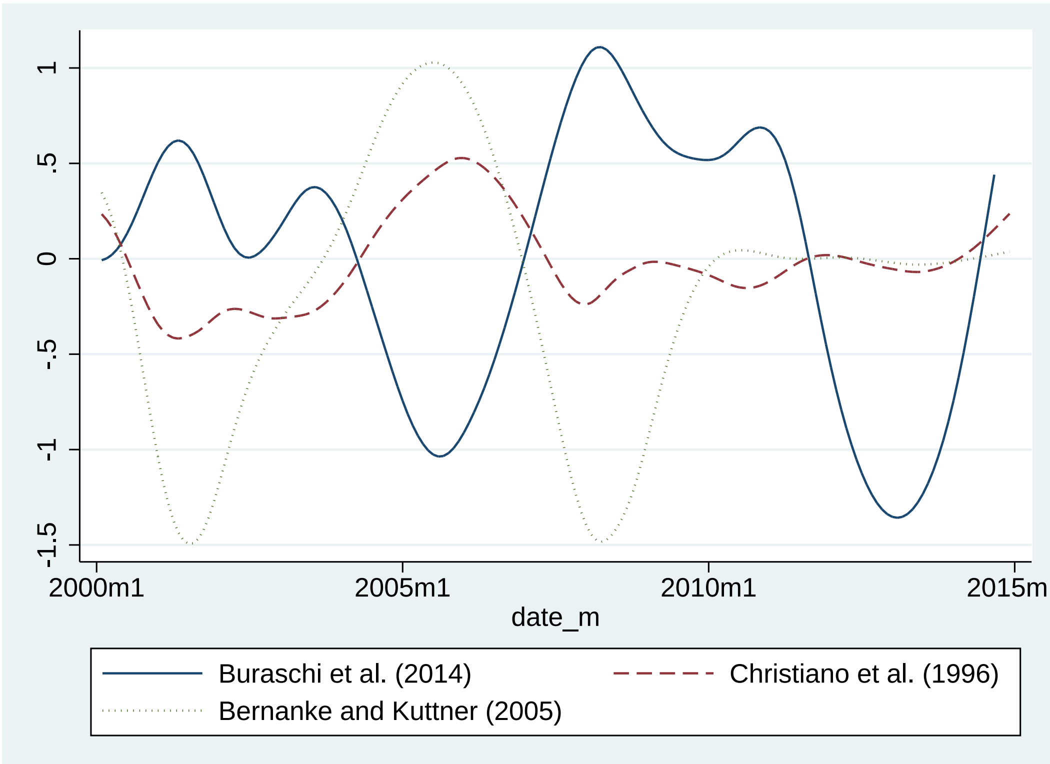
Notes: This figure displays the logarithm of the Fed's balance sheet assets over time.

Figure 7: Exogenous Monetary Policy Shocks



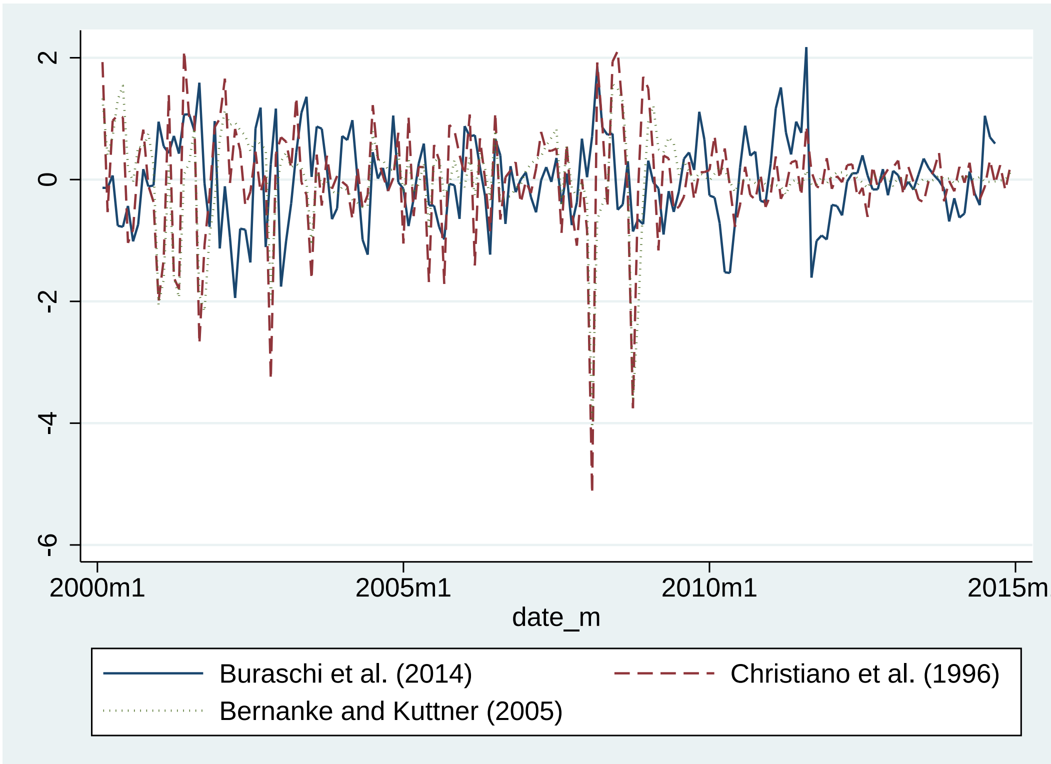
Notes: Buraschi, Carnelli and Whelan (2014), Bernanke and Kuttner (2005), Christiano, Epelbaum and Evans (1996)

Figure 8: Exogenous Monetary Shocks: HP Filter Trend



Notes: Exogenous monetary shocks, trend component from a Hodrick-Prescott filter, smoothing parameter of 1000.

