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Investment funds, risk-taking, and monetary policy in the euro area

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Abstract

We examine the transmission of monetary policy via the euro area investment fund sector using a Bayesian vector autoregressions framework. We find that expansionary shocks are associated with net inflows and that these are strongest for riskier fund types, reflecting search for yield among euro area investors. Search for yield behaviour by fund managers is also evident, as they shift away from low yielding cash assets following an expansionary shock. While higher risk-taking is an intended consequence of expansionary monetary policy, this dynamic may give rise to a build-up in liquidity risk over time, leaving the fund sector less resilient to large outflows in the face of a crisis.

JEL classification: E52; G11; G23

Key words: Monetary policy; non-bank financial intermediation; liquidity management

1 Non-technical summary

The investment fund sector has more than doubled in size since the global financial crisis. As the sector grows, so does its importance for the funding of economic activity and the transmission of monetary policy. But excessive risk-taking by funds can also have damaging effects for the wider financial system when it contributes to high levels of corporate leverage or when risky asset holdings need to be unwound quickly in times of market stress, as occurred in March 2020.

Traditionally banks have been central to the transmission of monetary policy within the euro area but, as the composition of the financial system changes, it becomes increasingly important to understand how other players react to monetary policy. Investment funds could contribute to the transmission of monetary policy via a risk-taking channel. Following expansionary monetary policy, investors may engage in search for yield, substituting away from safe bank deposits and towards investment fund shares. Investors may also substitute towards riskier fund types and fund managers themselves may rebalance their portfolios towards riskier assets. This in turn can ease funding conditions in the real economy.

This paper examines how euro area investment funds between 2007 and 2023 responded to monetary policy shocks using Bayesian vector auto-regressions. We examine aggregate flows into bond funds and compare flow responses across funds with different investment strategies. This allows us to infer how the response of investors to monetary policy affects the size, composition and riskiness of the fund sector. We then examine how fund managers respond to monetary policy in terms of asset allocation within funds, focusing on implications for liquidity risk-taking. Finally, we compare the response of both flows and liquidity buffers following long- and short-end yield curve shocks, as a proxy for the response to conventional and unconventional policies.

We find that expansionary monetary policy is indeed associated with fund inflows. The response is heterogeneous across asset classes, with riskier asset classes such as high yield funds and corporate bond funds receiving the largest proportional inflows. This suggests that monetary policy is transmitted via the fund sector, with fund investors responding to expansionary monetary policy with clear search for yield behaviour. Results point towards a stronger risk-taking response to unconventional monetary policy tools in terms of fund flows.

We also provide new insights into the response of fund managers to monetary policy. We find that across bond funds, expansionary monetary policy is followed by a drop in cash holdings. On one hand, higher risk-taking is an intended consequence of expansionary monetary policy, as increased demand for non-cash assets by fund managers will help ease financing conditions to the real economy. However, this dynamic may give rise to a build-up in liquidity risk over time, leaving the fund sector less resilient to large outflows in the face of a crisis. Indeed, outflows from corporate and high yield bond funds following the outbreak of the coronavirus crisis in Europe exceeded their cash holdings, resulting in forced asset sales which may have amplified the original market shock.

These side effects could be addressed through macroprudential tools which limit funds' capacity to take excessive liquidity risk. Given the increasingly important role of investment funds in the transmission of monetary policy in the euro area, policy tools that effectively mitigate the build-up of risks in the fund sector ex-ante could help to not only limit the liquidity risk in individual funds, but also to prevent system-wide liquidity strains. These could include, for instance, minimum liquid asset buffers or restrictions on redemption frequency and minimum redemption notice periods.

