The FOMC Risk Shift*

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Abstract

This paper presents new evidence on the channels through which asset markets respond to the revelation of monetary policy news. We find that a large part of stock market moves around FOMC meetings can be attributed to shocks that are uncorrelated with changes in bond yields but closely linked to changes in investors' attitude towards risk. These price effects are mirrored by investors' portfolio rebalancing decisions, manifesting themselves via economically sizeable shifts in fund flows. Return decompositions coupled with textual analysis suggest that "FOMC risk shifts" are related to changes in short-term uncertainty triggered by FOMC meetings.

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1. Introduction

The link between monetary policy and asset prices is of key importance for market participants and policymakers alike. While central banks ultimately aim at affecting macroeconomic outcomes such as real output growth and inflation, the most direct effect of changes in policy rates, and other forms of monetary policy, occurs in financial markets. And indeed, the broader macroeconomic transmission of monetary policy is widely thought to operate via asset prices, such that changes in the monetary policy stance will affect, e.g., consumers' borrowing costs, firms' cost of capital, intermediary net worth or the aggregate wealth of investors, in turn affecting consumption and investment decisions. Hence, understanding how monetary policy affects financial asset prices is of key importance for policy makers, academics, as well as investors.

Consequently, a long literature has studied how monetary policy affects equity prices. A common view is that equity prices move in response to new information about easing or tightening of monetary policy. Under this view, information is transmitted through bond yields to stock prices such that monetary easing increases stock prices because of higher future cash flows and/or lower discount rates. And indeed, a host of papers find that yield-based monetary policy shocks have a strong effect on observed stock return movements around FOMC meetings (e.g., Bernanke and Kuttner, 2005; Gürkaynak, Sack, and Swanson, 2005; Gorodnichenko and Weber, 2016; Swanson, 2017). These results also suggest, however, that a sizeable share of return movements around FOMC meetings is not driven by shocks transmitted through yields, though, and our analysis aims to shed light on this unexplained component of returns.

The seminal work by Bernanke and Kuttner (2005) as well as more recent evidence in, e.g., Bekaert, Hoerova, and Duca (2013) suggest that risk premia play a prominent role in the transmission of monetary policy to risky asset prices. While these papers also rely on yield-based shocks, our paper adds to this literature and provides a new perspective by documenting an additional (and complementary) channel which does *not* operate via yields. More specifically, we show that changes in the pricing of risk, which are uncorrelated with short and long-term yield changes by construction, play a prominent role in explaining both stock returns and fund flows around monetary policy announcements.

We start our analysis by gauging the economic drivers of asset price effects of Federal Reserve monetary policy decisions. To do so, we build on the methodology put forth by Gürkaynak, Sack, and Swanson (2005) and Swanson (2017) and perform a factor analysis on a cross-section of asset prices on FOMC days to extract orthogonal shocks. Similar to these papers, we use a cross-section of yields (from 3-months to 10-years) but we augment these yields with changes in a range of asset prices that are particularly sensitive to the repricing of risk: CDS spreads, a broad U.S. dollar index, as well as the option-implied volatility of U.S. stocks (the VIX).

Based on high-frequency data, we identify three distinct types of monetary policy shocks: (i) a shock to short-term rates up to 2-years, (ii) a shock to long-term rates (5 to 10 years), and (iii) a shock that affects risky asset prices (foreign currency returns, CDS premia, VIX), but is uncorrelated with the returns of safe assets. We label the third one "FOMC risk shifts" to describe that these shocks load negatively on standard measures of risk. Since these factors are orthogonal by construction, they capture distinct components of monetary policy shocks. Most importantly, FOMC risk shifts, capture information that is unspanned by the first two factors related to yields. Hence, we are able to disentangle FOMC risk shifts from shocks that are related to easing or tightening of monetary policy as reflected in the government yield curve. We rely on this categorization to study which types of monetary policy news is associated with the large stock market

Our second key contribution is to study the joint response of prices *and* quantities around scheduled monetary policy events. We measure the latter via investor reallocation decisions (changes in ETF fund flows) around FOMC meetings at a daily frequency. ETFs are frequently used by institutional investors to obtain tactical exposure to certain asset classes, in particular at short horizons (e.g., Ben-David, Franzoni, and Moussawi, 2013; Balchunas, 2016; Madhavan, 2016). In this sense, ETF fund flows are a proxy for the demand of institutional investors or, more generally speaking, "fast money". Measuring the response of prices and quantities is key as it allows us to study to which type of shocks specific investors respond in terms of actual money flows rather than just inferring the impact of news from changes in observed asset prices. Moreover, examining quantities around FOMC meetings enables us to provide evidence from outside the space of returns and allows for a fresh look at the impact of monetary policy for financial markets. To our knowledge, our paper is the first that studies the consequences of monetary policy for asset reallocations in a direct way at a high frequency that allows for a clean identification.

Our first main result is that the strong stock market reaction on FOMC days is difficult to rationalize by interest rate changes alone. Instead, our findings suggest that shifts in investors' attitude towards risk are the main driver of equity returns on FOMC days. Positive FOMC risk shifts are associated with a significantly positive return differential between equities and bonds. For example, a one-standard deviation FOMC risk shift corresponds to an initial event equity excess return of 0.76% (t-stat: 15.5). Around FOMC announcements, FOMC risk shifts account for about three-quarters of the intraday variation in equity returns (R^2=75%). Interestingly, the price response to FOMC risk shifts has a large transitory component and a substantial part of the initial reaction of prices is reversed after about four weeks. Compared to FOMC risk shifts, short and long rate monetary policy shocks have a much smaller impact on equity prices around FOMC meetings. This finding holds true when equity returns are measured intraday, daily, or at longer horizons.

Our second main result is that FOMC risk shifts also move quantities and lead to sizeable reallocation shifts from bond to equity ETFs. For example, a one-standard deviation FOMC risk shift corresponds to a reallocation from bonds to equities of 1.0% (relative to total assets) in the week following an FOMC meeting. Moreover, quantities closely follow prices. A substantial part of the initial flow reaction is reversed after about four weeks just as for stock prices.

We also find that these effects not just to be limited to equities but to carry over to other risky assets as well. Asset classes such as investment grade corporate credit, high-yield bonds, emerging market bonds, and emerging market equities all see significant inflows whenever there is a positive FOMC risk shift.

How can these findings be interpreted? We use the standard vector autoregression (VAR) approach (Campbell and Shiller, 1988, Campbell, 1991) to decompose daily stock return innovations into news about discount rates (or risk premia) and a residual. The short-term return predictors that we consider in this decomposition are the variance risk premium (Bollerslev, Tauchen, and Zhou, 2009) and the lower bound on the expected equity premium implied by option prices (the SVIX-based measure of the equity premium in Martin, 2017). Based on this setup, we show that up to 50% of the variation in stock returns on FOMC days is driven by discount rate news. Moreover, we find that FOMC risk shifts strongly co-move with innovations in the variance risk premium and the SVIX-based equity premium.

We provide evidence that the large shift in discount rates might stem from changes in uncertainty triggered by FOMC announcements. First, we rely on intraday data to measure monetary policy shocks (and equity returns) such that we measure the price reaction *after* the FOMC announcement – when new information hits the market. Second, our analysis of discount rate news on FOMC days shows that FOMC risk shifts are qualitatively in line with explanations where investors are sensitive to changes in uncertainty, e.g., Bollerslev, Tauchen, and Zhou (2009), or Ai and Bansal (2016). Third, we employ a quantitative textual analysis of market commentary and show that FOMC risk shifts tend to be larger when market participants state that the announcement was, e.g., "surprising", or "confusing" and when the terms "uncertainty" or "turmoil and crisis" are mentioned more frequently. Finally, a qualitative inspection of the market commentaries around large FOMC risk shifts suggests that policy news that are in line with the market's expectation tend to be accompanied by positive risk shifts (i.e., higher VIX, higher CDS spreads, and a weaker dollar) whereas policy news that deviate from the market's expectations tend to be accompanied by negative risk shifts.

The other side of our finding is that stock prices seem to move "too much" relative to what can be justified by shifts in the variance risk premium and SVIX-based expected returns alone. Depending on the VAR specification, up to 50% of the initial return reaction can be explained by discount rate news as discussed above. The other 50%, i.e., the residual, is highly transitory and largely reversed within about a week. This transitory nature speaks against the standard interpretation that the residual captures cash-flow news.

An alternative explanation in our context is that the part of the stock market reaction unrelated to discount rate shocks is due to temporary price pressure. In line with this price pressure interpretation, we find that the flow reaction after FOMC risk shifts is concentrated in the largest ETFs that are more liquid and known to be the most popular among large institutional investors (e.g., Balchunas, 2016). In addition, we find that large FOMC risk shifts forecast higher returns to liquidity provision (Nagel, 2012) around FOMC meetings.

In sum, we argue that stock returns around FOMC days are to a large extent driven by shocks to expected returns that are orthogonal to yields and that transitory price pressure accounts for another large portion of overall returns.

2. Related literature

There is a growing literature on the link between different dimensions of monetary policy and asset prices, following the seminal work by Bernanke and Kuttner (2005) and several recent papers have studied how monetary policy (surprises) might affect risk premia.[1]

All these papers suggest that monetary policy affects equity prices. The key point in our paper is that there is a component of monetary policy news that is *unrelated* to yield changes, but is crucial for understanding the sign and size of the stock market reaction on FOMC days. Thus, we do not rely on any indirect channels where higher or lower yields indirectly move (effective) risk aversion, e.g., by affecting intermediary net worth. To give an example, Boyarchenko, Haddad, and Plosser (2017) argue that changes in long rates are a proxy for market confidence.

[1] See, e.g., Shiller, Campbell, and Schoenholtz (1983) for an early contribution, as well as, among others, Adrian and Shin (2010), Borio and Zhu (2012), Bekaert, Hoerova, and Duca (2013), Morris and Shin (2014), Hanson and Stein (2015), Gertler and Karadi (2015), Hattori, Schrimpf, and Sushko (2015), Schmeling and Wagner (2016), Leombroni, Vedolin, Venter, and Whelan (2016), Adrian and Liang (2016), Neuhierl and Weber (2016), Ozdagli and Weber (2016), Boyarchenko, Haddad, and Plosser (2017), Drechsler, Savov, and Schnabl (2017) or Malamud and Schrimpf (2017) for more recent evidence.

In contrast, our measure of FOMC risk shifts is independent of yields and can increase or decrease when new information about monetary easing (or tightening) arrives. We argue that this decoupling of risk shifts from yields is key to explain a large fraction of the variation of equity returns on FOMC announcement days.

Moreover, different from our study, these papers do not investigate the joint response of prices and quantities and shed light on the role of specific investor demands that might lead to price pressure effects. Our findings show that news on FOMC days can trigger economically large investor flows. Again, FOMC induced changes in uncertainty, as proxied for by FOMC risk shifts, are the quantitatively important driving force behind asset reallocations.

A recent stream of the literature looks at average returns on FOMC announcement days. Savor and Wilson (2013) find significant average US excess stock returns on macroeconomic announcement days, including scheduled FOMC days. Lucca and Moench (2015) find evidence of a price drift ahead of FOMC announcements. They further find that basically the entire U.S. equity premium is earned around scheduled FOMC events. Brusa, Savor, and Wilson (2016) provide international evidence on this pattern and Mueller, Tahbaz-Salehi, and Vedolin (2017) study exchange rates in the context of FOMC meetings. Cieslak, Morse, and Vissing-Jorgensen (2018) detect a cycle in equity returns following the FOMC meeting schedule. Neuhierl and Weber (2017) document a drift around FOMC announcements starting 15 days before the announcement.

We complement this literature by focusing on the variation of returns (i.e., the news component of FOMC announcements), instead of looking at average returns. Our results suggest that FOMC announcements are days where the resolution of uncertainty plays an important role, particularly for institutional investors.[2]

More generally, we believe that our findings are helpful for developing new (and for discriminating between) theoretical explanations of FOMC announcement returns. For example, Ai and Bansal (2016) show that a model in which investors are compensated for uncertainty aversion

[2] To be clear, however, we do not offer an explanation of why average returns move *ahead* of FOMC announcements (Lucca and Moench, 2015).

can generate high average announcement returns. Their empirical analysis, however, does not connect measures of uncertainty to FOMC returns. Our results also suggest that different types of investors react differently to FOMC news. This opens the door for models that incorporate heterogenous agents. For example, Bogousslavsky (2017) shows that infrequent rebalancing by some investors can generate substantial seasonality in asset returns. In his model, rebalancing is purely exogenous. A model where rebalancing is triggered endogenously by changes in uncertainty around FOMC meetings might also be in line with the seasonality pattern of FOMC returns and the response of quantities documented in our paper.

Our paper is also related to a recent literature using investor fund flows to gauge investor expectations and preferences, e.g., Greenwood and Shleifer (2014) or Berk and van Binsbergen (2016). Several papers analyze the interaction of fund flows and subsequent returns, finding evidence for flow-induced price pressure.[3] Our results suggest that price pressure from fund flows plays an important role in understanding the response of equity returns around FOMC meetings.

3. Monetary policy shocks

We extract orthogonal shocks related to monetary policy news on FOMC announcement days by means of a factor analysis as in Gürkaynak, Sack, and Swanson (2005) and Swanson (2017). Similar to Swanson (2017), we include changes of 3-months rates, as well as 2-, 5- and 10-year Treasury yields implied by futures prices. The sources of the high-frequency data are Tickdata.com, Thomson Reuters TickHistory, and CMA (Credit Market Analysis Ltd.) Datavision.[4]

[3]Ben-Rephael, Kandel, and Wohl (2012) investigate monthly shifts from U.S. bond mutual funds to U.S. equity mutual funds. Jotikasthira, Lundblad, and Ramadorai (2012) document evidence for emerging markets.

[4]Treasury bond futures of a given maturity refer to a hypothetical bond with a coupon of 6%. We back out the future implied yield and assume that the maturity of the cheapest to deliver bond matches with the face maturity of the future. We do not include overnight (or 1-month) interest rates or Fed Funds futures surprises (e.g. Bernanke and Kuttner, 2005) since ultra short-term interest rates are trapped by the effective lower bound for most of our sample period. There are no CDX futures available. Intraday data on the CDX index is sourced from CMA Datavision who collects information on executable and indicative CDS quotes directly from dealers in credit markets.

We extend this set of yields with a number of additional asset prices from other asset classes in order to capture the pricing of risk (see, e.g., Boguth, Gregoire, and Martineau, 2016; Fernandez-Perez, Frijns, and Tourani-Rad, 2017; Mueller, Tahbaz-Salehi, and Vedolin, 2017, for related papers). In particular, we add changes in CDS spreads as proxied for by the CDX corporate investment grade index, changes in the value of a U.S. dollar index (for which a higher reading means an appreciation of the U.S. dollar), as well as changes in the implied volatility of S&P500 equity returns (VIX) to the analysis.[5] These three risk proxies are directly derived from market prices, i.e., they are able to quickly respond to news, which is an important feature for our subsequent analysis. In addition, these three variables are sensitive to changes in risk and/or the pricing of risk, which is what we intend to capture in the subsequent analysis. Further details on data sources are provided in the caption of Table 1.

First, we collect intraday data on scheduled (96) and unscheduled (2) FOMC announcements between 2006 and 2017. Our event list is available in the Internet Appendix, Table IA.6. We then measure the change of the seven variables within an event window of -15 minutes to +90 minutes around FOMC announcements. Since 2011, the FOMC frequently holds a press conference about one up to two hours after the actual announcement. Recent evidence suggest that these press conferences carry important information for investors (e.g., Boguth, Gregoire, and Martineau, 2016 and Cieslak and Schrimpf, 2018). In these cases (28), we extend the event window to the closing price (16:15) of the FOMC announcement day.

Importantly, relying on intraday data ensures that our monetary policy shocks are not affected by the pre-FOMC drift documented by Lucca and Moench (2015). Put differently, we look at market reactions upon the revelation of monetary policy news, abstracting from what happened ahead of the announcements. Because we are interested in how asset markets react to monetary policy news, we also include unscheduled announcements to the analysis.

We use log changes of the three risky asset prices to reduce the impact of heteroscedasticity and standardize all seven variables based on their FOMC day standard deviation. We then run a

[5] The recent literature has argued that movements in the dollar are related to monetary policy uncertainty (Mueller, Tahbaz-Salehi, and Vedolin, 2017) and, more generally, have become an important barometer of risk (Avdijev, Du, Koch, and Shin, 2017).

principal component analysis with all 98 scheduled and unscheduled FOMC announcement day observations. Our baseline sample ranges from January 2006 to December 2017. This period allows us to study the reactions of prices (returns) and quantities (fund flows) to monetary policy shocks for equities and bonds. We provide robustness based on a longer sample periods (with less detailed data) later in the paper.

>>> TABLE 1 ABOUT HERE <<<

The left hand side of Table 1 shows that the first three principal components explain more than 80% of the variances of the seven variables. The three principal components are purely determined by how much variance they explain. To obtain monetary policy shocks that are easier to interpret economically, we follow Swanson (2017) and apply an orthogonal factor rotation on the first three principal components. The first shock targets the front-end of the yield curve. It captures interest rate reactions due to changes in policy rates and their expected future path. The second shock targets the remaining long-term yields and thus is likely to capture potential effects of QE that may operate by affecting term premia embedded in long-term rates. The third shock targets the market-based risk proxies (VIX, CDS prices and the U.S. dollar).

The loadings of the rotated monetary policy shocks are reported as "orthogonal rotation" on the right hand side of Table 1. Based on the loading patterns, we classify the three shocks as follows:

1. "*Short Rate Shocks*": The first factor primarily loads on 3-month, and 2-year yields and has low loadings on all other variables. It is mildly exposed to the market-based risk proxies. However, these exposures are smaller in magnitude and also differ in their sign (positive for VIX, but negative for the CDX);

2. "*Long Rate Shocks*": The second factor loads particularly on 5-year and 10-year yields. While it has basically no exposure to short-term yields, it is somewhat exposed to the market-based risk proxies. However, these exposures are small in magnitude and also

have opposing signs (negative for VIX, but positive for the U.S. dollar) so that there is no clear link to risky asset prices;

3. "*Risk Shifts*": The third factor loads consistently negatively on all three market-based risk proxies. It hardly loads on the yield variables, though. A higher value of these risk shifts thus indicates a pick up in investors' desire to take on risk.

To be clear, the labels we assign to the monetary policy shocks are purely descriptive and simply indicate on which asset prices the market-based shocks primarily load. We shed light on the possible economic mechanisms driving these shocks in Section 6 of the paper.

We first plot the realizations of these three shocks (standardized to a unit standard deviation) in event time for the 98 FOMC announcements in our sample (Figures 1 to 3).

>>> FIGURE 1 ABOUT HERE <<<

>>> FIGURE 2 ABOUT HERE <<<

>>> FIGURE 3 ABOUT HERE <<<

Our monetary policy shocks indeed summarize important surprise market reactions to FOMC decisions along three key dimensions: *Short Rate* shocks trace surprises in the Fed's policy rate and medium-term expectations thereof, in particular in the period from 2006 to 2009 (Figure 1). Similarly, *Long Rate* shocks exhibit large swings that can be easily attributed to the monetary policy events that have a greater bearing on the longer-end of the yield curve (Figure 2). For instance, it decreases when the Fed approved or expanded QE1, and it shows a series of positive readings during the taper tantrum in 2013, and when the Fed hiked rates end of 2016. Finally, *Risk Shifts* (Figure 3) are positive on key announcements related to the introduction of QE2, and QE3. This suggests that while bond reactions seem to have been more muted, investors' attitude towards risk was positively affected by these later programs. By contrast, we observe a negative realization on the announcement of an unscheduled cut of interest rates by 75 bp in

January 2008. Likewise, we find a large negative risk shift also in mid-2013 when FOMC Chair Bernanke alluded to the possibility that the Federal Reserve might taper its asset purchases.

It seems interesting that certain types of monetary policy events are associated with a particularly large reaction in risk shifts, whereas the response of yields as depicted in Figures 1 and 2 generally tends to be more muted. It is important to stress that this finding does not indicate that risk shifts are independent of monetary policy. To the contrary, large risk shifts are clearly linked to important (unconventional) monetary policy decisions as well as both easing and tightening episodes. But, the risk shifts that we identify are uncorrelated with movements in the short and long end of the yield curve by construction and thus pick up a different dimension of monetary policy news. It is particularly this element of policy news that we are interested in, and shed more light on, in the remainder of this paper.

4. Gauging revealed preferences

4.1. Measuring quantities

A key feature of our analysis is to measure how *quantities* are driven by monetary policy. Greenwood and Shleifer (2014) show empirically that fund flows are related to investor expectations about future returns. Berk and van Binsbergen (2016) argue that if expected returns are misaligned with investors' preferences, an investment opportunity exists to which investors will react with corresponding fund flows. In our context, studying the response of quantities to monetary policy shocks allows us to investigate whether FOMC risk shifts do in fact lead to corresponding re-positioning by (some) market participants. If we observe non-zero flows, this implies that one subgroup of investors buys or sells from another subgroup of investors. Accordingly, investors must differ in their sensitivity towards this specific type of news, and flows help to detect this heterogeneity. Thus, flows can give rise to important price pressure effects (e.g., Jotikasthira, Lundblad, and Ramadorai, 2012). These could at least partially help us understand the response of market prices to monetary policy shocks.