Figure 9: Exogenous Monetary Shocks: HP Filter Cyclical Pattern



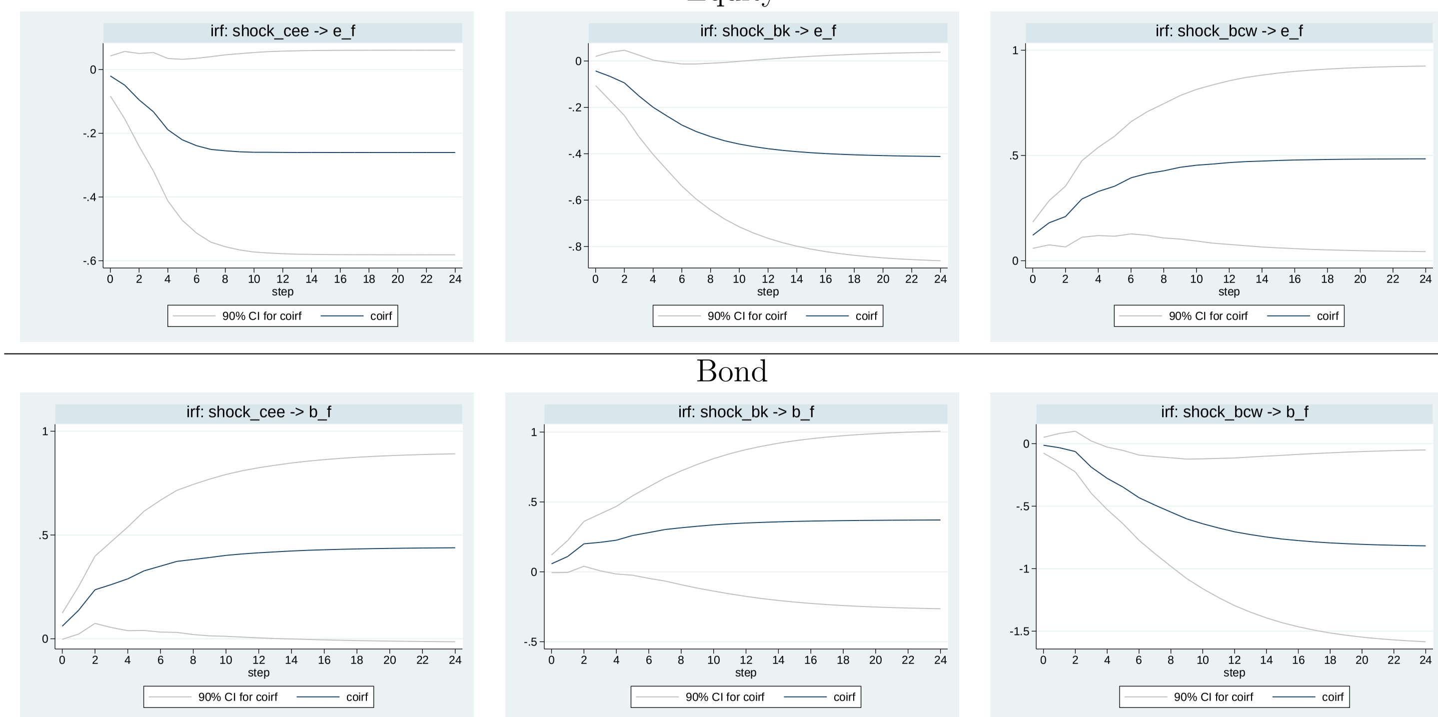
Notes: Exogenous monetary shocks, cycle component from a Hodrick-Prescott filter, smoothing parameter of 1000.