2 Introduction

Among the most significant changes in the global financial system over the last decade has been the rise of non-bank financial intermediaries in financing economic activity. Between 2008 and 2021 the share of financing coming from bond issuance and non-bank loans increased from 24% to 37% for euro area firms, while the share of bank loan financing has dropped from two thirds to under a half. Among non-banks the investment fund sector has experienced particularly rapid growth. In the euro area it has almost tripled in size since 2008, both in absolute terms and relative to the size of the banking sector (Figure 1).[1] In many economies banks have traditionally played a central role in the transmission of monetary policy and the literature on the response of non-banks to monetary policy changes is still in a nascent stage. As the composition of the financial system continues to change, this gap in the literature poses an increasing challenge to our understanding of monetary policy transmission.

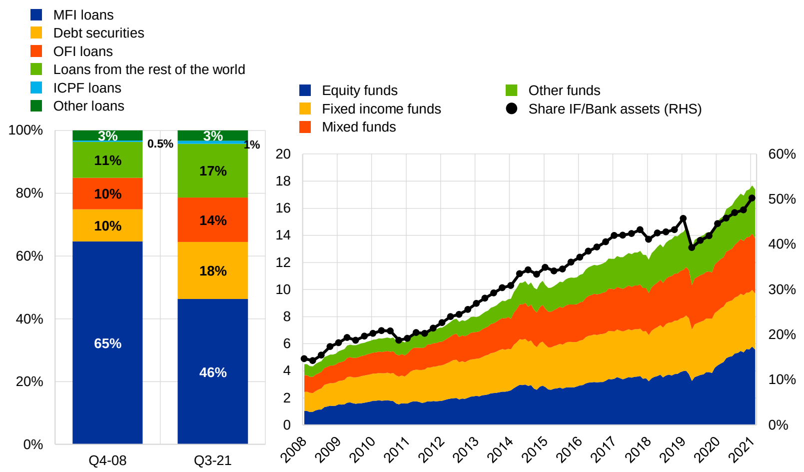


Figure 1: Financing structure of euro area non-financial corporations by instrument and total assets under management of euro area investment funds.

Notes: Left panel: Axis shows percentage of total borrowing. MFI stands for monetary financial institution, OFI for other financial institution and ICPF for insurance corporation or pension fund. Figure is taken from European Central Bank (2019). Right panel: Left axis in EUR trillions, right axis in percentages. The black dotted line shows percentage ratio of total assets of investment funds relative to banks in the euro area.

In this paper we use a Bayesian vector autoregression (BVAR) framework to provide a comprehensive examination of the response of investment funds to euro area monetary policy shocks between 2007 and 2023. The sample period covers both the low-yield environment and the sub-

[1] Similar trends are visible at the global level (see, e.g., Financial Stability Board, 2021). Investment funds, also abbreviated as “funds” when ambiguity can be ruled out, are the largest component of the non-bank financial intermediation sector, formerly known as “shadow banking system”.

sequent rate hikes, as well as the introduction and the phase-out of unconventional monetary policy measures. We show that the investment fund sector represents an active avenue for the transmission of monetary policy via both investors and asset managers. Our findings suggest that expansionary shocks are associated with net inflows, which are strongest for riskier fund types, reflecting search for yield among euro area investors. Search for yield behaviour by fund managers is also evident, as they shift away from low yielding cash assets following a monetary loosening. At the same time, reduced cash holdings by asset managers may also result in a build-up in liquidity risk over time, leaving the fund sector less resilient to large outflows in the face of a crisis or unexpected policy tightening. This provides further impetus to the development of macroprudential tools for investment funds, which would allow policy makers to address these risks in a targeted way.

These findings are in line with the notion that the fund sector could contribute to monetary policy transmission via the risk-taking channel (Hau and Lai, 2016; Borio and Zhu, 2012). Following an expansionary monetary policy shock, investors and asset managers may engage in search for yield. For investors this may include substituting away from safe bank deposits and towards investment fund shares. Investors may also substitute towards funds investing in riskier, higher yielding asset classes. The response of investors may be amplified by asset managers rebalancing the portfolios of their funds. Managers may substitute away from safe, low-yielding assets like cash and towards riskier assets. All of these actions increase demand for risky assets and suppress risk premia, which in turn can ease funding conditions in the real economy.