We use ETF fund flows to measure how investors increase or decrease their exposure to the stock or bond market in response to monetary policy shocks. ETF and mutual fund flows are to our knowledge the only investor flow data available at the daily frequency for stocks *and* bonds, and are available for a fairly long time period.

In our empirical analysis, we mainly focus on ETF fund flows as these flows are more likely to represent "fast money". Transaction costs are low for ETFs (there are no front-end loads). They allow investors to quickly build up, or reduce, positions in one asset class or another. This point is also made in Ben-David, Franzoni, and Moussawi (2016) and Lettau and Madhavan (2016), among others. For that reason, ETFs are frequently used by institutional investors to obtain tactical exposure to certain asset classes, in particular at short horizons.[6]

In the Internet Appendix to the paper, we also compare results from ETFs with mutual funds. We refer to mutual funds as "slow money", because of their fairly high transaction costs (front-end fees, but also buying/selling restrictions for large block investors). Mutual fund flows are thus likely to be less responsive to news (e.g., Barber, Odean, and Zheng, 2005; Frazzini and Lamont, 2008).

4.2. Data

We collect daily ETF (and mutual fund) data from TrimTabs. We aggregate individual funds to asset classes. Our measure for U.S. equity is based on all funds that belong to Morningstar's category "Blend". Our measure for U.S. bonds is based on all funds belonging to the Morningstar categories U.S. "government", or investment grade "bond". Fund flows at the asset class level are measured as:

[6] Balchunas (2016) and Madhavan (2016) argue that ETFs are popular among institutional investors for (short-term) tactical asset allocation decisions. Madhavan (2016) reports that ETFs have high institutional ownership (about 65%) and a much higher annual turnover (more than 20 times assets under management) compared to comparable passive mutual funds (less than 20%). Based on 13-F institutional holdings data, Ben-David, Franzoni, and Moussawi (2013) provide direct empirical evidence for institutional investors using ETFs for tactical asset allocation decisions.

$$F_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}\,(1 + R_{i,t})}{TNA_{i,t-1}}, \tag{1}$$

where $TNA_{i,t}$ are total net assets of asset class i (equity or bond) at time t, and $R_{i,t}$ is the fund return of asset class i. Because fund flows do not have an economically meaningful long-run mean or standard deviation, we follow the recent literature (e.g., Berk and van Binsbergen, 2016, Menkhoff, Sarno, Schmeling, and Schrimpf, 2016) and apply a normalization of flows. We rescale all flows to a zero mean and 1% standard deviation using a backward 250-days rolling window.

Absolute flows in one particular asset class are difficult to interpret economically. For example, an inflow in one asset class might go hand in hand with inflows in all other asset classes, thus, simply reflecting a wealth shock (Curcuru, Thomas, Warnock, and Wongswan, 2011). For that reason, we construct a flow-based factor by simply subtracting bond flows from equity flows (cf. Ben-Rephael, Kandel, and Wohl, 2012). We first take the difference of equity and bond flows and then apply the standardization of the flow factors. We provide additional details on these flow data in Appendix A.

From a portfolio perspective, investors' asset allocation can change either due to an active trading decision, or due to changes in relative prices of the securities held. Our flow factor captures the active change in the asset allocation. A positive flow number means that fund investors *actively* shift their asset allocation towards risky equities at the cost of safe bonds. This ensures neutrality with regard to wealth effects (i.e. common shocks).

Results for asset prices around the intraday event window are based on the intraday S&P500 index returns available from TickData. For results on prices and quantities at the daily or longer horizons, we simply rely on the fund return $R_{i,t}$ for asset class i. Using fund returns ensures that the fund flow identity implied by Equation (1) is exactly satisfied and we capture the total change of investors' exposure to asset class i. We complement our results obtained from daily fund returns with results based on daily S&P500 index future returns, the daily CRSP market return and other daily equity factor returns based on the CRSP data (from the website of Kenneth R. French). Our baseline results employ a sample starting in January 2006 and ends in December 2017 (3,019 daily observations; 98 FOMC announcements). The starting year 2006 ensures that all required intraday data are available to us and that we observe an equity flow at every single day and a bond flow on almost all days (at 97% of the observed days). Later in the paper, we also provide robustness based on a longer sample period starting in 1996 (using daily monetary policy shocks and less detailed flow data, though). Further details on the data and data coverage over time is provided in the Internet Appendix (Table IA.1 and Figure IA.1).

5. The FOMC risk shift

In this section, we first study how U.S. equity prices respond to the revelation of monetary policy news over short horizons. Subsequently, we study the permanent and transitory effects of monetary policy news on asset prices as well as quantities (24 hours, up to 20 days). We then provide additional evidence based on other risky asset classes, such as corporate bonds, high yield bonds, and emerging market bonds and equities.

5.1. Intraday results

Table 2 shows results of regressions of equity returns on our monetary policy shocks on FOMC announcement days. Monetary policy shocks and equity returns (S&P 500 futures) are measured intraday around FOMC announcements. The intraday event window is -15 minutes to +90 minutes for announcements without a press conference and -15 minutes to the closing price (16:15) for announcements with a press conference. As can be gleaned from the Table, short rate and long rate shocks negatively affect stock prices, but the estimates are imprecise and the regressions R^2 is well below 10%. Changes in yields thus do not account for a lot of variation in equity excess returns on FOMC days. Put differently, FOMC day returns must to a large extent react to news that are unrelated to yield changes.

>>> TABLE 2 ABOUT HERE <<<

A one standard deviation higher risk shift goes hand in hand with an equity return of 0.76%, which is highly significant (t: 15.5). The large R^2 of 75% shows that FOMC risk shifts carry important news for stocks markets or, equivalently, that the same factors that move the financial instruments underlying our FOMC risk shifts also move equity prices.

5.2. *Permanent and transitory effects of monetary policy shocks*

Having established a close link between equity prices and risk shifts, we next turn to quantifying the permanency of the effects of the three market-based monetary policy shocks, both for asset prices and quantities (fund flows). All left-hand side variables, flows and returns, are sampled daily (close-close) and are based on ETF fund data for consistency.

Following Swanson (2017), we use a method akin to the local linear projection proposed in Jorda (2005) to estimate the response of returns and ETF flows to monetary policy shocks. More specifically, we run the following regressions at the daily frequency:

$$X_{i,t+h} = a_h + b_h \times Monetary\ Policy\ Shock_{j,t} \times D_{FOMC,t} + \xi_{i,t+h},$$

where $X_{i,t+h}$ is either the market excess return or the flow from bond to equity funds, h is the event window running from $h = -1$ to h=20 business days, $Monetary\ Policy\ Shock_{j,t}$ is one of our three orthogonal monetary policy shocks as described in Section 3, and $D_{FOMC,t}$ is a dummy variable that takes the value of one at FOMC announcement days between 2006 to 2017. For horizons $h > 1$, X measures cumulative returns and flows. As before, we standardize the monetary policy shocks such that the slope coefficients b_h show the impact of a unit standard deviation shock (as in Figures 1 to 3).

Our goal in this section is to estimate the longer term response of asset markets to monetary policy shocks, which means that we have to deal with events that are potentially confounded by further monetary policy news that was released by the Fed within the event window. For this reason, we use a database of important monetary policy events also used in Cieslak and Schrimpf (2018) to screen for potentially confounding events that take place in the window from

h = +1 to h=+20 business days after a particular announcement. As a result, we remove 18 confounding events from the event list. These are 13 FOMC announcements that are followed by unscheduled announcements of unconventional monetary policy, one unscheduled FOMC rate decision that is shortly followed by a scheduled announcement, and four FOMC announcements that are followed by influential speeches given by Chairman Bernanke (e.g., Jackson Hole); see Table IA.6 in the Internet Appendix for details. This leaves us with 80 monetary policy decision events that allow us to estimate the longer term effects of our monetary policy shocks.[7]

>>> FIGURE 4 ABOUT HERE <<<

Starting with our FOMC risk shifts, we find that stock returns are highly sensitive to these shocks on FOMC days. Figure 4 summarizes the results. Reproducing our finding from above, a one unit standard deviation increase in the FOMC risk shift goes hand in hand with significantly higher daily equity excess returns of 0.69% (NW t-statistic of 5.31) on FOMC days (close-close, i.e., measured over 24 hours). However, as is also evident from Figure 4, the impact of the FOMC risk shift on stock prices is to a large extent transitory. After about one week, the initial increase in equity prices relative to bond prices begins to melt way and is substantially reversed after about four weeks.

Turning to the reaction of quantities (lower panel of Figure 4), we find that investors' portfolio reallocation decisions quite closely follow the price response discussed above (upper panel of Figure 4). More precisely, a positive one unit standard deviation FOMC risk shift leads to significant flows from bonds to equities of 0.49% (NW t-statistic of 3.56) on FOMC announcement days. In the following couple of days, the shift from bonds to equities continues and cumulates to about 1.00% after one week. After about two weeks, these reallocations are starting to reverse with investors pulling out from equities and back into bonds, mirroring the pattern for prices.

The effect of FOMC risk shifts is economically large. The annualized effect of a one-standard deviation shock raises equity returns by 5.5% p.a. (=0.69%×8). This is of the same order

[7] The 18 confounding events cluster around the financial crisis; 17 confounding events fall into the period 12/2007 - 08/2011.

of magnitude as historical estimates of the unconditional equity premium. The behavior of quantities is remarkably similar. Flows cumulate to about 1.0% after one week. Thus, a one-standard deviation FOMC risk shift corresponds to an annualized 8.0% reallocation from bonds to stocks.

We find that both yield-based factors have a significant and persistent impact on bond returns, as might be expected. We also find a one standard deviation increase in short rates to decrease equity prices by -0.38%, in line with the earlier literature (e.g., Swanson, 2017). However, in our sample period and measured at the daily frequency, these effects on stock prices are not statistically significant. Similarly, we find that an increase in short rates typically goes hand in hand with a short-term outflow from equities and inflow in bonds. These initial reallocations are economically sizeable (about -0.44% after one day, -0.75% after one week), and are also transitory at a four-week horizon.

Table 3 presents results for different horizons h. For the sake of completeness, the table also provides results separately for the corresponding equity and bond legs of the equity premium and FOMC risk shifts.

>>> TABLE 3 ABOUT HERE <<<

Taken together, these findings suggest a strong role for FOMC risk shifts to affect bonds and stocks. By contrast, we do not find such a prominent role for the two yield-based monetary policy shocks as drivers of equity returns around FOMC events (see Figure IA.2 in the Internet Appendix).

5.3. *Evidence from other asset classes*

Our fund dataset allows us to study the impact of FOMC risk shifts on a broader set of asset classes, as shown in Table 4. For the additional bond categories, the sample is shorter and starts in 2010. We find that FOMC risk shifts are accompanied by significantly higher returns in corporate bonds (+0.11%, t: 3.8), high yield bonds (+0.25%, t: 4.28), and emerging market bonds (+0.29%, t: 3.75) compared to U.S. government and investment grade bonds ("broad" market bonds). Similarly, emerging market equities outperform U.S. equities by 0.51% (t: 4.56).

Again, investor flows are largely the mirror image of the return patterns. They indicate significant outflows from the safe asset and inflows into its more risky counterpart at the weekly horizon. Interestingly, we find that the effects on high yield bonds are largely reversed after about 20 days. Overall, the results from other risk assets are broadly similar to the previous section that focuses on the U.S. equity premium.

>>> TABLE 4 ABOUT HERE <<<

5.4. *Evidence from macroeconomic news announcements*

Are FOMC announcements special? In the Internet Appendix (Figure IA.3), we show the response of equity prices and flows to risk shifts on days when important macroeconomic news (i.e. nonfarm payrolls, the producer price index, or the consumer survey report) are announced. To avoid events that overlap with FOMC announcements, we exclude observations 5 days prior and up to 10 days after FOMC announcement days (FOMC period) in this analysis.

On days with macroeconomic news announcements, we find that prices tend to react somewhat stronger in the short-term (+1.2%) but the overall effect on prices (after 20 trading days) has a large persistent component. The reaction of flows to macro news is also fairly weak, in stark contrast to their typical response to FOMC announcements.

Thus, macro news move prices permanently and do not impact flows very much. FOMC announcements have a considerable more transitory effect on prices and a stronger effect on flows. This finding suggests that macro news reveal news about cash flows (which cause a permanent change in prices), or long-horizon discount rate news (which are not reversed at the monthly horizon), whereas FOMC announcements lead to a largely transitory change in prices, most plausibly driven by changes in (short-term) discount rates (or risk premia).

5.5. *Does the financial crisis drive our results?*

Our finding of a transitory effect of FOMC risk shifts might be driven (at least in part) by special circumstances during the financial crisis, e.g., the announcement of unconventional monetary policy, or low liqudity/market depth. We do not find evidence of this empirically.

First, our baseline results already exclude events that might be confounded by additional announcement of monetary policy news within the event window. Second, in the Internet Appendix (Figure IA.4), we show results when the financial crisis period is removed form the event list, i.e., all FOMC announcements that fall into the period from 08/2007 - 12/2009 are excluded. Because most confounding events fall into this period anyways, we ignore other confounding events in this exercise. We find that the main conclusions from our baseline results are unchanged.

5.6. *Are events with a press conference different?*

The recent literature has shown that press conferences carry important information for investors (e.g., Boguth, Gregoire, and Martineau, 2016). Thus, it is interesting to ask whether results are different for FOMC announcements that are not followed by a press conference. To level the playing field between events with and events without a press conference, in this exercise, we extend the event window for events without a press conference to the closing price of the announcement day, i.e., the event windows are the same for both types of events.

In the Internet Appendix (Figure IA.5), we show that restricting the sample to the 53 FOMC announcements without a subsequent press conference leads to point estimates for return and flow responses similar to those for the baseline case. However, we find that long-horizon confidence intervals tend to be larger when press conferences are excluded.[8] On the other hand, restricting the sample to the 27 FOMC announcements with a subsequent press conference leads to tighter confidence intervals. Overall, our results do not seem to depend on the inclusion or

[8] Using the narrow -15m:+90m event window for events without a press conference leads also to similar point estimates but even wider confidence bands.

exclusion of press conferences even though including press conferences seem to be associated with more precise responses of returns and flows to risk shifts. The latter might be due to the fact press conferences reveal more precise information about the current and future stance of monetary policy to market participants (cf. Boguth, Gregoire, and Martineau, 2016).

6. What explains our results?

In this section, we shed light on *why* we observe such strong price movements around FOMC announcements as we have documented in the previous section. At the outset, there are two main possibilities, as also emphasized by Bernanke and Kuttner (2005). First, monetary policy may lead investors to change their expectations of future returns and/or future cash flows. Second, the large movement in stock prices could arise, at least in part, from price pressure driven by high demand for exposure to risky assets on behalf of some investors. In the following, we discuss the relative contributions of these two channels as potential drivers of the patterns we see in the data.

6.1. Discount rate news

Given the highly transitory nature of the price reaction on FOMC days (see Figure 4), it seems prima facie less likely that news about future cash flow are the drivers of FOMC risk shifts as such shifts in cash flow expectations should have more persistent effects and not be reversed so quickly. Moreover, traditional long-horizon return predictors (e.g., the dividend-price ratio Campbell and Shiller, 1988, or *cay* as considered in Lettau and Ludvigson, 2001) can be ruled out to bear a strong relation to the FOMC risk shift. These measures of expected returns are highly persistent and their effect on equity prices have half-lives of several quarters or even years.

Instead, recently proposed short-horizon equity premium predictors are prime candidates to test the idea that discount rate news might underlie FOMC risk shifts. Bollerslev, Tauchen, and

Zhou (2009) show that the difference between option implied volatility and expected realized variance predicts future returns at the monthly and quarterly horizon, but not at the annual horizon. Martin (2017) derives an option-implied lower bound on the equity premium for horizons from one month up to one year and shows that this proxy of the expected equity premium forecasts returns over the short run (also see Martin and Wagner, 2018).

We use the standard VAR procedure put forth by Campbell and Shiller (1988) to decompose daily market excess returns (S&P 500 index returns minus the short-term risk-free rate) into discount rate news and a residual. We consider three VAR model specifications to also provide evidence on the model specifications' stability. In the first specification, the only return predictor is the lower bound on the equity premium, i.e. the SVIX-based measure of the equity premium (Martin, 2017).[9] In the second specification, we include the variance risk premium (Bollerslev, Tauchen, and Zhou, 2009) as an *additional* predictor. The third VAR also adds the dividend-price ratio to the model specification. We refer to Appendix B for details on the implementation and the Internet Appendix (Table IA.3) for VAR estimates.

Finally, we also consider an (almost) model free specification by just looking at the change in Martin (2017)'s SVIX-based measure of the equity premium at the one year horizon. This is a conservative estimate because it is (1) a lower bound, and (2) it ignores changes in expectations from the one-year horizon onwards. However, this proxy cannot suffer from overfitting or sample selection issues, as the relationship with expected returns does not need to be estimated. The residual, or unexplained return component, is traditionally interpreted as cash-flow news. This interpretation stems from the accounting identity underlying the Campbell-Shiller decomposition and is natural when looking at low frequency data (quarterly, annual). However, as we are looking at daily data, the residual could also reflect short-term liquidity effects/price pressure.

>>> FIGURE 5 ABOUT HERE <<<

Figure 5 illustrates the response of asset prices to scheduled monetary policy events. The

[9] We only have SVIX data up to 08/2014, and therefore the analysis in this section is for a shorter sample period (69 FOMC announcements, 53 non-confounding).

black line shows the reaction of the total return (as before), and the colored lines represent the return component that can be attributed to changes in expected returns ($-1\times$ discount rate news). Thus, the difference between the black line and the colored line can be interpreted as the residual return component.

We find that short-term fluctuations in risk premia play a prominent role on FOMC days but we also find that stock returns move more than what can be justified by discount rate news alone. For example, we find that up to 50% of the initial return reaction can be explained by shifts in expected returns. The other 50% (the difference between the black line and the colored lines) are highly transitory and shrink towards a small number after about one week. This finding speaks against the idea that the residual captures cash-flow news, as one would expect such effects to be more persistent. However, this finding is well in line with the notion that price pressure effects amplify discount rate shocks on FOMC days.

6.2. Evidence on the potential sources of FOMC risk shifts

In this subsection, we dig deeper into the potential sources of discount rate changes associated with FOMC risk shifts. We have documented that FOMC risk shifts are highly correlated with innovations in the variance risk premium (in the following abbreviated as *VRP*, Bollerslev, Tauchen, and Zhou, 2009) and innovations in the SVIX-based measure of the equity premium (in the following abbreviated as *SVIX*, Martin, 2017). In our context, a natural candidate mechanism for affecting discount rates is an 'uncertainty channel' such that monetary policy announcements increases or decreases market participants' uncertainty. These changes in uncertainty would in turn be responsible for moving the *VRP* as well as the *SVIX* and show up in our measure of FOMC risk shifts.

Leading equilibrium asset pricing models (e.g., Campbell and Cochrane, 1999, Bansal and Yaron, 2004) do not generate (substantial) variation in the *VRP* and the option implied volatilities. This motivates Bollerslev, Tauchen, and Zhou (2009) to develop a model that combines Epstein-Zin preferences with an economy subject to time-varying uncertainty of uncertainty.

Their model can give rise to short horizon variation in expected returns that is mirrored in changes in the variance risk premium as well as changes in option implied volatility. This is qualitatively in line with our empirical results around FOMC meetings documented above. However, Martin (2017) shows, in a comprehensive comparison of alternative equilibrium asset pricing models, that none of the considered models can quantitatively match the properties of the *SVIX*.[10] In particular, the *SVIX* is more volatile and less persistent in the data relative to existing models. However, a high volatility and low persistence of discount rates are key to matching our findings as well. In short, existing equilibrium asset pricing models are unlikely to be able to explain the variation in key asset price moments on monetary policy announcement days. They all seem to understate, to a greater or lesser extent, the role of uncertainty shocks at the short horizon.

Textual analysis of market commentary. To examine whether changes in uncertainty might move discount rates around FOMC meetings, we turn to an analysis of market participants' own interpretation of monetary policy events. We collect market commentaries on the FOMC meeting from *Thomson Reuters Instant View*. *Thomson Reuters Instant View* collects and publishes views and commentary from market experts (e.g., traders, analysts, economists) on the outcome of the meeting shortly after an FOMC announcement (i.e., on the same day in the late afternoon). We always pick the complete *Thomson Reuters Instant View* column for each of our 96 scheduled FOMC announcements and do not select particular analysts or firms. We then run a simple textual analysis on these market commentaries and count the number of occurrences of specific words related to economic and financial conditions as well as words related to surprises and uncertainty. We then regress the size of our three monetary policy shocks (the absolute value of the shock) on the frequency of these words for the 96 scheduled FOMC meetings in our sample. Table 5 reports the results of these regressions.