Figure 10: Equity and Bond Mutual Fund Flows - Monetary Policy Shocks

Shock: CEE	Shock: BK	Shock: BCW

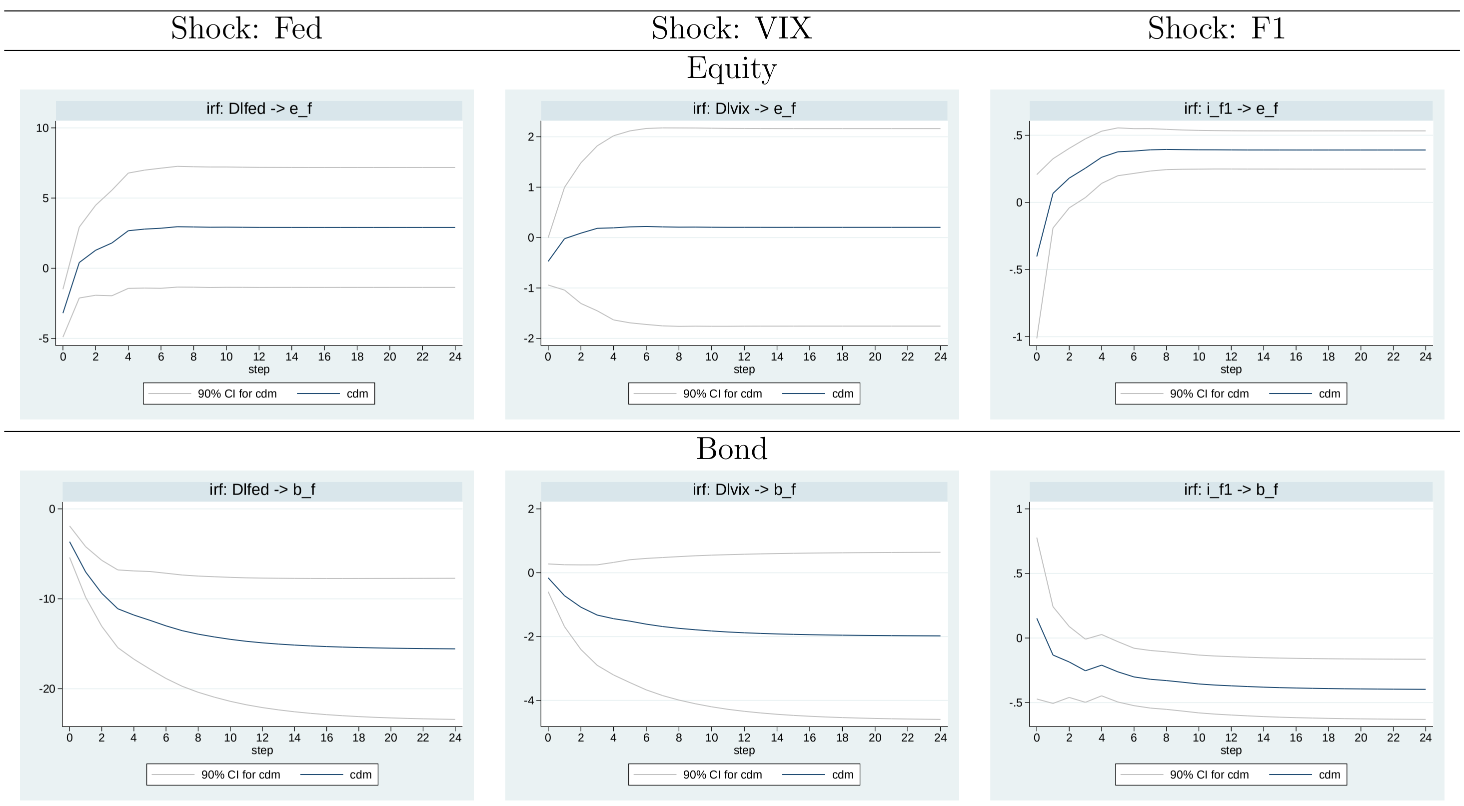
Equity

Bond



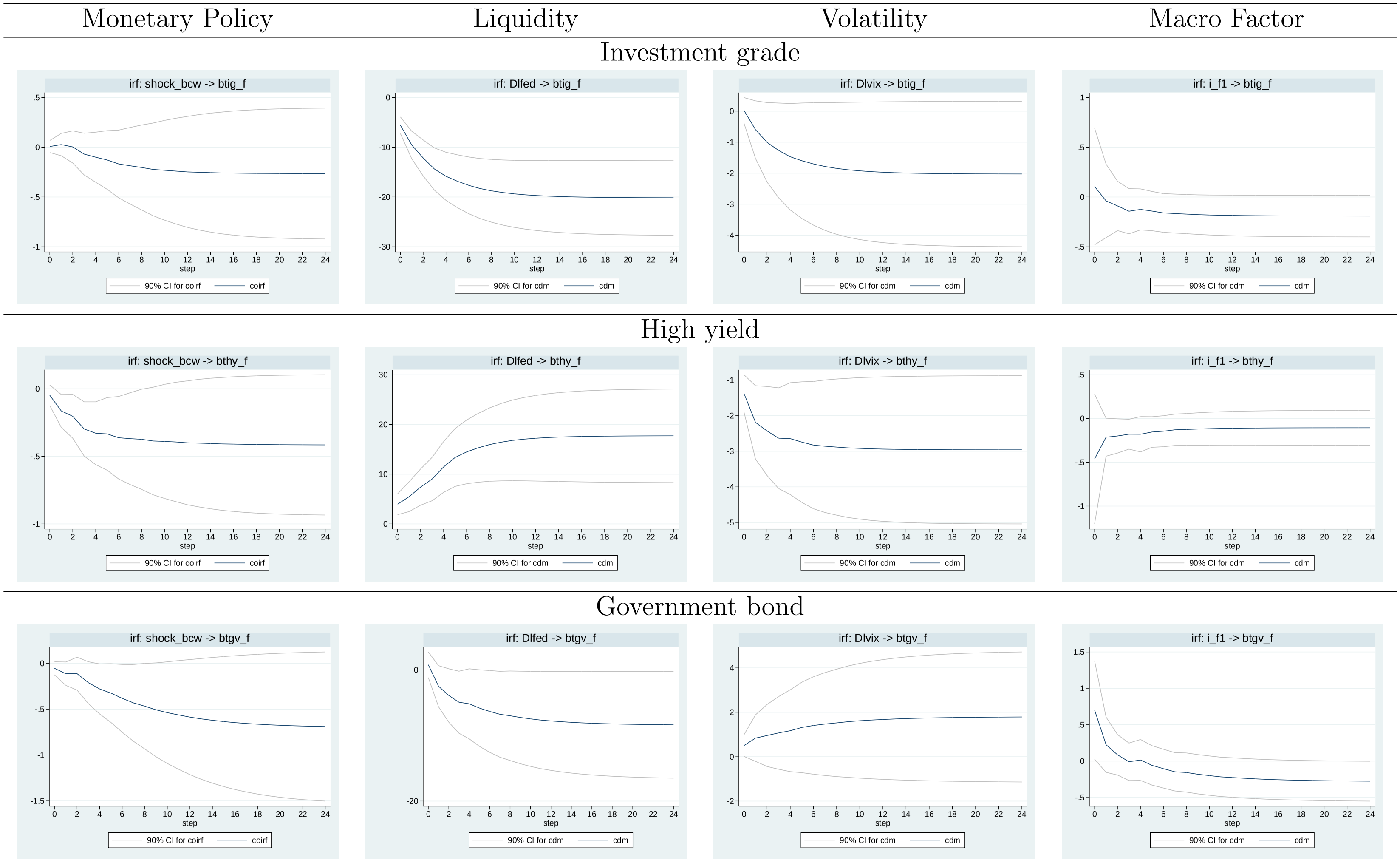
This figure reports the cumulative orthogonalized impulse response functions (IRF) of equity and bond fund flows to a positive 1 standard deviation shock to the corresponding monetary policy measure. Responses are in months. Results show 95% confidence intervals.

Figure 11: Equity and Bond Fund Flows - Other Shocks



This figure shows the cumulative orthogonalized impulse response functions (IRF) of equity and bond fund flows to a positive 1 standard deviation shock to changes in the size of the Fed's balance sheet (Fed), market volatility (VIX) and macro conditions factor (F1). Responses are in months. Results show 95% confidence intervals.

Figure 12: Bond Flows by Investment Strategy

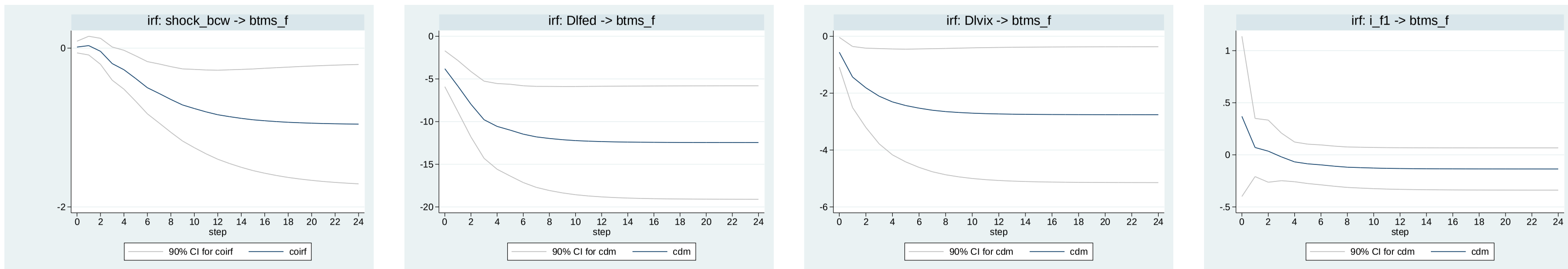


This figure shows the cumulative orthogonalized impulse response functions (IRF) of bond fund flows by investment strategy to a positive 1 standard deviation shock to monetary policy (as defined by BCW), the proxy for Fed's liquidity (Fed), volatility (VIX), and macro conditions factor (F1). Responses are in months. Results show 95% confidence intervals.