First, we use aggregate flow data for different types of euro area bond funds to analyse investors' response to monetary policy shocks. Our results show that expansionary monetary policy shocks are indeed associated with fund inflows across all asset classes. Importantly, the response is stronger in riskier asset classes, with high-yield funds and corporate bond funds receiving the largest proportional inflows. We show that investors also substitute into funds buying non-euro area assets after the easing of euro area monetary policy. Taken together these three results suggest that monetary policy is transmitted via the fund sector, with fund investors responding to expansionary monetary policy with search for yield behaviour. However, the international component of these flows indicates that the full effect may not be felt in the euro area. A breakdown of the results by investor type reveals that these inflows are driven both by retail and institutional investors, with the latter being relatively more responsive to monetary policy shocks.

Second, we use investment fund balance sheet data to analyse the response of asset managers to monetary policy shocks. We find that expansionary monetary policy shocks are followed by a drop in cash holdings. On the one hand, higher risk-taking is an intended consequence of expansionary monetary policy, as increased demand for non-cash assets by fund managers will help ease financing conditions to the real economy. On the other hand, this dynamic may give rise to a build-up in liquidity risk over time, leaving the fund sector less resilient to large outflows in the face of a crisis. For example, outflows from corporate and high-yield bond funds following the outbreak of the coronavirus crisis during March 2020 often exceeded their cash holdings, resulting in forced asset sales which may have amplified the original market shock (Chernenko and Sunderam, 2020; Falato et al., 2021a; Ma et al., 2022).[2]

Throughout our analysis we use the method laid out in Jarociński and Karadi (2020) for identifying monetary policy shocks. This method combines high-frequency identification with sign restrictions, allowing us to distinguish between shocks arising from pure monetary policy surprises and information shocks regarding the state of the macroeconomy. Given the role of market sentiment in driving fund flows, our focus on these pure monetary policy shocks throughout the paper allows to provide a clear picture of the role of funds in monetary policy transmission. We also show that this method can yield better results for several euro area financial markets variables by using the high-frequency response of bond market spreads instead of equity market reactions after monetary policy announcements.

The main focus of our analysis is on unconventional monetary policy shocks, given that short-term interest rates have been in close proximity of their zero lower bound for the largest part of our sample period. However, we also compare the response of investment funds to conventional and unconventional monetary tools, which we proxy by shocks to the short- and long-end of the yield curve. Results point towards a stronger risk-taking response to unconventional tools in terms of fund flows. Funds' liquidity buffers respond stronger to conventional shocks, reflecting the primary importance of the return on cash holdings to liquidity choices. While conventional policies affect the cost of cash, unconventional policies improve wider bond market liquidity. This suggests that the risk-taking channel may be particularly pronounced during periods when

[2]For an overview of the role of investment funds during the coronavirus stress episode as well as policy responses, see Falato et al. (2021b) and Breckenfelder and Hoerova (2023).

both accommodative conventional and unconventional monetary instruments are used. While this type of monetary policy can be necessary for central banks to achieve price stability goals, it may have unintended side effects from a financial stability perspective, particularly in terms of funds' liquidity.

These side effects could be addressed through macroprudential tools which limit funds' capacity to take excessive liquidity risk. Given the increasingly important role of investment funds in the transmission of monetary policy in the euro area, policy tools that effectively mitigate the build-up of risks in the fund sector ex-ante could help to not only limit the liquidity risk in individual funds, but also to prevent system-wide liquidity strains. These could include, for instance, minimum liquid asset buffers or restrictions on redemption frequency and minimum redemption notice periods (see, e.g., IMF, 2021 and Financial Stability Board, 2020).

