Bank of Israel **Research Department**

Monetary Policy and the Mutual Fund Market: Funding and Liquidity[1]

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מדיניות מוניטרית ושוק קרנות הנאמנות: מימון ונזילות

נעם בן-זאב, סיגל ריבון ורועי שטיין

תקציר

מחקר זה בוחן את שוק קרנות הנאמנות, ומתמקד בתפקידן בתמסורת המדיניות המוניטרית ובהשפעתן על נזילות בשוקי הנכסים. באמצעות נתונים יומיים על גיוסים ופדיונות בקרנות הנאמנות בישראל, מצאנו כי בתגובה להידוק מוניטרי של נקודת אחוז, במהלך חודש לאחר שינוי הריבית, משקיעי קרנות הנאמנות – בעיקר משקי בית – מקטינים את השקעתם בקרנות אג"ח ומניות ב-6-10%. במקביל, נרשמים גיוסים בקרנות הכספיות, מה שמעיד על מעבר של משקיעים קמעונאיים מנכסים מסוכנים יותר לנכסים מסוכנים פחות. בנוסף, נמצא כי משקיעים מוסדיים מגדילים בתקופה זו את השקעותיהם בנכסי סיכון. בו בזמן, אנו מתעדים ירידה בנזילות בשווקים של נכסי הבסיס של קרנות הנאמנות בתגובה להידוק מוניטרי. תוצאות המחקר מצביעות על כך שהתאמות בתיקי הנכסים דרך זרמים בקרנות הנאמנות מסבירות את הירידה בנזילות באופן חלקי בלבד. בניגוד לתגובה החזקה והמידית של קרנות נאמנות לאחר משברים ריאליים, כגון משבר הקורונה, התגובות לשינויי ריבית הן מתונות והדרגתיות, ולא משפיעות רבות על הנזילות במסחר.

Monetary Policy and the Mutual Fund Market: Funding and Liquidity

Noam Ben-Ze'ev, Sigal Ribon and Roy Stein

Abstract

We examine the mutual fund market, focusing on its role in the transmission of monetary policy and its impact on asset market liquidity. Utilizing daily data on mutual fund flows in Israel, we observe that in response to contractionary monetary policy of one percentage point, mutual fund holders—which are predominantly households—reduce their investments in corporate and government bonds and equity funds by approximately 6-10% of the funds' assets, over about a month after the change. This reaction is accompanied by an expansion of money market funds, indicating a shift by retail investors from higher-risk to lower-risk assets. This finding is supported by indications of a parallel increase of Institutional investors' holdings of higher-risk assets. Concurrently, we note a decrease in market liquidity of the underlying assets in response to the monetary tightening. Our findings suggest that the adjustments in asset portfolios through changes in mutual fund flows only partially explain the decline in liquidity. Unlike the strong and immediate reactions observed during real shocks such as the COVID crisis, responses to changes in monetary policy are moderate and gradual, posing less significant risks to market liquidity.

1. Introduction

Monetary policy is implemented in order to stabilize the business cycle – minimize the deviation of output from its potential and of inflation from its target. However, it has broader effects on the economy and on financial markets, which may be adverse or beneficial. This paper investigates possible effects of monetary policy on financial asset markets, and specifically explores the effect of monetary policy on mutual funds and their role in transmitting monetary policy to financial assets' markets.

Using daily data on mutual fund flows, liquidity indices and shocks to monetary policy, we find that tightening monetary policy causes outflows from equity and bond funds, and inflows into money market funds (MMFs). We show that these flows affect, alongside other factors, market liquidity following a monetary tightening.

In addition to influencing the cost of money and funding supplied by the banking system, monetary policy also affects non-bank funding – and specifically, mutual funds, which allow retail investors to hold, indirectly, business sector and government debt and business sector equity. Changes in monetary policy are expected to affect the tendency of households or other retail investors, to hold these funds, and therefore affect the price of the underlying assets and the share of funding by households to the business sector and the government. In addition, in the process of adjusting their portfolio, mutual fund holders, to the extent they react significantly to changes in monetary policy, may induce liquidity stress in the markets and threaten financial stability. Therefore, understanding the transmission of policy to the mutual funds market is important in order to assess the possible impact of monetary policy on this avenue of non-bank funding, and as a consequence its effect on liquidity in the underlying asset markets.

Our paper closely relates to the following papers: Banegas et al. (2022) find that a loosening (tightening) in monetary policy in the US leads to larger inflows (outflows) into equity and bond funds. Kaufmann (2023) finds the same result is true in euro-area funds. We document a similar result in Israel, and also find that alongside the outflows from bond and equity funds, money market funds enjoy higher (lower) inflows in reaction to tightening (loosening) monetary policy.

Our paper contributes to the literature on the relation between monetary policy and mutual fund flows, by documenting the effect of monetary policy on market liquidity through these flows, and quantifying the extent to which they impair liquidity. In particular, the paper contributes by informing policymakers whether the risks associated with (unexpected) large interest rate hikes might cause significant outflows from mutual funds, thereby impairing market liquidity.

Mutual funds are key financial market participants, as intermediaries managing the public's investments. The literature suggests that mutual funds respond quickly to market shocks, potentially exacerbating financial crises through large-scale asset sales (see for example Goldstein et al., 2017, Coval and Stafford 2007) This is in contrast to institutional investors who are known to be counter-cyclical (see for example Gompers & Metrick 2001, Badrinath and Wahal 2002). Given their significant market role, studying mutual funds is both important and insightful. During the Covid-19 crisis, mutual funds around the world, Israeli mutual

funds included, experienced large redemptions, setting off a fire sale (see for example Hadad et al 2021, Ma et al 2022, and Falato et al 2021).

Figure 1: Cumulative Net Flows in different categories of Israeli mutual funds, March 2020. Flows are normalized to 100 at the beginning of the month

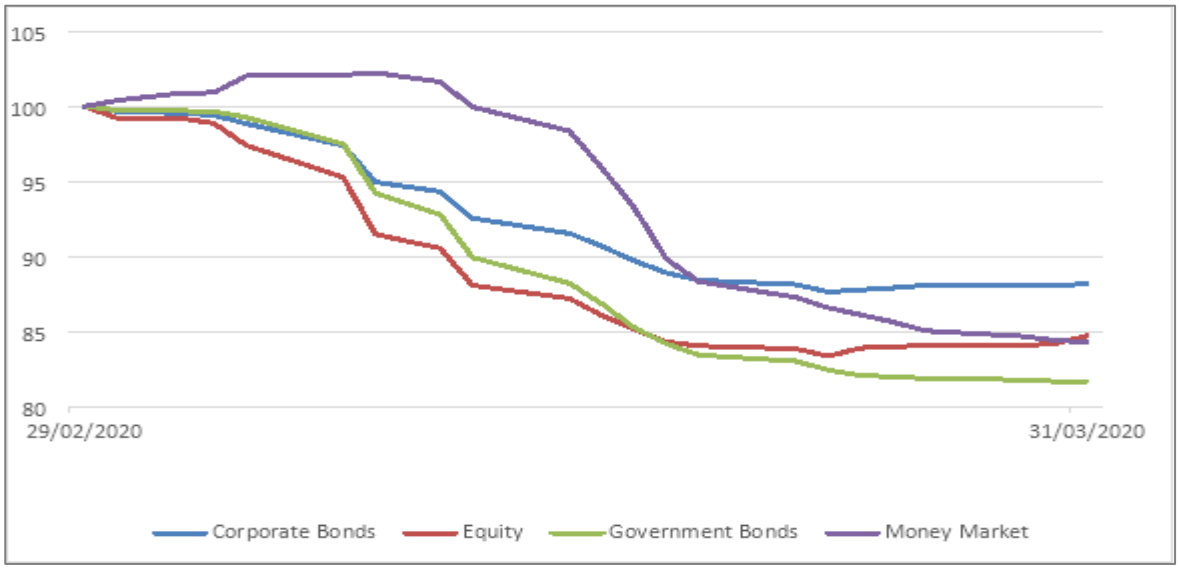


Figure 1 presents the cumulative net flows into mutual funds during March 2020. While all investment categories experienced large outflows, the corporate bond market experienced the largest decline in prices, due to the large size of mutual funds in proportion to the entire market (roughly a third). In total, mutual funds have sold more than NIS 11 billion in corporate funds, which are more that 10% of their assets, juxtaposed by institutional investors purchasing corporate bonds in a net sum of NIS 2.6 billion. The striking difference in these sums was an important contributing factor in the rise of corporate bond yields during that time.

This paper examines whether mutual fund holders react to changes in monetary policy in a manner consistent with responses to other market shocks documented in the literature, thereby increasing the risk of liquidity stress, or if reactions to monetary shocks are distinct.

We address these questions by assessing the response of fund flows and liquidity measures to unexpected shocks to short-term government (nominal) bond yields, as a proxy for unexpected monetary policy changes. (See Kuttner, 2001 and Gurkaynak, Sach and Swansson, 2005). We study the effect of monetary shocks on flows in and out of identified groups of mutual funds that specialize in specific local assets (government bonds, corporate bonds, equity and money market funds) using local projections in the spirit of Jorda (2005). This allows us to evaluate the sensitivity of each of the markets to monetary policy (shocks). In the second stage we look at the bid-ask spread and two additional liquidity indicators for the underlying asset markets and test whether liquidity conditions are affected by monetary policy and whether mutual fund flows are one of the channels through which monetary policy impacts liquidity. If this is the case, these considerations should be taken in account in shaping monetary policy.

We find that monetary policy affects the flows from and to mutual funds. Tightening policy induces outflows from mutual funds that specialize in government bonds, corporate bonds and equity of the cumulative magnitude of 6-10% of the stock of assets held by the funds, over a 30 trading days period, in reaction to a 1% unexpected increase of the policy rate, and accumulated inflows into money market funds of about 30% of their size.

At the same time, policy tightening tends to reduce liquidity in the underlying asset markets. We find, using several alternative identification strategies, that the flows from the mutual funds are responsible only partially for this effect on market liquidity. Although retail investors respond to policy changes with mutual fund flows, the limited share of fund holdings in the underlying asset markets is manifested in a relatively small effect on liquidity in these markets. Therefore, retail investors make a limited contribution to the change in liquidity conditions resulting from monetary policy adjustments. The theory and literature point to shocks to information and an increase in general uncertainty as possible additional avenues (see, for example. Bekaert et. Al. 2013).

Underlying Framework

This part lays out a simple partial equilibrium framework for retail investors' portfolio allocation. Consider a standard CAPM model, in which a risk averse agent (in our case – a retail investor), which maximizes mean-variance preferences, faces two assets: A riskless asset which pays riskless yields (in our setting, proxied by the monetary policy rate) and a risky asset paying higher yields in expectation, with higher risk (variance of returns).

The optimal portfolio choice between these two assets can be derived in closed form[1], and will depend on the following variables, in the following directions: the retail investor will increase the portfolio weights of the risky asset at the expense of the riskless asset, should the expected return on the risky asset increase, and decrease these weights should the risk of the risky asset increase, or the riskless return rises.

This simple and intuitive framework, based on the Capital Market Line, has tractable and measurable predictions: An increase in the policy rate should result in outflows from mutual funds, which are held mostly by retail investors, investing in risky assets such as equity and bonds, and inflows into mutual funds that invest in riskless assets – money market funds. In the empirical section of this paper, we indeed find evidence for these shifts in the data.

As discussed in other sections of this paper, mutual funds (or retail investors in general) are different from institutional investors in many aspects, including the time horizon of the investments. For this reason, it is useful to think of the above mentioned model – which is a static model, as an approximation of the considerations facing retail investors, that give larger weight to short-term yield-risk considerations but not institutional investors, which by nature optimize their portfolio based on long-term considerations. Contrary to the behavior of retail investors, in a general equilibrium, institutional investors, based on long-term yield optimization, will tend to increase their holdings in the risky asset after retail investors sell it, as the price goes down and the yields rise. We find empirical support for this view.

[1] For more details and the explicit equations see appendix 1

The remainder of this paper is organized as follows: Section 2 presents a brief literature review. Section 3 describes the setting and institutional background, and section 4 describes the data. Section 5 describes the methodology, section 6 presents the results and robustness checks, section 7 presents results for additional financial intermediaries, and section 8 concludes.

2. Literature Review

Our paper connects to two areas of interest in macro-finance literature: The first is the transmission channels of monetary policy via non-bank financial intermediation. The second is on the effect of flows from and to mutual funds on market liquidity.

While there is a vast body of literature studying the effect of monetary policy on asset prices, there is much less evidence on the effect of monetary policy on the flows. Among the papers referring to the effect on prices we will mention here the influential paper by Rigobon and Sach (2004), which shows that following an increase in the interest rates stock prices decline and the yield curve shifts upward – with smaller shifts for longer maturities. Paul (2020) identifies the dynamic response of stock prices to monetary policy shocks and shows, allowing for time-varying parameters that the reaction of stocks (and house prices) to monetary policy was particularly low just before the GFC in 2007-09.

More specifically, we are interested in understanding the effect of monetary policy on the portfolio composition of households, which we demonstrate using the flows from and to mutual funds, which are held mostly by households.

Several papers from recent years look at the effect of monetary policy on mutual funds. Giuzio et. al. (2021) show for the Euro area that expansionary monetary shocks are associated with net inflows to funds, and in particular and stronger to riskier funds, supporting the existence of the "risk channel" of monetary policy – a tendency to shift to riskier assets as the yield declines. Surprisingly, they find that money market funds also enjoy positive net inflows. They assume that might happen due to an increase in liquidity as a result of the monetary easing. They also find that fund managers shift away from cash assets, contributing to a possible liquidity risk in light of possible large outflows in the future. Banegas et al. (2022) show for the post GFC period – January 2009 to March 2017, that an unexpected increase in policy rates (of the size of 1pp) results in outflows on the magnitude of about 2.5-3.6% of assets for bond funds, and a larger long-term effect. The effect they find on equity funds is less consistent. The authors offer two possible related channels to the effect of monetary policy on fund flows: The performance-flows relations, i.e. tightening monetary policy creates downward pressure on asset prices, thus triggering outflows; and the expectations channel, i.e. the unexpected tightening changes investors' economic outlook, which triggers outflows. Kaufmann (2023) finds that similar results are true in euro-area funds. We document a similar result in Israel, a small open economy, and also find that flows to money market funds work in the opposite direction to that of bond and equity mutual funds: a tightening (loosening) of monetary policy leads to higher inflows (outflows) into money market funds.

Hau and Lai (2016) use the single short-term interest rate together with cross-country inflation variation among the Eurozone economies and find that lower *real* interest rates cause investors to move away from the money market into the equity market, consistent with the risk-shifting channel of monetary policy, mentioned above. Hodge and Weber (2023) in their working paper find, using a VAR estimation of monthly data, similar to the approach used by Banegas et al. (2022) that contractionary monetary shocks induce sustained outflows from long-term mutual funds and reduce their returns. A 100 basis points contractionary monetary policy surprise shock translates into a 2 percent fall in bond mutual fund net flows and a 4 percent fall in their returns, while the decline in net flows from equity funds are of a smaller magnitude (1%) and returns fall by more – about 12%. Contrary to these findings, Bubeck et. al. (2018) find that the reallocation is actually achieved via the change in the prices of the assets, and not by active reallocation of the assets. Holm et. al. (2021) in a paper investigating the effect of monetary policy on Norwegian households, using annual granular data, show that in response to a monetary shock households tend to decrease the share of risky assets in their portfolio and increase safe assets.

Gnabo and Sudant (2022) are an example for another strand of literature that looks at the portfolio decisions of the mutual fund managers in response to conventional and unconventional monetary policy, as opposed to that of the fund holders.

There is extensive literature on the potential hazards of fire sales in mutual funds and their ramifications for liquidity, financial stability and the real economy (see, for example, Shleifer and Vishny 1992, 2011; Coval and Stafford 2007). During the COVID-19 crisis we witnessed such fire sales. (See Figure 1). Hadad, Moreira, and Muir (2021) explored the disruption of debt markets during that period, demonstrating that outflows from bond funds were a major contributor to price dislocations. Mutual funds were compelled to sell assets to generate cash to facilitate investor redemptions. The excessive supply of bonds offered by funds at a rapid pace caused prices to plummet and yields to soar, impacting the real economy through corporations' increased cost of capital. Ma, Xiao, and Zeng (2022) quantified this effect, finding that sales pressure in debt mutual funds accounted for a staggering one-third of the increase in government bond yields and a quarter of the rise in corporate bond yields during the COVID-19 crisis. Falato, Goldstein, and Hortacsu (2021) examined the outflows in corporate bond funds during the COVID-19 crisis and the associated fire sale risk, as well as the Federal Reserve's measures to mitigate the transmission of these effects to the real economy. We are interested in examining whether this type and magnitude of reaction that was found for the COVID crisis also characterizes the reaction of fund holders to “small-scale” unexpected developments, such as monetary policy changes.

Different papers define liquidity in different ways[2]. Diaz and Escribano (2020) provide a broad review of the liquidity literature, and map out different liquidity measures to the different facets of liquidity. We follow them by choosing several liquidity measures that capture different aspects of liquidity: Bid ask spreads measure market tightness, i.e. the transaction costs. Turnover rates relate to market breadth and depth. Volatility is related to resilience and depths. These measures will be discussed in detail in the data section of this paper.

[2] See for example Fisher (1959), Demsetz (1968), Chordia et al. (2004) and Sarr and Lybek (2002).

3. Setting and Institutional Background

The Israeli mutual fund industry caters almost exclusively to domestic retail investors, with foreign investors holding less than 0.5% of the funds in terms of market value. This insular nature makes the mutual funds highly susceptible to domestic monetary policy, while largely insulating them from the direct impact of global monetary policy. Our analysis focuses on four well-defined categories of mutual funds that invest strictly in the local market: equity, government bonds, corporate bonds, and money market funds.[3] These well-defined funds comprise, on average, 41% of the total Israeli mutual funds industry. This focused scope enables us to examine the effect of changes in monetary policy in a relatively isolated manner, as all investments are domestic, and the asset classes are clearly delineated.

In Israel, there are no different share classes, meaning every mutual fund has a singular share for purchase, regardless of the type of holder. Foreign and domestic-institutional investors hold roughly 0.5% and 0.6% of Israeli mutual funds. The remaining 98.9% is held by local retail investors.

In three of the fund categories that we explore in this paper, equity, government bonds and corporate bonds, the underlying assets are well defined. In the fourth, money market funds (MMFs), it is not clear what underlying asset we should examine when testing the relation between flows and liquidity. MMFs hold a large variety of short-term low-risk assets: Government bonds, bank deposits, commercial papers and more. This means that the pass-through from fund outflows to asset liquidations is not as straightforward as it is in the case of the other funds in our data. Due to this characteristic, we concentrate on understanding the dynamics in the 3 classes of funds – government and corporate bonds and equity, and relate to MMFs only for completing the picture of flows, but give smaller weight to our findings. It is important to note that MMFs in Israel are perceived as riskless funds, which have the declared goal of providing investors with returns as close as possible to the monetary policy rate.