>>> TABLE 5 ABOUT HERE <<<

[10]Models under study include Campbell and Cochrane, 1999, Bansal and Yaron, 2004, Bollerslev, Tauchen, and Zhou, 2009, Bansal, Kiku, and Yaron, 2012, Drechsler and Yaron, 2011, Wachter, 2013).

First, we count the frequency of phrases related to economic or financial conditions: inflation, employment, growth, confidence, uncertainty and risk, volatility, turmoil and crisis. Panel A of Table 5 shows that economic conditions (inflation, employment, growth) do not explain a large share of the size of FOMC risk shifts. In line with our discussion of a potential channel related to (resolution of) uncertainty above, the phrases "uncertainty and risk", "confidence", or "turmoil and crisis" are indeed closely related to FOMC risk shifts. We also find a connection of long rate shocks with uncertainty phrases, but not for short rate shocks.

The latter finding seems to make sense since long rates mostly move because of term premia - hence they will also respond to risk perceptions. Moreover, this result is in line with the idea that monetary policy factor shocks inferred from long rates are potential proxies for market confidence (Boyarchenko, Haddad, and Plosser, 2017), or forward guidance (Swanson, 2017). The main point in our results above is is that not all shifts in risk are revealed through movements in yields which seems to be in line with the finding that risk shifts move more in response to discussions about risk and uncertainty. In other words, our results imply that there is a component of monetary policy shocks related to uncertainty that moves risky asset prices, but not long rates.

Second, Panel B of Table 5, reports regression results for words related to surprises or the quality of information, i.e. words that start with shock*, surpris*, confus*, and vague*. We use these word stems to get a better sense of how important a channel based on (resolution of) uncertainty potentially is. Reassuringly, the frequency of words starting with surpris* (i.e., surprise, surprising, surprised etc.) is significantly related to all three monetary policy shocks, which suggests that our shocks are indeed related to new information hitting the market. The size of FOMC risk shifts are also significantly positively correlated with words that start with "shock*" and "confus*", indicating again that risk shifts might be related to changes in uncertainty.

Qualitative analysis of market commentary. Finally, we qualitatively examine the market comments on days with large absolute risk shifts, i.e., we read the news commentary around large risk shifts (up or down) and identify what market participants have to say about the outcome of the meeting and how the outcome stacks up against their expectations. We find that large *positive* risk shifts tend to be accompanied by market commentary saying that the Fed meets market expectations (a prime example is the announcement of QE3). By contrast, we find that market participants tend to disagree with the Fed and commentators question monetary policy decisions substantially more when we observe large *negative* risk shifts (a prime example is the taper tantrum). Hence, when the Fed deviates from the market's expectations (i.e., the Fed deviates from the market's perception of its reaction function), we tend to observe lower stock returns, a higher VIX, higher CDS spreads and a stronger dollar. By contrast, events where the policy outcome is in line with the market's expectation tend to be accompanied by higher stock prices and lower readings of the VIX, CDS spreads, and a weaker dollar.

6.3. Price pressure

We have shown above that there are quantitatively large flows from safe to risky assets around FOMC announcement days. In the following, we study the possible price pressures that may be associated with such reallocation shifts.

Big vs small ETFs. We label ETF flows as "fast money" because ETFs allow investors to obtain quick exposure to a particular asset class and because there is evidence that institutional investors make use of ETFs for (short-term) tactical asset allocation decisions (e.g., Ben-David, Franzoni, and Moussawi, 2013; Balchunas, 2016; Lettau and Madhavan, 2016, among others). Accordingly, we would expect that especially large investors prefer big and more liquid ETFs over small and less liquid ETFs.

To test the idea that "fast institutional money" is a driving force behind the FOMC risk shift, we sort all ETFs that invest in U.S. blend equity into two portfolios according to their total net assets. The first portfolio contains the 50% funds with the largest total net assets (BIG) and the second portfolio contains the 50% fund with the smallest total net assets (SMALL). We then form flow and return factors of "BIG" funds minus "SMALL" funds. Importantly, our big and small funds invest in the underlying stocks, their return correlation is 0.98. And, they have almost the same average returns (9.76% p.a. vs 9.61% p.a.). They only differ in their total net assets, i.e., the availability of fund shares on the market and their liquidity.

>>> FIGURE 6 ABOUT HERE <<<

Figure 6 shows that risk shift reallocations are predominantly driven by big funds whereas small funds do not show important inflows (lower panel). In line with a price pressure story, big funds outperform small funds on FOMC announcement days, i.e. big funds' share prices are pushed up more strongly. However, this effect is largely reversed over the following days (upper panel of Figure 6). We interpret the spike in the price of big funds on days with large FOMC risk shifts as a liquidity fee for providing timely exposure to the stock market.

The returns to liquidity provision. To shed further light on the price pressure hypothesis, we investigate returns to a short-term reversal (STR) strategy around FOMC events. An STR strategy buys the last day's loser stocks and finances this position by selling the last day's winner stocks. Nagel (2012) shows that STR returns proxy for the returns to liquidity provision in equity markets.

>>> FIGURE 7 ABOUT HERE <<<

On the one hand, large absolute risk shifts trigger large absolute flows which should consume liquidity and in turn should drive up the returns to liquidity provision. Hence, we would expect to see higher STR returns after large shocks (positive or negative). On the other hand, Nagel (2012) shows that the returns to liquidity are higher in times of high uncertainty (as measured by the VIX). Based on this reasoning, we would expect to see a positive correlation between risk shifts and subsequent returns to the short-term reversal strategy. Thus, we should observe higher STR returns after large risk shifts but more so for negative risk shifts (and when uncertainty increases).

Figure 7, shows results from separate event-time projections of short-term reversal returns on positive (green) and negative (red) FOMC risk shifts. In line with the price pressure hypothesis, we find that large short-term reversal returns follow negative risk shifts. There is also a positive relationship to positive risk shifts, but the link is clearly weaker. However, the large confidence bands indicate low significance levels, i.e., these relationships are rather imprecisely measured.

Overall, our findings suggest that institutional investors are particularly sensitive to monetary policy news and that they react with economically large reallocations between bonds and equities as well as other risky assets. These flows in turn lead to significant price pressure effects and higher returns to liquidity provision around FOMC meetings.

7. Further Results & Robustness

This section provides further results and robustness checks: We extend the sample period back to 1996, look at mutual funds versus ETFs, and present evidence that FOMC risk shifts are related to the FOMC cycle of Cieslak, Morse, and Vissing-Jorgensen (2018).

Extended sample (1996-2017): We extend the sample period back to 1996 by focusing on returns and flows of the SPDR S&P 500 ETF (ticker: SPY) from State Street Global Advisors. The SPY was the first ETF introduced in 1993 and is until today the largest U.S. equity ETF. We count almost no zero flows after 2006 for the SPY (less than 5%). However, around one half of the flow observations are zero in the earlier sample from 1996 to 2005, which indicates less frequent ETF trading in this sub-sample. There are no bond ETF funds available for the complete 1996 - 2005 sample period and for that reason we focus on equity markets only. Due to data availability, we recalculate our monetary policy factors for the sub-sample from 1996 to 2005 using the VIX as the only risky asset. Furthermore, we use daily data (close-close) for the complete sample period 1996 - 2017, because intraday data on risky assets are not available for the early period (1996 - 2005). This means that our monetary policy shocks used in this section might be potentially confounded by the pre-FOMC drift (Lucca and Moench, 2015). The results of the factor analysis are very similar to our baseline and can be found in the Internet Appendix (Table IA.2).

>>> FIGURE 8 ABOUT HERE <<<

Figure 8 provides the results for the full sample from 1996-2017 as well as the sub sample 1996-2005. Overall, the reaction of returns and flows is very similar to the results documented above for the more recent sample period. Prices revert back to a large extent within two weeks. However, we find less return mean-reversion at a horizon of 10+ days in the earlier sample period, which is not too surprising given the comparatively crude measurement of FOMC risk shifts in this sample period and the relatively large confidence bands at longer horizons. Finally, results based on the 2006-2017 sample show that FOMC risk shifts measured from the close-to-close are not substantially different compared to the baseline results computed from intraday data.

Mutual funds vs ETFs: It is interesting to contrast our results on FOMC risk shifts based on ETFs with those obtained when looking at mutual fund flows. We label mutual fund flows as "slow money" since they are typically subject to front-end fees and thus are not well suited for gaining short-term exposure to an asset class. Furthermore, retail clients account for a sizeable share of mutual fund volume, and retail investors are typically less responsive to news (Frazzini and Lamont, 2008). Based on this reasoning, we expect that mutual fund flows are not subject to (large) FOMC risk shifts.

As for the ETFs in the baseline results, we form equity minus bond fund portfolios and then compute the equity premium (prices) and risk shifts (flows). Figure IA.6 in the Internet Appendix provides the results. We find that mutual fund flows do not respond in a meaningful way to FOMC risk shifts. In fact, flows remain flat within the event window. However, mutual fund returns follow the overall market, as one might expect.

The FOMC Risk Shift Cycle. Cieslak, Morse, and Vissing-Jorgensen (2018) detect a cycle in equity returns following the FOMC meeting schedule: returns are high in even weeks in FOMC meeting time. In Figure IA.7 of the Internet Appendix, we replicate their analysis for

ETF fund returns and complement their results with ETF fund flows.[11] We find that even weeks are also weeks where investors shift on average from bond funds to equity funds and this pattern is mirrored in the average risk shift factor as well.

Cieslak, Morse, and Vissing-Jorgensen (2018) discuss potential mechanisms behind the FOMC cycle and argue that the FED reduces the amount of uncertainty via informal channels in even weeks. Our ETF fund flow results provide evidence that institutional investors are particulary sensitive to the FOMC cycle and seem to play a prominent role in this process. The fact that our FOMC risk shift factor also co-moves with returns and flows is in line with the idea that uncertainty and not news about rates drive the FOMC cycle.

Alternative Risk Shifts: To see whether one specific risky asset (the VIX, CDX, or DOL) in fact drives the risk shift factor, we drop one after another of three variables, re-run the factor analysis, and then re-estimate the effect of risk shifts on asset markets. Figure IA.8 of the Internet Appendix shows that the results are virtually unchanged to the baseline results (i.e., two of the risky asset prices span the information content of all three variables).

To see how our factor analysis to extract monetary policy shocks might affect the main results, we consider an alternative, more simple, risk shift measure in Figure IA.9 of the Internet Appendix. The alternative risk shift factor is the simple average of the three (standardized) risky asset price changes, orthogonalized with respect to the four yield changes using linear regressions. We find very similar results: large initial price and flow reactions that show a large transitory component.

Outlier Analysis: Figure IA.10 - IA.12 of the Internet Appendix show the effect of the three monetary policy shocks on returns and flows when we drop one single observation from the sample. We find that results on risk shifts are unaffected, as might be expected, given the tight confidence bands.

[11]For this analysis, we rely on the extended sample dataset from 1996-2017, as introduced in the subsection before.

Regarding the short rate and long rate shocks, our baseline point estimates are comparable to the recent literature (Swanson, 2017), however, our estimates come along with relative large standard errors. As documented elsewhere (e.g., Bernanke and Kuttner, 2005), we find that the yield based factors are more sensitive to specific observations/outlier. Indeed, dropping single observations (particularly during the financial crisis) points in some cases towards more significant effects. Our takeaway from this analysis is that the relationship between yields and stock returns is simply more difficult to measure (as indicated by relative wide confidence bands of the baseline results) and our sample does not allow us to identify this relationship more precisely. Thus, we argue that our paper does not add to (or challenge) our understanding of the relationship between yields and risky asset prices on FOMC days (which is the subject of a large previous literature). However, we show that the effects that go beyond the information spanned by yield changes, which we label FOMC risk shifts, account for a larger fraction of stock return variation and are for the for the same reason easier to pin down.

8. Conclusion

The goal of this paper is to better understand the strong stock market reaction to news about monetary policy. To shed light on the underlying drivers, we rely on factor-analysis and fund flows to sharpen the analysis of monetary policy shocks around FOMC meetings. A key finding is that a large share of the stock market's reaction to monetary policy news seems to be driven by changes in risk pricing.

The behavior of quantities matches that of prices in a remarkably consistent way. A pick-up in investors' risk appetite is associated with a significant shift from fixed income to equity ETF flows. Similar reallocations can be observed for emerging market bonds, emerging market equities, and corporate bonds. Our findings suggest that these FOMC risk shifts by largely institutional investors trigger significant price pressure effects. Consistent with this finding, we observe that the compensation for liquidity provision rises significantly in these episodes.

Closer inspection of the mechanism reveals that FOMC risk shifts are related to changes in proxies for expected returns. For example, we show that positive realizations of FOMC risk shifts are accompanied by a decline in discount rates implied by variance risk premia as well as changes in option-implied measures of the equity premium (SVIX). Moreover, textual analysis of market commentary after FOMC meetings suggests that FOMC risk shifts relate to changes in uncertainty and risk.

Our results provide a new perspective on monetary policy's role in affecting the prices of equities and bonds. We detect a direct and distinct impact of monetary policy on investors' risk perception that operates independently from the effects of changes in interest rates. Our analysis of flows provides evidence that investors react heterogeneously to changes of uncertainty induced by FOMC meetings. A deeper theoretical analysis of these channels constitutes an interesting avenue for future research.

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Appendix

A. Details on fund data and variables construction

As discussed above, we collect daily ETF (and mutual fund) data from Trimtabs.[12] The dataset covers (almost) all ETFs traded in the U.S., about 2 trillion USD total net assets at the end of 2015 (and about 1.6 trillion USD in total net assets for mutual funds). From 2010 onwards, the database covers all ETFs. Before 2010, a few ETFs seem to be missing (in particular newly introduced ETFs). With respect to mutual funds, Trimtabs conduct their own survey to obtain fund flows and returns for approximately 15% of the market.[13]

We aggregate individual funds to asset classes. Our measure for U.S. equity is based on all funds that belonging to Morningstar's category "Blend".[14] Our measure for U.S. bonds is based on all funds that belong to the Morningstar categories U.S. "government", or investment grade "bond".[15]

Fund flows at the asset class level are measured as:

$$F_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}\left(1 + R_{i,t}\right)}{TNA_{i,t-1}},$$

where $TNA_{i,t}$ are total net assets of asset class i (equity or bond) at time t, and $R_{i,t}$ is the fund return of asset class i. Because fund flows do not have an economically meaningful long-run mean or standard deviation, we follow the recent literature (e.g., Berk and van Binsbergen, 2016, Menkhoff, Sarno, Schmeling, and Schrimpf, 2016) and use a normalization. In particular, we normalize flows by their moving average and standard deviation:

$$\tilde{F}_{i,t} = \frac{F_{i,t} - \mu_{i,t}\left(F_{i,t-250;t-1}\right)}{\sigma_{i,t}\left(F_{i,t-250;t-1}\right)},$$

[12] http://trimtabs.com/data/fund-flows.html.

[13] The Investment Company Institute estimates the mutual fund market - all equity and bond funds - to about 12 trillion USD at the end of 2015, see http://www.ici.org/research/stats/trends.

[14] Morningstar categorizes all U.S. funds into nine categorizes along the dimension value, blend, growth, and large, mid, small. We aggregate the categories blend-large, blend-mid, and blend-small to blend.

[15] The Morningstar categories we rely on are given as follows: short government, intermediate government, long government, short-term bond, intermediate-term bond, and long-term bond. The latter three categories invest only in investment-grade bonds and target the "broad" market.

where $\mu_{i,t}(F_{i,t-250;t-1})$ and $\sigma_{i,t}(F_{i,t-250;t-1})$ are computed over lagged 250-day rolling days. If there is a zero flow, we ignore this observation when computing the rolling mean or standard deviation and we also do not adjust any zero flow observation in the sample. Following Staer (2016), we move reported flows one day forward to account for the lag between fund share creation and reporting.[16] More importantly, to take delayed reporting into account, we allow flows to respond with lags in our empirical analysis.

Equity ETF data start in 1993, and bond ETF data start in 2002. However, the total ETF assets under management are low in the earlier years and the time-series are notoriously plagued with zero flow observations, indicating low activity. To have some numbers, total assets under management in ETFs are 1.7 billion in 1997 (the first year they cross 1 billion), about 250 billion in 2006, and more than 2,000 billion in 2015. Figure IA.1 provides an overview of total net assets of ETFs over time, as well as % of daily zero flow observations. The cut-off year 2006 for our baseline results ensures that we almost always observe non-zero flows for "Blend" equity and "Broad" bond funds.

B. Details on the return decomposition

Campbell and Shiller (1988) show that unexpected realized returns are equal to revisions in future expected dividends minus revisions in future expected returns:

$$r_{t+1} - E_t[r_{t+1}] = \eta_{d,t+1} - \eta_{r,t+1},$$

where $\eta_{d,t+1} = E_{t+1}\left[\sum_{j=0}^{\infty}\rho^j d_{t+1+j}\right] - E_t\left[\sum_{j=0}^{\infty}\rho^j d_{t+1+j}\right]$ summarizes "cash-flow news", and $\eta_{r,t+1} = E_{t+1}\left[\sum_{j=1}^{\infty}\rho^j r_{t+1+j}\right] - E_t\left[\sum_{j=1}^{\infty}\rho^j r_{t+1+j}\right]$ summarizes "discount rate news".

To decompose stock returns, we follow a large literature (including Campbell and Shiller, 1988) and use a VAR of the form $\boldsymbol{z}_{t+1} = \boldsymbol{A}\boldsymbol{z}_t + \boldsymbol{\varepsilon}_{t+1}$, with $\boldsymbol{z}_t = [Ret_t - Rf_t,\ \boldsymbol{x}_t]'$. The first element of $\boldsymbol{z}_t$

[16]ETF flows are triggered when authorized participants buy the stocks underlying the ETF portfolio and exchange these with the fund against new ETF shares. However, the clearing takes place after markets close and before they re-open. New shares then typically show up the next day (or even later) in the funds balance sheet, when the trade was approved by the counterparties. Thus, moving reported ETF flows one day forward better matches with when the underlying stocks were actually bought, or sold, in the market. For further details about the creation and redemption process, see the excellent reviews by Ben-David, Franzoni, and Moussawi (2016) and Lettau and Madhavan (2016), or for even more details on the timing, "Understanding Exchange-Traded Funds: How ETFs Work", by the Investment Company Institute available at https://www.ici.org.

is the excess return of the S&P 500 index ($Ret_t - Rf_t$) and the following elements contain the up to three return predictors ($\boldsymbol{x}_t$). The VAR coefficient estimates for the model with three predictors can be inspected in Table IA.3.

Defining a vector where the first element is one and all other elements are zero (e.g., $\mathbf{e1}' = [1, 0, 0, 0]'$) we can measure discount rate news as:

$$\eta_{r,t+1} = \mathbf{e1}' \sum_{j=1}^{\infty} \rho^j \boldsymbol{A}^j \boldsymbol{\varepsilon}_{t+1} = \mathbf{e1}' \rho \boldsymbol{A} \left(I - \rho \boldsymbol{A}\right)^{-1} \boldsymbol{\varepsilon}_{t+1}.$$

According to the VAR, the unexpected excess return is equal to $(Ret_{t+1} - Rf_{t+1}) - E_t\left[Ret_{t+1} - Rf_{t+1}\right] = \mathbf{e1}'\boldsymbol{\varepsilon}_{t+1}$. Because unexpected excess returns are the difference between revisions in expected future dividends ($\eta_{d,t+1}$) and discount rate news ($\eta_{r,t+1}$), it is possible to back out cash-flow news as $\eta_{d,t+1} = \mathbf{e1}'\boldsymbol{\varepsilon}_{t+1} + \eta_{r,t+1}$. This definition assumes that the predictor variables in the VAR indeed capture all available information about future returns, i.e. any missing information will go into the residual.

The return component that can be attributed to discount rate news is $-\eta_{r,t+1}$, and hence we run the linear projections:

$$-\eta_{r,t+1} = a + b_h \times MP\ Shock_{j,t} \times D_{FOMC,t} + \xi_{t+h},$$

and plot these in Figure 5. We compare results to linear projections of $Ret_{t+1} - Rf_{t+1}$. Thus, the difference between the two projections show (approximately) how the residual return component reacts to monetary policy shocks.

Tables and Figures

Table 1: Monetary Policy Shocks

We collect the following seven variables around scheduled (96 events) and unscheduled (2) FOMC announcements from 01/2006 to 12/2017: simple changes of three month interest rates as proxied by Eurodollar futures (ED), simple changes of the two, five, and ten year treasury yields as proxied by treasury futures (TU, FV, TY, provided by Thomson Reuters Tick History, TR), the log change of the squared CBOE Volatility Index (VIX^2, provided by Tickdata), log changes of the Credit Default Spread Index of investment grade corporate bonds with a maturity of five years (CDX, provided by CMA Datavision), the log change of an equally weighted portfolio of foreign exchange futures (DOL, denomination is in FCUs for one USD; the FCs are: AUD, CAD, CHF, EUR, GBP, JPY, NZD, provided by TR). We normalize all seven variables by their event standard deviation. The event window is -15m:+90m if the announcement is not followed by a press conference (70) and -15m:close if the announcement is followed by a press conference (28). In a first step, we run a principal component analysis on FOMC announcement days (98 observations) to extract statistical factors (results below "PCA on FOMC Days"). Following Swanson (2017), in a second step, we apply a standard (orthogonal) factor rotation on the first three principal components to extract economic monetary policy shocks (results below "Orthogonal Rotation"); * indicate our target matrix. The obtained shocks are labeled: "Short Rate", as these shocks load on short maturity yields; "Long Rate", as these shocks load on long maturity yields; and "Risk Shift", as these shocks load negatively on risky assets (VIX^2, CDX, DOL).