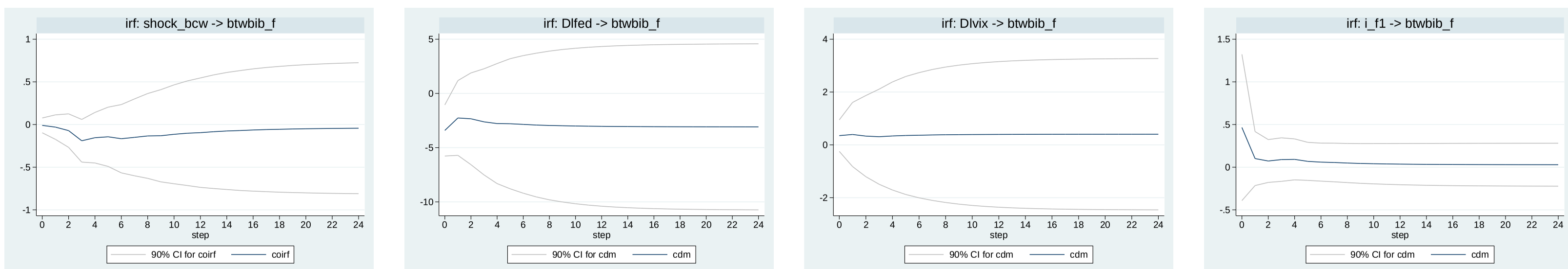
Figure 12: Bond Flows by Investment Strategy (Cont.)