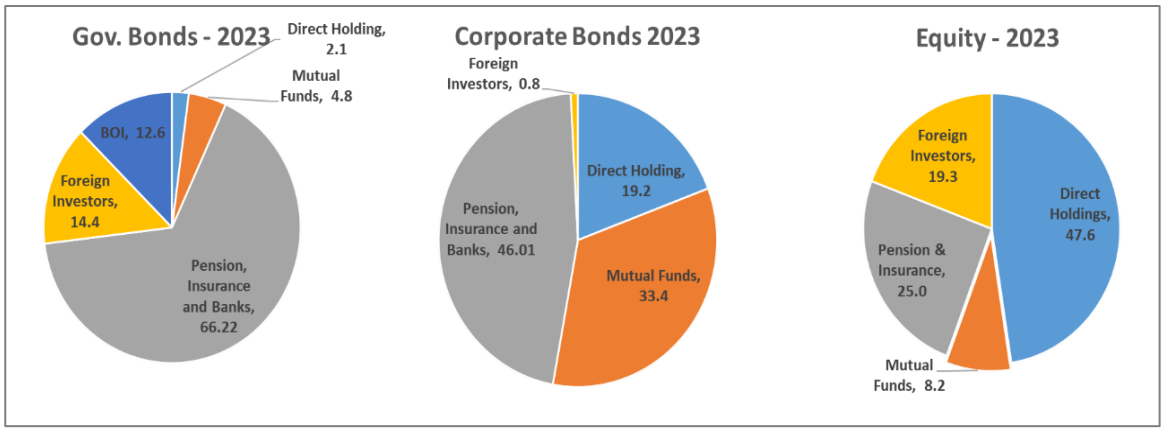
It is worth noting that all of the aforementioned assets - equity, government bonds and corporate bonds – are traded on a limit order book exchange, and mutual funds managers buy and sell on the exchange, rather than over the counter. This is quite unique, and allows us to directly observe market data, including high frequency liquidity measures.

The reaction in the asset markets to a monetary policy shock depends on the composition of investors in each market, and on how each of these investors react. Figure 2 presents the distribution of holders in each of the markets we examine in this paper. As we know from previous studies, and also find support in this study, institutional investors react relatively slowly and in a counter-cyclical manner, whereas mutual funds tend to react swiftly and pro-cyclically to unexpected shocks. This means that the larger the share of mutual funds in a given market, we may expect larger flows and possibly a larger risk that monetary policy tightening would dampen liquidity. The importance of mutual funds is apparent in the Israeli corporate bond market, where mutual funds hold roughly a third of the market as of 2023.

[3] We do not include use mutual funds classified as "flexible" or "mixed," which allow fund managers to operate across different asset markets and frequently adjust asset allocation in our sample. We exclude index funds from our sample, as is customary in the literature. In unreported results we repeat the tests for index funds and find our results remain qualitatively unchanged.

For equity, mutual funds hold about 8%, while the public holds directly about 50%. The share of government bonds held by mutual funds has declined from about 10% in 2019 to about 5% due to the QE purchases executed by the Bank of Israel during COVID. In addition, as both mutual funds and direct holdings are held by retail investors, it is natural to assume that their activity is correlated, and that results based on mutual fund data generally hold for direct holders as well. Mutual funds may also be a meaningful market player in terms of volume and price discovery: In the Israeli stock market, for example, they represent 20% of turnover, although they hold only 8.2% of the market.

Figure 2: Holders of government bonds, corporate bonds and equity, by sector, 2023



Looking at the financial asset portfolio of households, we find that households hold about 47% of their assets indirectly via institutional investors, and 8% via mutual funds. Of the remaining assets that are held directly by households, 75% are cash and bank deposits.

4. Data

Our analysis is based on three major data sources. The daily flows in and out mutual funds, daily shocks to monetary policy (once every few weeks, about 120 times in our sample)[4] and daily liquidity indices in the different asset markets.[5] We will describe in short each of these data sources. The period we analyze is constrained by the availability of data and stretches from 2011 until June 2023.

4.1 Mutual fund data and additional data

We employ a rich data set on mutual funds from the Tel-Aviv Stock Exchange, containing granular daily data at the individual fund level, including flows, market value, fund price and category. For the panel estimation we combine this with an additional proprietary data set, which includes monthly fund level data, with detailed information on different types of fees

[4] Until April 2017 monetary decision were taken monthly, 12 times a year. Since then, monetary policy is set 8 times a year.

[5] Additional analysis, presented in section 7, is based on monthly data for the stock of assets held by institutional investors and daily bank deposit data.

and loads, and a passive/active classification (i.e., whether or not the fund tracks an index). We only use data for four well identified categories of active mutual funds that invest in different asset markets: Corporate bond funds, Government bond funds, equity funds and money market funds. We exclude index-tracking funds, and "flexible" and "mixed", funds which allow the manager to invest in different types of assets. In addition, we use daily data from different financial markets, such as inflation expectations and the local VIX.

While we only use mutual funds that are of well identified and distinct investment categories, it is important to note that they might represent larger flows. Flexible funds, holding different kinds of assets, are likely to experience flows that are close to a linear combination of the categories we present in this paper, weighted by their holdings[6]. In addition, as mutual funds in Israel are held almost exclusively by retail investors, it is a weak assumption that the flows are data captures are highly correlated to the flows of direct holders, for which we cannot observe flows directly[7].

Table 1 shows that average daily net flows are small and negative for bond and equity funds, and positive for money market funds. Another interesting fact is that flows in and out of money market funds tend to be larger (as a share of the fund) than from equity funds, and flows from these larger on average than those in out of bond funds. In addition, the similarity between daily flows, as seen in the daily autocorrelation is relatively high.

Table 1: Inflows, Outflows and Net inflows (as % assets) statistics, 2011-June 2023

Investment Group	Mean Flows (%)	Standard Deviation of Flows (%)	Daily Autocorrelation
Corporate Bonds	-0.002	0.17	0.76
Equity	-0.005	0.22	0.62
Government Bonds	-0.017	0.18	0.85
Money Market	0.039	0.47	0.51

4.2 Monetary shocks

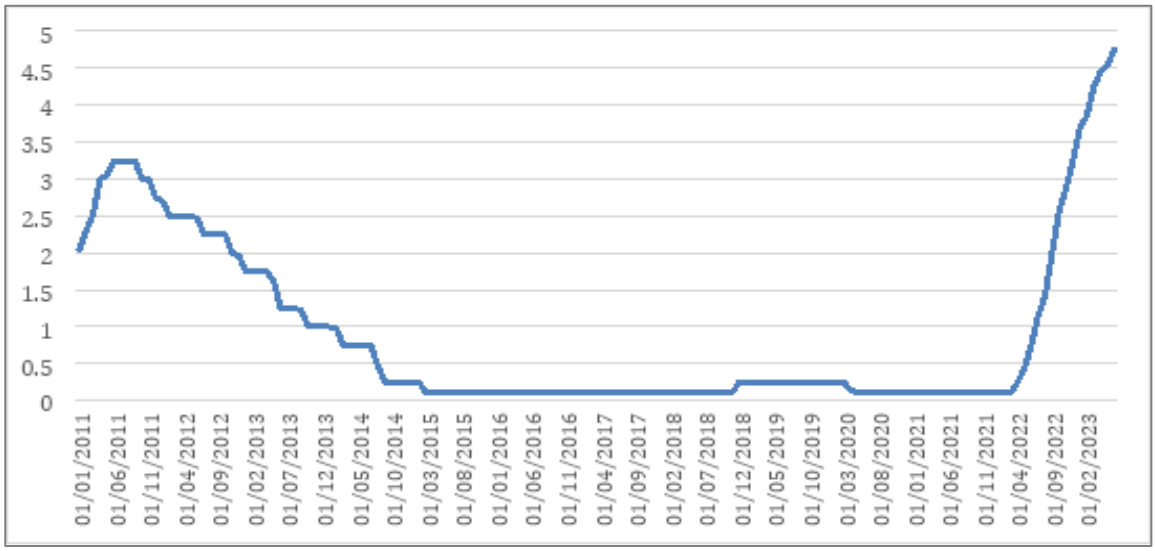
Monetary policy during the period we investigate, 2011 to June 2023, is characterized by three major periods. The first, after a few months of interest rate hikes, starting in October 2011, monetary policy is characterized by an accommodative path, in light of the aftermath of the GFC and the European debt crisis, and on the background of the moderation of inflation and domestic activity. The policy rate reached its minimum at 0.1%, which is considered to be the effective lower bound, in March 2015, and stayed there during the COVID-19 crisis, until April 2022, (excluding a short period when the rate was set at 0.25). The third period, starting in April 2022 is characterized by a rapid increase of rates, similar to the global trend, in light of the accelerating inflation rate with the recovery from the pandemic. The BOI interest rate reached 4.75% in June 2023, the ending point of our sample. (Figure 3).

[6] While the flows in the flexible funds are similar to the funds that we include in our sample, we exclude them as they are likely to respond differently, selling assets in a packing list order, starting with the most liquid.

[7] This is the case for corporate and government bonds and for the money market. In the equity market, however, many of the direct holders are insiders who have broader considerations.

As decisions and activity in financial markets are affected significantly by the expectations of participants concerning future developments, and in particular expected monetary policy, the effect of policy – actual and expected – is embedded in market behavior already in the present. Therefore, in order to identify the investors' reaction to the monetary policy, we use an indicator for the unexpected change in the policy - the part that the markets have not yet internalized. The methodology we use in order to quantify the domestic monetary policy shocks follows the well-known and widely used methodology suggested by Kuttner (2001) and Gurkaynak, Sack, and Swanson (2005).

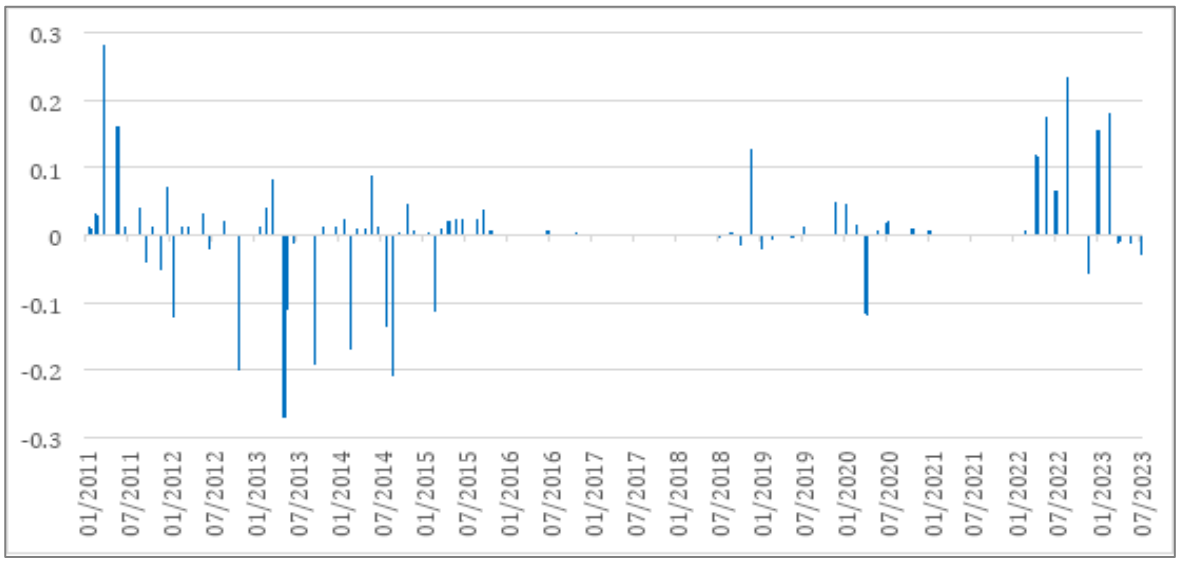
Figure 3: Bank of Israel Policy Rate, 2011 – June 2023



Assessing the response of the market to unexpected changes in monetary policy enables us to understand the effect of changes in monetary policy in general. As common in this literature, we use the change in short-term (Telbor) yields within a short window around the time of the announcement on the policy rate in order to evaluate the size of the unexpected change in policy. Due to data limitations, we use daily frequency of changes – computing the difference in the yields between the daily yield data on the day following the decision date, that of the day of the policy announcement.[8] Figure 4 shows the shocks measured according to this method, based on the 3-months yields. The first period, until the end of 2014, is characterized mostly by negative shocks – the rate was reduced more than expected. In the second period, until the beginning of 2022, shocks are usually very small due to the rates being close to the ELB. In the third period the shocks are mostly positive, meaning the Bank increased the policy rate faster than what has been expected.

[8] As the Telbor price is set on 11 am daily, and the interest rate decision is announced in the afternoon, the effect of the announcement is measured only on the following trading day.

Figure 4: The change in 3-months yields around policy decisions, 2011-July 2023



During the period investigated the Bank of Israel made used of additional monetary tools when it purchased 85 Billion shekel worth of Government bonds during the COVID pandemic and a small volume of corporate bonds of about 3.5 billion shekels. We do not study the effect of these measures on the flow of funds, but we do include in our estimation dummy control variables for the dates of the announcements of the Government bond purchases on 23 March 2020 (which was not an interest decision date) and 22 October 2020 (a decision date), and for the announcement of the corporate bond purchases on 6 July 2020 (a decision date). The Bank of Israel has also been intervening in the FX market on a discretionary basis since August 2009.[9] As this policy framework, including the use of FX interventions as an additional monetary tool was known to the market prior to the start of our investigation period and the actual size of the intervention is not known in real time, and is published only on the beginning of the next month, we assume the response of the markets to unexpected interest rate changes is given this monetary policy framework.

4.3 Market liquidity indicators

Measuring the liquidity of financial assets makes it possible to assess the functioning of the trading process and assess the degree of uncertainty regarding the asset prices which in extreme events may cause market failure. Since the measurement of liquidity is based on different indices, each of which reflects a partial picture of the liquidity level, it is important to examine several liquidity indices. We consider three alternative established and widespread liquidity indices. These are the bid-ask spread, turnover rate and volatility. The BAS will be the major indicator we will refer to. Analysis referring to the other indicators will be presented in the Appendix.

[9] Starting from March 2008 and until August 2009 the Bank of Israel purchased fixed preannounced daily amounts of FX – first 25 million and later 100 million a day. During our period of investigation the Bank of Israel only purchased FX. On 9 October 2023, which is after the end point of our sample, following the terrorist attack on Israel and the initiation of the war, the Bank of Israel has announced it will sell up to $30 billion dollars in order to support stability in the markets.

Bid Ask Spread (BAS): the average difference between the best buy and best sell prices relative to the actual transaction price at regular time intervals throughout the day (intra-day data).

Implication: the BAS is an ex-ante indicator of the cost of purchasing liquidity, which is an inverse measure of the level of liquidity, and more specifically – of market tightness. A higher acquisition cost expresses a lower liquidity level.

Turnover Rate: the ratio between the daily turnover and the total issued capital.

Implication: the turnover rate is an indicator for the level of activity in the market which is an ex-post measure of the level of liquidity, and specifically of market breadth and depth. It is often considered as a measure of the average holding period of an asset. The higher the turnover rate, the lower the average holding period, which implies lower spreads

Volatility: the standard deviation of the rate of change in the asset's price at regular time intervals throughout the day (intra-day data).

Implication: intra-day volatility is a direct measure of the functioning of the trading process - market efficiency. It is associated with two different facets of liquidity – resilience and depth. Technically, volatility measures the stability of the price throughout the day[10]. Low volatility indicates a high level of liquidity.

Table 2: Liquidity indices statistics, 2011-2023*

	Corp. bonds	Gov. bonds - total	T-bills (MAKAM)	Equity
Average				
Bid – Ask spread	0.116	0.066	0.021	0.239
Volatility	0.068	0.043	0.008	
Turnover	0.164	0.405	0.189	0.139
Standard dev.				
Bid – Ask spread	0.050	0.027	0.013	0.070
Volatility	0.043	0.018	0.004	
Turnover	0.077	0.152	0.164	0.083

* Due to data limitations we lack the volatility index for the equity market. BAS for the equity market for 2012-2023.

[10] A situation in which the price changes at a uniform rate in each time interval throughout the day, will be expressed in zero volatility, even if this rate of uniform change is very large.

Figure 5: Bid-ask spreads 2011-June2023

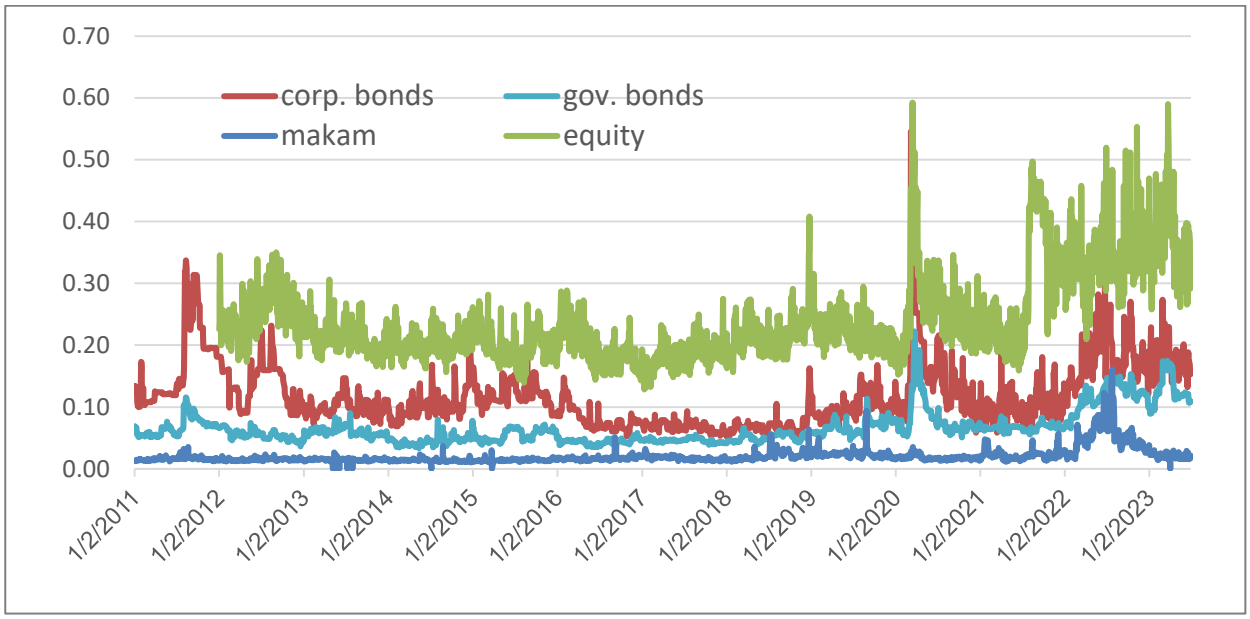


Table 2 shows that bid-ask spreads are larger on average for equity and corporate bonds, while government bonds, and Makam (T-Bills) enjoy lower spreads and volatility. The turnover of government bonds is considerably larger than that of other assets, which signify a larger and deeper market for government bonds.

Figure 5 shows the bid-ask spreads for the four markets.[11] As expected the bid-ask spread is the narrowest for short term T-bills ("Makam"), and the widest for equity. The outbreak of the COVID pandemic is easily seen and a tendency for higher and more volatile spreads may be seen after 2020.

4.4 What's different about monetary decision days?

Before delving into the effect of unexpected monetary policy movements on mutual fund flows, we want to evaluate how exceptional or special are the "surprises" or movements in the market on policy decision days, relative to other trading days. We find that the changes in the 3 months yields following monetary decision days, which serve as a proxy for the unexpected movement of the policy rate are significantly larger than those in other trading days. Table 3 shows that on average, the absolute movement in the 3 months' yield on decision days are about 0.035%, while on other days they are of a much smaller magnitude – about 0.005%. However, these extraordinary movements in the yields do not translate into exceptional flows or changes in the Bid-Ask spread, except for somewhat larger (absolute) net flows to corporate bonds' mutual funds. These indicators support the perception that monetary policy changes, even if unexpected, as long as they preserve the stable and known monetary policy framework, do not tend to produce exceptional movements in the market

[11] Due to data limitations for the equity market we have access only to the BAS, and only starting from 2012 and ending in June 2023.

that endanger the market's stability. The figures presented in Appendix 2 depict movements in yields, flows and the BAS on decision days (in blue) and on other days (in gray).