	Monetary Policy Shocks					
	PCA on FOMC Days (#98)			**Orthogonal Rotation**		
	(1)	**(2)**	**(3)**	**"Short Rate"**	**"Long Rate"**	**"Risk Shift"**
$\triangle ED(3M)$	0.32	-0.15	-0.85	0.92*	0.00	0.00
$\triangle TU(2Y)$	0.45	-0.24	-0.12	0.30	0.42	0.09
$\triangle FV(5Y)$	0.49	-0.11	0.26	-0.05	0.56	-0.02
$\triangle TY(10Y)$	0.46	-0.12	0.35	-0.15	0.58*	0.00
$\triangle log(VIX^2)$	0.13	0.64	-0.24	0.16	-0.13	-0.66*
$\triangle log(CDX)$	0.13	0.66	0.06	-0.12	-0.02	-0.67*
$\triangle log(DOL)$	0.45	0.21	0.13	0.01	0.40	-0.33
Var. expl., %	53.49	25.88	10.65			

Table 2: Conditional FOMC Returns

This table reports conditional returns of the S&P 500 index around an event window of -15m:+90m (without press conference), or -15m:close (with press conference) for 98 FOMC announcements from 01/2006 to 12/2017. The upper panel shows results from regressions of returns on monetary policy shocks on FOMC days. The lower panel shows average returns conditional on observing a positive or a negative monetary policy shock. HC robust GMM t-statistics / standard errors are reported.

	Intraday Event Window Around FOMC Announcements		
	Short Rate	**Long Rate**	**Risk Shift**
	$R_{t\|FOMC} = a + b \times MP\ Shock_{t\|FOMC} + \xi_{t\|FOMC}$		
a	0.13	0.16	-0.01
$t(a)$	1.46	1.85	-0.31
b	-0.17	-0.13	0.76
$t(b)$	-0.89	-0.91	15.50
R^2	3.63	2.23	74.54
	Conditional Average Returns		
$mu_{MP\ Shock \geq 0}$	0.14	0.13	0.62
$s.e.(mu_{MP\ Shock \geq 0})$	0.17	0.11	0.08
$mu_{MP\ Shock < 0}$	0.18	0.20	-0.62
$s.e.(mu_{MP\ Shock < 0})$	0.10	0.14	0.10

Table 3: Permanent and Transitory Components of Monetary Policy Shocks

This table reports the effect of a unit standard deviation monetary policy shock on daily fund returns (close-close) and daily fund flows on FOMC announcement days ($h = 0$), the cumulated impact over the next 5 business days ($h = 5$), and the next 20 business days ($h = 20$). Results are obtained from linear projections of the form:

$$X_{t+h} = a_h + b_h \times Monetary\ Policy\ Shock_{j,t} \times D_{FOMC,t} + \xi_{t+h},$$

where X_{t+h} is the fund return, or flow, at time $t + h$, $Monetary\ Policy\ Shock_{j,t}$ is one of the three orthogonal monetary policy shocks measured intraday around FOMC announcements (see Table 1 for details), and $D_{FOMC,t}$ is a dummy variable which is one on FOMC announcement days. T-statistics are HAC robust (Newey-West, 20 lags); inference on cumulated effects is based on the full b coefficient covariance matrix. If another monetary policy announcement falls into the event window (-1d:+20d), we remove this event from the sample (18 cases, as listed in the Internet Appendix). The sample period is from 2006 to 2017 with 80 non-confounding FOMC announcements.

	Returns, %			**Flows, %**		
	"Equity Premium" Equity-Bond	**Equity**	**Bond**	**"Risk Shift" Equity-Bond**	**Equity**	**Bond**
			Short Rate Shocks on FOMC Days			
b_0	-0.38	-0.36	0.03	-0.44	-0.48	0.05
$\sum_{h=0}^{5} b_h$	-0.25	-0.21	0.04	-0.78	-0.62	0.78
$\sum_{h=0}^{20} b_h$	-0.30	-0.38	-0.08	0.08	0.02	-0.04
t_0	-1.29	-1.20	0.72	-1.62	-1.65	0.35
$t_{\sum 5}$	-0.57	-0.53	0.59	-2.41	-1.78	1.91
$t_{\sum 20}$	-0.53	-0.80	-0.66	0.14	0.03	-0.06
			Long Rate Shocks on FOMC Days			
b_0	0.21	-0.01	-0.22	-0.22	-0.16	0.20
$\sum_{h=0}^{5} b_h$	0.76	0.39	-0.36	0.55	0.65	-0.25
$\sum_{h=0}^{20} b_h$	0.00	-0.27	-0.27	0.42	0.94	0.31
t_0	1.17	-0.07	-10.59	-1.23	-0.97	1.07
$t_{\sum 5}$	2.32	1.29	-6.37	1.53	1.77	-0.67
$t_{\sum 20}$	-0.01	-0.67	-2.37	0.57	1.46	0.35
			Risk Shifts on FOMC Days			
b_0	0.69	0.78	0.08	0.49	0.56	-0.08
$\sum_{h=0}^{5} b_h$	0.52	0.61	0.09	1.00	0.70	-0.99
$\sum_{h=0}^{20} b_h$	-0.14	0.01	0.15	0.58	-0.35	-1.92
t_0	5.31	6.97	2.62	3.56	4.00	-0.69
$t_{\sum 5}$	2.22	2.87	1.29	3.26	2.25	-3.25
$t_{\sum 20}$	-0.40	0.03	1.88	1.16	-0.75	-3.14

Table 4: Other Risky Asset Classes and Risk Shifts

This table reports for an extended set of risky asset classes the effect of a unit standard deviation risk shift on daily fund returns (close-close) and daily fund flows on FOMC announcement days ($h = 0$), the cumulated impact over the next 5 business days ($h = 5$), and the next business 20 days ($h = 20$). Estimation and inference is as described in Table 3. The risky asset classes are proxied by long-short strategies based on Morningstar categories: "Corp.-Broad" is corporate minus all broad and U.S. government bond funds, "HY-Broad" is high yield minus all broad and U.S. government funds, "EM-US Bonds" is emerging market bond minus all broad and U.S. government bond funds, and "EM-US Equities" is emerging market equity minus minus all U.S. blend equity funds. The max. sample period is from 2006 to 2017 (EM-US Equities) and is shorter for the bond categories. #FOMC reports the number of non-confounding FOMC announcement days available.

	Other Risky Asset Classes & Risk Shifts			
	Bonds			**Equities**
	Corp.-Broad	**HY-Broad**	**EM-US**	**EM-US**
#FOMC	**57**	**57**	**54**	**80**
	Returns, %			
b_0	0.11	0.25	0.29	0.51
$\sum_{h=0}^{5} b_h$	0.18	0.20	0.45	0.17
$\sum_{h=0}^{20} b_h$	0.15	-0.14	0.13	0.66
t_0	3.80	4.28	3.75	4.56
$t_{\sum 5}$	2.95	1.75	3.14	0.63
$t_{\sum 20}$	1.65	-0.76	0.55	1.20
	Flows, %			
b_0	0.23	0.38	0.51	0.22
$\sum_{h=0}^{5} b_h$	1.14	1.61	2.06	0.97
$\sum_{h=0}^{20} b_h$	1.20	0.46	4.82	1.44
t_0	1.16	2.02	2.50	1.12
$t_{\sum 5}$	2.13	3.97	3.17	1.86
$t_{\sum 20}$	0.94	0.28	3.74	1.10

Table 5: Textual Analysis of Market Commentary

We collect market commentary on scheduled FOMC announcement days from *Thomson Reuters Instant View.* We then count the frequency, $F_{i|\text{FOMC}}$, of words that relates to economic and financial conditions (Panel A) or the surprise content of the news (Panel B), and run the following univariate regressions: $|Z_{t|FOMC}| = a + bF_{i,\text{ t|FOMC}} + e_{t|FOMC}$, where$|Z_{t|FOMC}|$ is the absolute value of one of our three monetary policy shocks (short rate, long rate, and risk shift). The sample period is from 2006 to 2017; 96 scheduled FOMC announcements.

Panel A: Words Related to Economic and Financial Conditions

	Short Rate		**Long Rate**		**Risk Shift**	
	b	R^2	b	R^2	b	R^2
inflation	0.03	0.16	0.04	0.25	0.07	0.83
t	[0.49]		[0.50]		[1.10]	
employment	-0.02	0.07	0.07	0.92	0.09	1.41
t	[-0.23]		[0.72]		[1.41]	
growth	0.05	0.41	0.09	1.61	0.09	1.52
t	[1.05]		[1.10]		[2.23]	
confidence	0.07	0.81	0.27	13.98	0.20	7.72
t	[1.11]		[3.53]		[2.30]	
uncertainty and risk	0.11	2.20	0.21	8.32	0.20	7.74
t	[1.69]		[4.71]		[2.73]	
volatility	0.03	0.12	0.14	3.57	0.10	1.89
t	[0.41]		[2.24]		[2.19]	
turmoil and crisis	0.07	0.88	0.07	1.05	0.12	2.54
t	[1.24]		[0.85]		[4.68]	

Panel B: Words Related to Surprises

	Short Rate		**Long Rate**		**Risk Shift**	
	b	R^2	b	R^2	b	R^2
shock*	0.06	0.68	0.11	2.29	0.13	3.29
t	[1.21]		[1.31]		[3.74]	
surpris*	0.14	3.70	0.20	7.49	0.15	4.44
t	[2.10]		[3.11]		[3.52]	
confus*	0.03	0.13	0.11	2.42	0.10	1.82
t	[0.51]		[1.98]		[4.02]	
vague*	0.03	0.20	0.03	0.19	0.06	0.71
t	[0.73]		[0.36]		[0.98]	

Figure 1: Short Rate Shocks on FOMC Announcement Days

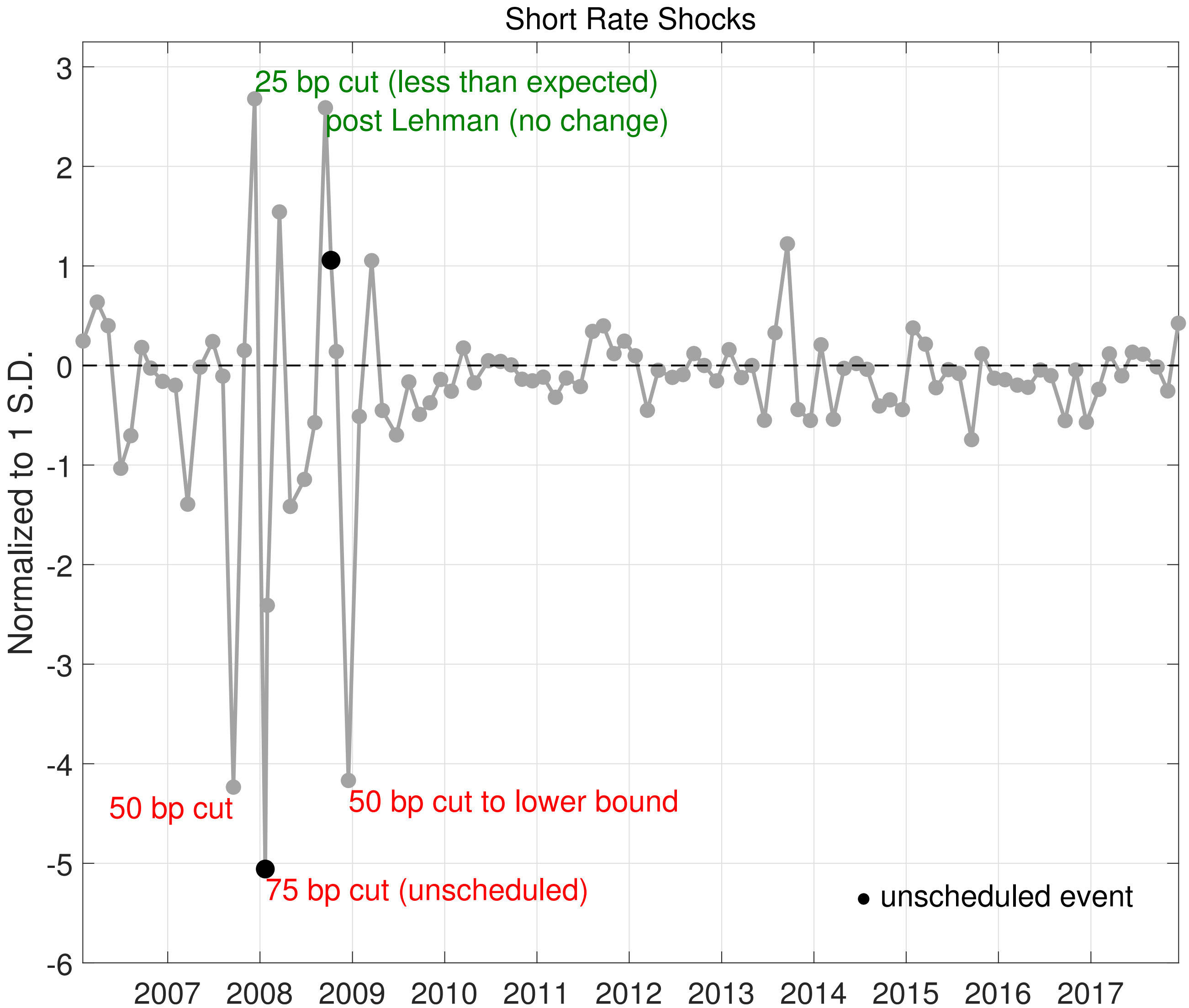


Figure 2: Long Rate Shocks on FOMC Announcement Days

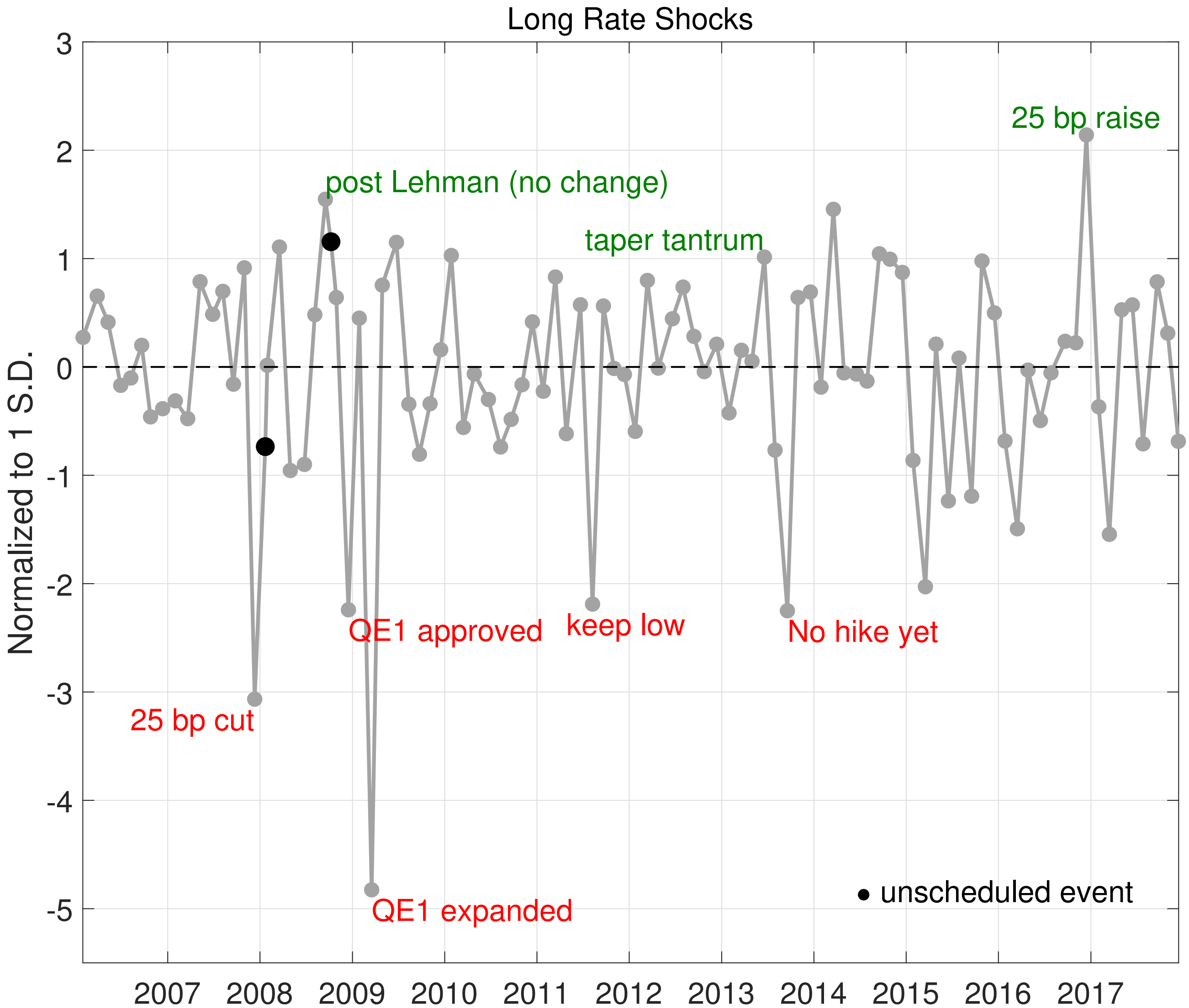


Figure 3: Risk Shifts on FOMC Announcement Days

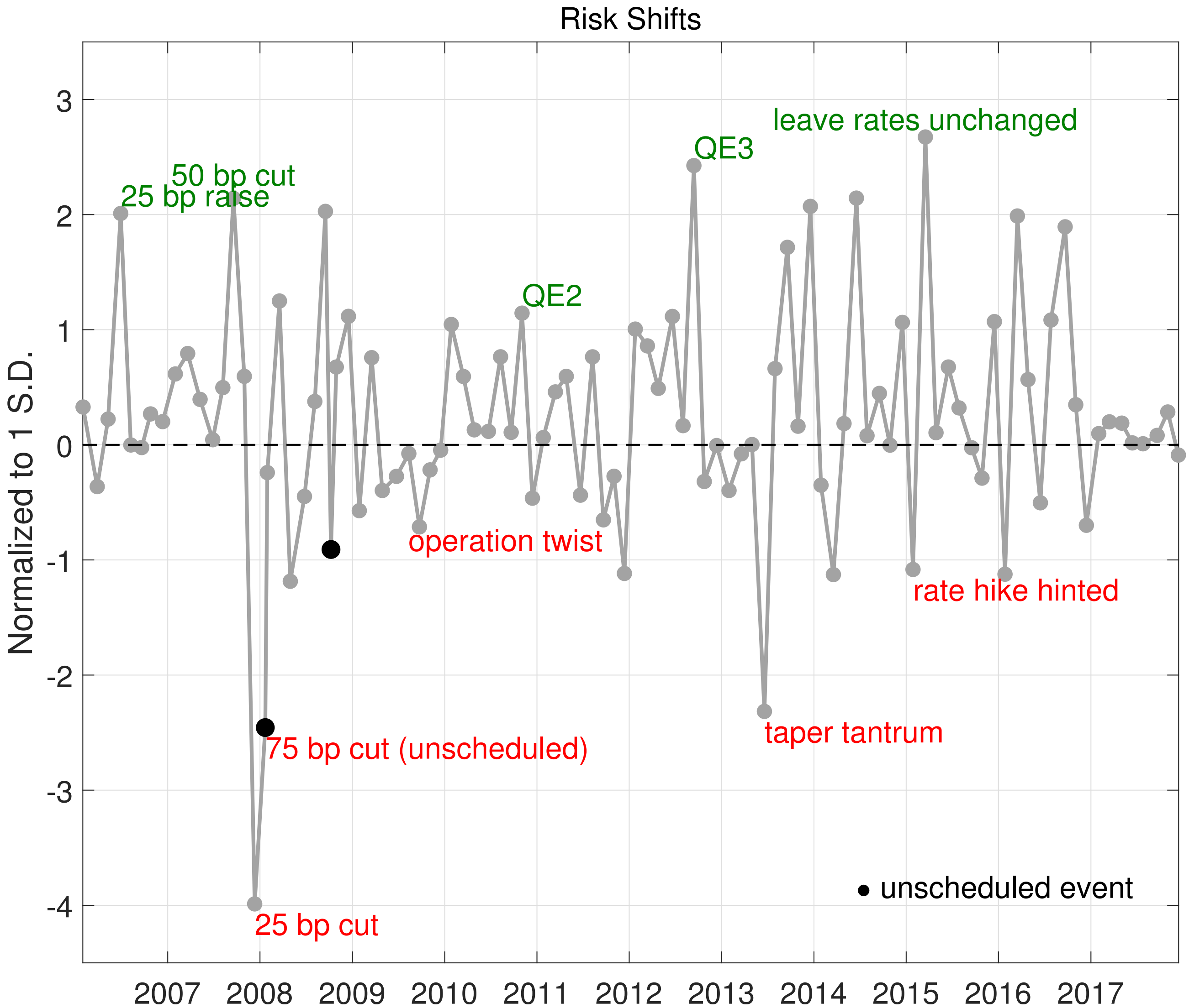
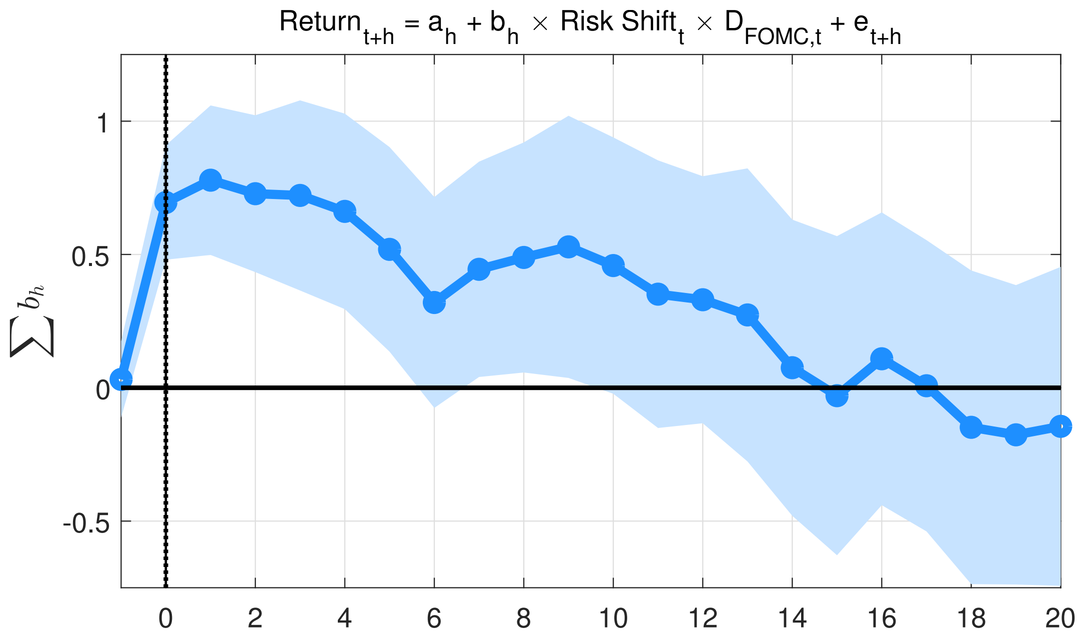


Figure 4: The FOMC Risk Shift

This figure shows the effect of a unit standard deviation risk shift on the returns (equity ETF minus bond ETF returns, top) and flows (equity ETF minus bond ETF flows, bottom) on FOMC announcement days (h=0) and the cumulative response in the event window -1 to +20 days. Estimation is based on the linear projections as described in Table 3. The shaded area represents HAC robust 90% confidence intervals. Returns and flows are measured daily (close-to-close); the sample period is from 2006 to 2017; 3019 observations with 80 non-confounding FOMC announcements.