Monetary Policy	Liquidity	Volatility	Macro Factor

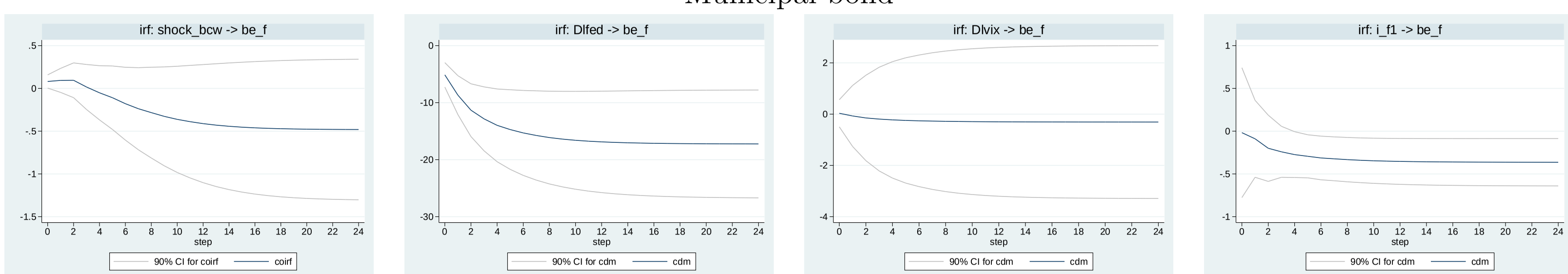
Multisector bond



International bond

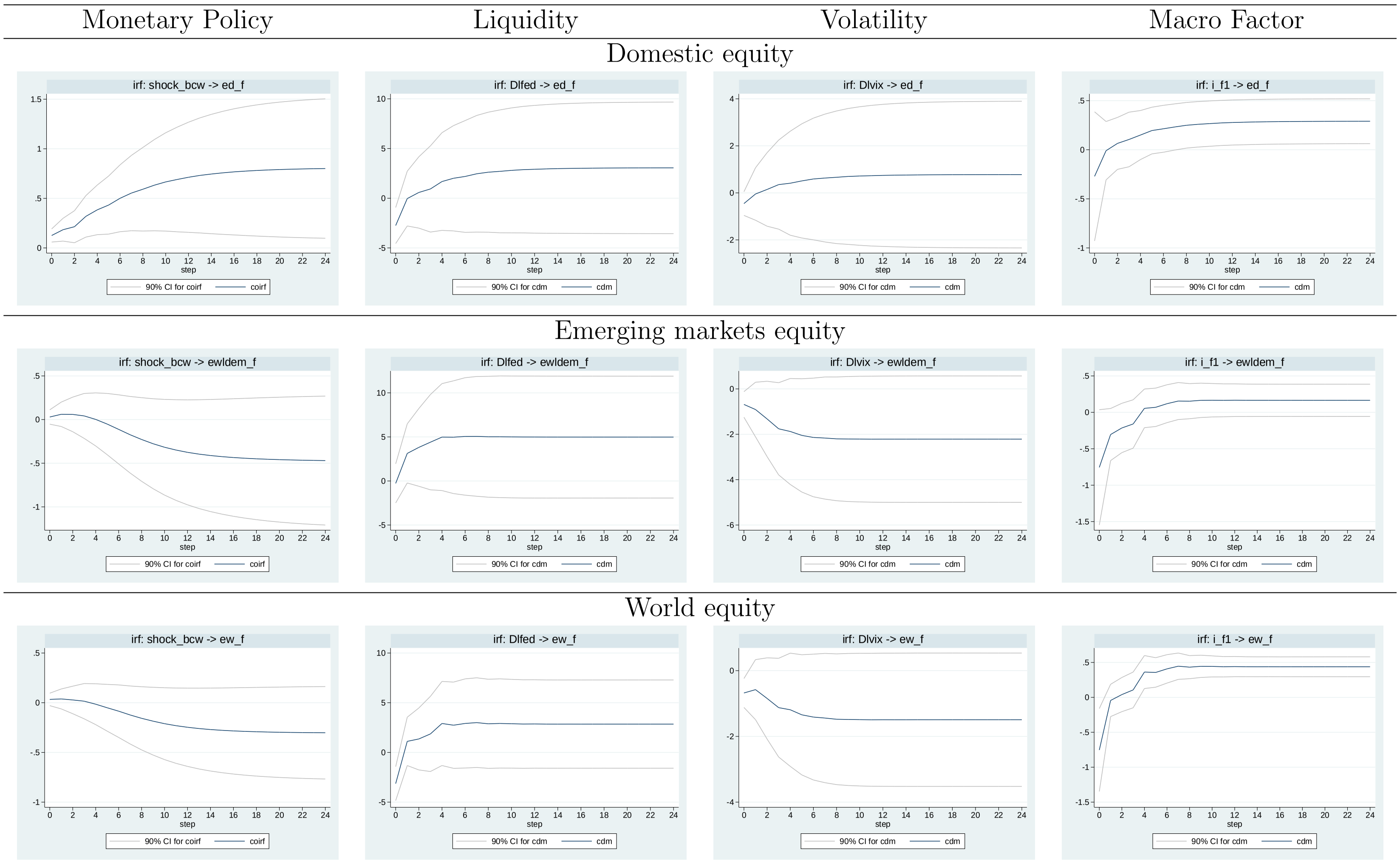


Municipal bond



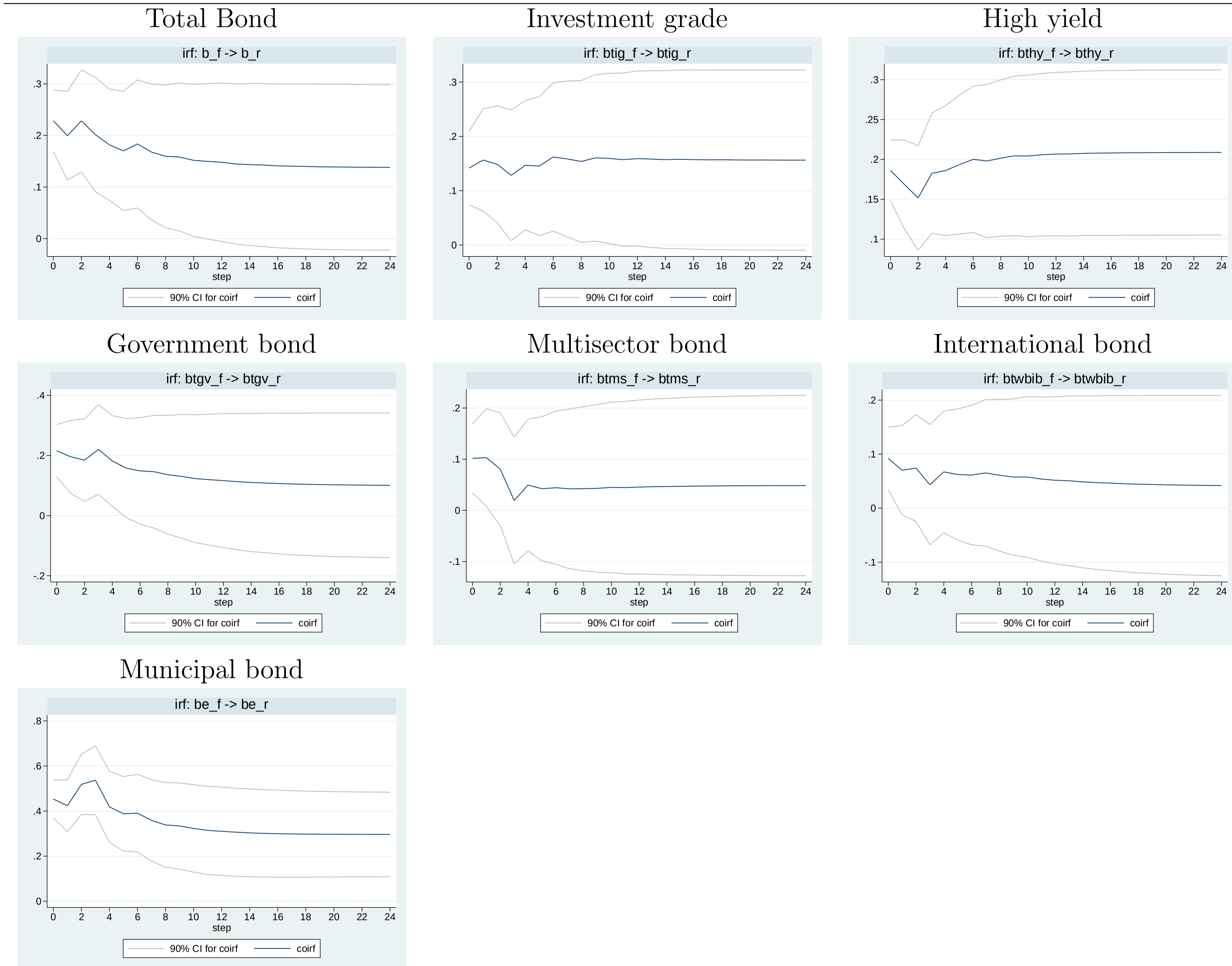
This figure shows the cumulative orthogonalized impulse response functions (IRF) of bond fund flows by investment strategy to a positive 1 standard deviation shock to monetary policy (as defined by BCW), the proxy for Fed's liquidity (Fed), volatility (VIX), and macro conditions factor (F1). Responses are in months. Results show 95% confidence intervals.