Related literature: Our paper adds to a number of strands of existing literature. The papers most closely related to our own are Hau and Lai (2016) and Banegas et al. (2022), both of which examine the response of investment funds to monetary policy. We add to their analysis in a number of ways. First and foremost, none of these papers examine the response of the asset managers to monetary policy shocks, which we do by analysing changes in cash holdings. To our knowledge our paper is the first to examine this mechanism, which has important wider financial stability implications. Also, our sample includes accommodative and tightening cycles, as well as the introduction and the depletion of unconventional monetary policy measures.

Hau and Lai (2016) use country-panel regressions to analyse the behaviour of euro area retail investors in equity and money market funds between 2003 and 2010. While the authors also provide insights for the euro area, their sample excludes the euro area's two major fund hubs (Ireland and Luxembourg) while ours includes funds in all euro area countries. They also do not analyse flows into bond funds, whose role in providing financing to the real economy increased significantly after the global financial crisis. Given the sample period, their analysis is restricted to conventional monetary policy instruments only. Our paper, in comparison, focuses on bond funds and studies responses to both conventional and unconventional monetary policy instruments.

Banegas et al. (2022) examine the response of US bond and equity fund flows and returns to US monetary policy shocks. The authors' analysis also differs from ours, as they do not split central bank information shocks out from pure monetary policy shocks. As we show in our analysis, however, these shocks have quite different effects on fund flows. By separating the two we provide a clear picture of the specific effects of monetary policy shocks. This is of central importance to our paper's objective: Understanding the role of the fund sector in monetary policy transmission. Finally, the monetary policy shocks used in Banegas et al. (2022) focus on medium- and longer-term interest rates. Their analysis, therefore, does not allow for a comparison between the effects of conventional and unconventional shocks.

Our findings are also related to a number of papers, who study risk-taking in US mutual and money market funds using micro data. Choi and Kronlund (2017) show that US corporate bond funds can generate higher returns and receive more inflows when they invest in riskier assets. They also link this result to the level of interest rates. Di Maggio and Kacperczyk (2017) show that money market funds too invest in riskier assets when interest rates are lower. Daniel et al. (2021) find that investors increasingly reach for income in mutual funds that hold riskier securities when interest rates are low. While our results for the euro area are consistent with these papers, our analysis explicitly allows to study the effects of different types of monetary policy instruments at the short and the long-end of the yield curve. Moreover, we can separate the effects of genuine monetary policy from other central bank information shocks when analysing changes in interest rate levels.

Analysing the role of investment funds in transmitting the global financial cycle, Kaufmann (2023) shows that the fund sector increases globally after a monetary loosening by the US Federal Reserve. Complementary to our results, he documents that flows into investment funds focusing on European assets rise, especially in riskier market segments.

Furthermore, our alterations to Jarociński and Karadi (2020)'s method provide a more effective mechanism for euro area monetary policy shock identification and we show that it can be used to compare conventional and unconventional shocks. Our findings are also robust to alternative identification methods, such as a Cholesky decomposition, and changes in the period examined, namely to include or exclude the global financial crisis.

Our paper provides key insights for a number of other areas of research. Regarding how the shift towards non-bank financing could change the overall transmission of monetary policy, International Monetary Fund (2016) argues that a growing non-bank sector could decrease the role of bank-based channels while increasing others, such as the risk-taking channel. Holm-Hadulla and Thürwächter (2021) confirm that the overall response of bank lending to monetary policy shocks in the euro area is weaker in countries with a higher ratio of bond to bank financing. However, Nelson et al. (2018) find that assets of non-bank financial entities involved in securitisation increase rather than decrease after contractionary monetary shocks, suggesting that not all types of non-banks transmit monetary policy in the same way. Relatedly, Xiao (2019) document that higher interest rates imply inflows to money market funds in the US, as these entities pass through higher rates more quickly to yield-sensitive depositors than banks do. In contrast, we show that the investment fund sector is highly responsive to monetary policy shocks, confirming empirically the argument of International Monetary Fund (2016) that non-banks can support monetary policy transmission if the response of banks weakens.