Table 3: Averages on decision days[12] and other days

	Mean on other days (2952 obs.)	Mean on decision days (108 obs.)	Mean difference	t-stat for difference between groups	P-value
Change in 3M yield	.00067	.0056	-.0049	-2.64	.00
Absolute change 3M	.0049	.0352	-.0337	-17.9	.00
Net Flows					
Corp. bonds	-.002	.000	-.002	-.12	.90
Equity	.0047	-.0159	.0111	.53	.59
Gov. bonds	-.017	-.016	-.001	-.04	.96
Money Market	.043	-.071	.114	2.50	.01
Absolute net flows					
Corp. bonds	.099	.124	-.024	-1.82	.068
Equity	.134	.146	-.012	-.72	.47
Gov. bonds	.108	.120	-.012	-.84	.40
Money Market	.267	.275	-.008	-.22	.83
BAS					
Corp. bonds	.116	.116	-.000	-.03	.97
Equity	.239	.230	.009	1.22	.22
Gov. bonds	.066	.063	.0029	1.12	.26
Money Market	.021	.020	.000	.47	.64

5. The methodology

We divide our analysis to two parts. First, we investigate the effect of monetary policy innovations on the flows in and out of mutual funds. After establishing this relationship, we will want to substantiate the importance of these findings by evaluating the association between these flows and the liquidity of the underlying assets. This will allow us to link between changes to monetary policy and changes in the liquidity in the market and its sources. We will employ a number of examinations in order to assess the trilateral connection between monetary policy, mutual funds flows and the liquidity of the underlying assets.

5.1 The effect of monetary policy on flows

In order to identify the effect of monetary policy on the flow of funds in each class of mutual funds (corporate bonds, government bonds, equity and money market), we estimate the response of these flows to monetary shocks using Local Projections in the spirit of Jorda (2005), using the net aggregated flows to each of fund class in response to a monetary shock.

[12] In practice we link the trading day following the policy decision to the effects of the decision as the yields in the Telbor markets are set on 11am, while the decision is published in the afternoon, and sell/buy orders for mutual funds are executed the following days. We assume the BAS, and other liquidity indicators, which are measured through the trading day of the following day better reflects the effects of the monetary policy decision.

For each fund class *j* we estimate separately as the benchmark specification:

$$y_{j,t+h} - \ y_{j,t-1} \ = \alpha_{(h)} + \beta_{(h)}\varepsilon_t + \sum_{m=1}^{M} \gamma_{(h)j} \ (y_{t-m}) + \sum_{n=1}^{N} \delta_{(h)} \ (\varepsilon_{t-n}) + \eta_{(h)}x_t + u_{(h)j,t+h},$$

With $y_{j,t+h}$ the net flows to fund class *j* relative to its total assets *t+h* periods after the monetary shock ε_t on day *t,*[13] and $\beta_{(h)}$ for each period h, the coefficient of interest, measures the sensitivity of the volume of flows after h trading days as a result of a unit shock to monetary policy.

Formally, we can write:

$$\beta_{(h)} = \mathcal{R}_{\varepsilon,y}(h) = E\left[y_{j,t+h} \mid \varepsilon_t = 1; \boldsymbol{X}_t \right] - E\left[y_{j,t+h} \mid \varepsilon_t = 0 \, ; \boldsymbol{X}_t \right]$$

We also include in the aggregate estimation a set of control variables, x_t which include market based break-even inflation (lagged one day), the local VIX, both averaged over a month, the change in the (log) of dollar/shekel exchange rate and in the (log) Nasdaq index, both lagged one and two days, a linear trend, monthly dummies, a dummy for the first day of each month, dummy for march 2020 (the outset of the COVID pandemic which was accompanied by extraordinary changes in market yields) and three dummies for interest decisions that also included declarations concerning intervention of the Bank of Israel in the government bond market during the first phases of the COVID pandemic.[14] We also include 10 lags of the dependent variable but do not include lags of the shocks, as they are zero at least a month prior to the date examined.

We estimate the response in each of the classes of funds (equity, government bonds, corporate bonds, money market) separately, using an OLS regression with Huber-White robust standard errors.

Alternatively, we estimate a panel local projection at the individual fund level, as presented in the robustness section of this paper.

We later assess the stability of our findings by looking at sub-periods – until to 2019, just before COVID, and starting in 2015, and excluding the ZLB period estimating the response to a change in longer horizon yields and distinguishing between positive and negative and small and large shocks to the policy rate.

5.2 Flows and market liquidity

In this section we seek to investigate the relationship between mutual fund flows (relative to assets) and liquidity indicators. As presented above we refer to the bid-ask spread, which is available for all asset classes, as the main liquidity indicator. In addition we look into the volatility and turnover ratio indices, which are not available for the equity market. We employ

[13] Until April 2014 interest decisions were published after the closing of the trading day. Since then they are published on 4pm, about an hour before closing. In any case, as joining or leaving a mutual fund is only possible on the day after the interest rate decision, we mark the shock to the policy a day after it was published in order not to contaminate the initial response.

[14] We assign a dummy on the declaration dates: March 23, July 6, and October 22, 2020.

several examinations that allow us to assess whether monetary policy changes impact not only flows but also market liquidity.

Our identification assumption is that things unfold in this order: The monetary policy changes and brings about fund flows by retail investors from and to the mutual funds. The day after that, or possibly later, mutual funds buy or sell in the underlying asset markets, and their transactions affect liquidity.

It is important to refer to the timing of each of the changes in the market. The flows we measures are those initiated by the retail investors, wishing to buy or sell mutual fund shares in exchange to cash. According to their order the fund manager is obliged to transfer cash to their account (in the case of redemptions) by the next day, or buy in her name (in the case of inflows), with the same-day value. The fund manager will usually approach the underlying asset market only on the subsequent trading day (or even later, at her discretion), and only then will potentially affect the liquidity of the underlying assets. Therefore, in all our analyses we match the liquidity index referring to day *s* with the fund flows on trading day *s-1*.

1. SVAR: We estimate a 3-variable VAR system including the monetary shock, mutual fund flows and a liquidity indicator (in this order), separately for each of the fund classes and liquidity indicators and study the response of flows and liquidity to monetary shocks. We identify the structural shocks using a simple Cholesky decomposition. Ordering the liquidity indicator after the net flows is consistent with the functioning of the markets, as described above. Then we zero out the flows' coefficients in all three VAR equations (without re-estimating, keeping the previously estimated coefficients unchanged), and re-examine the impulse response function – now with the flows transmission channel muted. The difference between the two responses of liquidity in the two exercises indicates the importance of the fund flow channel in the effect of monetary policy on the underlying assets' liquidity.
2. LP: We estimate the effect of monetary policy shocks on liquidity indicators using local projections (LP), alternating between a specification including or excluding the flow of funds in the previous day (and additional lagged periods) as control variables. The difference between the response of liquidity to monetary shocks with and without controlling for flows is an indicator for the contribution of fund flows to the transmission of policy to liquidity.
3. 2-stage IV estimation: We proceed with a two stage approach: We first evaluate the flows generated by the monetary shock using local projection estimation for the response of flows to monetary shocks. Similarly to equation (1) we have: $flows_{i,t+h} = \alpha_{(h)} + \delta_{(h)}\varepsilon_t + \cdots_+$ We then use the estimated flows for each period *t+h* separately in a second stage OLS estimating the effect of flows in *t+h-1* (generated by monetary shocks) on liquidity in *t+h*. $BAS_{i,t+h} = \gamma_{(h)} + \theta_{(h)}\widehat{flows_{\iota,t+h-1}} + \cdots$. The indirect effect of the monetary shock, via the flows, on the liquidity index is therefore $\delta_{(h)} * \theta_{(h)}$. The size of this effect relative to the direct response of the liquidity indicator to the monetary policy shock, is the share of fund flows in the transmission of monetary shocks to market liquidity.

6. Results

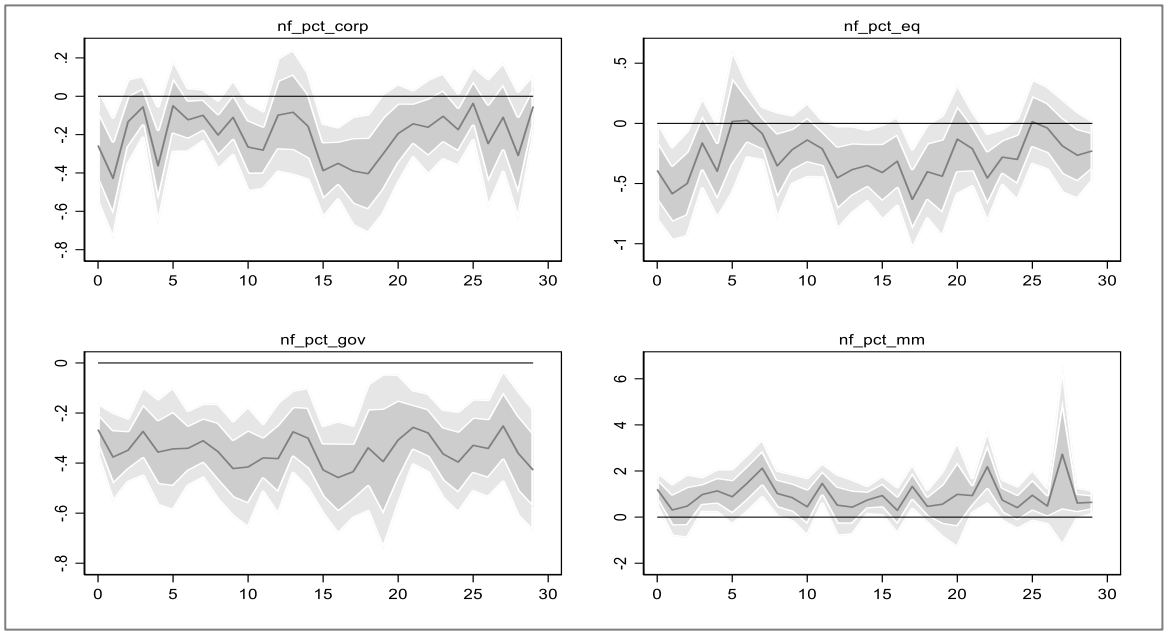
We present the response of each of the mutual fund classes to an (unexpected) change in the policy rate. We show results both for panel estimation – looking at the flows in each specific fund over time, and results for the aggregated flows in each of the mutual funds' classes – government bonds, corporate bonds, equity and money market funds. In addition, we investigate the trilateral links between monetary policy, mutual fund flows and asset market liquidity and present several robustness checks. Our results show that both on the individual and aggregate level, contractionary monetary policy of the size of 1pp, will tend to induce daily outflows from bond and equity funds in magnitude of about 0.2%-0.3% of their assets. In contrast, the money market funds induce inflow of a magnitude of 1% of assets per day, over about 30 trading days. These flows accumulate to an outflow of about 6-10% of the assets and an inflow of about 28% to money market funds over a period of 30 trading days. This represents a change in risk-taking by retail investors, who, in the face of a monetary tightening reduce both credit risk and duration associated (mainly interest rate) risk. The magnitude of the response of bond and equity mutual funds is of a similar magnitude to that found in previous research. (See for example Banegas et al. 2022).

When testing for the effect that these flows have on liquidity, we find a significant, yet mild effect, leading to the conclusion that mutual fund flows explain only a small part (roughly 20%) of the decline in liquidity following a monetary tightening.

6.1 The effect of monetary policy on flows

We examine the effect of monetary policy on flows using the aggregated net flows to each of the classes of funds. Using aggregate flows, we capture the extensive margin, i.e. the net effect of mutual funds in the underlying asset market. As is shown in figure 6, In reaction to a contractionary shock, flows to funds specializing in corporate bonds, government bonds or equity decline with an average daily rate of about 0.3% of their total assets, while flows to money market funds increase by about 1% of their total assets. It is interesting to note that the effect of the monetary shock on flows of investors from and to mutual funds persists, most evidently for funds specializing in government bonds and less so for the other classes. The flows from government bond mutual funds diminish only after about 60 trading days (not shown here). This phenomenon suggests that the "players" in this market, i.e. mostly households react gradually. The cumulative outflow throughout the first 30 trading days after the policy change is about 6% of assets in the corporate bonds' funds, for a 1% (unexpected) increase in policy, 8% for equity funds and about 10% of assets for the government bond funds. The inflow during this period into money market funds, is of the magnitude of about 30% of their assets. Table 1 indicated that the volatility of flows in the money market funds is much larger than in other funds.

Figure 6: The response of mutual fund net flows, by class, *aggregate* data, percent, 2011-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the funds assets.

Given the stock of each class of funds in the market, we can assess whether, or to what extent, the outflow from bond and equity funds supports the inflows to money market funds. As a first order approximation, given that for 2023 the stock of corporate bond, equity and government bond funds is about 22, 14 and 18 billion shekel, respectively, and that the rate of daily outflow accumulates, according to the response functions, to about 6%, 8% and 10%, the total outflow from these funds totals to about 4.2 billion shekel. On the other hand an inflow of a magnitude of 28% of a 67 billion shekel stock of money market funds, is about 19 billion shekels – almost five times larger than the estimated outflows. We must note that we refer only to mutual funds investing in well-defined asset classes, therefore, it is reasonable to assume that there are outflows into money market funds from flexible or passive funds as well as other financial assets, such as equity and bonds held directly and bank deposits.

6.2 The link between flows and liquidity

We have demonstrated above that unexpected monetary policy brings about changes in net flows to mutual funds. We take our investigation a step forward and look at the links between flows in and out of mutual funds, in particular those induced by monetary policy, and the liquidity in the underlying asset markets – the corporate bond market, government bond market, equity market[15] and the MAKAM (T-Bill) market. We employ alternative approaches, as detailed above, in order to establish these links. We find that flows to and from mutual funds, due to changes in monetary policy are one of the channels by which monetary policy affects market liquidity. Outflows from funds, as a result of monetary tightening, tend to

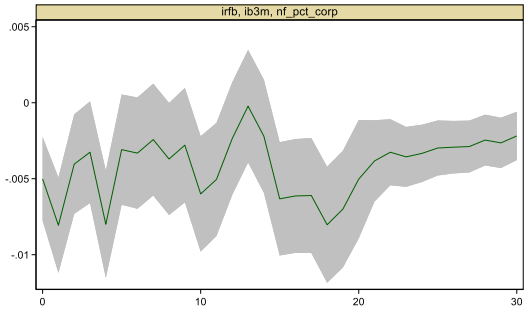
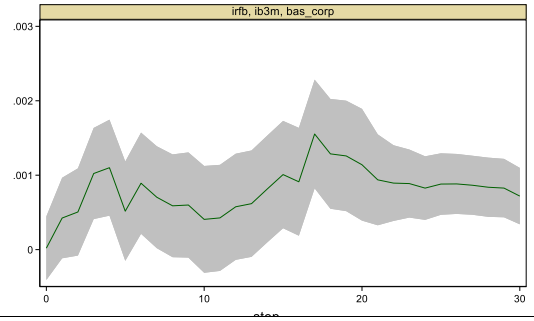
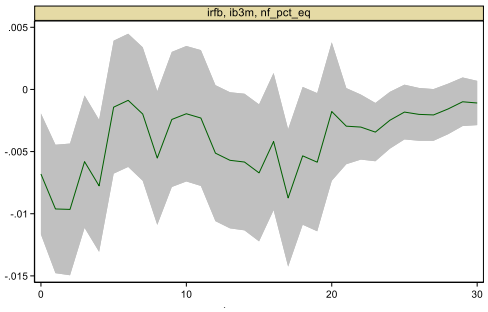
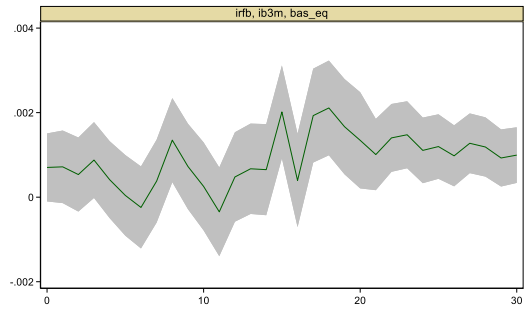
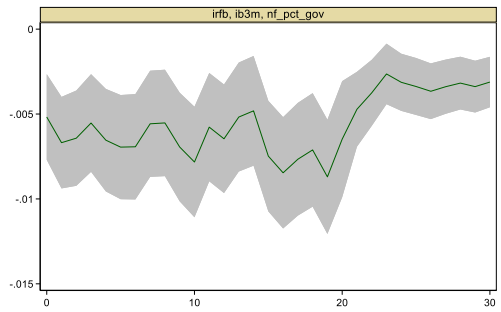
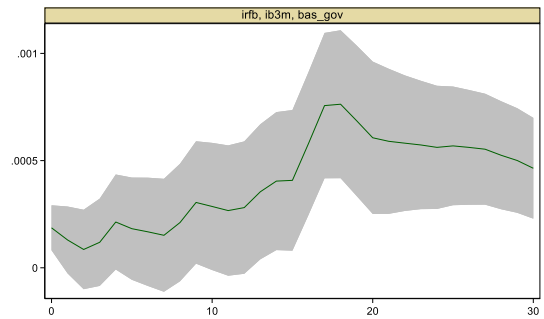
[15] Only partially due to lack of data.

reduce liquidity in the underlying asset markets although their contribution to changes in the liquidity indicators is not large.

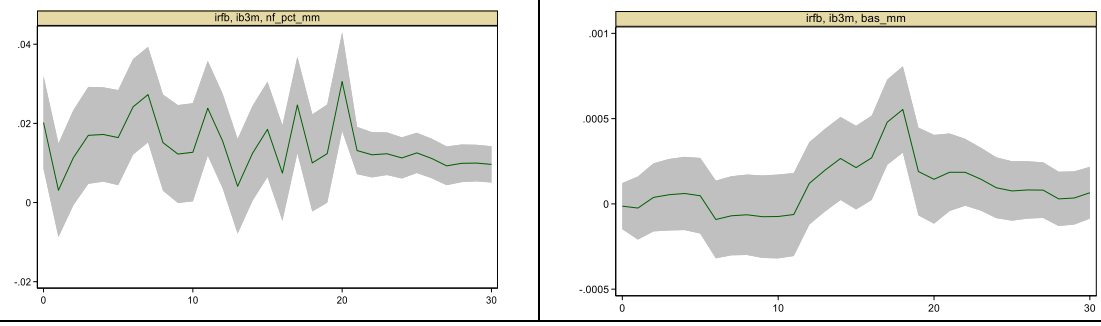
6.2.1 SVAR

Our first approach is to estimate a 3 variable structural vector auto-regression for each of the markets including the monetary shock, the net aggregated flows in the specified asset class and an indicator for liquidity in the underlying asset market. The order of the variables, as stated, serves as the identifying scheme for the structural shocks, using a Cholesky decomposition. We first present the response of flows and liquidity in each of the markets, using the BAS as the liquidity indicator, to a 1 std, which is about 0.014pp, (unexpected) change in the policy rate. In Appendix 3 we present the results for alternative liquidity indices.