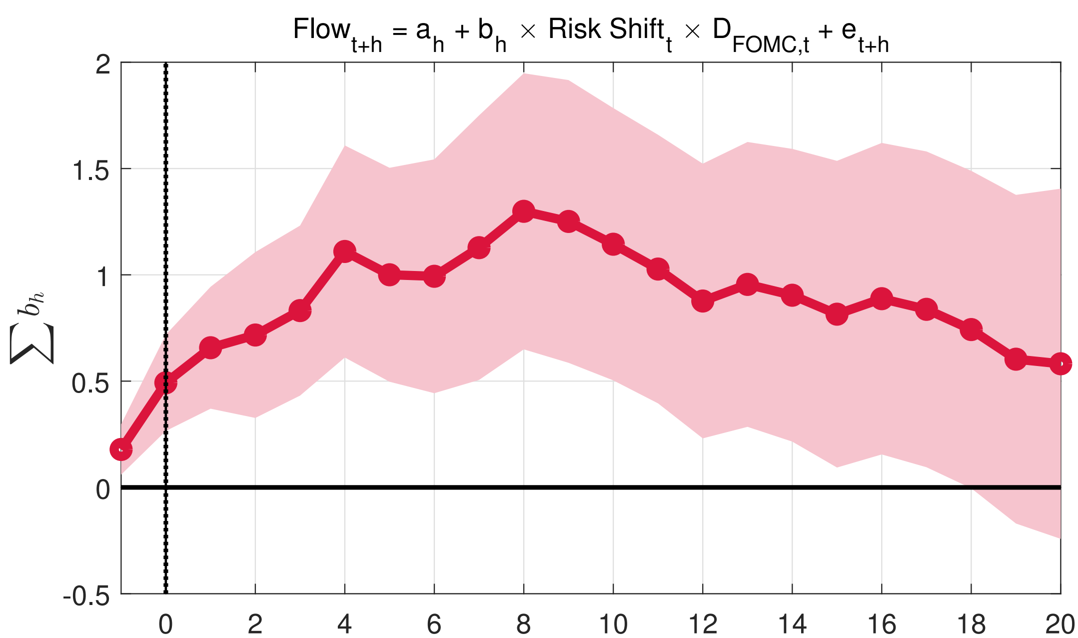


Figure 5: The FOMC Risk Shift: The Role of Discount Rate News

The black line plots the (cumulative) response of daily S&P 500 returns in excess of the (short-term) risk free rate to a unit standard deviation risk shift on FOMC announcement days (h=0) in the event window -1 to +20 days. Colored lines correspond to the return component that can be attributed to "discount rate news". We use three standard VAR models to decompose daily returns into "discount rate news" and the residual (=distance from colored lines to the black line). In the first VAR (red), the only return predictor is the option implied lower bound on the equity premium for the one month horizon ("SVIX"-based expected return, as in Martin, 2017), the second VAR (magenta) adds the variance risk premium ("VRP", as in Bollerslev, Tauchen, and Zhou, 2009) as a predictor, and the third VAR (blue) adds the dividend-price ratio ("DP") to the model. VAR parameter estimates are reported in the Internet Appendix. The final proxy (green) is purely data driven and shows results for simple changes of SVIX-based expected returns for a horizon of one year (as in Martin, 2017). Returns and flows are measured daily (close-to-close); the sample period is from 2006 to 08/2014; 2180 observations with 53 non-confounding FOMC announcements.

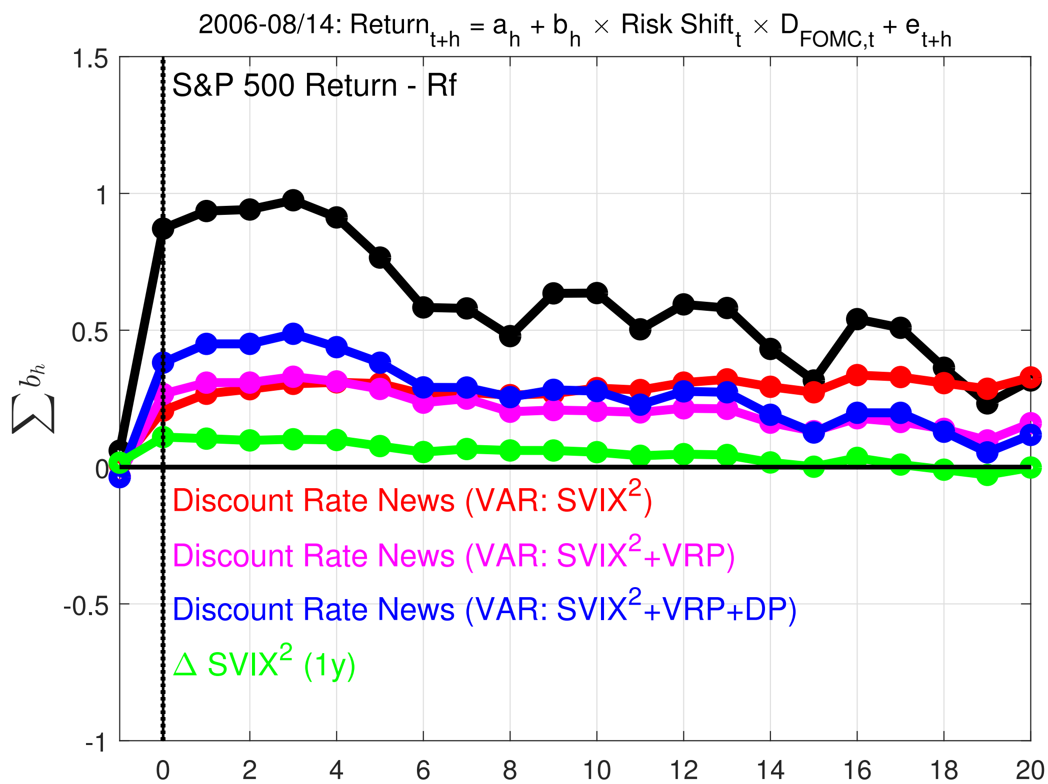


Figure 6: The Role of ETF Liquidity: Big minus Small Funds

In contrast to Figure 4, results are provided for returns and flows of BIG ETF funds minus SMALL ETF funds. ETF funds that invest in Blend U.S. stocks are sorted by their total assets under management and then grouped into large funds ("BIG", top 50%) or small funds ("SMALL", bottom 50%). Estimates are scaled such that they show the effect of a one standard deviation risk shift on FOMC announcement days. The shaded area represents HAC robust 90% confidence intervals. BIG and SMALL ETFs invest in the same stocks; BIG (SMALL) funds have an annualized average return 9.76% (9.61%); the correlation coefficient for the returns is 0.98. Returns and flows are measured daily (close-to-close); the sample period is from 2006 to 2017; 3019 observations with 80 non-confounding FOMC announcements.

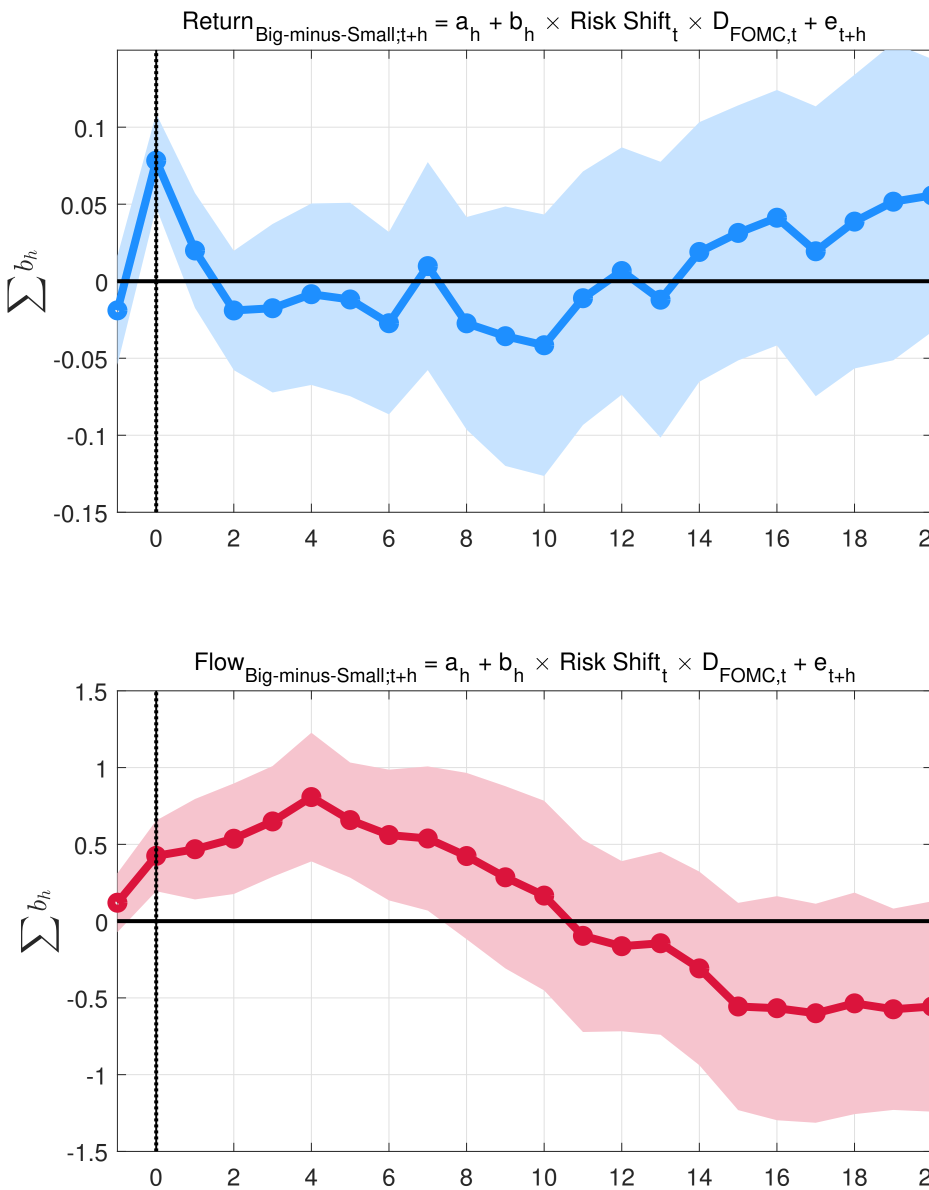


Figure 7: The Short-Term Reversal Strategy and Risk Shifts

This figure plots linear projections (Σb) of short-term reversal strategy returns (available from Kenneth R. French's website) on positive FOMC risk shifts (green) and negative FOMC risk shifts (red). CRSP stocks are sorted daily into 2×3 portfolios based on firm size and the prior day return. The short-term reversal strategy is the portfolio that goes long in the two loser portfolios and short in the two winner portfolios. The dotted lines correspond to HAC robust 90% confidence intervals. Returns are measured daily (close-to-close); the sample period is from 2006 to 2017; 3019 observations with 80 non-confounding FOMC announcements.

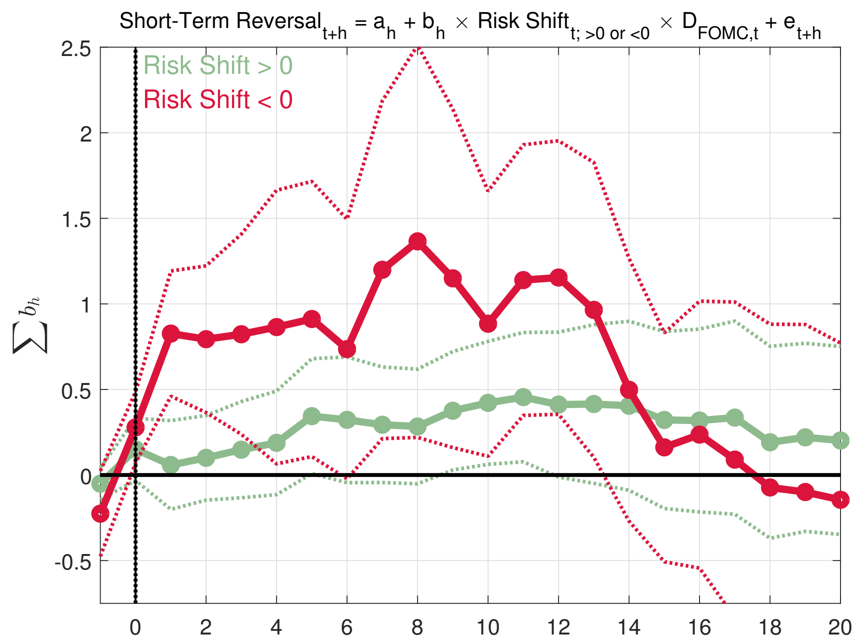
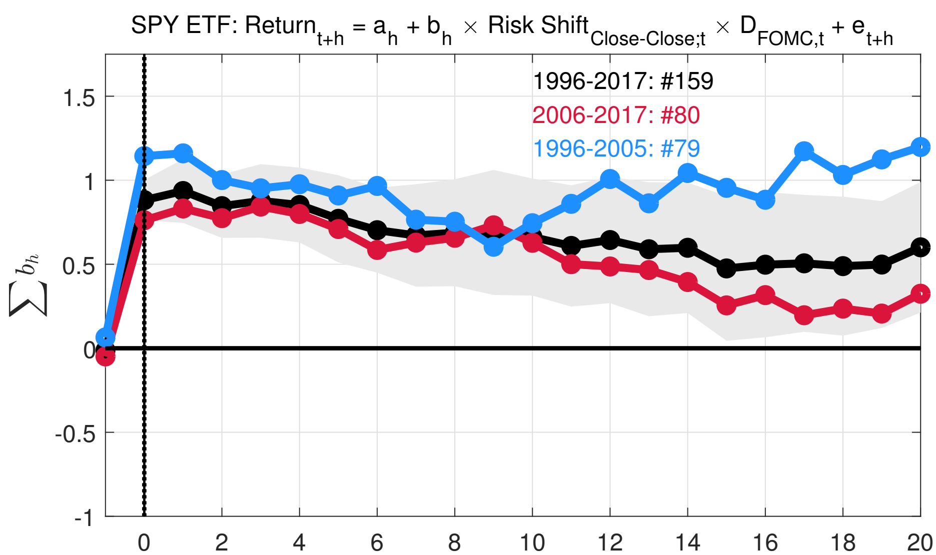
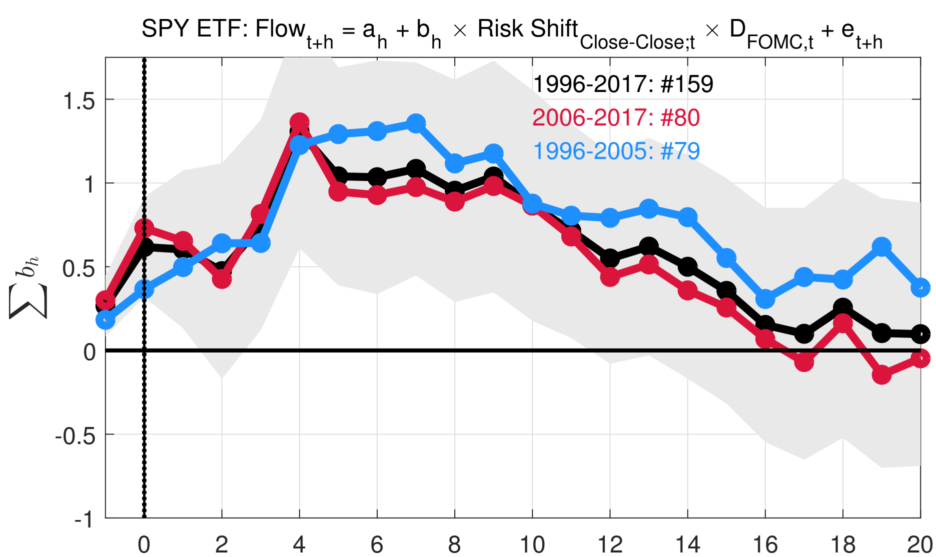


Figure 8: The SPDR S&P 500 ETF and Risk Shifts on FOMC Days from 1996-2017

In contrast to Figure 4, returns and flows are measured by the the SPDR S&P 500 ETF (ticker: SPY) from State Street Global Advisor's. No bond returns or flows are subtracted. Estimates are scaled such that they show the effect of a unit standard deviation risk shift on FOMC announcement days. The SPY was the first ETF introduced in 1993 and is until today the largest U.S. equity ETF. Results are shown for an early sub sample (blue, 1996-2005), the baseline sample (red, 2006-2017), and the full sample (black, 1996-2017). In the early sample (2517 total obs.), we count 1464 zero flows for the SPY. Accordingly, no fund share creations, or redemptions, were triggered for more than one half of the observations in the early sample period. For the period 2006-2017 (3019 obs.), we count 62 zero flows, and almost always share creations, or redemptions, were triggered. Returns and flows are measured daily (close-to-close); the full sample period from 1996 to 2017 has a total of 5536 observations with 159 non-confounding FOMC announcements.





Internet Appendix for

The FOMC Risk Shift

(not for publication)

Descriptive statistics - returns and flows Table IA.1 reports descriptive statistics for equity and bond fund returns, as well as flows. Remarkable is the modest degree of equity (bond) fund flow persistence, as indicated by variance ratios close to one (well below 2) at the 20-day horizon. Low persistence indicates that ETF flows, particularly in the case of equities, quickly respond to new information.

Further results on monetary policy shocks: Table IA.2 shows results for a factor analysis extended to the sample period 1996-2017. For this extended sample period, the variables CDX, and DOL are not available to us. For that reason, the VIX is the only market-based risk proxy in the long sample. Otherwise, the factor analysis for the extended sample period leads to very similar result as in the main paper. In Table IA.5, we provide results for regressions of the (daily) Fama and French (2015)-factors on our three monetary policy shocks on FOMC announcement days. For the Fama-French market factor, we find virtually the same results as for our fund data-based measure of the equity premium. However, we do not find interesting results for equity factor returns, like *size* and *value*.[17] In unreported results, we also do not find significant flows from funds that invest in big stocks vs funds that invest in small stocks or from growth to value funds, which is in line with the evidence from prices.