By examining the response of fund's cash holdings to monetary policy shocks we also contribute to the growing literature on liquidity risk in the investment fund sector. Feroli et al. (2014) and Morris and Shin (2016) argue that extended periods of accommodative monetary policy may result in the fund sector building up positions that can cause wider disruption as they unwind. We show that this dynamic may take place via funds' decreasing cash positions. Our work also shows that fund liquidity risks examined in Chen et al. (2010), Goldstein et al. (2017) and Ma et al. (2022) may be more pronounced during periods of accommodative monetary policy. Our results are also related to Morris et al. (2017), who document that investment funds pro-cyclically hoard cash when facing outflows.

Finally, our paper contributes to the literature on the transmission mechanisms of unconventional monetary policies. For example, Rogers et al. (2014), Rogers et al. (2018) and Vissing-Jorgensen and Krishnamurthy (2011) seek to examine the effects of quantitative easing on asset prices beyond those bought by the central bank, as this is crucial to the ultimate transmission of the policy. Our fund flow analysis allows us to directly examine the response of investors to monetary policy and so illustrate a mechanism by which these asset price changes occur. This contrasts with the findings of Bubeck et al. (2018) who suggest that passive valuation changes are the main driver of portfolios changes among euro area fund investors following ECB monetary policy announcements.

The rest of this paper is structured as follows: Section 3 provides an overview of our data set and Section 4 explains our methodology. Section 5 presents our core results in relation to fund flows and fund liquidity. Section 6 concludes and considers implications for policy.

3 Data set

We use fund flow data from the commercial data provider EPFR Global. We run our analysis on a monthly basis from April 2007 until June 2023, giving us up to 195 usable observations. Our capacity to run analysis for periods before April 2007 is limited by bond fund flow data availability. EPFR decomposes the evolution of total net assets over time into nominal flows and into valuation changes. This allows us to identify changes in the composition of the sector beyond those which are a mechanical pricing result of monetary policy changes. Changes in flows instead reflect direct buying and selling decisions of investors. We use the cumulative flows in percent of lagged assets under management as our main flows variable because monthly flow series are very noisy. The construction of these series follows the methodology by EPFR Global, which allows for a straightforward interpretation in percentage terms. Throughout our analysis we examine dynamics for euro area domiciled funds.

EPFR also allows for aggregate sectoral fund flows to be calculated with breakdowns by domicile, asset class focus and geographic focus. Using this information we construct aggregate fund flow series for euro area domiciled bond funds. Within bond funds we further decompose flows into those to government, high-yield and corporate bond funds. In our baseline analysis we focus on funds buying European assets as these are most relevant to the transmission of ECB monetary policy. We separately examine the response of flows to funds buying American and Emerging Market assets. This level of granularity allows us to build a rich picture of the investment fund sector's response to monetary policy shocks.[3]

To measure fund liquidity, we use fund cash holdings in absolute amounts and relative to total assets. We rely on the ECB Euro area investment funds balance sheet database (ECB IVF) to construct this measure for different open-ended fund types. In particular, we consider as cash

[3] The data from EPFR does not cover the full market capitalisation of the investment fund universe. However, Kaufmann (2023) shows that total Assets under Management (AuM) of funds reporting to EPFR account for the majority of AuM covered by official statistics.

holdings all the deposit and loan claims held by funds vis-a-vis monetary financial institutions.[4] This variable is available monthly since October 2008. The ECB data allows us to analyse aggregate bond funds but not more granular breakdowns.

To construct the high-frequency monetary policy shocks, we make use of the "Euro Area Monetary Policy Event-Study Database" by Altavilla et al. (2019). This intra-day data includes the changes of a broad set of financial market variables in a narrow time window of monetary policy events on all monetary policy meetings of the ECB's Governing Council since January 1999. In particular, we use data for the whole monetary event window that calculates changes in the median quote from the window 13:25-13:35 before the press release to the median quote in the window 15:40-15:50 after the press conference. For the shock identification, we use OIS and Bund yield changes at various maturities as well as the change of the EuroStoxx 50.