Figure 7: VAR Impulse response – 3 variable system (monetary shock, flows, BAS index)

Response of flows	Response of BAS
Corporate bonds	
	
Equity	
	
Government bonds	
	

Money Market



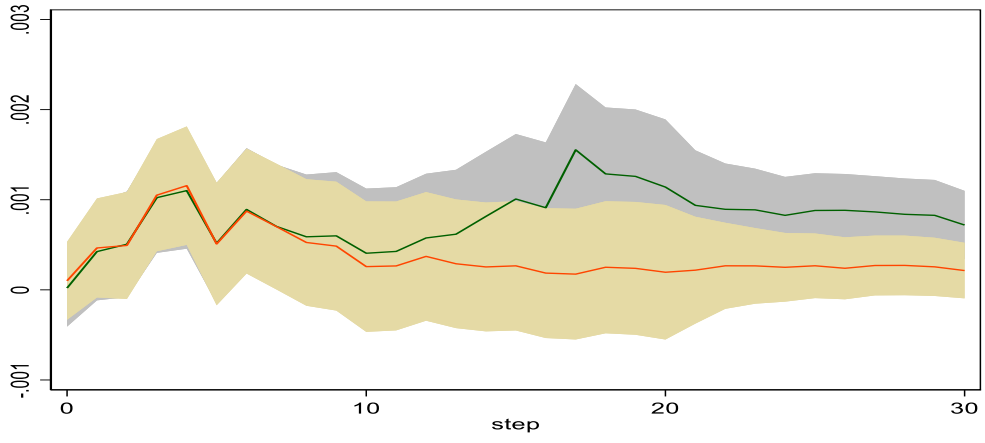
* The line depicts the response to a 1std shock to the policy rate (0.014). The gray area depicts a 90% confidence band.

In response to a monetary shock, net inflows to corporate bond funds decline alongside an increase in the bid-ask spread in the corporate bonds market. Translating the shock to a 1pp shock to the policy rate, we obtain a daily decline in flows in the magnitude of about 0.3-0.4% percent of assets, similar to our previous results, accompanied by an increase of about 0.07 to 0.14 pp in the BAS. A similar effect may be seen in the government bond and equity markets. For the money market we observe an increase in inflows, without a significant effect on the liquidity in the MAKAM market. This first exercise shows that monetary policy influences the liquidity in the asset markets alongside its effect on the mutual fund market. (Figure 7).

Monetary policy shocks tend to increase volatility and marginally decrease turnover of bonds and equity while increasing turnpver in the money market,, indicating impairment of liquidity, although the effect is only marginally significant (See Appendix 3).

Figure 8: SVAR Impulse response of the BAS index, 3 variable (red) and 2 variable (green) systems

Corporate bonds



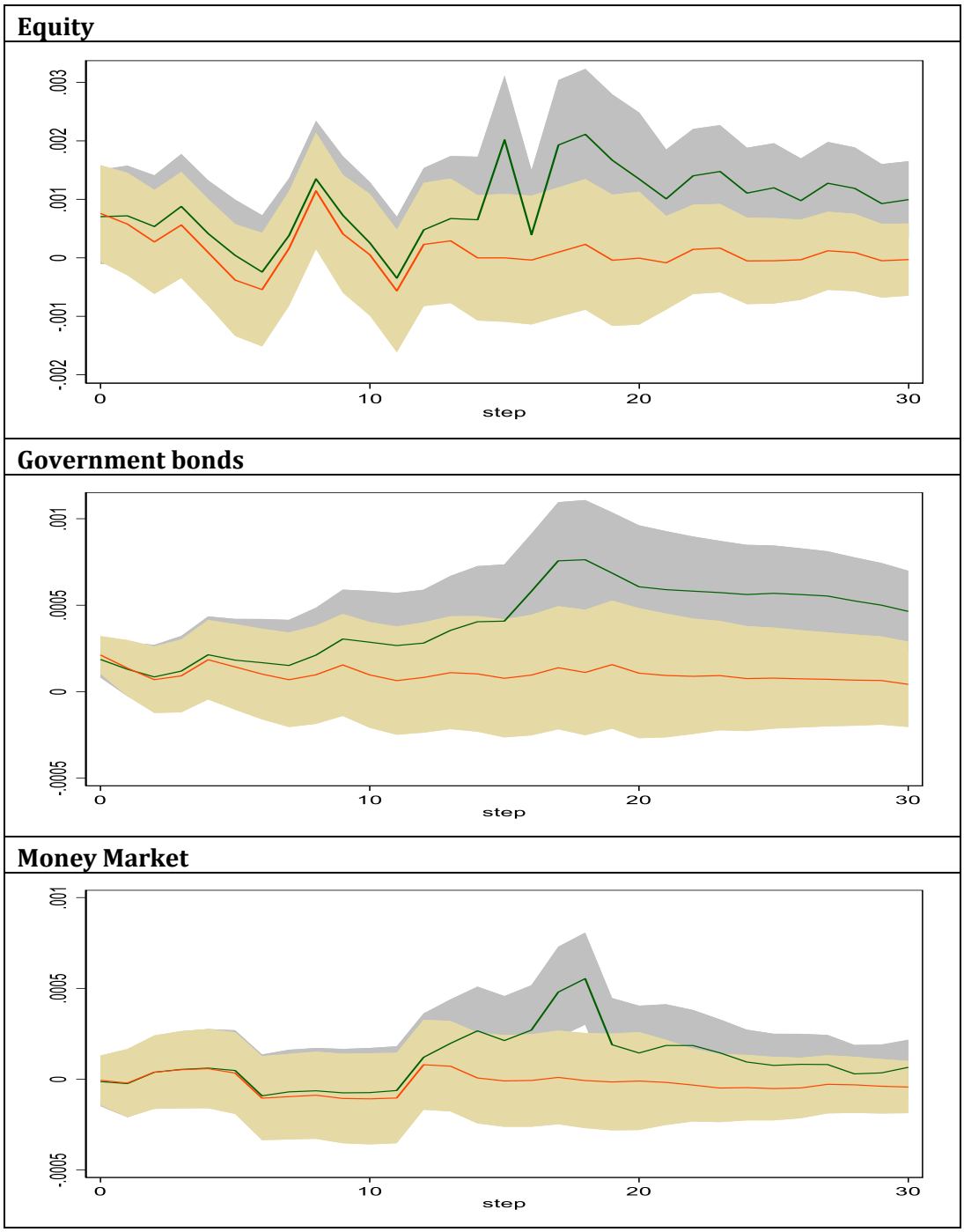


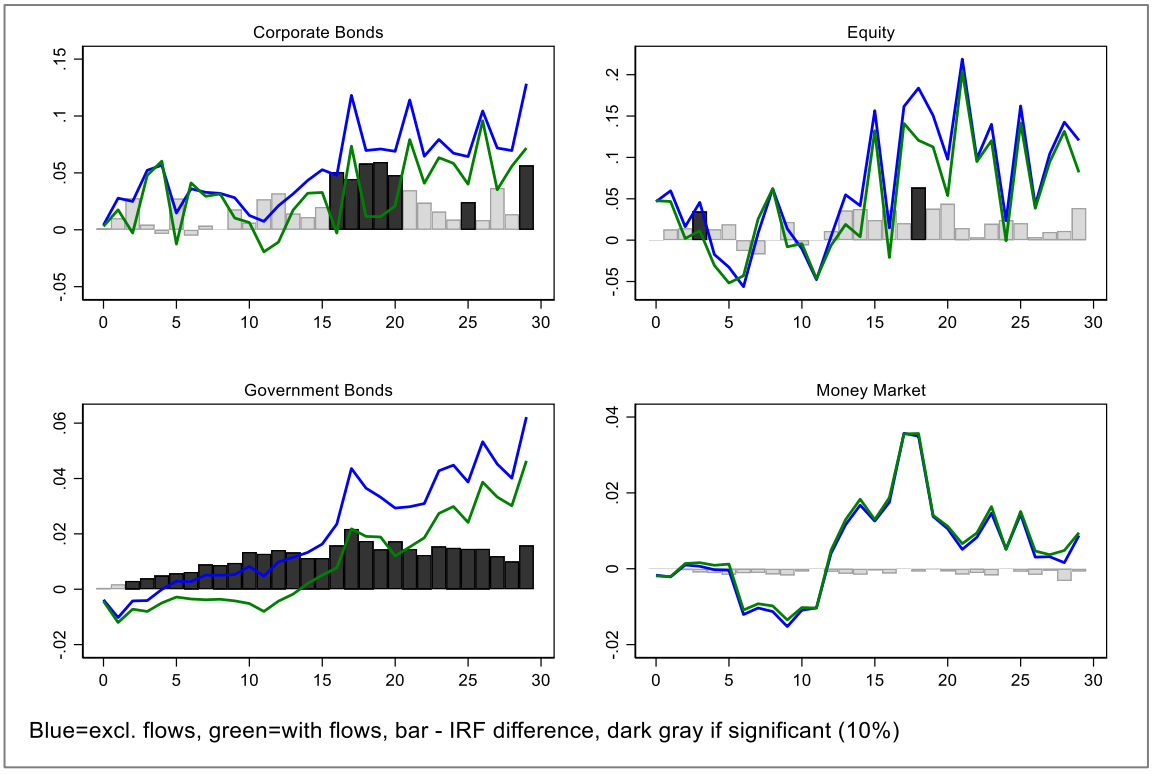
Figure 8 presents the response of the BAS index in the two alternative specifications of the response function, as described above. The green line with the shaded gray area depicts the basic 3-VAR estimation, paralleling the responses shown in Figure 7. The red line with the shaded yellow area shows the response of the BAS when the flow-of-funds-channel is muted. Generally, it seems that the flows from the mutual funds do not have any effect on the market liquidity in the initial days, and only some effect after about 10 trading days. This may indicate that even if mutual fund holders react to changes in the monetary rate, fund managers approach the market in order to adjust the asset holdings of the fund only gradually.

6.2.2 Local Projections with and without flows as a control variable

A second approach we use is assessing the contribution of flows in explaining the effect of monetary policy on market liquidity. We do this by estimating the response of liquidity in time t+k to monetary policy shocks in time t, using the Local projections methodology including flows in time t+k-1 (and in additional lagged periods), again as described above due to the timing of fund manager's actions, , and alternatively excluding flows from the specification. As before, we repeat this exercise for the various liquidity indicators. The additional results are presented in Appendix 4.

Figure 9 shows the response of the BAS when the flows as a control variable are included (in green) and excluding flows (in blue). The bars indicate the difference between the 2 specifications, which may be interpreted as the contribution of the flows in explaining the response of BAS to the change in the policy rate. Darker bars depict a significant difference. First, it is important to mention that we find that monetary policy affects market liquidity, as measured by the BAS and other indicators – BAS increases, turnover in the bond market declines, and volatility increases. Second, the results show that flows have a role in transmitting the effect of policy on market liquidity in particular in the government bond market, and to a lesser extent in the corporate bond market. In the equity market and the money market the effect of policy on liquidity is mostly insignificant. Flows from funds contribute to most of the increase in the government bonds BAS in the first days following the shock, a partial fraction of the change in the BAS for the corporate bond market after about 2 weeks. The results for the volatility and turnover indices (in Appendix 4) show that the flows from funds contribute to the impairment of liquidity in the underlying asset markets most evidently in the government bond market and to some extent in the corporate bonds market.

Figure 9: The effect of monetary policy on the Bid-Ask spread, including (in green) and excluding (in blue) flow of funds.



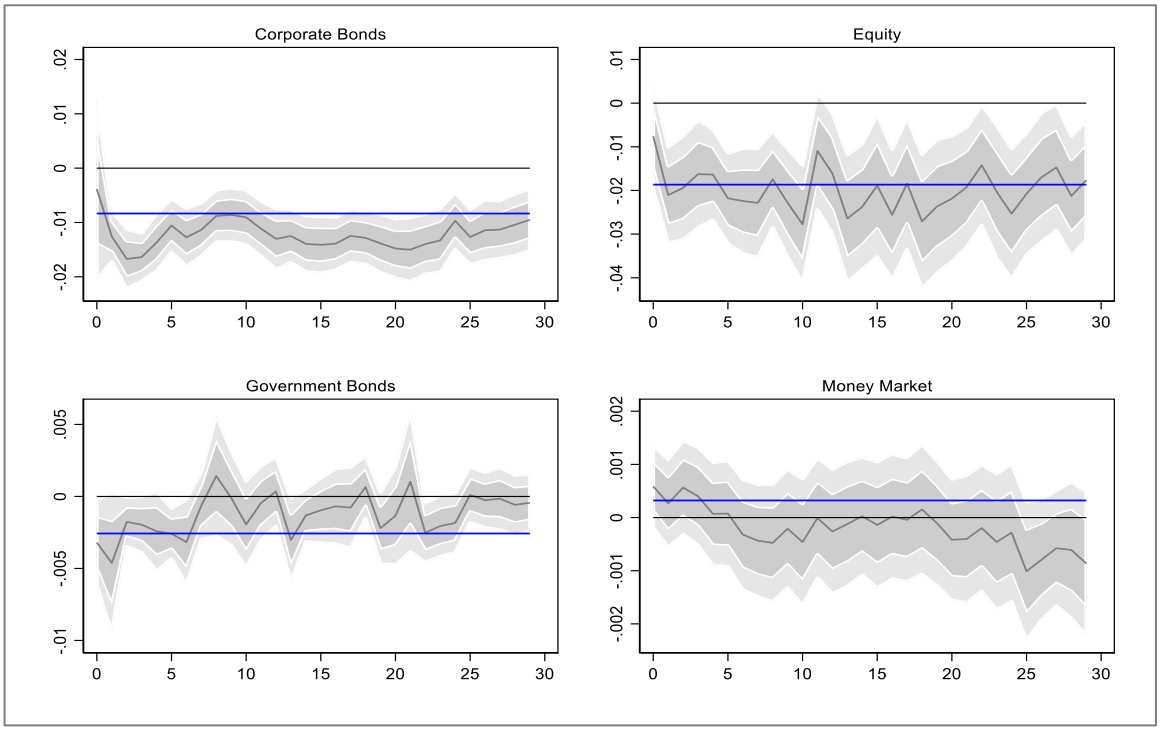
6.2.3 2SLS - Instrumenting flows

As mentioned before, including the flows as a control variable suffers from the fact that they are endogenous, as they incorporate the response to the monetary shock. An alternative approach we propose is to instrument flows using a first stage Local Projections estimation of the response of flows to a monetary shock in the first *h* periods following the shock. Then, in the second stage, for each *h*, we estimate the effect of the estimated flows on liquidity (on the next day). Again, using BAS as the main indicator, and alternatively the other liquidity indicators (shown in Appendix 5). In addition, as a benchmark, we estimate a simple OLS equation tying between flows and liquidity irrespective of monetary shocks.

The first stage estimation is actually the response of the flows to a monetary shock, as presented in Figure 6. In the second stage we assess the importance of these flows on the underlying assets' market liquidity for each horizon *h.* Figure 10 presents the second stage OLS estimation, as described earlier, the response of the BAS of each underlying asset market, in time *t+h*, as a function of the estimated change in net flows in the relevant mutual fund class due to a monetary policy shock*, t+h-1* periods after the shock. In addition, we show (with the blue line) the unconditional coefficient of the BAS on flows.

The figure shows that the BAS in the corporate bonds market and the equity market is affected by changes in flows to the relevant mutual funds, as a result of monetary shocks. The effect on the government bond market, which is more liquid, and that mutual funds consist a smaller share in that market, is less pronounced but still negative. In the money market, liquidity improves somewhat, but only marginally significant. As we have shown previously that a monetary shocks leads to a decline in flows to bond and equity funds, the negative coefficient here means that following a monetary shock that decreases flows to mutual funds the BAS is expected to increase. In addition, it should be noted that the coefficients shown for each *h* are *not* to be interpreted as the effect after h periods, rather the relation between the response of flows *h-1* periods after the monetary shocks and the liquidity index a day later. Therefore it is very likely that the coefficients obtained will be relatively stable over all *h*'s, as seen in the figure below.

Figure 10: The second stage effect of estimated flows on the Bid-Ask spread



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the funds assets. The blue line depicts the OLS coefficient of BAS on flows.

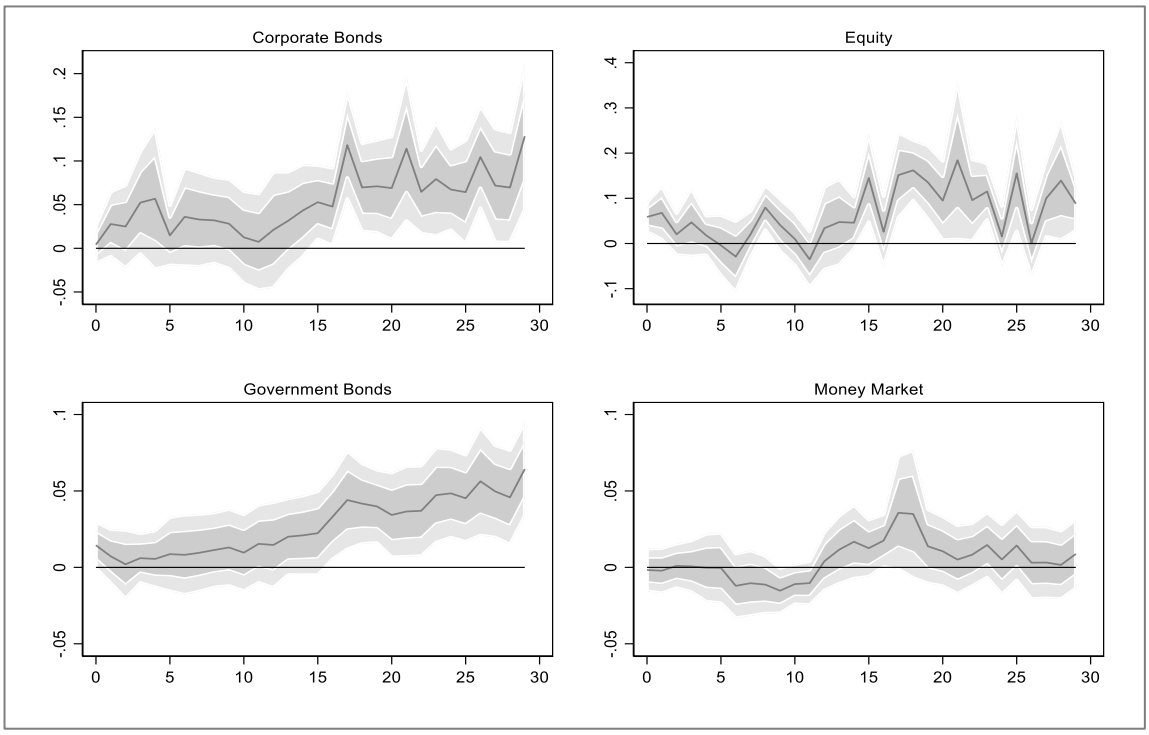
Examining the results for the volatility and turnover of the bond markets (Appendix 5) we confirm the same qualitative results, although the effect of flows on government bond turnover is mostly insignificant. When flows increase, the volatility in the corporate and government bond markets declines, so in response to an increase in policy rates that is followed by a decline in inflows to these funds, volatility increases. The results for the turnover are mixed. So, according to the 2-stage procedure we employ we find that tightening monetary policy indirectly induces a deterioration in liquidity due to the decline in net flows to mutual funds.

In order to assess the importance of this channel, we estimate the *direct* effect of monetary policy on the BAS, by implying the Local projections methodology that was presented above with the BAS as the dependent LHS variable. The specification is similar to that employed above for the response of flows to monetary policy, with the same set of lagged and exogenous variables on the right hand side. We deliberately do not include flows as control variables in order to allow the response of the liquidity indicator to absorb all transmission channels, including a possible effect of the liquidity conditions in the markets. Figure 11 shows that an (unexpected) increase in policy rates is expected to increase the BAS spread in the corporate and equity markets and to a lesser extent in the government market, which is deeper and generally more liquid.