Figure 13: Equity Flows by Investment Strategy



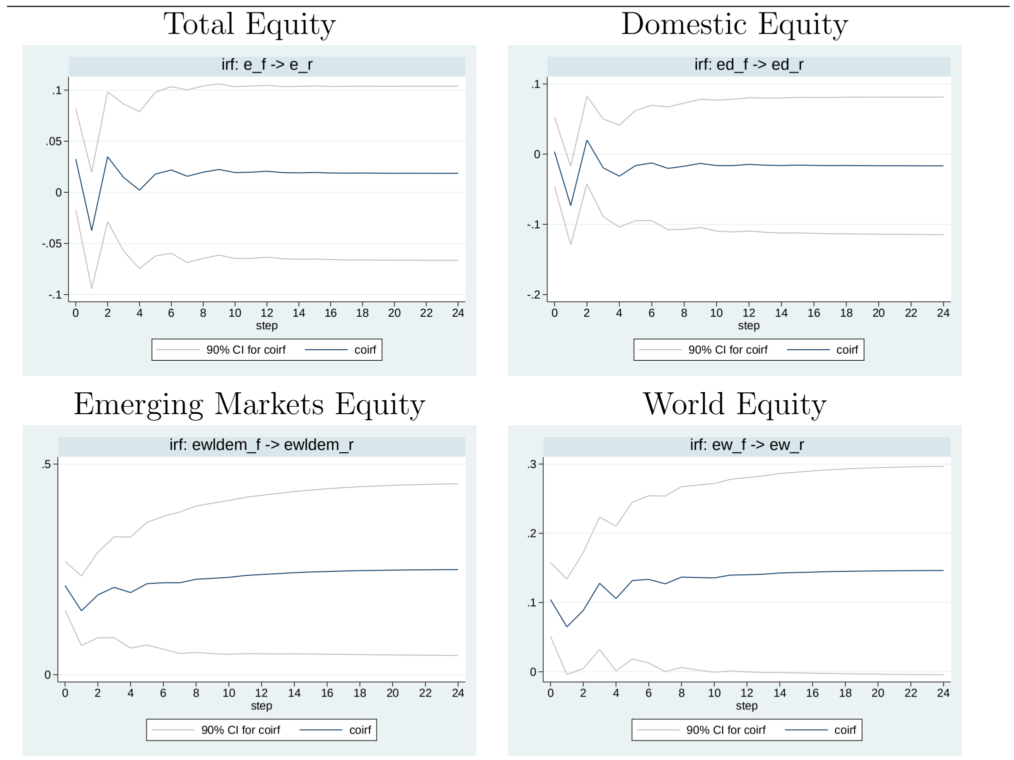
This figure presents the cumulative orthogonalized impulse response functions (IRF) of equity fund flows by investment strategy to a positive 1 standard deviation shock to monetary policy (as defined by BCW), the proxy for Fed's liquidity (Fed), volatility (VIX), and macro conditions factor (F1). Responses are in months. Results show 95% confidence intervals.

Figure 14: Price Response to Shocks to Bond Fund Flows



This figure reports the cumulative orthogonalized impulse response functions (IRF) of bond fund risk-adjusted returns, by investment strategy, to a positive 1 standard deviation shock to fund flows. Responses are in months. Results show 95% confidence intervals.

Figure 15: Price Response to Shocks to Equity Fund Flows



This figure reports the cumulative orthogonalized impulse response functions (IRF) of equity fund risk-adjusted returns, by investment strategy, to a positive 1 standard deviation shock to fund flows.

Responses are in months. Results show 95% confidence intervals.

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

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Panel A: Investment Strategy															
Equity Funds															
Capital Appreciation	1,434	1,105	766	1,041	1,149	1,233	1,319	1,420	809	1,086	1,248	1,178	1,319	1,725	1,856
World	565	444	369	535	716	956	1,360	1,719	899	1,308	1,541	1,356	1,612	2,034	2,079
Total Return	1,936	1,843	1,508	2,077	2,478	2,697	3,153	3,275	1,930	2,479	2,808	2,679	3,007	4,004	4,379
	3,934	3,392	2,642	3,653	4,343	4,885	5,833	6,413	3,637	4,873	5,597	5,213	5,939	7,763	8,314
Bond Funds															
Investment Grade	246	311	406	474	518	570	640	760	736	1,050	1,241	1,365	1,572	1,451	1,525
High Yield	110	109	108	159	168	159	176	176	118	198	243	271	342	420	378
World	33	32	34	44	53	60	81	110	106	159	246	294	367	429	464
Government	125	154	219	198	177	167	153	158	188	210	225	242	298	239	254
Multisector	32	37	43	50	56	62	80	101	85	131	160	174	231	248	273
State Muni	132	140	153	149	144	147	154	156	135	159	156	159	178	145	156
National Muni	146	156	177	187	184	192	211	218	203	299	318	339	403	354	410
	824	939	1,141	1,262	1,299	1,358	1,496	1,680	1,571	2,207	2,591	2,844	3,391	3,286	3,461
Hybrid Funds	361	358	335	448	552	621	732	822	562	718	841	883	1,029	1,267	1,352
Total Long-term MFs	$5,119	$4,690	$4,118	$5,362	$6,194	$6,865	$8,060	$8,914	$5,771	$7,797	$9,029	$8,940	$10,359	$12,316	$13,127
Panel B: Investor Type (ex. MMF)															
Individual Investors	94%	94%	94%	94%	94%	93%	93%	93%	93%	92%	92%	92%	92%	92%	92%
Institutional Investors	6%	6%	6%	6%	6%	7%	7%	7%	7%	8%	8%	8%	8%	8%	8%
Panel C: Retirement-related Assets															
Share over total assets	37%	35%	34%	38%	40%	41%	42%	41%	36%	39%	42%	42%	43%	45%	46%
Panel D: Mutual Fund Concentration															
	1995	2000	2005	2010	2011	2012	2013								
Largest 5 complexes	34%	32%	37%	40%	40%	40%	40%								
Largest 10 complexes	47%	44%	48%	53%	53%	53%	53%								
Largest 25 complexes	70%	68%	70%	74%	73%	73%	72%								

Notes: This table shows the evolution of total net assets of long-term mutual funds from 2000 to 2014, 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 as a share of total assets. Panel D describes the concentration of the largest mutual fund complexes. Data is from the Investment Company Institute.