We complement this with the daily changes of corporate bond spreads at the monetary policy dates with data taken from iBoxx. We use the spread between bonds issued by euro area non-financial corporations (NFC) with an average maturity of about 5 years and the 5-year German Bund yield. We use daily instead of intra-day changes in corporate bond spreads for the shock identification to account for to the generally lower liquidity on corporate bond markets compared to government debt or stock markets. As corporate debt securities tend to be traded less frequently, their prices can take more time to adjust to monetary policy innovations. For robustness checks, we calculate the bond spread changes after monetary policy meetings also over longer time windows of up to 10 days.[5] In the baseline case, we stick to the more conservative one-day window, as with longer time spans we risk that the effect of the monetary policy shocks is confounded by other market news.

All other data used in this paper are standard financial and macroeconomic time series from various private and public data providers.

[4] A more granular breakdown into deposit and loan claims is not available, but we assume that most of these holdings are made of cash deposits.

[5] This is in line with, for example, Anderson and Cesa-Bianchi (2020) and Gertler and Karadi (2015), who use one- and two-week windows for the analysis of corporate bond spreads after monetary policy events, respectively.

4 Monetary policy shock identification and estimation

4.1 Monetary policy shock identification

Jarociński and Karadi (2020) propose a method for identifying monetary policy shocks that is based on a combination of high-frequency identification and sign restrictions methods. They show that surprise changes of federal funds rate futures in a 30-minutes window around Federal Open Market Committee announcements do not always coincide with stock market movements in the opposite direction, as would be expected from economic theory. The authors argue that central banks' monetary policy decisions can create two types of shock and these can be distinguished by taking into account the contemporaneous response of the stock market. A pure monetary policy shock can be identified by a negative co-movement of interest rates and stock market growth immediately after policy announcements. A positive co-movement arises instead from a central bank information shock: By loosening interest rates the central bank provides the market with negative information regarding the state of the economy. The authors show that the responses of US macroeconomic and financial market variables can differ decisively under these two types of shocks, suggesting that other methods may be unintentionally conflating the effects of information and monetary policy shocks.

However, when the authors apply this method to the euro area the responses of several macroeconomic and financial variables are insignificant or are inconsistent with the predictions of standard economic theory. For example, although the method implements a high-frequency decline of stock prices after a contractionary monetary shock, the response of the monthly stock index remains insignificant. And in contrast to the conventional notion, the monthly BBB bond spread used in their model declines on impact following the contractionary shock. Reliable and plausible results for these variables are of high importance given the relevance of these variables to fund flows. To address these shortcomings we make two adjustments to the original methodology that we describe in the next two subsections.

4.1.1 Long-end instead of short-end yield curve shocks

First, we focus on long-end rather than short-end shocks, as most monetary policy variation in our sample period happened in the longer part of the yield curve and less so at the short-end due to interest rates being close to their effective lower bound. Moreover, investment funds are mainly investing in debt securities of a medium-term maturity. Changes in monetary policy that affect this part of the yield curve are therefore expected to have the strongest effects on funds' returns and potentially also on flows and their risk-taking.

To ensure that we capture surprise changes over the whole longer-end of the yield curve, instead of focusing on the potentially idiosyncratic changes of yields at a certain maturity, we apply the method by Gürkaynak et al. (2005) to separate a "target factor" of monetary policy from a "term structure factor". First, we use intra-day data from Altavilla et al. (2019) on changes of the overnight index swap rate (OIS) with maturities of one week, 1, 3, 6 months and 1 year and add changes of the German Bund with maturities of 2, 5, and 10 years to this set. Following the procedure by Gürkaynak et al. (2005), we calculate the first two principal components of this data. After suitable transformations, these can be interpreted as a monetary policy target factor, capturing changes in the current monetary policy stance, and as a term structure factor, which captures monetary policy induced movements throughout the yield curve.