Examining the total effect, as seen in the direct response of the BAS to the monetary shock (Figure 11) and the results from the 2 stage procedure presented above, we can give a rough assessment for the importance of the "mutual-fund-channel" of monetary policy on market

liquidity. Recalling that a 1% increase in the policy rate decreases net flows to bond and equity mutual funds by about 0.2-0.3% of their assets (every period, Figure 6), and that each percentage point of flows decreases the BAS by about 0.015-0.02 percentage points(Figure 10), which is of the magnitude of one standard error (Table 2), we may infer that the indirect effect of 1% increase in rates on the BAS, via the change in flows is about 0.002-0.006 percentage points. We compare this to the total direct effect, (Figure 11), which is for corporate bonds and equity about 0.03, and may conclude that the activity in the mutual fund market in response to monetary policy changes contributes to the decline in liquidity in the market, but it is not the major contributor to the impairment of liquidity following a tightening of monetary policy.

Figure 11: The direct response of the BAS to monetary shocks, by class, 2011-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the funds assets.

6.3 Robustness Tests

We perform various robustness checks and find that results remain qualitatively unchanged.

6.3.1. Panel Estimation

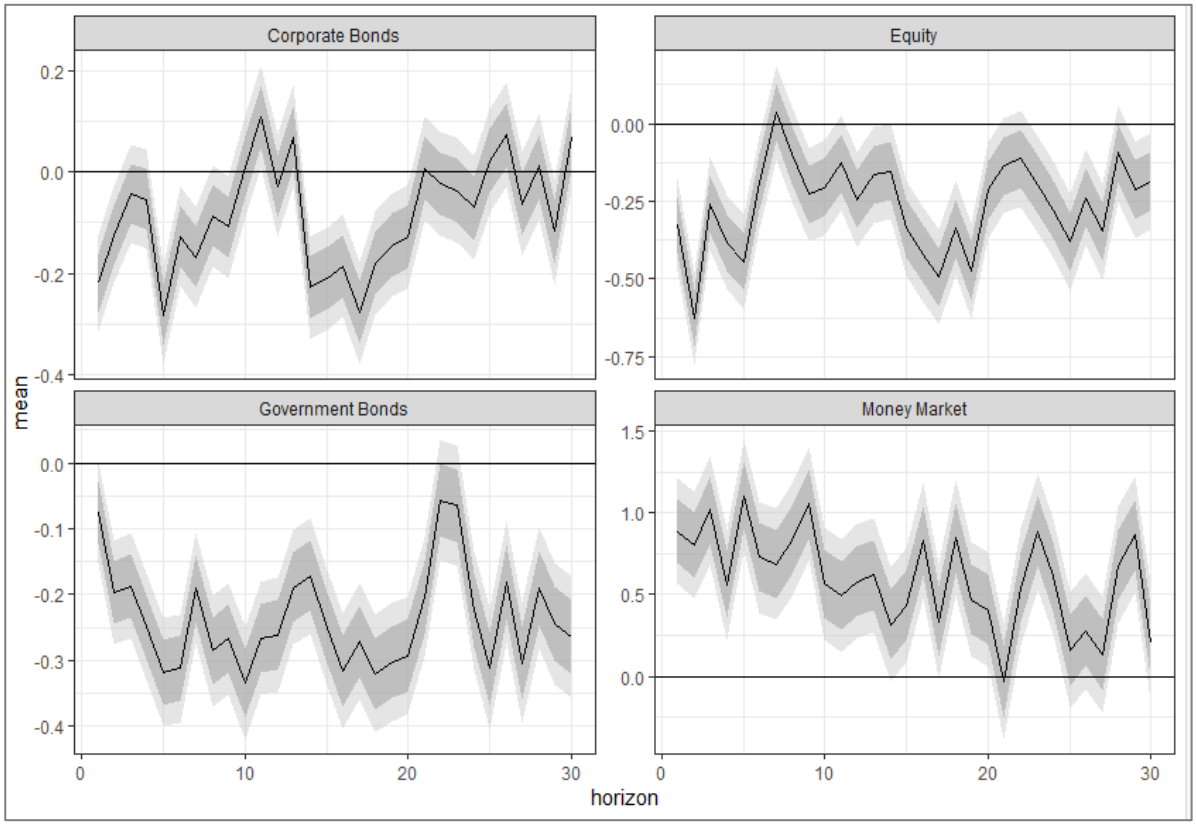
Figure 12 presents the response of each of the mutual funds classes to a monetary policy shock, based on panel estimation of net flows to individual funds. Controls include market based break-even inflation, the local VIX, both averaged over a month and lagged one day, monthly dummies, and three QE dummies for interest decisions that also included declarations concerning intervention of the Bank of Israel in the government bond market during the first phases of the COVID pandemic. We also include 10 lags of the dependent

variable but do not include lags of the shocks, as they are zero at least a month prior to the date examined.

Holders of mutual funds specializing in corporate bonds or equity tend to reduce daily inflows to these funds by about 0.1-0.2% of the assets, while the reduction in flows to government bond funds is somewhat larger and more persistent.

The effect of a contractionary monetary shock on money market funds is opposite, with a permanent increase in the net flows to these mutual funds. These results, based on panel data, confirm the indications obtained for the aggregate data.

Figure 12: The response of mutual fund net flows, by class, *panel* data, 2011-2023

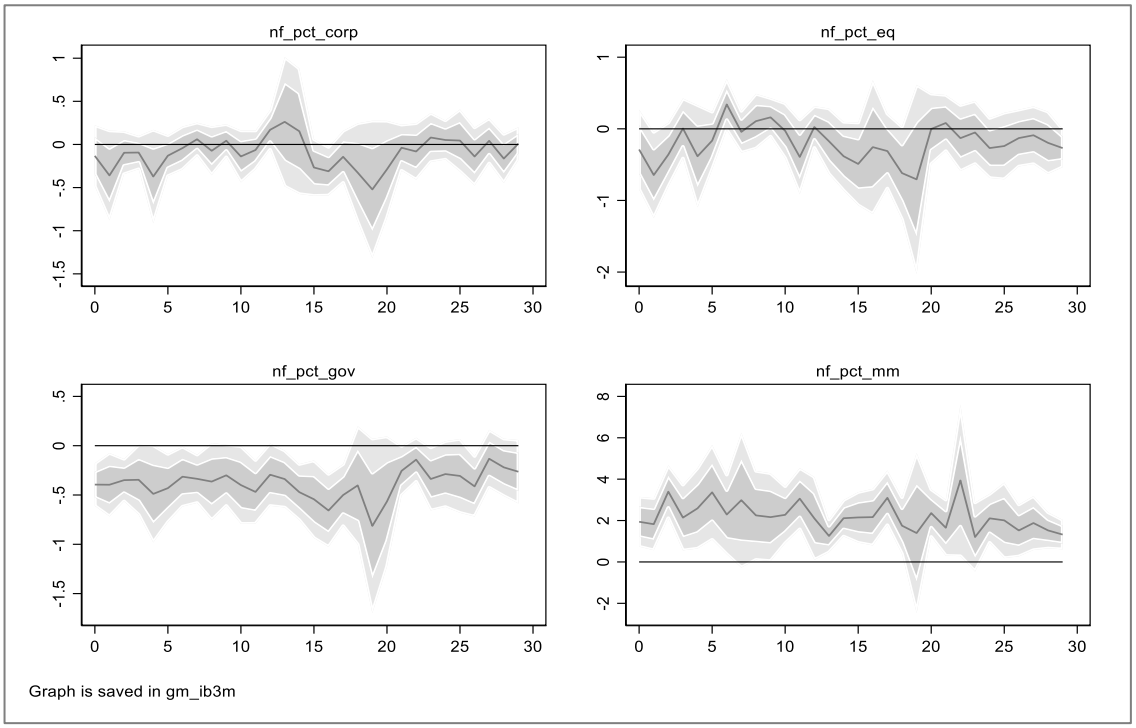


Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the funds' assets.

6.3.2 Partial Samples

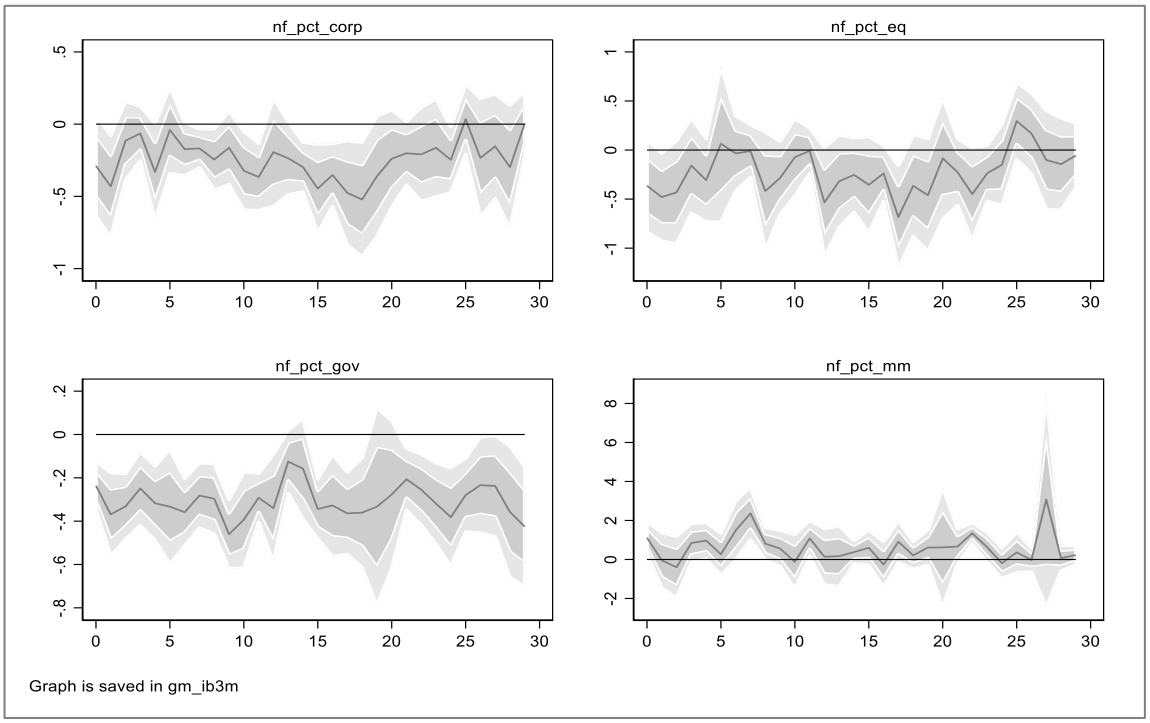
As our sample is relatively long, starting from 2011, we re-estimate our basic aggregated local projections response functions for a shorter period, starting from 2015. Our qualitative results remain unchanged, but the significance of the effect is somewhat weakened. Truncating the sample to begin in 2019 does not affect noticeably the results and reassures us that our results are not an artifact only of recent years. Figure 13 presents the results for the sample 2015-June 2023, and Figure 14 the results for the period ending in 2019.

Figure 13: The response of mutual fund net flows, by class, *aggregate* data, 2015-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

Figure 14: The response of mutual fund net flows, by class, *aggregate* data, 2011-2019

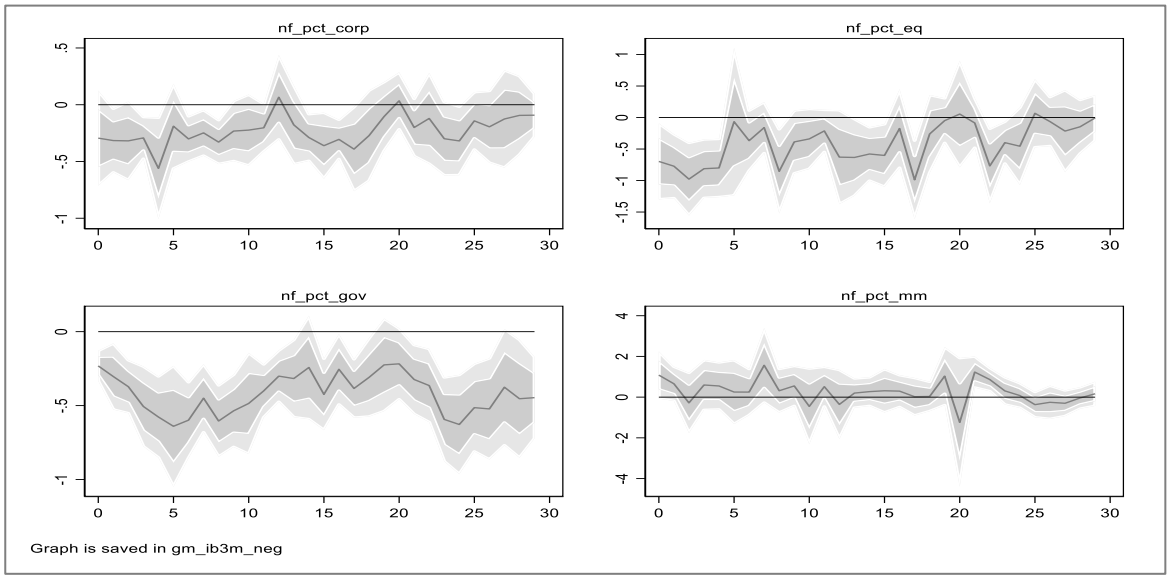


Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

6.3.3 Negative vs. positive surprises

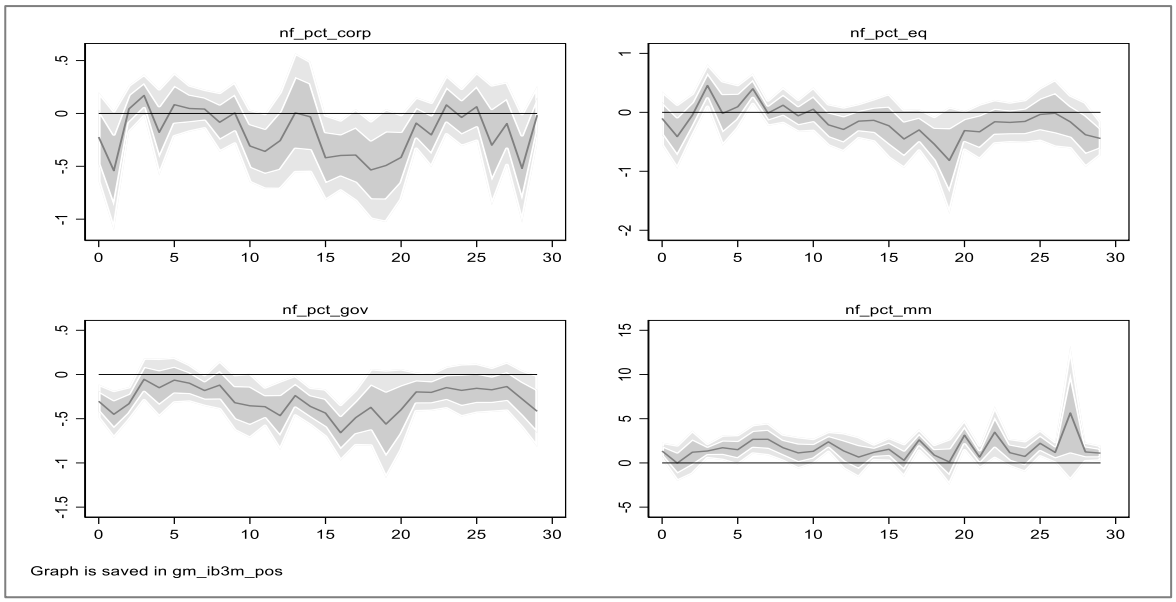
Figure 4 above presents the monetary policy shocks during the years we investigate. Throughout the years surprises were occasionally negative, more frequently in earlier years, and sometimes positive, in particular in recent years.

Figure 15: The response of mutual fund net flows, by class, *aggregate* data, *negative* shocks 2011-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

Figure 16: The response of mutual fund net flows, by class, *aggregate* data, *positive* shocks 2011-2023



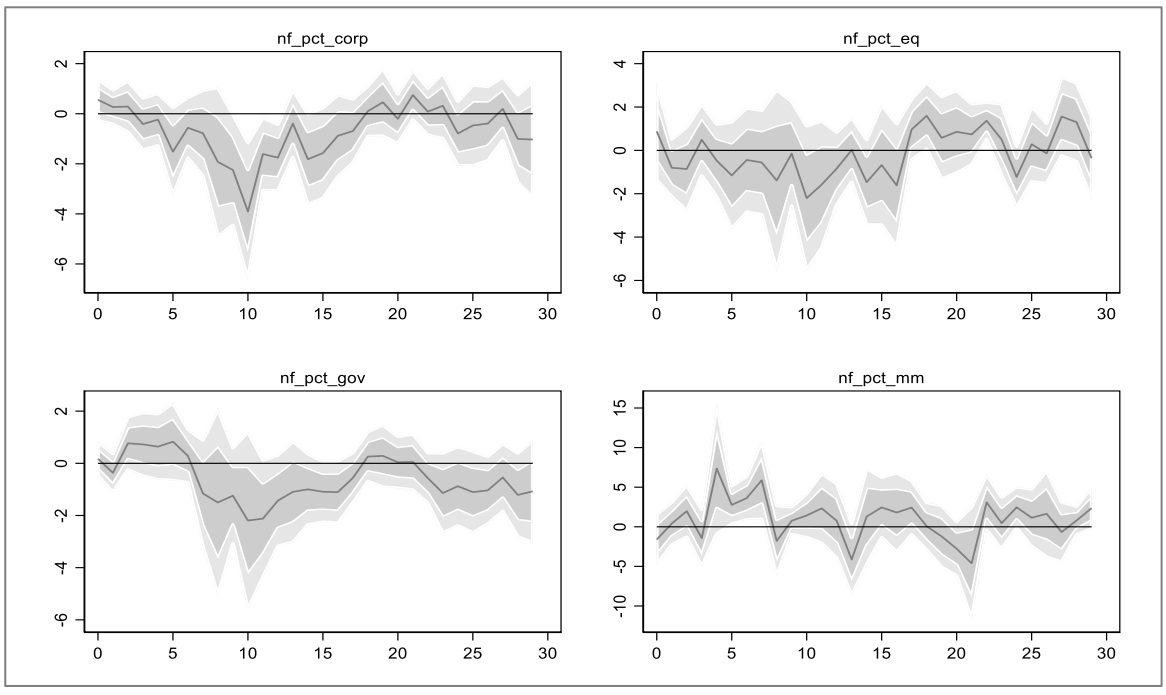
Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

We want to investigate whether positive shocks, i.e. tighter monetary policy than was expected, that is expected to be followed by outflows from bond and equity funds, have a stronger or weaker effect relative to negative shocks – a more than expected accommodative policy. Figures 15 and 16 show the response of the different classes of funds to negative and positive monetary shocks. As seen in the figures, the direction and magnitude of the response is similar to that in the benchmark estimation, but there are some differences between the response to positive and negative shocks to monetary policy. A higher than expected interest rate (positive shock) encourages increasing money market holdings which enjoy the increase in the rates, but the decrease in the holdings of corporate bonds, government bonds and equity is relatively weak. In the case of an accommodative policy the tendency to exit money market funds is absent, while fund holders do respond and increase (in the figure a negative number, but the shock itself is negative) there holdings of bond and equity funds.