Table 2: Mutual Fund Flows Summary Statistics

	Equity	Hybrid	Bond	Investment Grade	High Yield	Multisector Bond	World Bond	Municipal Bond	Domestic Equity	World Equity	EME Equity
Panel A: Full sample											
Mean	3,497	2,158	7,777	3,982	526	1,220	1,312	665	-761	4,258	945
Max	56,710	12,526	47,185	24,284	11,749	6,611	17,334	10,323	34,004	23,929	6,184
Min	-70,499	-16,625	-60,010	-24,862	-15,592	-5,129	-7,702	-16,475	-48,790	-26,448	-4,300
p25	-6,462	472	-394	899	-1,082	147	-136	-806	-9,125	-28	-80
p50	5,660	2,623	7,593	3,483	675	608	792	1,078	-1,101	4,498	724
p75	14,736	4,233	15,559	7,334	2,630	2,475	2,583	2,734	7,942	8,556	1,942
Standard Dev.	18,269	3,642	14,792	7,263	3,550	1,832	2,615	3,789	13,701	7,595	1,599
Skewness	-0.62	-0.94	-0.47	-0.60	-0.80	0.43	1.16	-1.36	-0.21	-0.44	0.13
Kurtosis	4.63	6.83	5.40	5.76	6.82	3.91	10.60	6.99	3.78	4.71	4.25
Panel B: Pre-crisis											
Mean	8,760	1,754	4,693	3,570	-126	325	617	438	3,816	4,944	593
Max	56,710	7,072	28,284	14,017	5,871	1,845	4,349	5,016	34,004	23,929	5,179
Min	-52,769	-7,305	-16,521	-2,027	-4,382	-1,261	-608	-5,109	-48,790	-17,713	-4,300
p25	446	399	-724	1,275	-1,560	-73	-136	-694	-3,586	307	-170
p50	9,559	2,135	4,732	3,218	-51	310	436	570	4,167	4,413	220
p75	18,986	3,666	9,193	5,555	1,115	625	1,060	1,678	12,111	9,130	1,093
Standard Dev.	16,938	2,733	7,990	3,166	1,857	591	979	1,863	13,669	7,239	1,352
Skewness	-0.59	-0.87	0.07	0.65	0.23	0.26	1.52	-0.36	-0.56	0.25	0.49
Kurtosis	4.99	4.17	3.26	3.39	3.37	3.19	5.89	3.21	4.72	3.45	5.51
Panel C: Post-crisis											
Mean	-3,705	2,711	11,998	4,546	1,418	2,443	2,262	974	-7,024	3,319	1,428
Max	37,598	12,526	47,185	24,284	11,749	6,611	17,334	10,323	18,556	19,042	6,184
Min	-70,499	-16,625	-60,010	-24,862	-15,592	-5,129	-7,702	-16,475	-44,051	-26,448	-3,935
p25	-15,683	727	2,834	71	-204	1,349	-156	-996	-13,837	-1,420	520
p50	-1,208	3,309	14,414	5,684	2,498	2,877	3,081	2,378	-6,456	4,836	1,563
p75	8,121	5,261	26,473	11,500	4,301	3,829	4,758	4,701	789	8,058	2,405
Standard Dev.	17,652	4,568	20,082	10,563	4,894	2,214	3,663	5,415	11,075	8,011	1,785
Skewness	-0.81	-1.13	-1.00	-0.64	-1.22	-1.05	0.24	-1.25	-0.34	-1.09	-0.42
Kurtosis	4.74	6.24	4.26	3.18	5.13	4.65	5.92	4.23	3.58	5.25	4.14

Notes: This table shows summary statistics for monthly mutual fund flows, by asset class (equity, hybrid and bond funds) and by investment strategy. Panel A covers the full sample period (2000–2014), Panel B the pre-crisis period, and Panel C the post-crisis period. These descriptive statistics are caltulated using data from the Investment Company Institute.

Table 3: Mutual Fund Flow Correlations

	Equity	Hybrid	Bond	IG	HY	Multisector	World Bond	Municipal	Domestic Eq.	World Eq.	Eme Eq.
Panel A: Pre-crisis											
Equity	1										
Hybrid	0.12	1									
Bond	-0.48	0.10	1								
IG	-0.41	0.18	0.91	1							
HY	0.19	0.23	0.33	0.11	1						
Multisector	-0.15	0.41	0.53	0.52	0.23	1					
World Bond	-0.25	0.32	0.42	0.48	-0.07	0.37	1				
Municipal	-0.36	0.10	0.85	0.71	0.23	0.40	0.41	1			
Domestic Eq.	0.91	0.01	-0.52	-0.50	0.23	-0.33	-0.43	-0.40	1		
World Eq.	0.62	0.25	-0.14	-0.01	0.01	0.28	0.23	-0.10	0.24	1	
Eme Eq.	0.42	0.35	0.08	0.17	0.07	0.41	0.27	0.08	0.08	0.82	1
Panel B: Post-crisis											
Equity	1										
Hybrid	0.71	1									
Bond	0.11	0.33	1								
IG	0.01	0.14	0.92	1							
HY	0.39	0.51	0.23	0.00	1						
Multisector	0.52	0.61	0.51	0.34	0.26	1					
World Bond	0.29	0.56	0.57	0.36	0.23	0.59	1				
Municipal	-0.06	0.02	0.82	0.79	-0.15	0.27	0.24	1			
Domestic Eq.	0.95	0.62	0.15	0.06	0.45	0.43	0.18	0.00	1		
World Eq.	0.90	0.72	0.03	-0.06	0.23	0.55	0.40	-0.13	0.70	1	
Eme Eq.	0.60	0.64	0.30	0.15	0.34	0.47	0.62	0.04	0.46	0.69	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 caltulated using data from the Investment Company Institute.