The target factor is normalised such that a one-unit change corresponds to a one percent change of the OIS 1-month. The term structure factor is normalised such that a one-unit change corresponds to one percent change of the 5-year Bund, which we use as a proxy for the euro area safe interest rate. The correlation between the factors and their normalisation partners is high: the correlation between the target factor and the OIS 1-month is 84%, while it reads 96% between the term structure and the 5-year Bund.

Figure 2 plots the surprise change of the term structure factor as our long-rate shock and of the OIS 3-month as a short-rate shock against the surprise changes in bond spreads and the EuroStoxx 50. The figure demonstrates the significantly higher variation of the term structure factor compared to the short-end shock. Econometrically, this higher variability facilitates the identification of monetary policy shocks over our sample period. Table 1 shows summary statistics on the different shock measures, confirming the higher variation in the longer-rate shocks.

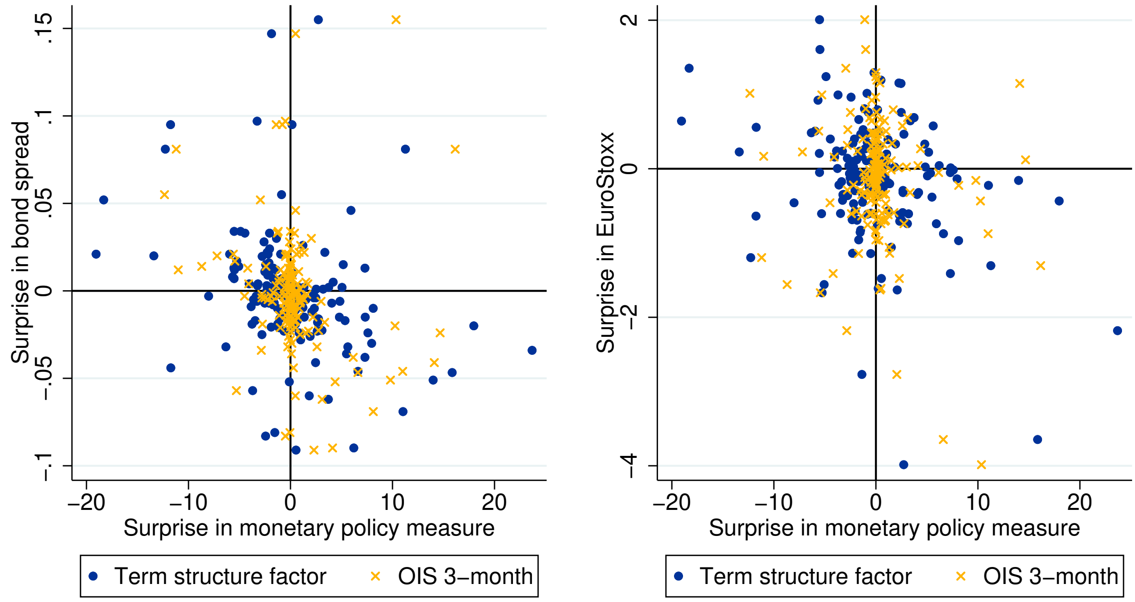


Figure 2: Surprise changes of monetary policy and financial markets variables on ECB Governing Council meeting dates

Notes: Horizontal axis in basis points. Vertical axis left panel in percent, vertical axis right panel in index points. Each dot/cross represents one ECB Governing Council meeting between April 2007 and June 2023.

Table 1: Summary statistics of monetary policy shock alternatives

	Mean	Std. Dev.	Min	Max
OIS 1-month	0.21	3.56	-20.2	19.5
OIS 3-month	0.23	3.64	-12.4	16.2
Target factor	0.10	3.26	-16.4	15.1
Bund 5-year	-0.13	5.42	-19.9	25.7
Term structure factor	-0.09	5.27	-19.1	23.7

Notes: The table shows summary statistics on monetary policy shock measures at the 161 ECB Governing Council meetings between April 2007 and June 2023. An increase of the term structure (target) factor by one unit reflects a 100bps increase of the 5-year German Bund (1-month overnight index swap) rate. All statistics are given in bps.