6.3.4 Small vs. Large surprises

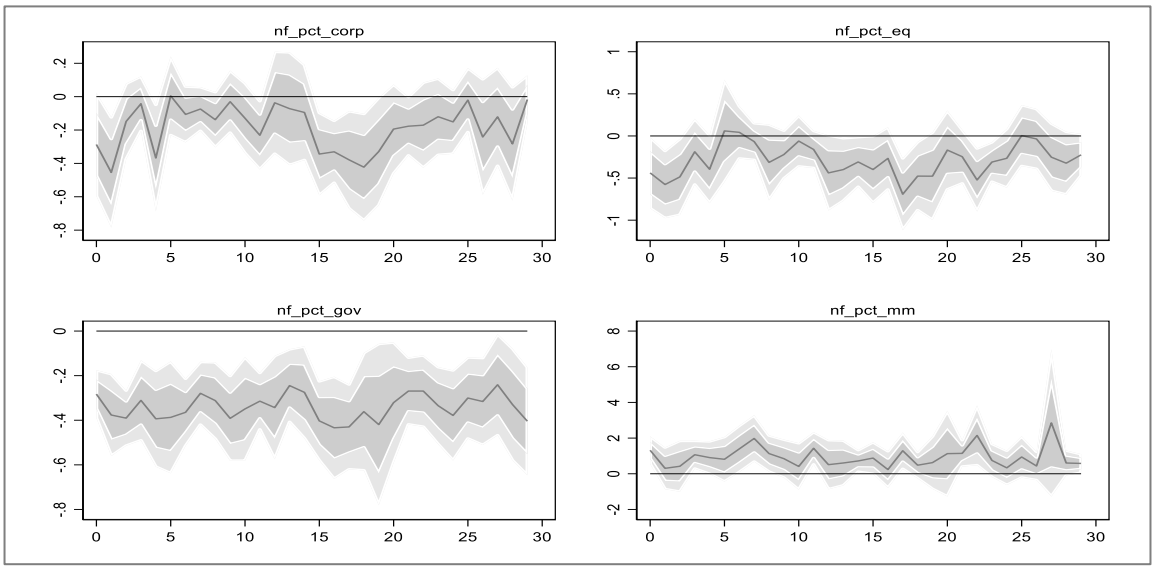
We further check whether the response of flows depends on the size of the surprise, i.e. a non-linear response. We find, and show in Figures 17 and 18 that the response to large shocks, which are defined as shocks larger than the sample mean of the absolute value of the surprises, is stronger than the response to smaller shocks. This may demonstrate a stronger sensitivity to more meaningful changes in policy, or the better ability to identify, using our empirical method, the response of the market, when the actual surprise is larger.

Figure 17: The response of mutual fund net flows, by class, *aggregate* data, *small* shocks 2011-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

Figure 18: The response of mutual fund net flows, by class, *aggregate* data, *large* shocks 2011-2023



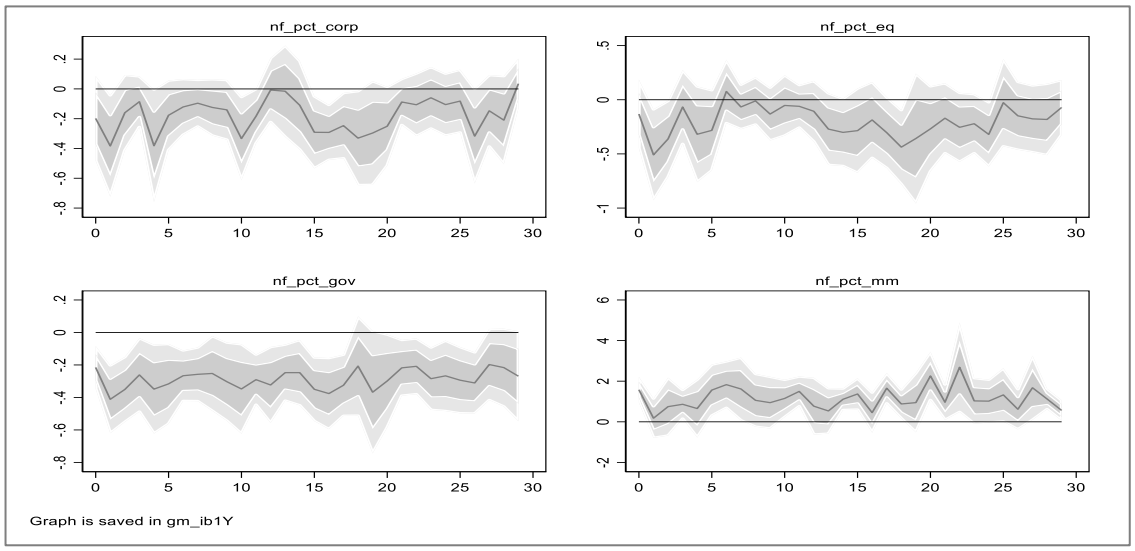
Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

6.3.5 Longer horizon yields

For our benchmark investigation we chose to use the change in the 3-month *Telbor* (short-term T-bills) yield in order to evaluate the unexpected change in monetary policy. Alternatively, we can use the response of longer horizon yields for 1 year and 2 years, around the announcement of the policy rate.[16] These take into account not only the unexpected change in the current target rate, but also the change in the expected path or trajectory of the policy in the future, due to possible Forward Guidance – explicit or implicit that accompanied the decision concerning the policy rate.

[16] The correlation between the change in the 3 month yield and the 1 year yield on relevant days is 0.85 and between the 3 month and the 2 year yield it is 0.76.

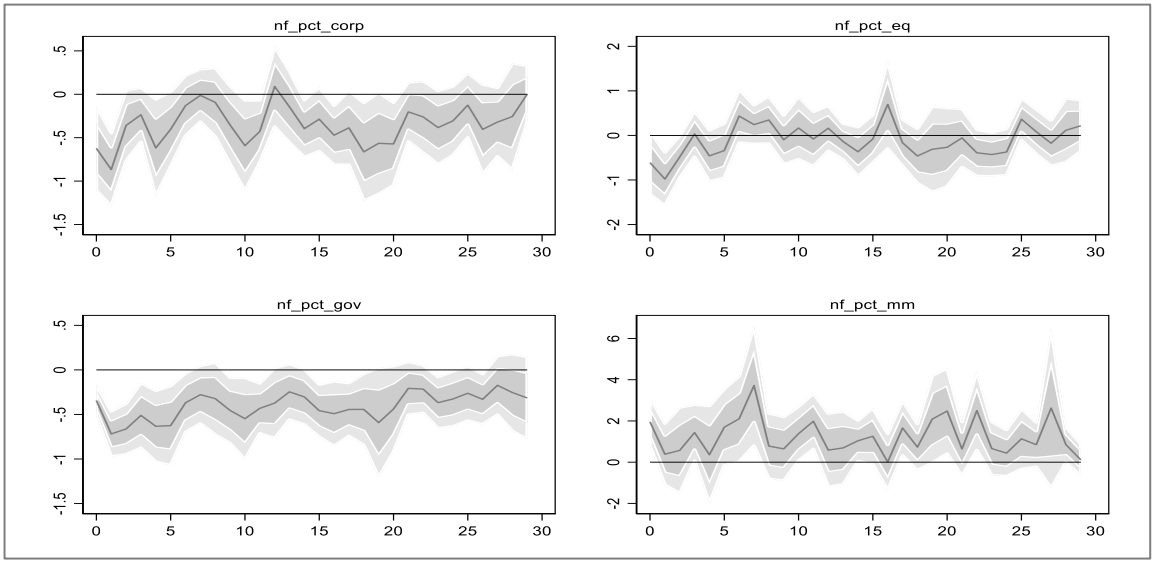
Figure 19: The response of mutual fund net flows, by class, funds, aggregate data, *1-Y yields*, 2011-2023



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

Figure 19 shows the results when using the (change in the) yields for 1 year, and Figure 20 for the 2 year horizon. Generally our results also hold when considering a longer horizon, although for equity funds the effect is somewhat weaker. For funds specializing in government bonds the effect of longer term yields is even somewhat stronger. This result indicates that it is the path and not only the current interest rate that is relevant for investor considerations and asset allocation.

Figure 20: The response of mutual fund net flows, by class, funds, aggregate data, *2-Y yields*, 2011-2023

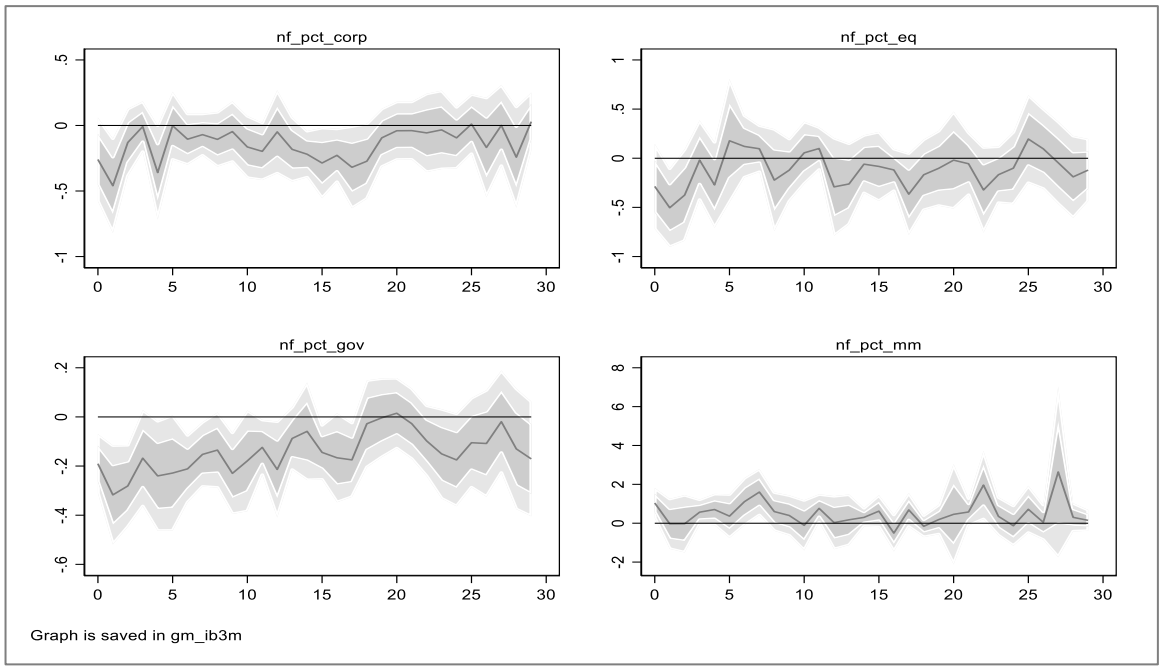


Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

6.3.6 Excluding the ZLB

A significant share of the period investigated, from 2011 to mid 2023, was characterized by a very low level of interest rate, close to zero, which is know to be the Zero Lower Bound. Figure 2 shows that between September 2014 and until March 2022, the interest rate was lower than 0.5%. Given the perception that setting a negative rate is possible but unlikely, the probability of an additional loosening of policy, when already at the ZLB is small or even zero. Therefore, it may be that the response of markets to policy changes in the ZLB is different. In addtion, as seen in Figure 4, unexpected changes in policy rates were actually relatively small during this period. We re-estimate our benchmark specification, excluding the ZLB period, i.e., excluding the months between September 2014 and March 2022. Figure 21 shows that even when we are left with only about a third of the original number of observations, the qaulitative results remain unchanged, although the significance of the response of flows to equity funds is weakened. Again, the effect of policy shocks on funds investing in government bonds is robust and strong.

Figure 21: The response of mutual fund net flows, by class, funds, aggregate data, 2011-2023, *excluding the ZLB period*



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.

7. What's Different about Mutual Funds?

Our main interest in this paper is understanding the response of mutual funds, i.e., the retail investors that hold these funds, to changes in monetary policy, and its effect on the liquidity of the underlying assets. To complete the picture, it is important to compare the reaction of different financial intermediaries. This section compares the reaction of flows in mutual funds to portfolio rebalancing by institutional investors and flows in the banking system.

7.1 Comparing to Institutional Investors

As demonstrated in Figure 2, while mutual funds are a significant share of corporate bond holders, their share in the government bond market and the equity market is much smaller. This is probably one of the reasons, alongside changes in risk perception, for the partial effect of pass through from mutual funds flows to the liquidity of the underlying assets, as was demonstrated above. Therefore, in order to complete the picture, we show the reaction of other non-bank intermediaries to monetary policy shocks.

Institutional investors vary from retail investors in many ways, the main two differences being investment horizons and skill. IIs typically manage long term investments, and do so by using professional investors, analysis and research departments, and investing many resources in their investment decisions. Retail investors, on the other hand, are typically non-professional investors who tend to react strongly to news and short term "noise". This has been referred to in the literature as "smart money" and "dumb money", respectfully (see for example Akbas et. al. 2015, Gibson et. al. 2004 and Frazzini & lamont 2008). We therefore expect mutual fund flows to act in the opposite direction of institutional investors in certain contexts. As mentioned above, during the Covid-19 crises, while mutual funds experienced a fire sale, institutional investors purchased these assets, profiting from the lower prices (higher yields). Little is known about the different reactions institutional investors have to monetary policy changes, in comparison to mutual funds. This section compares between mutual fund flows and institutional investors portfolio rebalancing in reaction to changes in the riskless yield. As in the rest of the paper, we use monetary surprises for purposes of identification. We find that as shown in the literature, institutional investors (IIs) increase their holdings of riskier assets, contrary to the tendency of mutual fund holders.

Unfortunately we do not have daily frequency data for IIs portfolio, but only monthly data documenting their holdings. Still, as a first approximation, we may assess the effect of monetary shocks on the net flows of these institutions and compare them to the results we obtained for mutual funds. In order to allow fair comparison we will re-estimate the response of mutual funds using monthly frequency data, aggregated from the daily data we have at hand.

We investigate the response of three classes of institutional investors: provident funds, pension funds and insurance companies. Table 4 presents the distribution of the underlying assets – government and corporate bonds, equity and Makam (short term T-bills) between the different institutional investors in 2023 (monthly average).

Table 4: Holding distribution of underlying assets, 2023, (%)

	Gov. bonds	Corp. bonds	Equity	Makam	Total
Provident funds	38	45	33	46	40
Pension	40	23	41	38	36
Insurance	22	32	26	16	24
Total	100	100	100	100	100
% of ins. Inv. in asset holding (Figure 2)	66	46	25	25	

Provident funds tend to hold less equity, pension funds hold relatively a large share of government bonds while insurance companies tend to hold more corporate bonds.

While we observe holdings in terms of market cap, we are interested in flows and not in the changes arising from changes in prices. To approximate for flows, we look at the monthly change in holdings after controlling for market returns (represented by the appropriate index[17] for each asset), similar to the methodology in Goldstein et. al. (2017).

The specification we follow in order to understand II's reaction to changes in monetary policy is very similar to that presented in equation (1) above, adjusting the control variables to monthly frequency, including the (log) change in the dollar-shekel exchange rate and the (log) change in the NASDAQ index, both lagged one and two months, lagged one year inflation expectations, the VIX index, trend variable, dummies for March 2020, monthly seasonal dummies, QE1 QE2 QE3 for announcements of QE programs, as explained above, and dummies for August and September 2018 due to atypical data. We limit ourselves to referring to the first two months following the shock, based on the assumption that the reaction of financial assets to monetary shocks is relatively fast.[18] Table 5 presents the cumulative response in the first month (labeled "0" in the Figure), Table 6 presents the cumulative response in the second month (labeled in the Figure as "1) – both comparable to the response after 30-60 days in the daily data, in terms of the percent of flows relative to the stock held by the investor.[19] For comparison, results for mutual funds' monthly data are presented in the first row. Figure 22 presents the results for the mutual funds, in monthly frequency and Figure 23 for aggregated institutional investors.

Table 5: The flows(%) in response to a monetary shock, by investor and asset, first month

	Gov. bonds	Corp. bonds	Equity	Makam
Mutual Funds	**-3**	**-4**	**-5**	**4**
Provident funds	3	-2	**9**	0
Pension	-2	**1**	2	**-5**
Insurance	-2	-0	3	**-5**
All Inst. Inv.	0	-0	5	**-2**

* Figures in bold indicate significant response (90% confidence band)

Table 6: The flows(%) in response to a monetary shock, by investor and asset, second month

	Gov. bonds	Corp. bonds	Equity	Makam
Mutual Funds	**-8**	**-9**	**-9**	**12**
Provident funds	-2	0	**15**	**-5**
Pension	-4	**6**	**15**	**-8**
Insurance	-3	2	**14**	**-6**
All Inst. Inv.	-2	2	**15**	**-5**

* Figures in bold indicate significant response (90% confidence band)

[17] TA135 for equities, Telbond60 for corporate bonds, Gov bond index and T-Bill (Makam) index for government bonds and Makam.

[18] Data in monthly frequency does not allow to identify the timing within the month of the shock. Until early 2017, when the frequency was changed from 12 to 8 decisions a year, most decisions were published a few days before the month end. Afterwards about half of the decisions are published towards the end of the month and the other half usually in the first week.

[19] The results for accumulated flows over 3 months are very similar.