[17] Interestingly, Neuhierl and Weber (2017) also do not find a differential drift around FOMC announcements for equity style premia.

Internet Appendix: Tables

Table IA.1: Descriptive Statistics: Daily Fund Returns and Flows

This table reports descriptive statistics for daily ETF fund returns and ETF fund flows. "Equity" are funds from all U.S. Blend Equity categories according to the Morningstar fund classification. "Bond" are all funds from the U.S. Broad Bond and U.S. Government Bond categories according to the Morningstar fund classification. "Equity Premium" are equity minus bond returns and, analogously, "Risk Shifts" are the equity minus bond flows. The reported statistics are the mean (*mu*, % p.d.) and standard deviation (*s.d.*, % p.d.), the variance ratio (vr_h) computed for horizons from $h = 2$ up to $h = 20$ days, the number of zero observations (#*zeros*), and the number of total observations (#*obs*). The lower panel reports conditional moments for the 98 scheduled and unscheduled FOMC announcements in our sample period from 01/02/2006 to 12/30/2017. Flows are de-meaned and normalized by the lagged 250-day moving average and moving standard deviation (zero flow observations are left untouched). The fund data are obtained from Trimtabs.

	Returns, %			**Flows, %**		
	"Equity Premium" Equity-Bond	**Equity**	**Bond**	**"Risk Shift" Equity-Bond**	**Equity**	**Bond**
	All Observations					
mu	0.03	0.04	0.01	0.00	0.00	-0.01
s.d.	1.33	1.25	0.22	0.95	0.95	0.94
vr_2	0.92	0.93	0.96	1.11	1.11	1.07
vr_5	0.80	0.82	0.88	1.24	1.16	1.36
vr_{10}	0.70	0.73	0.81	1.25	1.03	1.64
vr_{20}	0.66	0.69	0.87	1.33	0.92	2.04
#*zeros*	0	0	0	0	0	72
#*obs*	3019	3019	3019	3019	3019	3019
	FOMC Announcement Days (t=0)					
mu	0.34	0.38	0.04	0.11	0.16	0.17
s.d.	1.40	1.38	0.33	1.29	1.20	1.52
#*obs*	98	98	98	98	98	98

Table IA.2: Monetary Policy Shocks: Extended Sample (1996 - 2017)

Principal component analysis as in Table 1, but using daily data (close-close) and without the CDX, and DOL. The sample is extended to 1996 - 2017.

	Monetary Policy Shocks					
	PCA on FOMC Days (#96)			Orthogonal Rotation		
	(1)	(2)	(3)	"Short Rate"	"Long Rate"	"Risk Shift"
$\triangle ED(3M)$	0.75	0.61	-0.11	0.97*	0.00	0.00
$\triangle TU(2Y)$	0.47	-0.26	-0.03	0.20	0.50	-0.02
$\triangle FV(5Y)$	0.38	-0.50	-0.02	-0.02	0.63	-0.03
$\triangle TY(10Y)$	0.26	-0.55	0.03	-0.15	0.59*	0.00
$\triangle log\left(VIX^2\right)$	-0.09	-0.06	-0.99	0.00	-0.03	-1.00*
Var. expl.,%	64.17	24.52	8.75			

Table IA.3: Discount Rate News: VAR Parameter Estimates

This table shows VAR parameter estimates (b) for a first-order VAR model including a constant, the daily S&P500 excess return ($Ret_t - Rf_t$), the option implied lower bound on the expected equity premium for a horizon of one month (EP_t), as in Martin, 2017), the variance risk premium (the difference between option implied variance and the expected realized variance, $VIX_t^2 - RV_t^2$, as in Bollerslev, Tauchen, and Zhou, 2009; where we estimate the expected realized variance as in Corsi, 2009), and the dividend price ratio (provided by Datastream, "DSDY"). EP_t and $VIX_t^2 - RV_t^2$ are scaled such that they correspond to a daily frequency. We then apply the classic formulas (e.g., Campbell and Vuolteenaho, 2004) to compute "discount rate news" and the "cash-flow news" (="residual news"). This proxy of "discount rate news" is then used in Figure 5 as a dependent variable. The data are daily (close-close) and the sample period is from 2006 to August 2014.

	VAR Parameter Estimates			
	$Ret_{t+1} - Rf_{t+1}$	EP_{t+1}	$VIX_{t+1}^2 - RV_{t+1}^2$	DP_{t+1}
$b(Ret_t - Rf_t)$	-0.07	0.00	0.02	0.00
$b(EP_t)$	15.09	0.91	-4.66	-0.41
$b(VIX_t^2 - RV_t^2)$	0.66	0.00	0.74	-0.02
$b(DP_t)$	-0.22	0.00	0.07	1.00
$t(Ret_t - Rf_t)$	-2.58	0.82	5.06	2.23
$t(EP_t)$	2.54	31.96	-5.88	-2.40
$t(VIX_t^2 - RV_t^2)$	3.25	-3.05	26.60	-3.16
$t(DP_t)$	-0.80	2.15	2.54	128.43
F, pv	0.00	0.00	0.00	0.00
R^2, %	2.79	94.65	81.29	98.88
$Var(CF)$	27.71			
$Var(DR)$	31.38			
$Cov(DR, CF)$	-20.45			

Table IA.4: Average FOMC Returns and Monetary Policy Shocks

This table reports average returns of the S&P 500 index (provided by tickdata) and average monetary policy shocks (normalized to a unit standard deviation) around an event window of -15min:+90min (without press conference), or -15m:close (with press conference) for 98 FOMC announcements from 01/2006 to 12/2017. HC robust GMM standard errors are reported in braces. $\#pos : \#neg$ provides the number of positive and negative observations.

	Intraday Event Window Around FOMC Announcements			
	Returns	**Monetary Policy Shocks**		
	S&P 500, %	**Short Rate**	**Long Rate**	**Risk Shift**
mu	0.12	-0.26	0.05	0.28
s.e.	(0.12)	(0.10)	(0.10)	(0.10)
$\#pos : \#neg$	53:43	35:61	50:46	59:37

Table IA.5: Monetary Policy Shocks and Equity Style Premia

This table reports regression results of various equity style premia (daily data, close-close) on monetary policy shocks on FOMC days. The monetary policy shocks are short rate shocks (SR), long rate shocks (LR), and risk shifts (RS), as described in Table 1. The equity premia are taken Kenneth R. French's website and include: Mkt-Rf - the return of the stock market minus the short-term risk free rate, SMB - the return of small stocks minus big stocks, HML - the return of value (high book-to-market ratio) stocks minus growth (low book-to-market) stocks, RMW - the return of profitable (reasonable) stocks minus unprofitable (weak) stocks, CMA - the return of stocks that invest conservative minus stocks that invest aggressive, and the short-term reversal (STR) - the return of past days loser stocks minus past days winner stocks. mu_{All} is the average return over all observations, mu_{FOMC} is the average return conditional on FOMC announcement days. T-statistics are HC robust. The sample period is from 2006 to 2017; 98 scheduled and unscheduled FOMC announcements.

	Fama-French Factors and Monetary Policy Shocks on FOMC Days					
$R_{t\|FOMC}$	**Mkt-Rf**	**SMB**	**HML**	**RMW**	**CMA**	**STR**
	Average Returns, FOMC Days vs All Days					
$mu_{All} \times 10000$	3.85	0.50	-0.07	1.35	0.22	3.01
$mu_{FOMC} \times 10000$	39.61	1.83	12.93	-6.94	-7.33	15.53
	$R_{t\|FOMC} = a + b_{SR}SR_{t\|FOMC} + b_{LR}LR_{t\|FOMC} + b_{RS}RS_{t\|FOMC} + \xi_{t\|FOMC}$					
$a \times 10000$	7.71	-3.13	4.19	-3.59	-2.65	-10.31
t	0.75	-0.44	0.55	-0.83	-0.69	-1.48
b_{SR}	-0.14	-0.08	-0.08	0.00	-0.05	-0.12
t	-0.67	-1.13	-1.40	0.08	-1.10	-0.77
b_{LR}	0.16	0.01	0.18	-0.07	-0.08	0.00
t	1.11	0.18	1.97	-1.28	-1.63	0.04
b_{RS}	0.75	0.06	-0.02	0.02	-0.05	0.21
t	6.34	0.85	-0.27	0.42	-1.01	2.17
$R^2, \%$	38.11	1.83	7.57	2.89	5.44	10.18
	$R_{t\|FOMC} = a + b_{RS}RS_{t\|FOMC} + \xi_{t\|FOMC}$					
$a \times 10000$	11.59	-1.84	7.39	-4.48	-2.88	-8.55
t	1.13	-0.26	0.99	-1.02	-0.75	-1.25
b_{RS}	0.73	0.06	-0.05	0.03	-0.03	0.22
t	6.50	0.85	-0.72	0.73	-0.65	2.34
$R^2, \%$	34.95	0.89	0.56	0.55	0.59	8.49

Table IA.6: Event List of FOMC Rate Decissions: 1996-2017

No.	Date and Time	Scheduled	Unsched.	With PC	Confounding and Date		Distance	Description
1	31.01.1996 14:16	1	0	0	0			
2	26.03.1996 11:39	1	0	0	0			
3	21.05.1996 14:16	1	0	0	0			
4	03.07.1996 14:14	1	0	0	0			
5	20.08.1996 14:17	1	0	0	0			
6	24.09.1996 14:14	1	0	0	0			
7	13.11.1996 14:17	1	0	0	0			
8	17.12.1996 14:16	1	0	0	0			
9	05.02.1997 14:13	1	0	0	0			
10	25.03.1997 14:14	1	0	0	0			
11	20.05.1997 14:15	1	0	0	0			
12	02.07.1997 14:15	1	0	0	0			
13	19.08.1997 14:15	1	0	0	0			
14	30.09.1997 14:13	1	0	0	0			
15	12.11.1997 14:12	1	0	0	0			
16	16.12.1997 14:15	1	0	0	0			
17	04.02.1998 14:12	1	0	0	0			
18	31.03.1998 14:12	1	0	0	0			
19	19.05.1998 14:15	1	0	0	0			
20	01.07.1998 14:15	1	0	0	0			
21	18.08.1998 14:12	1	0	0	0			
22	29.09.1998 14:15	1	0	0	1	15.10.1998 15:15	16	Unscheduled FOMC Rate Decision
23	15.10.1998 15:15	0	1	0	0			
24	17.11.1998 14:15	1	0	0	0			
25	22.12.1998 14:15	1	0	0	0			
26	03.02.1999 14:15	1	0	0	0			
27	30.03.1999 14:15	1	0	0	0			
28	18.05.1999 14:15	1	0	0	0			
29	30.06.1999 14:15	1	0	0	0			
30	24.08.1999 14:15	1	0	0	0			
31	05.10.1999 14:15	1	0	0	0			
32	16.11.1999 14:15	1	0	0	0			
33	21.12.1999 14:15	1	0	0	0			
34	02.02.2000 14:15	1	0	0	0			
35	21.03.2000 14:15	1	0	0	0			
36	16.05.2000 14:15	1	0	0	0			
37	28.06.2000 14:15	1	0	0	0			
38	22.08.2000 14:15	1	0	0	0			
39	03.10.2000 14:15	1	0	0	0			
40	15.11.2000 14:15	1	0	0	0			
41	19.12.2000 14:15	1	0	0	1	03.01.2001 13:15	15	Unscheduled FOMC Rate Decision
42	03.01.2001 13:15	0	1	0	0			
43	31.01.2001 14:15	1	0	0	0			
44	20.03.2001 14:15	1	0	0	0			
45	18.04.2001 10:55	0	1	0	1	15.05.2001 14:15	27	Scheduled FOMC Rate Decision
46	15.05.2001 14:15	1	0	0	0			
47	27.06.2001 14:12	1	0	0	0			
48	21.08.2001 14:15	1	0	0	1	17.09.2001 08:20	27	Unscheduled FOMC Rate Decision
49	17.09.2001 08:20	0	1	0	1	02.10.2001 14:15	15	Scheduled FOMC Rate Decision
50	02.10.2001 14:15	1	0	0	0			
51	06.11.2001 14:20	1	0	0	0			
52	11.12.2001 14:14	1	0	0	0			
53	30.01.2002 14:15	1	0	0	0			
54	19.03.2002 14:15	1	0	0	0			
55	07.05.2002 14:15	1	0	0	0			
56	26.06.2002 14:15	1	0	0	0			
57	13.08.2002 14:15	1	0	0	0			
58	24.09.2002 14:15	1	0	0	0			
59	06.11.2002 14:14	1	0	0	0			
60	10.12.2002 14:15	1	0	0	0			
61	29.01.2003 14:16	1	0	0	0			
62	18.03.2003 14:15	1	0	0	0			
63	06.05.2003 14:13	1	0	0	0			
64	25.06.2003 14:15	1	0	0	0			
65	12.08.2003 14:15	1	0	0	0			
66	16.09.2003 14:19	1	0	0	0			
67	28.10.2003 14:15	1	0	0	0			
68	09.12.2003 14:15	1	0	0	0			
69	28.01.2004 14:15	1	0	0	0			
70	16.03.2004 14:15	1	0	0	0			
71	04.05.2004 14:15	1	0	0	0			
72	30.06.2004 14:15	1	0	0	0			
73	10.08.2004 14:15	1	0	0	0			
74	21.09.2004 14:15	1	0	0	0			
75	10.11.2004 14:15	1	0	0	0			
76	14.12.2004 14:15	1	0	0	0			
77	02.02.2005 14:15	1	0	0	0			
78	22.03.2005 14:15	1	0	0	0			
79	03.05.2005 14:15	1	0	0	0			
80	30.06.2005 14:15	1	0	0	0			
81	09.08.2005 14:15	1	0	0	0			
82	20.09.2005 14:15	1	0	0	0			
83	01.11.2005 14:15	1	0	0	0			
84	13.12.2005 14:15	1	0	0	0			

Table IA.6 continued...

No.	Date and Time	Scheduled	Unsched.	With PC	Confounding and Date		Distance	Description
85	31.01.2006 14:14	1	0	0	0			
86	28.03.2006 14:15	1	0	0	0			
87	10.05.2006 14:15	1	0	0	0			
88	29.06.2006 14:15	1	0	0	0			
89	08.08.2006 14:15	1	0	0	0			
90	20.09.2006 14:15	1	0	0	0			
91	25.10.2006 14:15	1	0	0	0			
92	12.12.2006 14:15	1	0	0	0			
93	31.01.2007 14:15	1	0	0	0			
94	21.03.2007 14:15	1	0	0	0			
95	09.05.2007 14:15	1	0	0	0			
96	28.06.2007 14:15	1	0	0	0			
97	07.08.2007 14:15	1	0	0	0			
98	18.09.2007 14:15	1	0	0	0			
99	31.10.2007 14:15	1	0	0	0			
100	11.12.2007 14:15	1	0	0	1	12.12.2007 05:03	1	Announcement of Unconventional MP
101	22.01.2008 08:20	0	1	0	1	30.01.2008 14:15	8	Scheduled FOMC Rate Decision
102	30.01.2008 14:15	1	0	0	0			
103	18.03.2008 14:15	1	0	0	0			
104	30.04.2008 14:15	1	0	0	1	02.05.2008 04:11	2	Announcement of Unconventional MP
105	25.06.2008 14:15	1	0	0	0			
106	05.08.2008 14:15	1	0	0	0			
107	16.09.2008 14:15	1	0	0	1	18.09.2008 02:55	2	Announcement of Unconventional MP
108	08.10.2008 07:00	0	1	0	1	13.10.2008 02:00	5	Announcement of Unconventional MP
109	29.10.2008 14:17	1	0	0	1	25.11.2008 08:15	27	Announcement of Unconventional MP
110	16.12.2008 14:15	1	0	0	1	19.12.2008 08:02	3	Announcement of Unconventional MP
111	28.01.2009 14:15	1	0	0	1	03.02.2009 08:00	6	Announcement of Unconventional MP
112	18.03.2009 14:15	1	0	0	1	19.03.2009 04:25	1	Announcement of Unconventional MP
113	29.04.2009 14:15	1	0	0	0			
114	24.06.2009 14:15	1	0	0	1	25.06.2009 12:00	1	Announcement of Unconventional MP
115	12.08.2009 14:15	1	0	0	0			
116	23.09.2009 14:15	1	0	0	1	24.09.2009 10:00	1	Announcement of Unconventional MP
117	04.11.2009 14:15	1	0	0	0			
118	16.12.2009 14:15	1	0	0	0			
119	27.01.2010 14:15	1	0	0	0			
120	16.03.2010 14:15	1	0	0	0			
121	28.04.2010 14:15	1	0	0	1	10.05.2010 21:18	12	Announcement of Unconventional MP
122	23.06.2010 14:15	1	0	0	0			
123	10.08.2010 14:15	1	0	0	1	27.08.2010 10:00	17	Bernanke speech, Jackson Hole
124	21.09.2010 14:15	1	0	0	1	15.10.2010 08:15	24	Bernanke speech, Boston Fed
125	03.11.2010 14:15	1	0	0	0			
126	14.12.2010 14:15	1	0	0	1	21.12.2010 09:00	7	Announcement of Unconventional MP
127	26.01.2011 14:15	1	0	0	0			
128	15.03.2011 14:15	1	0	0	0			
129	27.04.2011 12:30	1	0	1	0			
130	22.06.2011 12:30	1	0	1	1	22.06.2011 14:15	7	Announcement of Unconventional MP
131	09.08.2011 14:15	1	0	0	1	26.08.2011 10:00	17	Bernanke speech, Jackson Hole
132	21.09.2011 14:15	1	0	0	0			
133	02.11.2011 12:30	1	0	1	0			
134	13.12.2011 14:15	1	0	0	0			
135	25.01.2012 12:30	1	0	1	0			
136	13.03.2012 14:15	1	0	0	0			
137	25.04.2012 12:30	1	0	1	0			
138	20.06.2012 12:30	1	0	1	0			
139	01.08.2012 14:15	1	0	0	0			
140	13.09.2012 12:30	1	0	1	0			
141	24.10.2012 14:15	1	0	0	0			
142	12.12.2012 12:30	1	0	1	0			
143	30.01.2013 14:15	1	0	0	0			
144	20.03.2013 14:00	1	0	1	0			
145	01.05.2013 14:00	1	0	0	1	22.05.2013 10:00	21	Bernanke Testimony
146	19.06.2013 14:00	1	0	1	0			
147	31.07.2013 14:00	1	0	0	0			
148	18.09.2013 14:00	1	0	1	0			
149	30.10.2013 14:00	1	0	0	0			
150	18.12.2013 14:00	1	0	1	0			
151	29.01.2014 14:00	1	0	0	0			
152	19.03.2014 14:00	1	0	1	0			
153	30.04.2014 14:00	1	0	0	0			
154	18.06.2014 14:00	1	0	1	0			
155	30.07.2014 14:00	1	0	0	0			
156	17.09.2014 14:00	1	0	1	0			
157	29.10.2014 14:00	1	0	0	0			
158	17.12.2014 14:00	1	0	1	0			
159	28.01.2015 14:00	1	0	0	0			
160	18.03.2015 14:00	1	0	1	0			
161	29.04.2015 14:00	1	0	0	0			
162	17.06.2015 14:00	1	0	1	0			
163	29.07.2015 14:00	1	0	0	0			
164	17.09.2015 14:00	1	0	1	0			
165	28.10.2015 14:00	1	0	0	0			
166	16.12.2015 14:00	1	0	1	0			
167	27.01.2016 14:00	1	0	0	0			
168	16.03.2016 14:00	1	0	1	0			
169	27.04.2016 14:00	1	0	0	0			
170	15.06.2016 14:00	1	0	1	0			
171	27.07.2016 14:00	1	0	0	0			
172	21.09.2016 14:00	1	0	1	0			
173	02.11.2016 14:00	1	0	0	0			
174	14.12.2016 14:00	1	0	1	0			
175	01.02.2017 14:00	1	0	0	0			
176	15.03.2017 14:00	1	0	1	0			
177	03.05.2017 14:00	1	0	0	0			
178	14.06.2017 14:00	1	0	1	0			
179	26.07.2017 14:00	1	0	0	0			
180	20.09.2017 14:00	1	0	1	0			
181	01.11.2017 14:00	1	0	0	0			
182	13.12.2017 14:00	1	0	1	0			

Internet Appendix: Figures

Figure IA.1: Coverage of ETF Flow Data

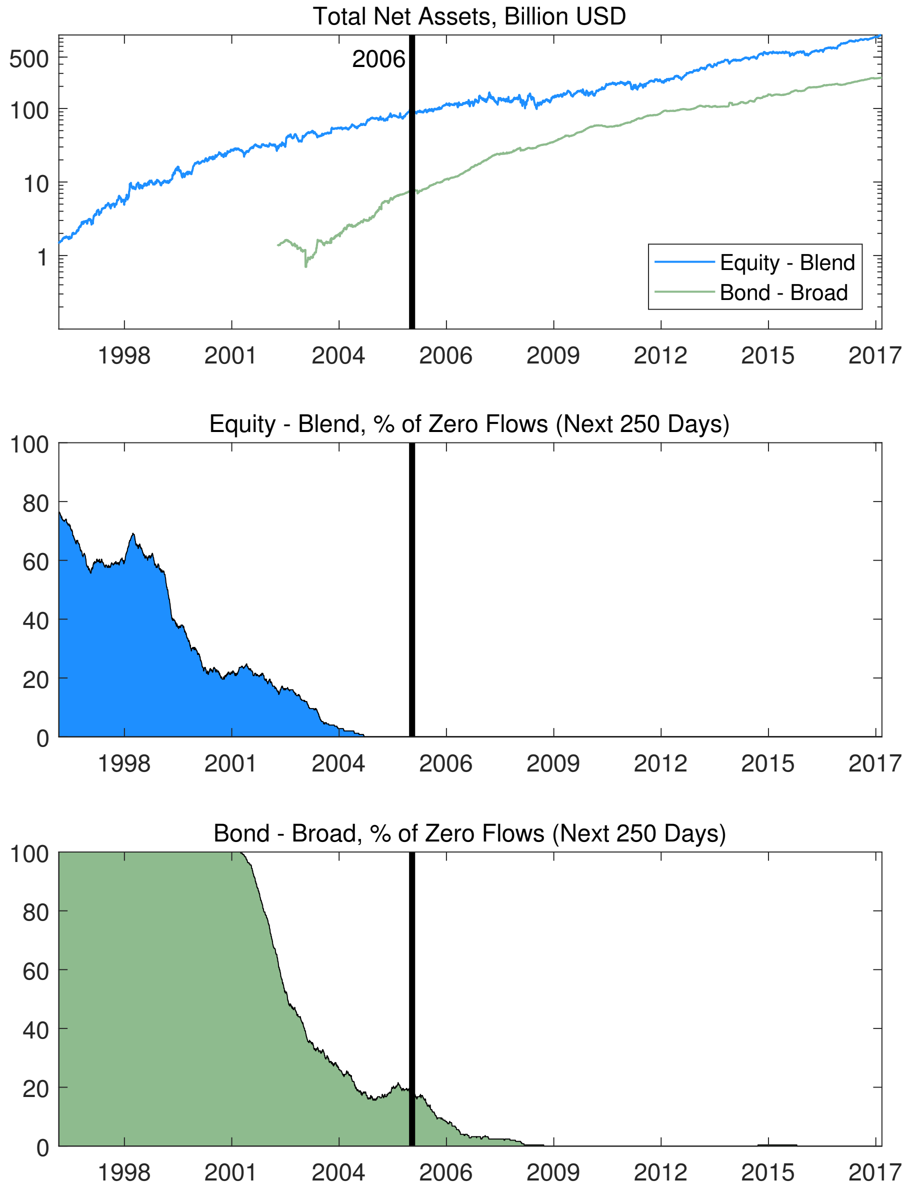


Figure IA.2: Stock Market Response to Short and Long Rate Shocks on FOMC Days

In contrast to Figure 4 of the main paper, this figure provides results for the "short rate" (left) and the "long rate"(right) shocks.