Table 4: Mutual Fund Returns - Summary Statistics

	Equity	Hybrid	Bond	Investment Grade	High Yield	Government	Multisector Bond	World Bond	Municipal Bond	Domestic Equity	World Equity	EME Equity
Panel A: Full sample												
Mean	0.37%	0.26%	0.10%	0.18%	0.01%	0.05%	0.19%	0.25%	0.02%	0.40%	0.33%	0.74%
Max	11.18%	6.89%	3.47%	2.98%	18.52%	6.71%	4.22%	10.58%	4.22%	11.50%	12.92%	28.03%
Min	-19.21%	-13.24%	-5.54%	-4.80%	-17.82%	-4.25%	-8.74%	-10.52%	-5.44%	-18.35%	-21.79%	-28.12%
p25	-2.17%	-1.53%	-0.50%	-0.47%	-1.10%	-0.48%	-0.59%	-0.72%	-0.66%	-2.20%	-2.84%	-3.07%
p50	1.21%	0.56%	0.22%	0.26%	0.35%	0.10%	0.31%	0.27%	0.21%	1.11%	0.74%	1.01%
p75	3.53%	2.06%	0.74%	0.91%	1.06%	0.62%	0.94%	1.27%	0.77%	3.51%	3.57%	5.05%
Standard Dev.	4.74%	2.99%	1.13%	1.08%	3.55%	1.01%	1.46%	2.30%	1.34%	4.68%	5.14%	7.06%
skewness	-0.68	-0.81	-1.10	-0.97	-0.22	0.87	-1.11	-0.01	-0.81	-0.68	-0.60	-0.39
kurtosis	4.07	5.13	7.35	6.04	13.97	13.17	9.87	9.24	6.17	3.93	4.33	5.46
Panel B: Pre-crisis												
Mean	0.17%	0.20%	0.09%	0.20%	-0.18%	0.07%	0.23%	0.30%	0.04%	0.13%	0.35%	1.03%
Max	8.66%	5.78%	2.06%	2.33%	5.06%	1.46%	4.22%	5.44%	2.16%	8.89%	9.41%	11.42%
Min	-10.19%	-6.57%	-2.31%	-2.42%	-5.90%	-2.35%	-2.22%	-3.40%	-5.07%	-10.81%	-10.69%	-13.75%
p25	-2.28%	-1.47%	-0.45%	-0.48%	-1.18%	-0.41%	-0.48%	-0.63%	-0.66%	-2.26%	-3.12%	-3.07%
p50	0.58%	0.48%	0.20%	0.28%	0.25%	0.19%	0.28%	0.25%	0.27%	0.83%	0.97%	2.11%
p75	3.02%	1.69%	0.63%	0.87%	0.88%	0.57%	0.90%	1.19%	0.72%	2.79%	3.44%	5.05%
Standard Dev.	4.17%	2.33%	0.83%	0.90%	1.88%	0.77%	1.12%	1.51%	1.10%	4.18%	4.29%	5.60%
Skewness	-0.50	-0.34	-0.34	-0.31	-0.31	-0.66	0.34	0.50	-1.19	-0.48	-0.44	-0.39
Kurtosis	2.94	3.34	2.91	3.01	4.17	3.46	3.68	4.16	6.50	3.02	2.67	2.46
Panel C: Post-crisis												
Mean	0.61%	0.34%	0.11%	0.15%	0.24%	0.03%	0.16%	0.19%	0.00%	0.72%	0.30%	0.41%
Max	11.18%	6.89%	3.47%	2.98%	18.52%	6.71%	3.84%	10.58%	4.22%	11.50%	12.92%	28.03%
Min	-19.21%	-13.24%	-5.54%	-4.80%	-17.82%	-4.25%	-8.74%	-10.52%	-5.44%	-18.35%	-21.79%	-28.12%
p25	-2.08%	-1.54%	-0.55%	-0.44%	-0.70%	-0.55%	-0.69%	-1.17%	-0.65%	-2.14%	-2.58%	-3.17%
p50	1.60%	0.79%	0.24%	0.20%	0.49%	-0.05%	0.32%	0.48%	0.19%	1.99%	0.48%	0.54%
p75	3.70%	2.58%	0.89%	0.95%	1.49%	0.66%	1.00%	1.47%	0.86%	3.92%	4.13%	4.61%
Standard Dev.	5.36%	3.63%	1.41%	1.27%	4.83%	1.25%	1.78%	2.97%	1.58%	5.21%	6.01%	8.47%
Skewness	-0.81	-0.93	-1.18	-1.17	-0.29	1.24	-1.40	-0.04	-0.59	-0.85	-0.63	-0.30
Kurtosis	4.33	4.61	6.32	6.06	8.89	12.14	8.97	6.91	5.18	4.26	4.27	5.18

Notes: This table shows summary statistics for monthly mutual fund returns, by asset class and by investment strategy. Panel A covers the full sample period (2000–2014), Panel B the pre-crisis period, and Panel C the post-crisis period. These descriptive statistics are caltulated using data on total net assets and net flows from the Investment Company Institute.

Table 5: Mutual Fund Return Correlations

	Equity	Hybrid	Bond	IG	HY	Government	Multisector	World Bond	Municipal	Domestic Eq.	World Eq.	Eme Eq.
Panel A: Pre-crisis												
Equity	1											
Hybrid	0.92	1										
Bond	0.14	0.23	1									
IG	-0.02	0.07	0.93	1								
HY	0.66	0.66	0.46	0.25	1							
Government	-0.27	-0.16	0.78	0.85	-0.06	1						
Multisector	0.31	0.38	0.77	0.70	0.45	0.52	1					
World Bond	0.35	0.37	0.71	0.65	0.46	0.43	0.71	1				
Municipal	-0.08	0.03	0.83	0.71	0.15	0.68	0.53	0.41	1			
Domestic Eq.	1.00	0.92	0.12	-0.03	0.65	-0.27	0.29	0.31	-0.08	1		
World Eq.	0.94	0.86	0.19	0.04	0.65	-0.23	0.39	0.47	-0.06	0.91	1	
Eme Eq.	0.82	0.77	0.25	0.09	0.66	-0.17	0.48	0.51	-0.04	0.79	0.90	1
Panel B: Post-crisis												
Equity	1											
Hybrid	0.98	1										
Bond	0.69	0.77	1									
IG	0.55	0.65	0.94	1								
HY	0.71	0.77	0.82	0.66	1							
Government	-0.01	0.00	0.25	0.37	-0.24	1						
Multisector	0.61	0.62	0.60	0.49	0.42	0.32	1					
World Bond	0.76	0.83	0.88	0.76	0.90	-0.04	0.49	1				
Municipal	0.04	0.04	0.33	0.36	-0.10	0.52	0.33	-0.09	1			
Domestic Eq.	1.00	0.97	0.66	0.53	0.71	-0.03	0.58	0.74	0.03	1		
World Eq.	0.97	0.96	0.72	0.60	0.69	0.06	0.67	0.79	0.08	0.94	1	
Eme Eq.	0.88	0.90	0.81	0.69	0.86	-0.04	0.48	0.91	-0.03	0.85	0.90	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 caltulated using data from the Investment Company Institute.

Table 6: Price Responses and Underlying Asset Class Volatility

	Initial Risk-adj. Effect	Initial Effect	Monthly Returns (%) Vol (stdv)	Mean	Min	Max
Total Bond	0.23	0.261	1.134	0.10	-5.54	3.47
Investment grade	0.15	0.163	1.084	0.18	-4.80	2.98
High yield	0.18	0.639	3.552	0.01	-17.82	18.52
Government bond	0.21	0.213	1.014	0.05	-4.25	6.71
Multisector bond	0.10	0.146	1.461	0.19	-8.74	4.22
International bond	0.90	2.751	3.057	0.40	-9.82	18.16
Municipal bond	0.45	0.603	1.340	0.02	-5.44	4.22
Total Equity	0.04	0.166	4.744	0.37	-19.21	11.18
Domestic Equity	0	0.000	4.683	0.40	-18.35	11.50
Emerging Markets Equity	0.19	1.340	7.055	0.74	-28.12	28.03
World Equity	0.10	0.514	5.139	0.33	-21.79	12.92

Notes: This table shows the initial price response (performance effect) of a positive 1 standard deviation shock to fund flows, across investment strategies. Initial risk-adjusted effect is the initial effect on performance following the shock and is defined in terms of return over standard deviation. Initial effect is the same as the risk-adjusted effect but expressed in percentage terms. The final columns are summary statistics of the underlying monthly return series, by investment strategy, also in percentage terms.