Figure 22: The response of mutual funds net flows, monthly frequency, %, by class, 2011-2023

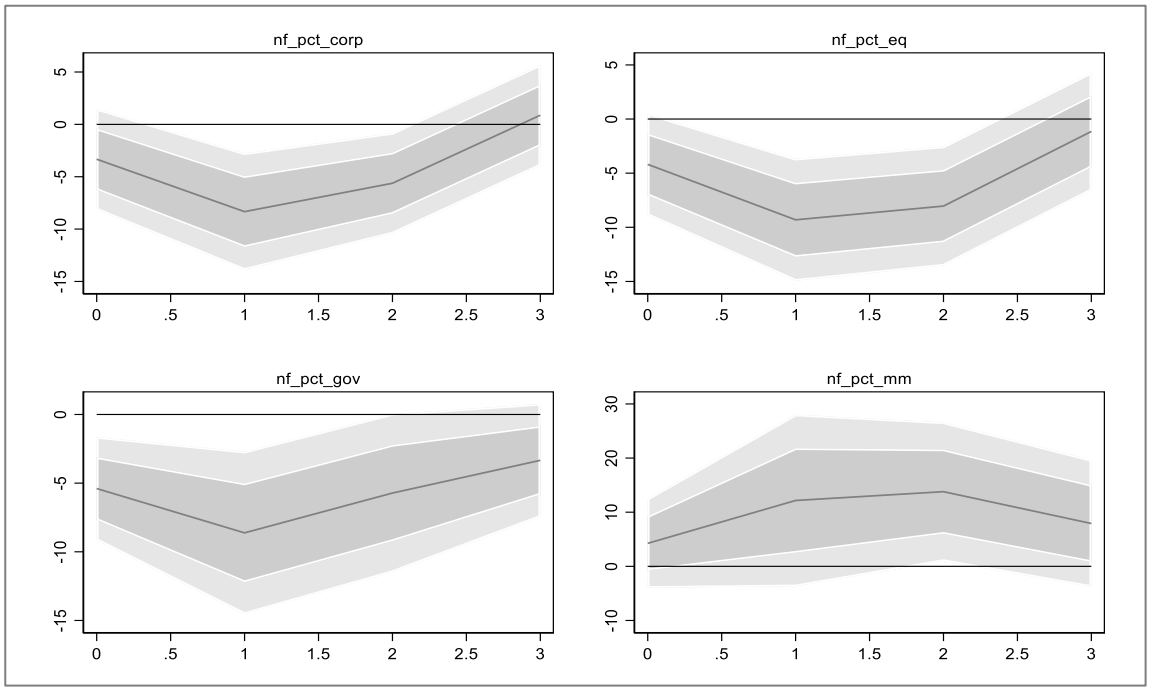
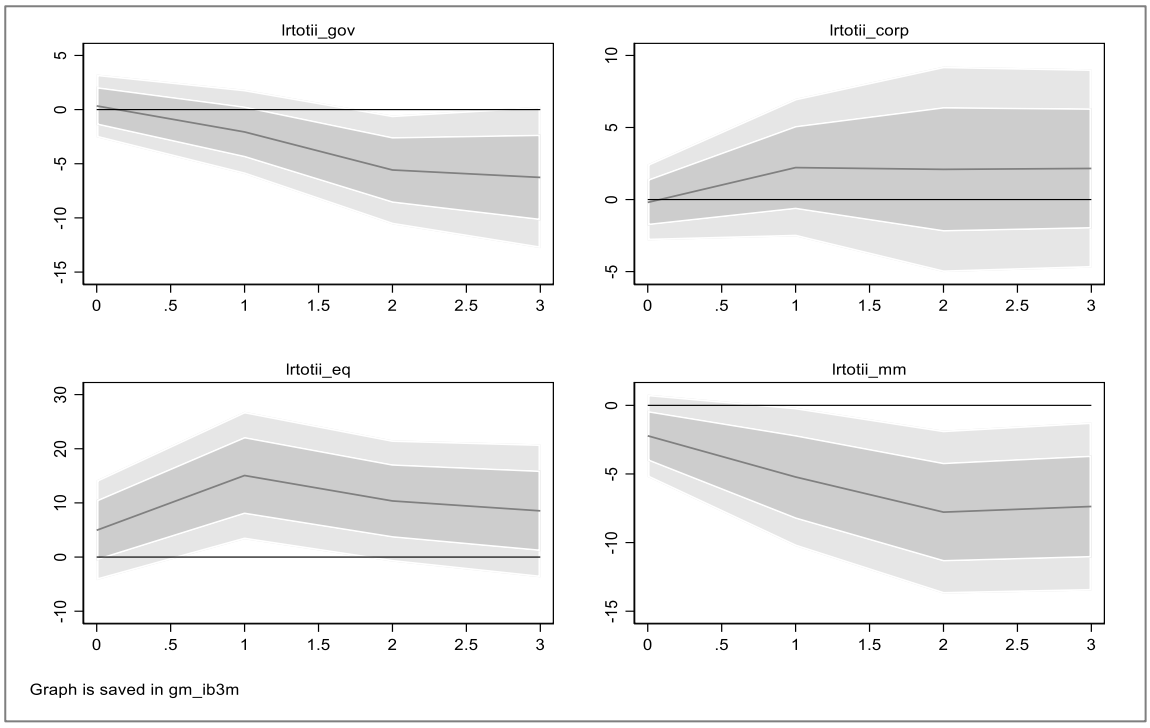


Figure 23: The response of Institutional Investors net flows, by class, monthly frequency, 2011-2023



First, the results concerning mutual funds, using the monthly data and averaging between the first and second month, are very similar, to those obtained for the daily data we have only for mutual funds' flows. An outflow of about 7-8% of the stock of bonds and equity accompanied by an inflow of a similar relative magnitude into money market funds. Second, all institutional investors react by increasing equity holdings and decreasing holdings of T-bills – opposite to the movements by mutual funds investors. It seems that IIs react and enter the market in response to movements by mutual funds, increasing the share of risky assets, contributing to the stabilization of the market. Third, IIs exit to some extent from the government bond market, similar to the direction of movement by mutual funds and act only moderately in the corporate bond market, possibly in order to finance the purchases of riskier assets. The response of mutual funds in the bond market is stronger (relative to their assets) than that of IIs. The results show that retail investors and institutional investors differ in their reaction to changes in monetary policy. Retail investors move from risky assets to safe assets, while institutional investors do the opposite.

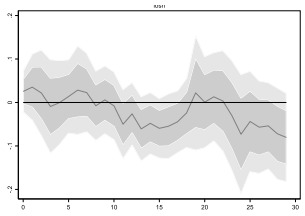
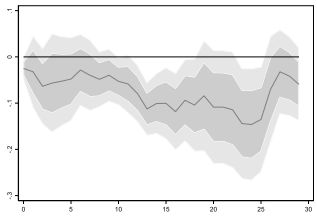
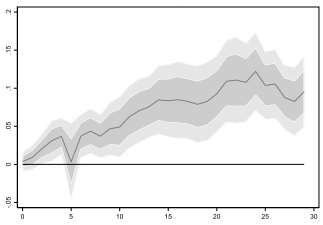
7.2 Comparing to Banks

As mentioned before our main interest in this paper is understanding the response of mutual funds and its effect on the liquidity of the underlying assets. The previous section compared mutual funds to institutional investors, which are substitute investors in the underlying assets markets. However, mutual funds are also comparable to banks, in the sense that they are a liquid source of funds for retail investors. In both occasions, the invested money is used in the financial system: when households hold mutual funds they supply direct non-bank funding for investment, while by increasing their bank deposits, households supply indirect funding for investment, via the banks.

We investigate the response of bank deposits[20] to monetary policy shocks using *daily* data on the stock of demand deposits, over-night deposits and time deposits (1 week to 1 year), using the same methodology presented in section 5 above. Figure 24 shows the cumulative response of deposits to a monetary shock over the first 30 days. As expected, demand deposits tend to decline, but mostly insignificantly, possibly due to the fact that demand deposits are more sensitive to activity and less to yield as they principally serve as a means of payment. Overnight deposits which are a bit less liquid than demand deposits and bear (a relatively very low) interest, decline, maybe contrary to expected, but possibly due to movements to time deposits which yield higher income. Time deposits grow by about 10% over the first month in reaction to a 1pp increase in short term yields due to monetary contraction. Given the stocks of deposits, over the sample, the net outflow from or to these bank deposits is around zero. The magnitude of response relative to the stock of retail deposits is similar to that evident in the mutual fund market.

[20] About 40% of deposits are held by households and about 25% by institutional investors, the rest are business-sector deposits.

Figure 24: The response of bank deposits to a monetary shock, 2011-2023

Demand deposits	Overnight deposits	Time deposits – 1W to 1Y
		
Cumulative response (%): -8.0	-5.9	+9.6

8. Concluding remarks

This paper investigates the role of the mutual fund market in the transmission of monetary policy in Israel, and its effect on the underlying asset market liquidity. We examine the response of net flows to four well-defined classes of mutual funds: those investing in corporate bonds, government bonds, equity and money market funds. Our analysis is based on daily flow data to and from mutual funds and market-based identification of monetary policy shocks.

We find that one of the transmission mechanisms of monetary policy is via its effect on the mutual fund market held by retail investors. According to our analysis, in response to a(n unexpected) 1 percentage point tightening of monetary policy, fund holders - primarily retail investors, and in particular households, reduce net inflow to corporate bond, government bond and equity funds over the following month, in the cumulative magnitude of about 6-10% of the funds' assets, which is of a similar magnitude to the results in the literature. We perform a set of robustness checks and find that our results hold for different sub-samples and other modifications. We find that a higher than expected interest rate (positive shock) increases flows into money market funds, but we do not find evidence for outflows from MMFs in the case of a lower than expected change (negative shock). We find that market liquidity deteriorates following an increase in the riskless rate. However, using several identification strategies, we find that the contribution of mutual fund movements to this deterioration is only partial. In contrast to unexpected macro-economic shocks, which are dramatic and indicate a major change in macro-economic conditions (e.g. 2008 GFC or 2020 COVID) where fund holders were found to react rapidly and massively, thereby jeopardizing market stability, in the case of ordinary (unexpected) monetary policy changes, which usually do not indicate a key change in economic environment, fund holders react gradually and do not pose a significant risk to market liquidity.

We document the response of additional financial intermediaries to changes in monetary policy. We find that in response to a rise in the interest rate money in the banking system shifts from demand and overnight deposits to longer horizon deposits. Institutional investors rebalance their portfolios by selling government bonds and purchasing riskier assets, namely stocks and corporate bonds.

References

Akbas, F., Armstrong, W. J., Sorescu, S., & Subrahmanyam, A. (2015). Smart money, dumb money, and capital market anomalies. Journal of Financial Economics, 118(2), 355-382.

Banegas, A., G. Montes-Rojas and L. Siga, (2022), "The effects of U.S. monetary policy shocks on mutual fund investing", *Journal of International Money and Finance*, 123

Badrinath, S. G., & Wahal, S. (2002). Momentum trading by institutions. The Journal of Finance, 57(6), 2449-2478.

Bekaert, G., Hoerova, M., & Duca, M. L. (2013). Risk, uncertainty and monetary policy. Journal of Monetary Economics, 60(7), 771-788.

Bubeck J., M. M. Habib and S. Manganelli, (2018), "The portfolio of euro area fund investors and ECB monetary policy announcements", Journal of International Money and Finance, 89, 103-126.

Blomhoff Holm, M., P. Paul and A. Tischbirek, (2021),"The transmission of monetary policy under the microscope", Journal of Political Economy, 129(10).

Chordia, T., & Subrahmanyam, A. (2004). Order imbalance and individual stock returns: Theory and evidence. Journal of Financial Economics, 72(3), 485-518.

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

Demsetz, H. (1968). The cost of transacting. The quarterly journal of economics, 82(1), 33-53.

Díaz, A., & Escribano, A. (2020). Measuring the multi-faceted dimension of liquidity in financial markets: A literature review. Research in International Business and Finance, 51, 101079.

Falato, A., Goldstein, I., & Hortaçsu, A. (2021). Financial fragility in the COVID-19 crisis: The case of investment funds in corporate bond markets. Journal of Monetary Economics, 123, 35-52.

Fisher, L. (1959). Determinants of risk premiums on corporate bonds. Journal of political economy, 67(3), 217-237.

Frazzini, A., & Lamont, O. A. (2008). Dumb money: Mutual fund flows and the cross-section of stock

Gibson, S., Safieddine, A., & Sonti, R. (2004). Smart investments by smart money: Evidence from seasoned equity offerings. Journal of Financial Economics, 72(3), 581-604.

Giuzio, M., C. Kaufmann, E. Ryan and L. Cappiello, (2021), "Investment funds, risk-taking, and monetary policy in the Euro area", ECB Discussion Paper Series no. 2605, October 2021.

Goldstein, I., Jiang, H., & Ng, D. T. (2017). Investor flows and fragility in corporate bond funds. Journal of Financial Economics, 126(3), 592-613.

Gompers, P. A., & Metrick, A. (2001). Institutional investors and equity prices. The Quarterly Journal of Economics, 116(1), 229-259.

Gürkaynak, R. S., Sack, B., & Swanson, E. T. (2005). Do actions speak louder than words? The response of asset prices to monetary policy actions and statements. International Journal of Central Banking, 1(1).

Haddad, V., Moreira, A., & Muir, T. (2021). When selling becomes viral: Disruptions in debt markets in the COVID-19 crisis and the Fed's response. The Review of Financial Studies, 34(11), 5309-5351.

Hau H. and S. Lai, (2016), "Asset allocation and monetary policy: Evidence from the eurozone", Journal of Financial Economics, 120: 309-329.

Hodge, A. and Weber, A., (2023) "The Heterogeneous Effects of U.S. Monetary Policy on Non-Bank Finance", IMF Working Paper No. 2023/055.

Jorda, O. (2005), "Estimation and Inference of Impulse Responses by Local Projections," American Economic Review, vol. 95(1), pages 161-182, March.

Kuttner, K. (2001), "Monetary policy surprises and interest rates: evidence from the Fed funds futures market", Journal of Monetary Economics, 523-44.

Kaufmann, C. (2023). Investment funds, monetary policy, and the global financial cycle. Journal of the European Economic Association, 21(2), 593-636.

Ma, Y., Xiao, K., & Zeng, Y. (2022). Mutual fund liquidity transformation and reverse flight to liquidity. The Review of Financial Studies, 35(10), 4674-4711.

Paul, P. (2020), "The time-varying effect of monetary policy on asset prices", The Review of Economics and Statistics, 102 (4), 690–704.

Rigobon, R. and B Sach, (2004), "The impact of monetary policy on asset prices", Journal of Monetary Economics, 51, 1553-1575.

Sarr, A., & Lybek, T. (2002). Measuring liquidity in financial markets. SSRN working paper.

Shleifer, A., & Vishny, R. (2011). Fire sales in finance and macroeconomics. Journal of economic perspectives, 25(1), 29-48.

Shleifer, A., & Vishny, R. W. (1992). Liquidation values and debt capacity: A market equilibrium approach. The journal of finance, 47(4), 1343-1366.

Tenreyro S. and G. Thwaites, (2016), "Pushing on a string: US monetary policy is less powerful in recessions", American Economic Journal: Macroeconomics, vol.8(4), 43-74.

Appendix 1

Underlying Framework Equations.

We begin with a simple utility function of an investor with standard mean-variance preferences: (1) $= E(r) - \frac{1}{2}A\sigma^2$, where E(r) and σ^2 are the expected return and the variance of the portfolio, and A is the investors' risk preference (with A>1 for risk averse investors.

Considering how (2) $E(r) = r_f + w_r E(r_r - r_f)$ (where r_f is the risk-free rate, and r_r, w_r are the return and weight of the risky asset), and (3) $\sigma^2 = w_r^2\sigma_r^2$ (as the riskless asset has no variance), we can substitute equations 2 and 3 into equation 1, and get the following optimization problem:

(4) $U = E(r) + w_r E(r_r - r_f) - \frac{1}{2}Aw_r^2\sigma_r^2$

Deriving equation 4 with respect to w_r and setting the derivative to zero, yields the following result for the optimal weight of the risky asset in the portfolio:

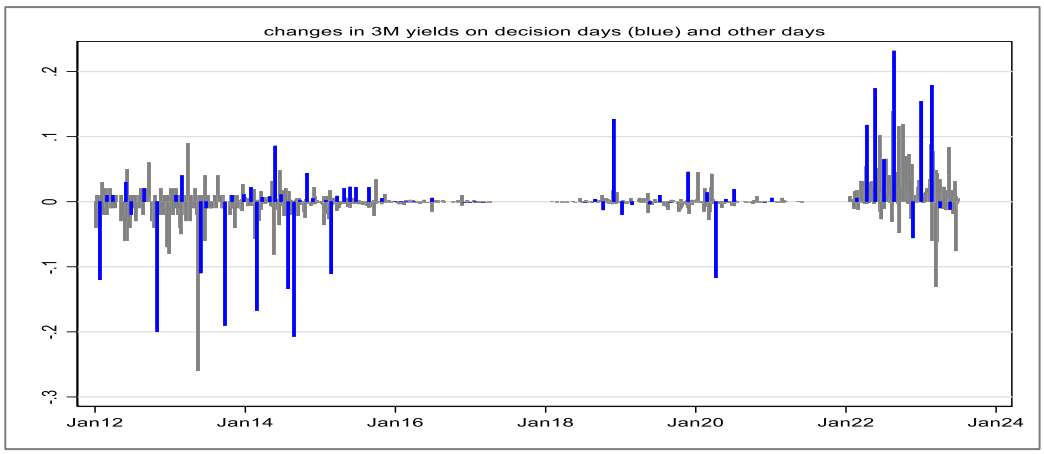
(5) $w_r = \frac{E(r_r)-r_f}{A\sigma_r^2}$

The variable of interest in our study is the riskless rate, r_f. It is easy to see from equation 5 that raising it lowers the weight of the risky asset and increases the rate of the risk-less asset (which is by design, $1 - w_r$). In our setting, this translates to outflows from equity and bond funds, and inflows into money market funds. Indeed, our results are consistent with the models' predictions.

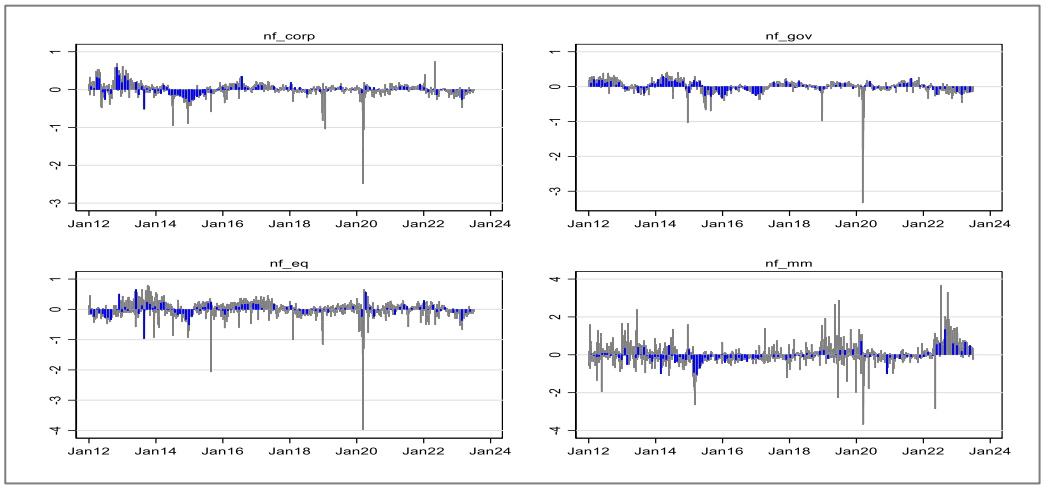
Appendix 2

The Change in 3 month yields, Mutual Funds Net Flows and Bid Ask Spreads, on policy decision days and other days.