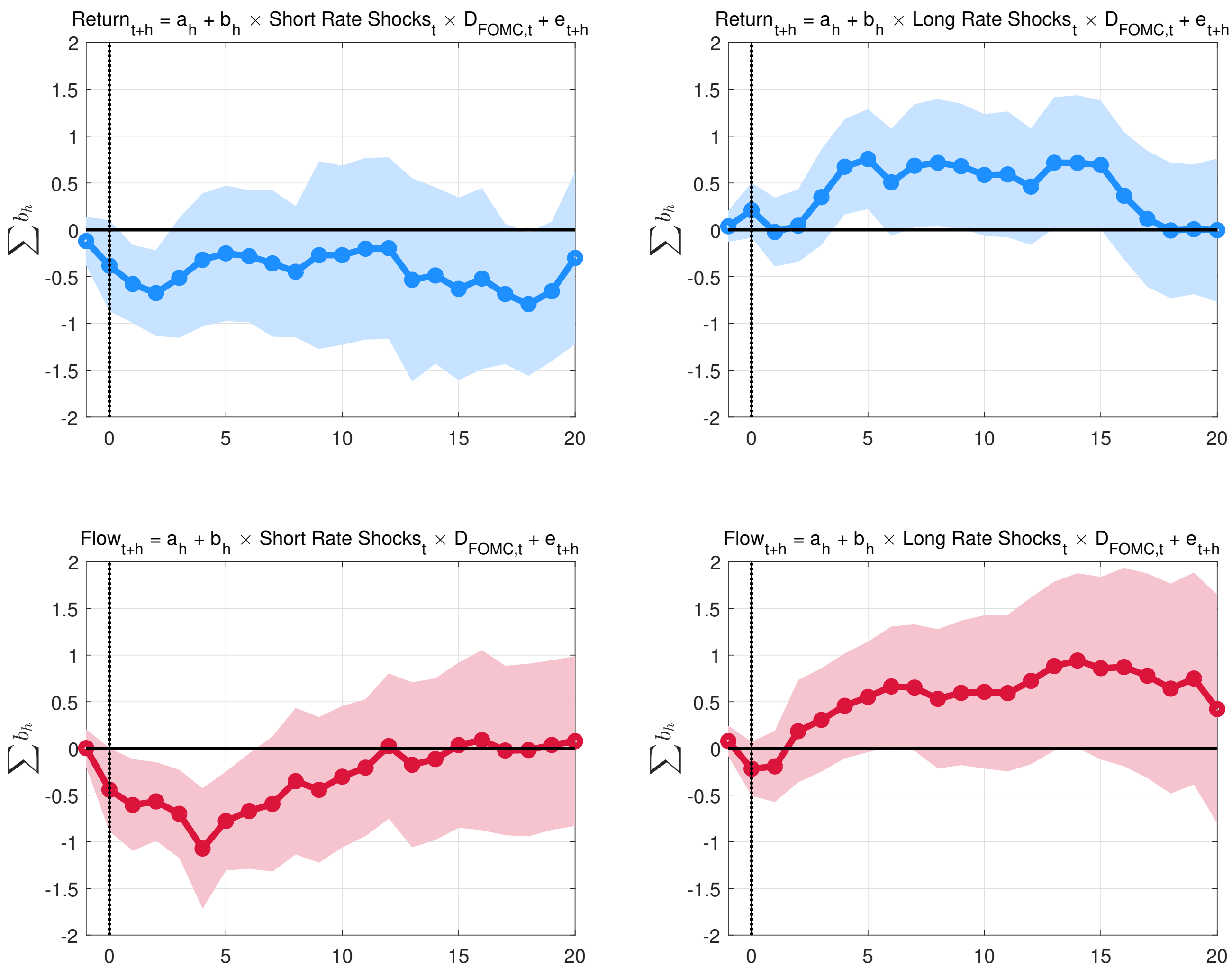


Figure IA.3: Macro Announcements

In contrast to Figure 4 of the main paper, this figure shows the effect of risk shifts on returns (blue) and flows (red) on days that include a macroeconomic news announcement, excluding observations 5 days prior and up to 10 days after scheduled FOMC announcements, i.e. approximately the half of the sample that is as far as possible away from scheduled FOMC announcements. The macroeconomic news announcements include the non-farm payroll/economic situation report, the producer price index, and the consumer survey report.

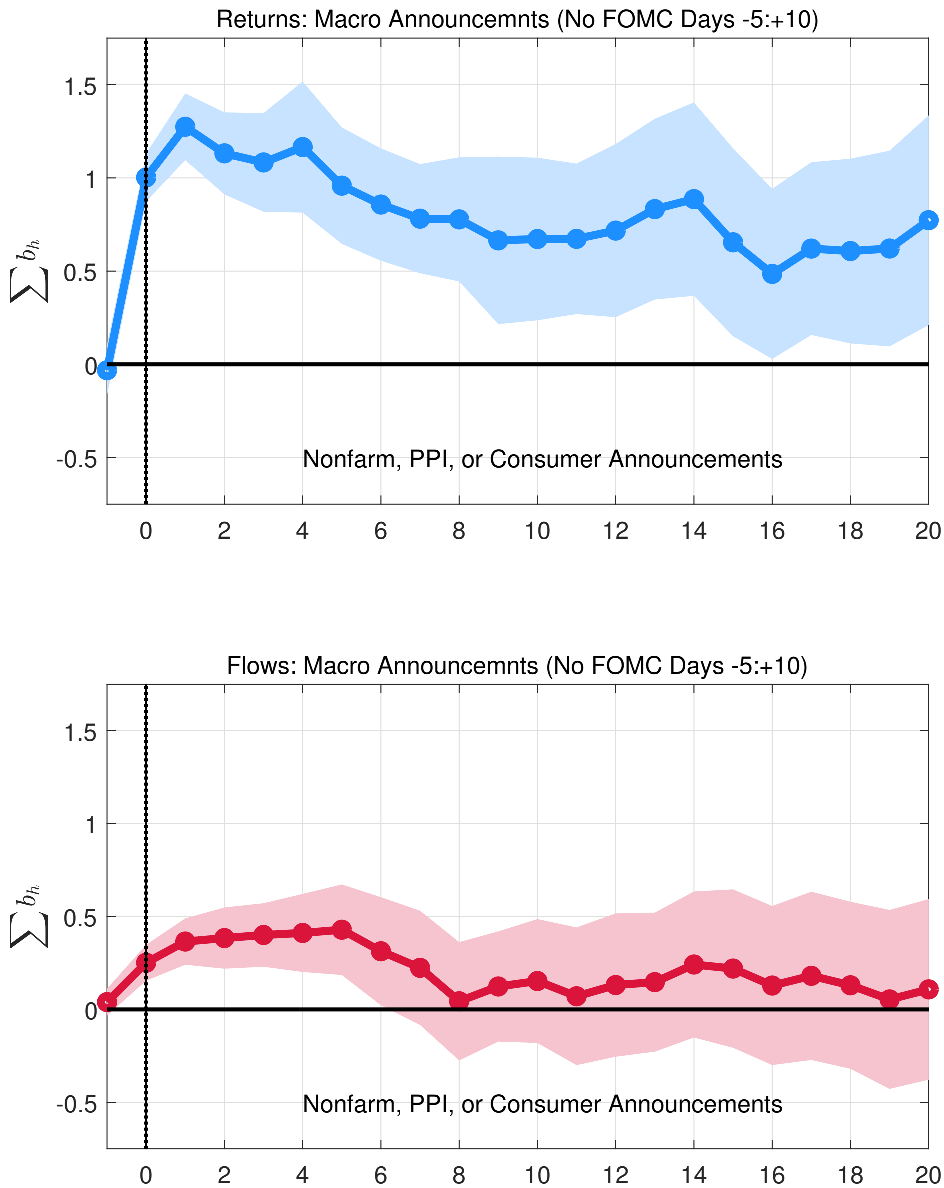
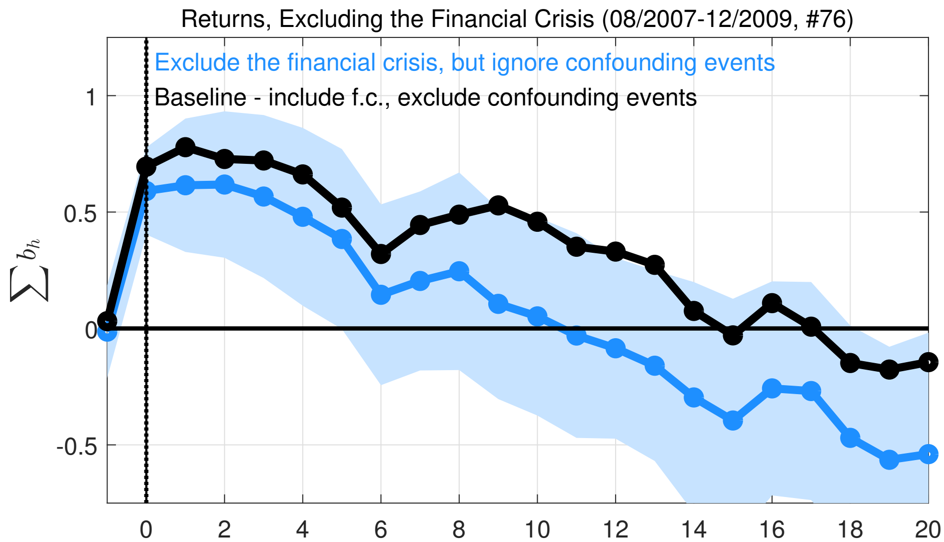


Figure IA.4: Excluding the Financial Crisis

This figure shows results when the financial crisis (08/2007 - 12/2009) is excluded from the sample, but confounding events are ignored. Most confounding events fall into the period of the financial crisis, when unconventional monetary policies were frequently announced between scheduled FOMC rate decisions. The baseline results keep the financial crisis in the sample but remove all confounding events from the event list, as documented in Table IA.6 in detail.



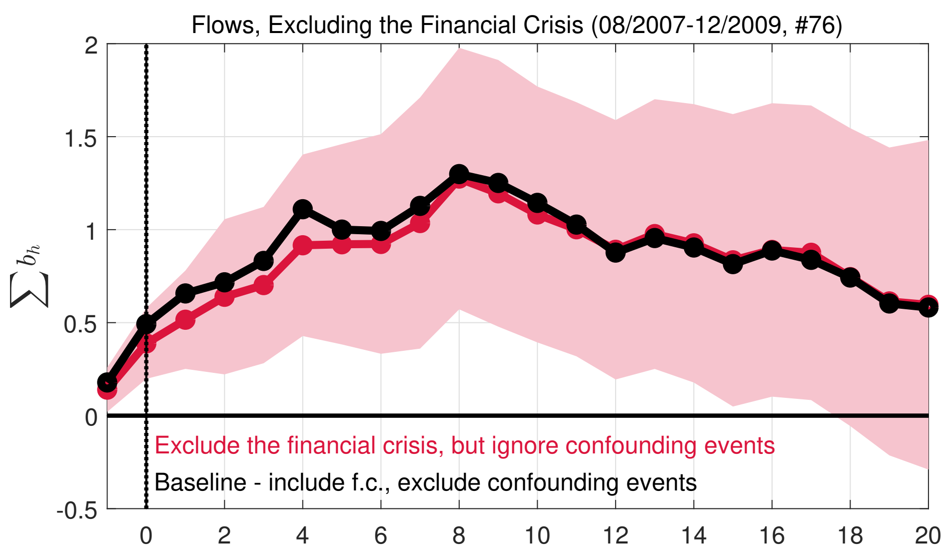


Figure IA.5: Exclude or Focus on Events with Subsequent Press Conference

This figure shows results when when FOMC announcement with a subsequent press conference are excluded from the sample (53), or when the sample is restricted to FOMC announcements with a subsequent press conference (27). The dates of FOMC announcements with a subsequent press conference are documented in Table IA.6 in detail.

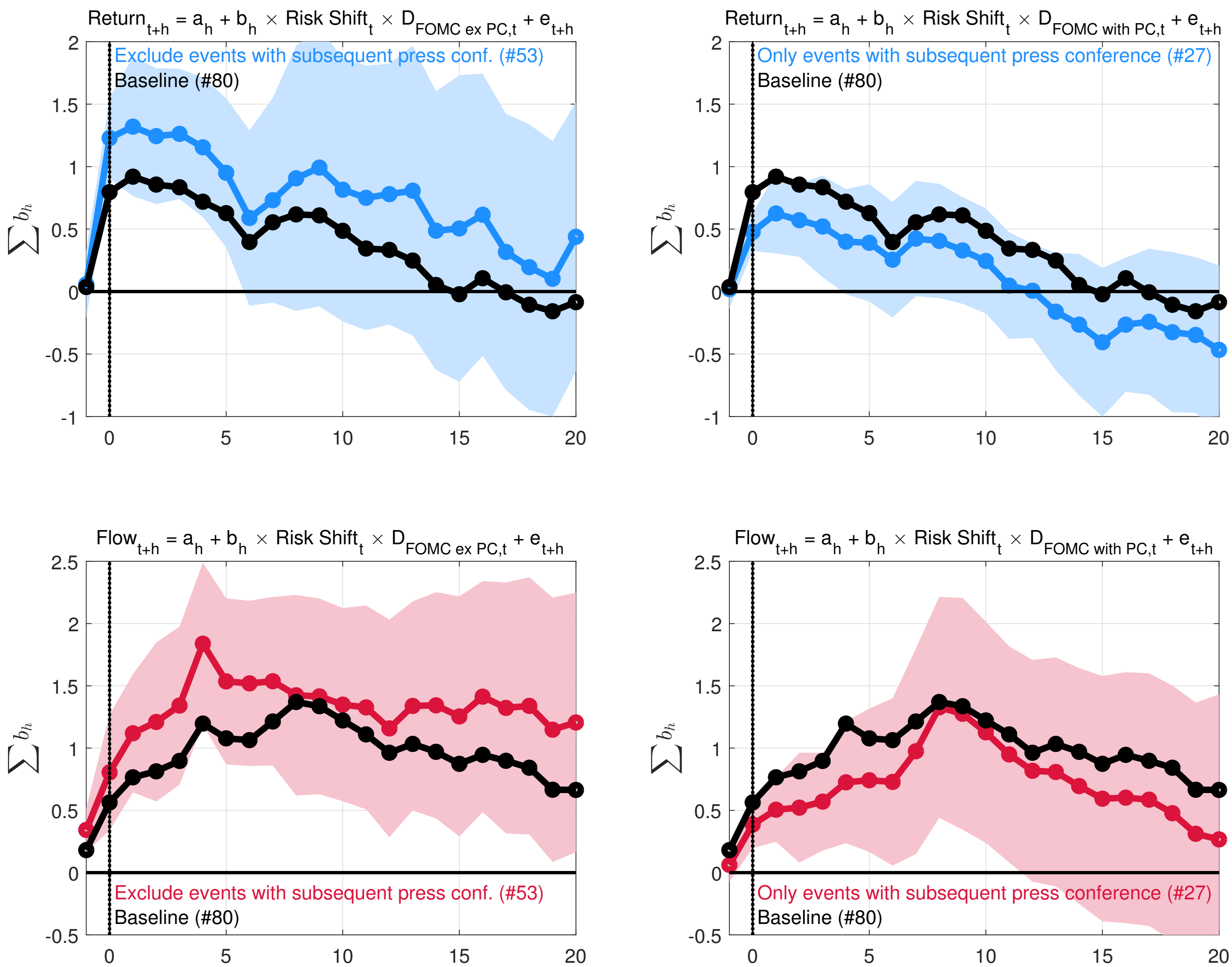


Figure IA.6: Mutual Funds

In contrast to Figure 4, ETF flows and returns are replaced by mutual fund flows and returns. Estimates are scaled such that they show the effect of a one standard deviation risk shift on FOMC announcement days. The shaded area represents HAC robust 90% confidence intervals. Flows and returns are measured daily (close-to-close); the sample period is from 2006 to 2017; 3019 observations with 80 non-confounding FOMC announcements.

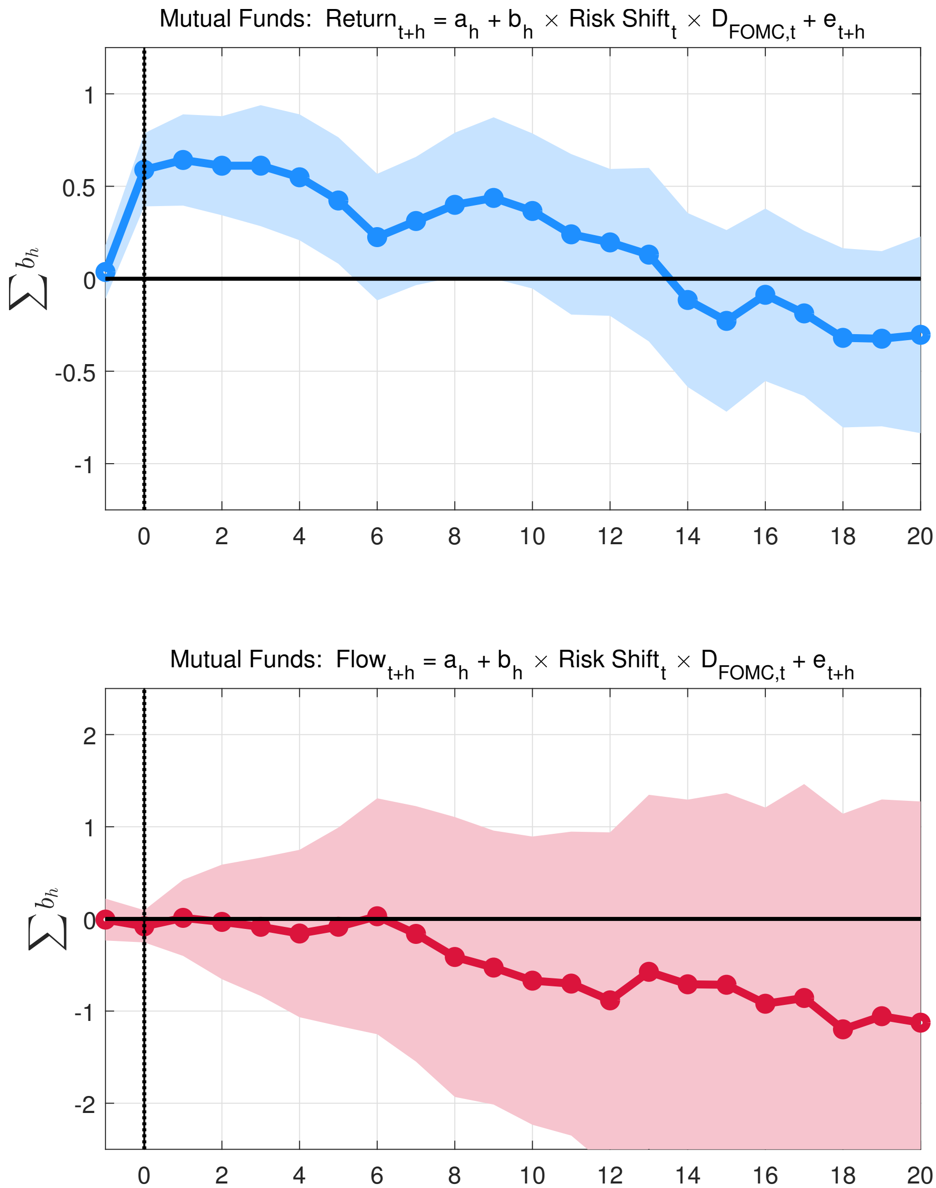


Figure IA.7: The FOMC Risk Shift Cycle

Cieslak, Morse, and Vissing-Jorgensen (2018) show that stock returns are unusually high in even weeks in "FOMC-cycle" time. This figure complements their results on prices by showing weekly ETF flow quantities and "risk shifts" over the FOMC cycle. Shaded areas correspond to even weeks in FOMC time. Week zero is defined as the days -1 to +3 around scheduled FOMC announcements; "weeks" exclude the weekend but keep holidays/non-trading days.

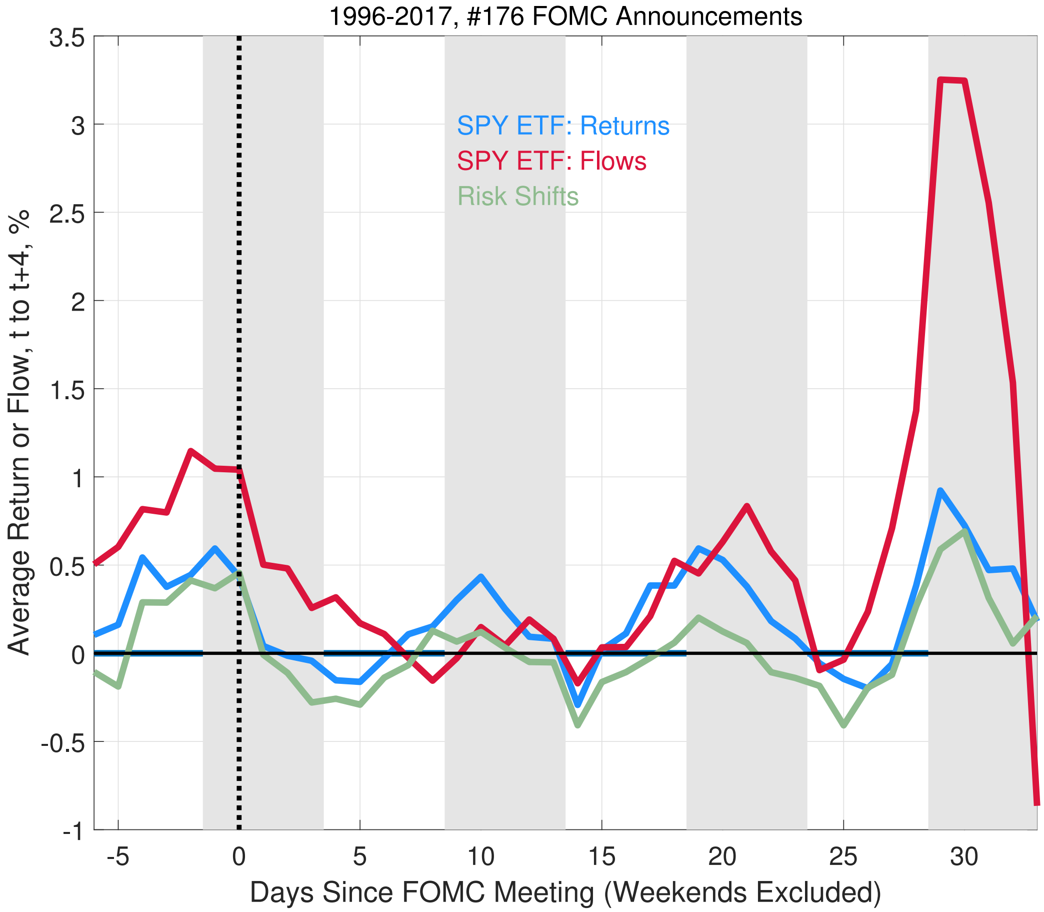
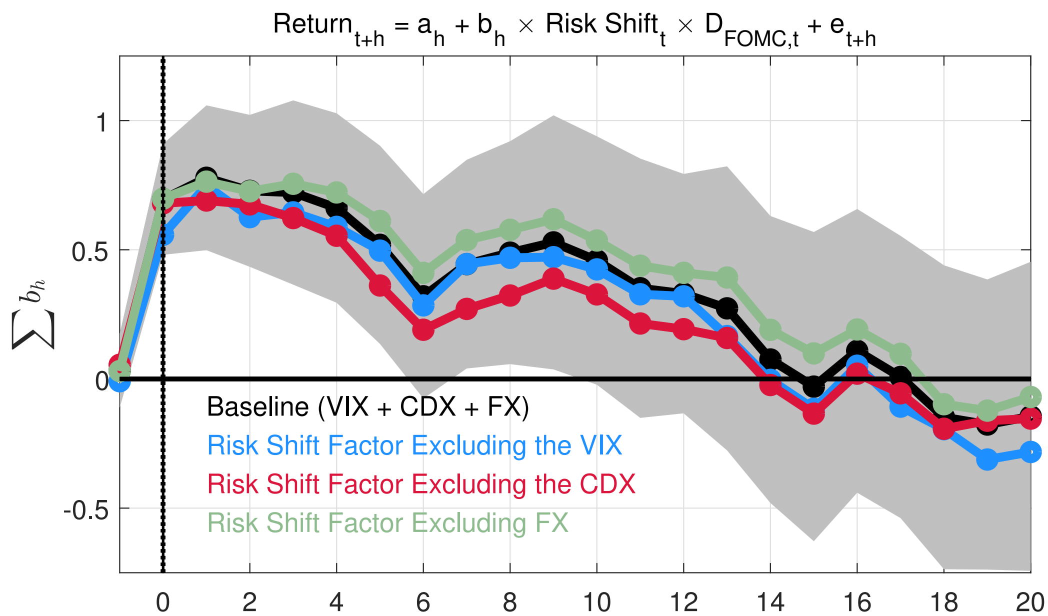


Figure IA.8: Alternative Risk Shift Factor: Dropping the VIX, CDX, or FX

In the main paper, the factor analysis used to extract the risk shift factor includes three risky asset prices, the VIX, CDX, and FX (a dollar portfolio). This figure provides results for an alternative risk shift factor: We drop one of the three risky asset prices and then re-run the factor analysis and estimate the response of equity minus bond returns and equity minus bond fund flows.



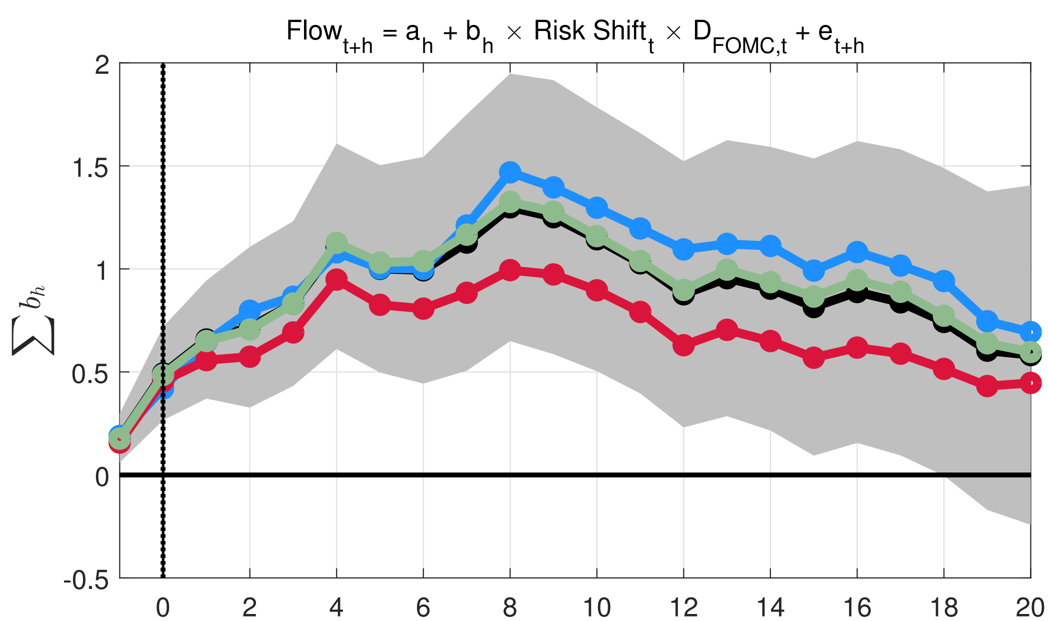
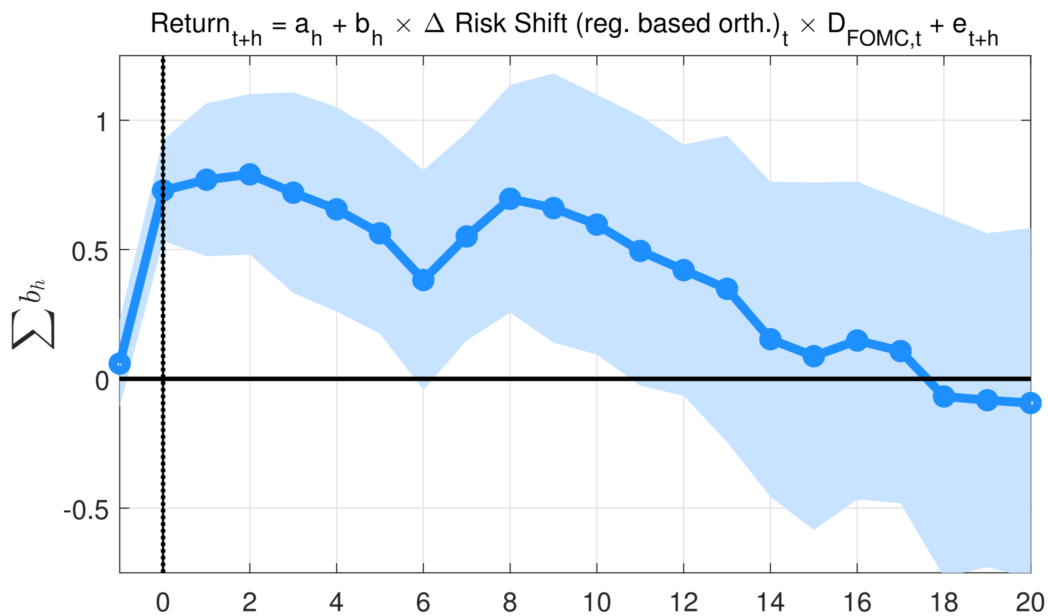


Figure IA.9: Alternative Risk Shift Factor: Regression-based Orthogonalisation

In the main paper, the risk shift factor is derived from a factor analysis as in Swanson (2017). This figure provides results for an alternative risk shift factor: We first build an equally weighted portfolio of the three (normalized) risky asset prices. We then orthogonalize this portfolio of risky asset prices with respect to changes in yields (3M, 2Y, 5Y, 10Y) using linear regressions.



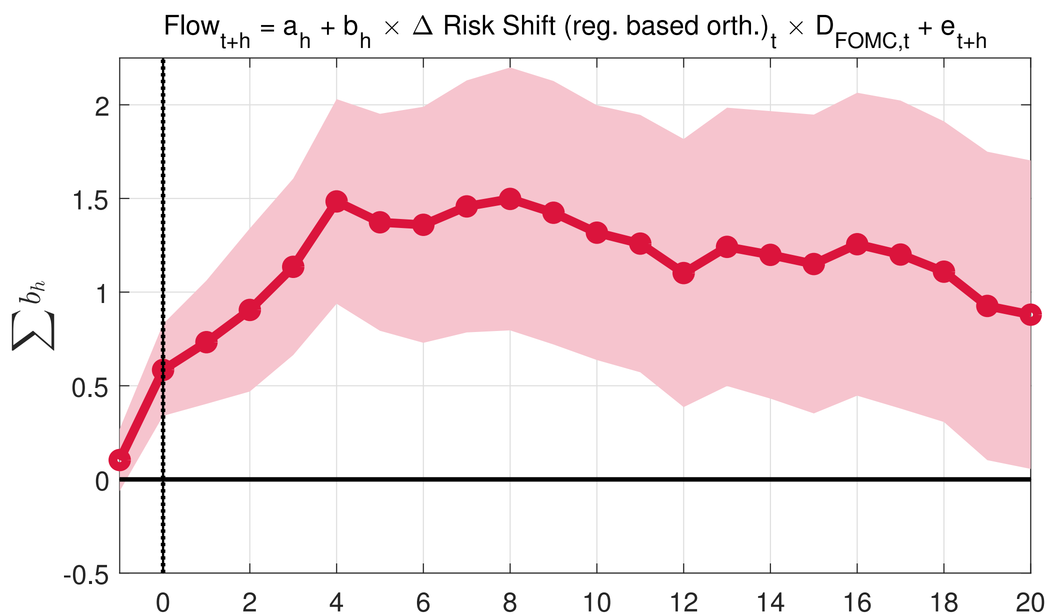


Figure IA.10: Outlier Analysis: S&P 500 Intraday Returns

We drop each single observation and then re-estimate the initial impact of a given monetary policy shock on S&P 500 (future) intraday returns. For comparisons, the figure also provides results based on all observations ("all") and when the financial crisis is excluded ("ex.FC", 08/2007-12/2009). Vertical lines indicate 90% confidence bands based on HC standard errors.

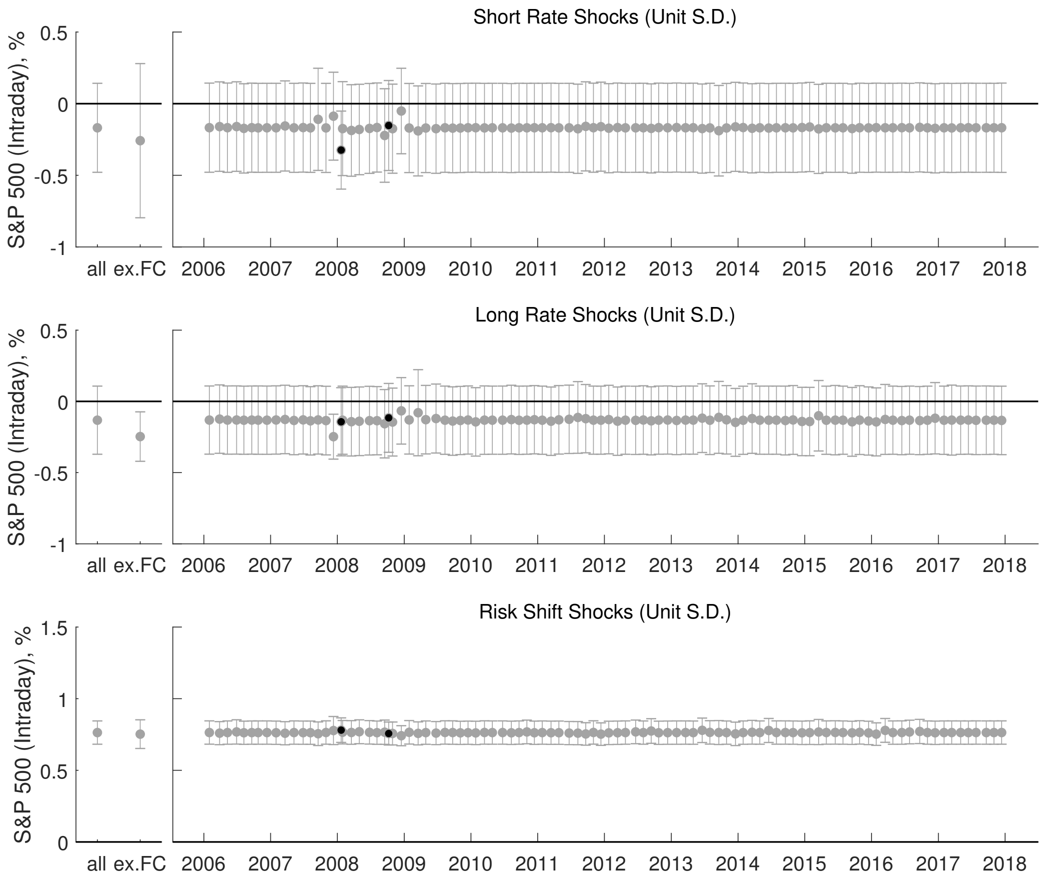


Figure IA.11: Outlier Analysis: Daily Fund Returns

We drop each single observation and then re-estimate the initial impact of a given monetary policy shock on daily equity minus bond fund returns. For comparisons, the figure also provides results based on all observations ("all") and when the financial crisis is excluded ("ex.FC", 08/2007-12/2009). Vertical lines indicate 90% confidence bands based on HC standard errors.

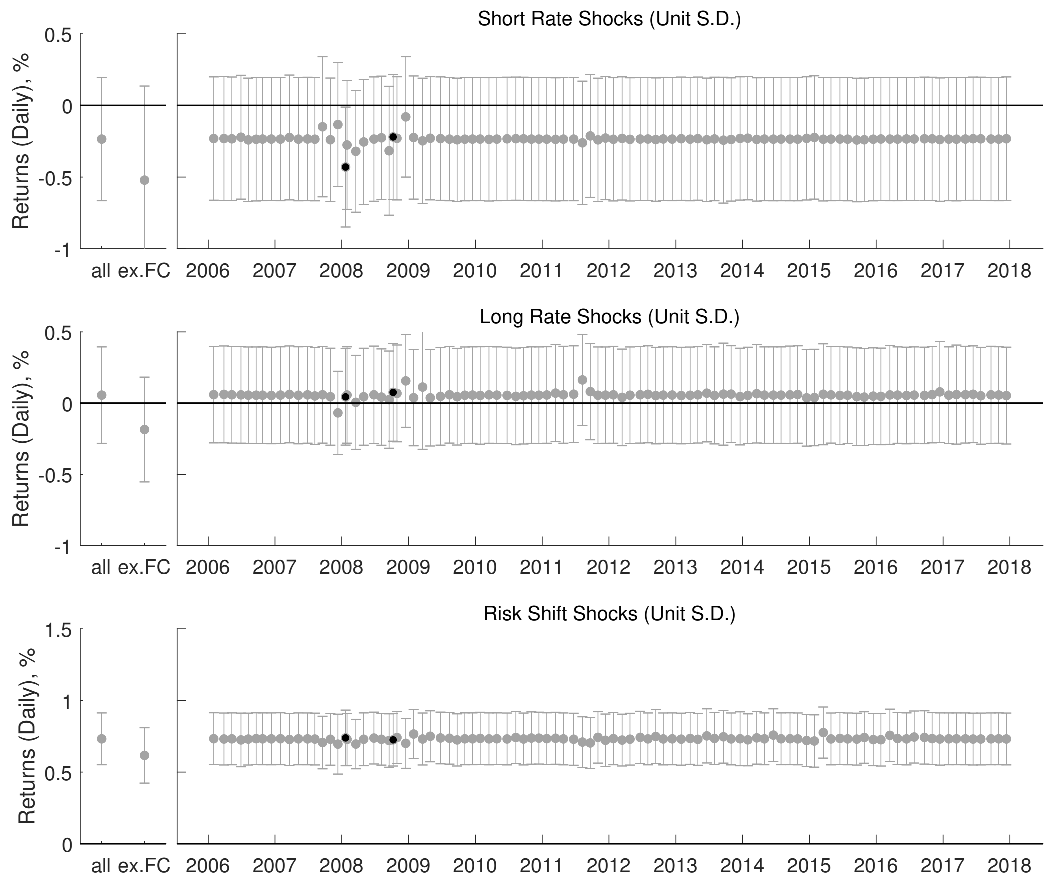


Figure IA.12: Outlier Analysis: Daily Fund Flows

We drop each single observation and then re-estimate the initial impact of a given monetary policy shock on daily equity minus bond fund flows. For comparisons, the figure also provides results based on all observations ("all") and when the financial crisis is excluded ("ex.FC", 08/2007-12/2009). Vertical lines indicate 90% confidence bands based on HC standard errors.