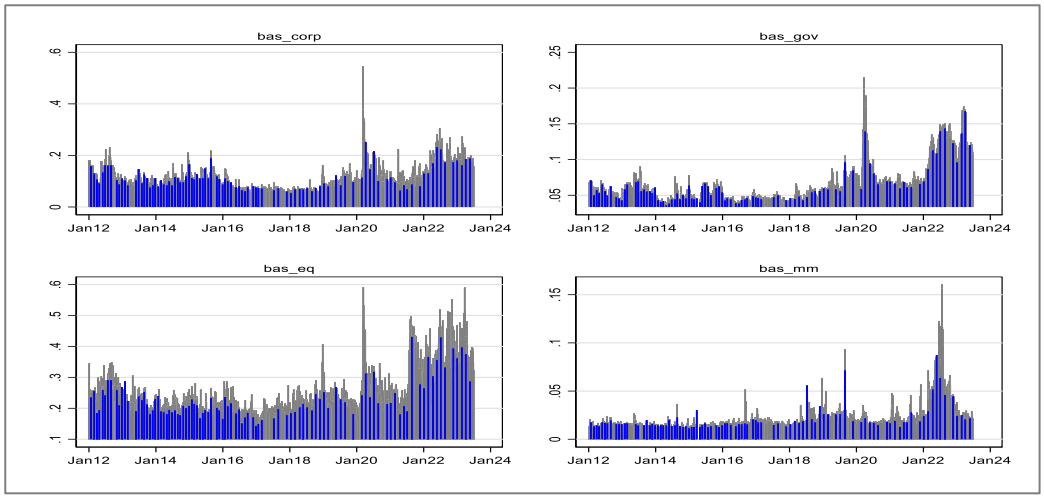
a. 3 months yield



b. Mutual fund flows (corporate bonds, gov. bonds, equity and money market)



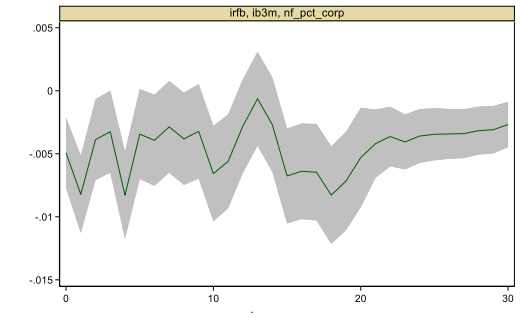
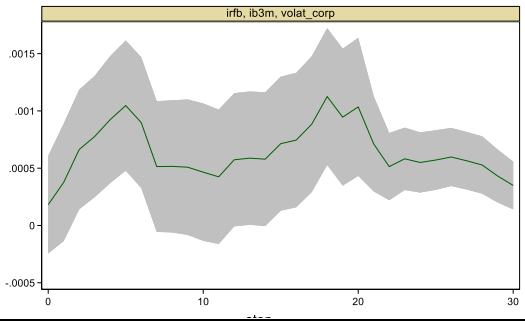
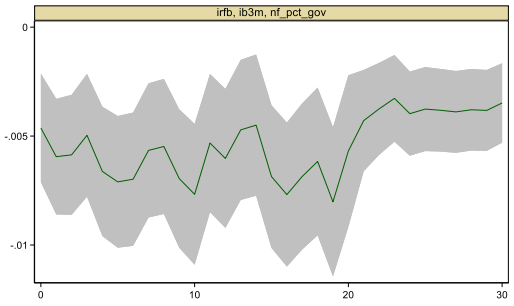
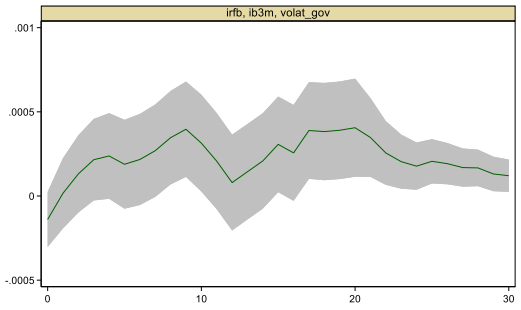
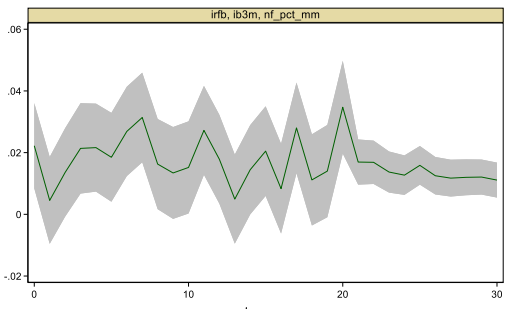
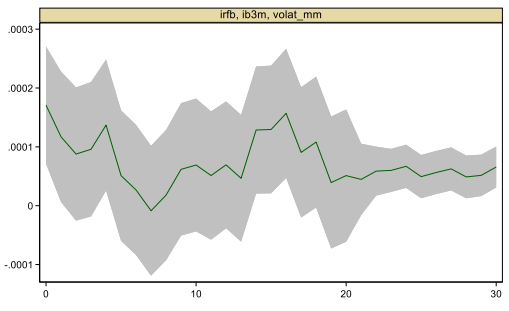
c. BAS spread (corporate bonds, gov. bonds, equity and money market)



Appendix 3

Additional VAR results for alternative liquidity indicators[21]

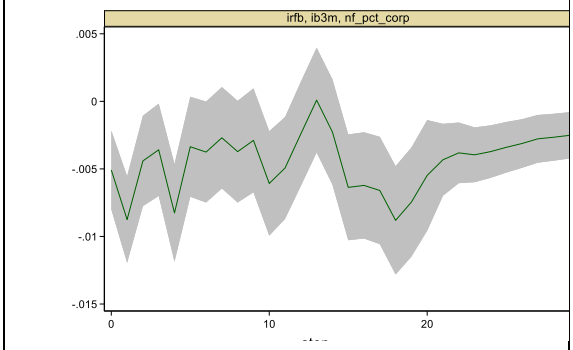
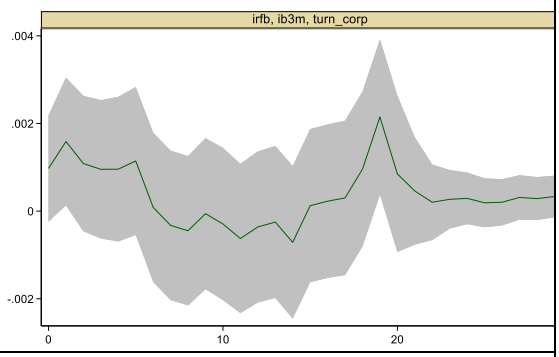
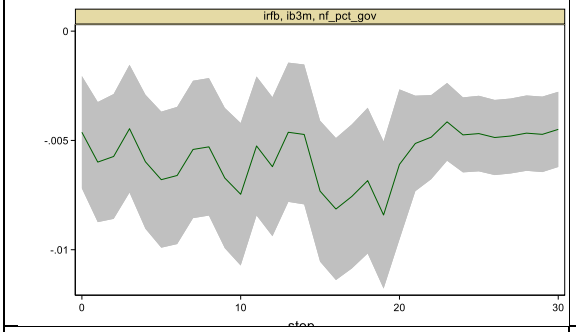
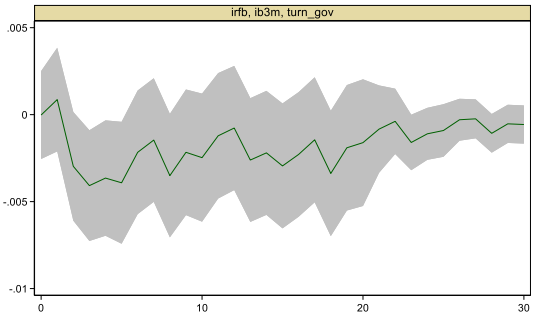
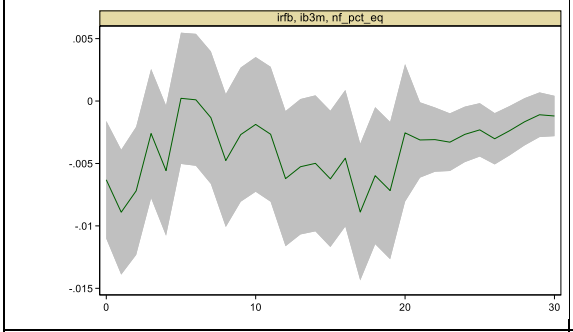
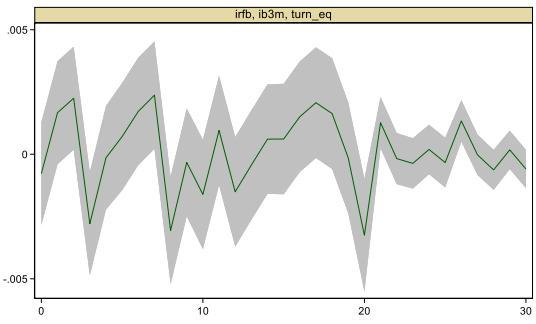
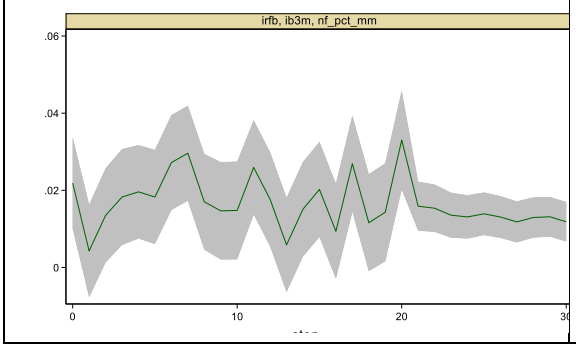
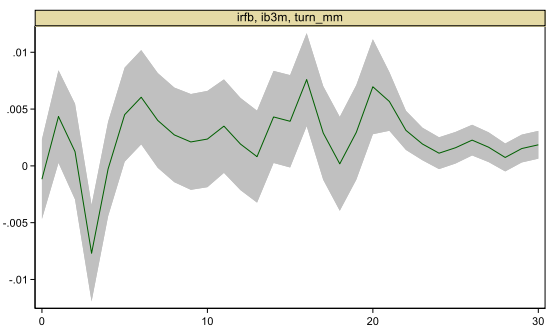
1. Volatility

Response of flows	Response of Volatility
Corporate bonds	
	
Government bonds	
	
Money Market	
	

* The line depicts the response to a 1std shock to the policy rate (0.014). The gray area depicts a 90% confidence band.

[21] We do not have information concerning the velocity and turnover liquidity indices for the equity market.

2. Turnover

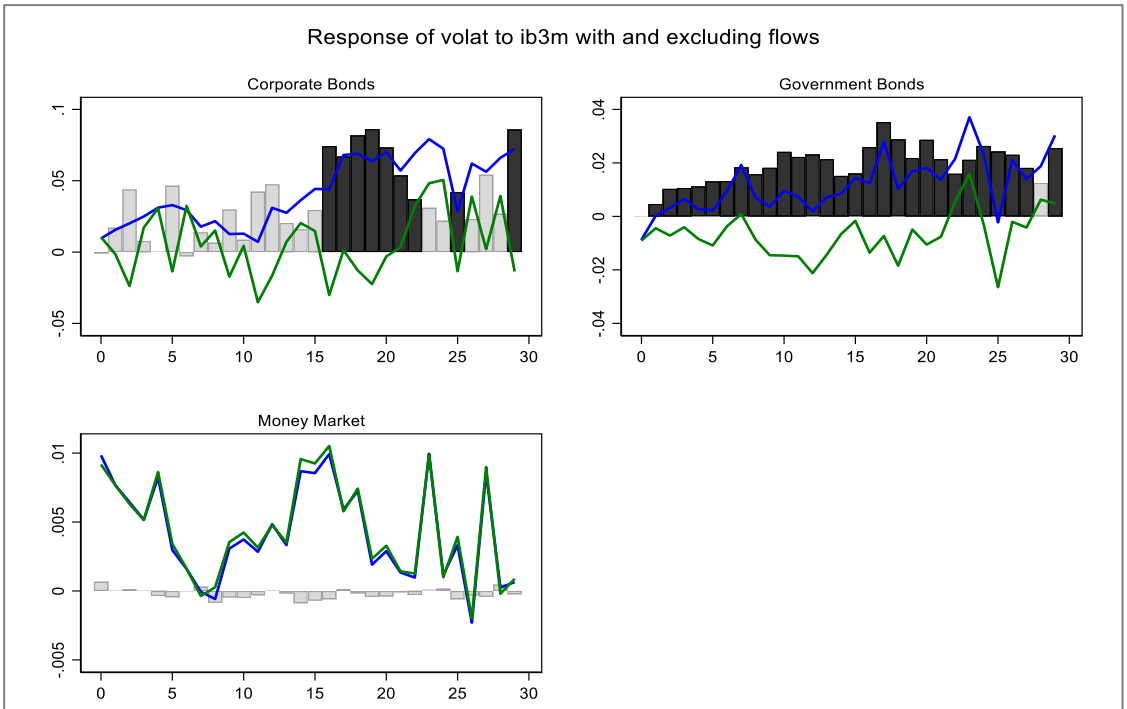
Response of flows	Response of Turnover
Corporate bonds	
	
Government bonds	
	
Equity	
	
Money Market	
	

* The line depicts the response to a 1std shock to the policy rate (0.014). The gray area depicts a 90% confidence band.

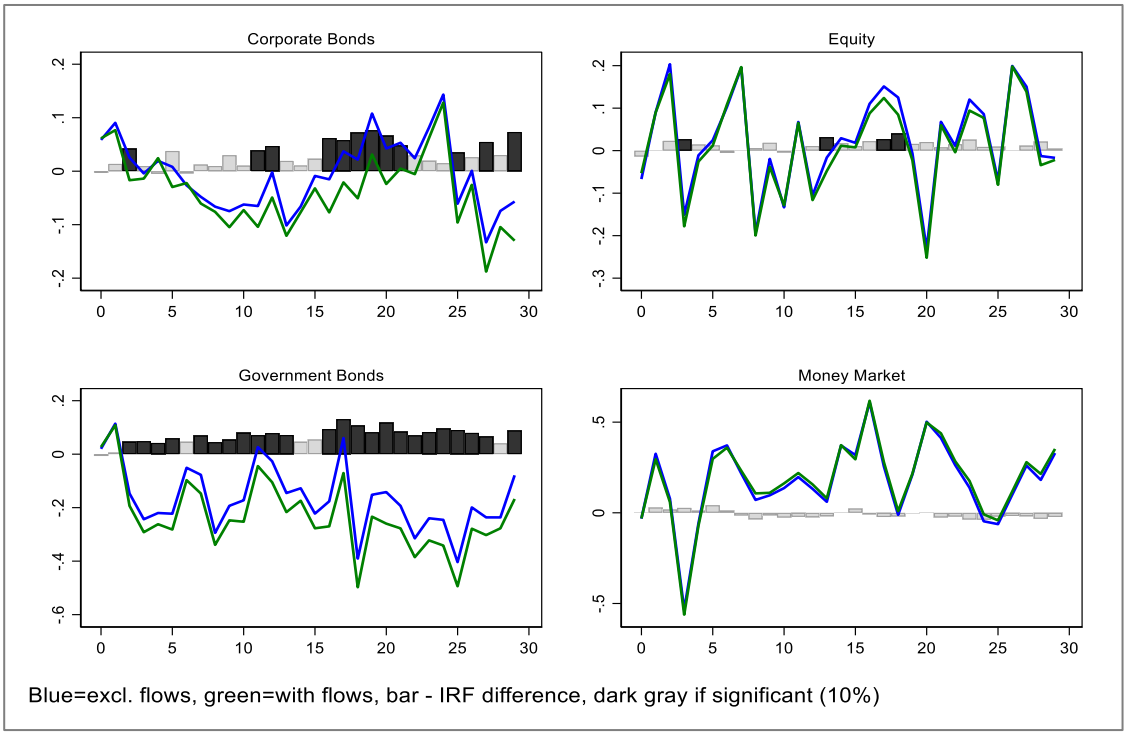
Appendix 4

The effect of monetary policy on alternative liquidity indicators, including (in green) and excluding (in blue) flow of funds

1. Volatility



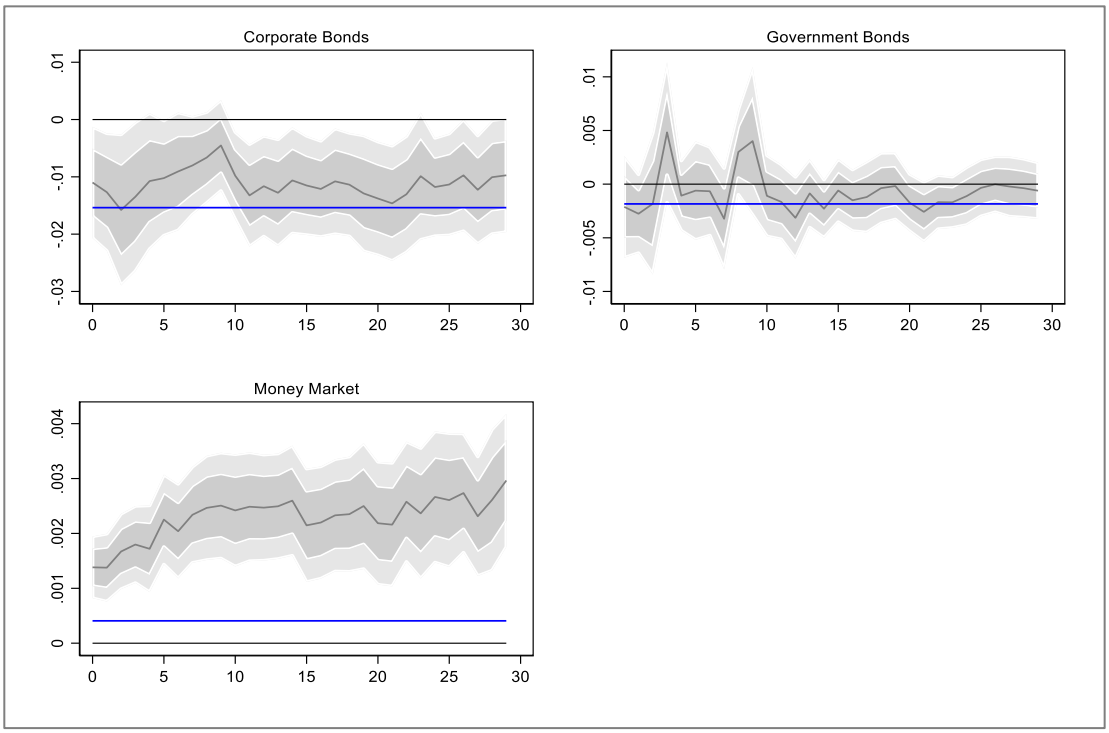
2. Turnover



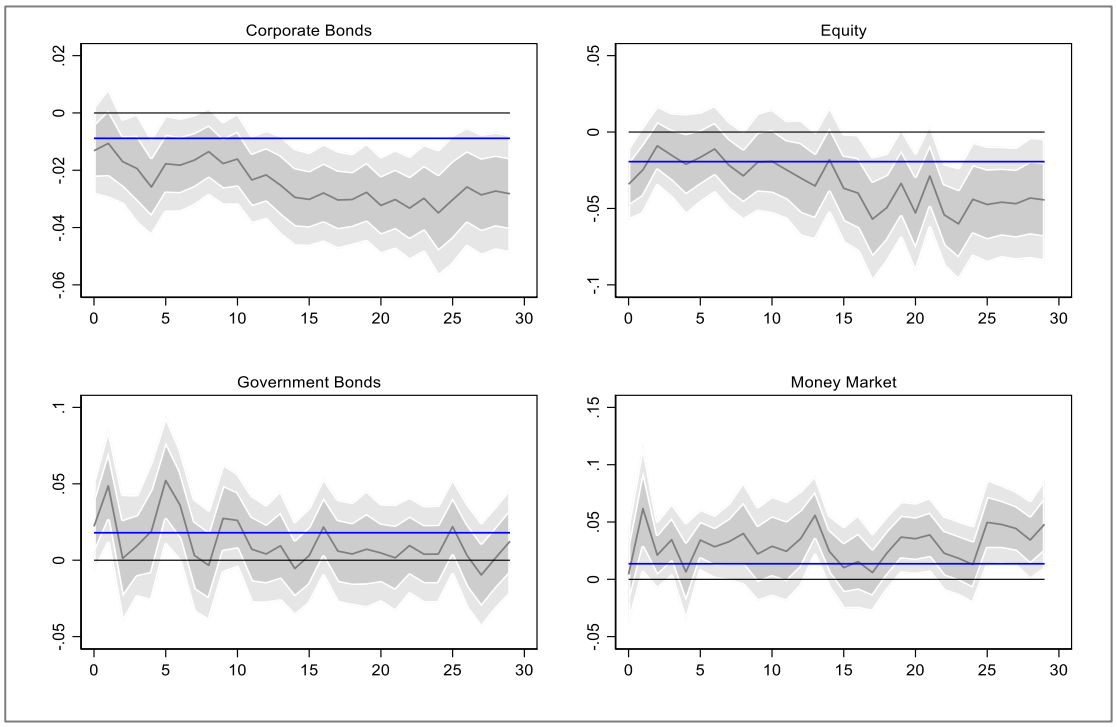
Appendix 5

Second stage response of liquidity indicators to estimated flows in t+h

1. Volatility



2. Turnover



Remarks: The solid line depicts the response of net flows to a 100bp shock to policy rates. The dark gray area indicates 1 std error (68%), and the light gray 1.645 (90%). On the y-axis is the percent of flows relative to the fund's assets.