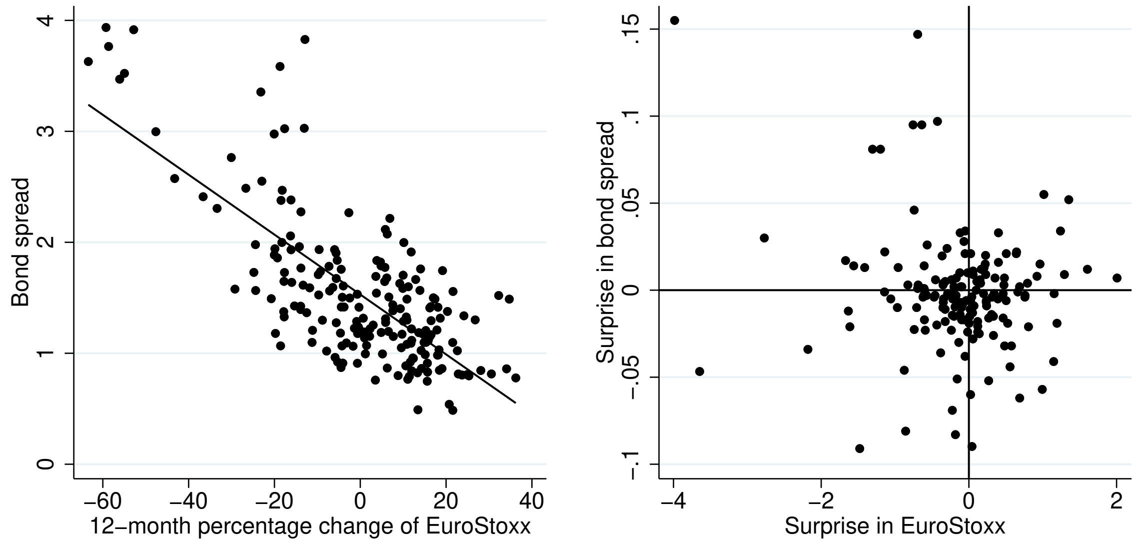


Figure 3: Monthly and high-frequency surprise changes of bond spreads and the EuroStoxx

Notes: Left panel: Monthly observations of NFC bond spreads in percent against the 12-month percentage change of the EuroStoxx 50. Right panel: High-frequency surprise change of NFC bond spreads in percent against surprise change of the EuroStoxx 50 in index points. Each dot represents one ECB Governing Council meeting between April 2007 and June 2023.

4.1.2 Bond spreads instead of stock indices

Second, the original method by Jarociński and Karadi (2020) identifies genuine monetary policy shocks by focusing on negative co-movement incidents between monetary policy measures and stock market surprises on monetary policy ECB Governing Council meeting dates. Instead of using equity market surprises, we use surprise changes of NFC bond spreads at meeting dates. Our motivation for this is twofold: First, bond yields and spreads are more closely related to the financing conditions of firms than the responses on the oftentimes rather "noisy" stock markets. Second, a series of papers (including Gertler and Karadi, 2015 and Caldara and Herbst, 2019) documents the importance of considering corporate credit spreads to obtain reasonable responses in macro-financial VAR models after monetary policy shocks.

A monetary policy shock in this case is identified as a positive co-movement between a surprise change in a monetary policy measure and a surprise change in the bond spread.[6] Both methods

[6]In support of our approach, Anderson and Cesa-Bianchi (2020) use high-frequency data for the US to show

are closely related to each other as bond spreads and equity markets are strongly inversely correlated. Nevertheless, we find that our method based on bond spreads yields more realistic ("correctly signed") and significant responses of financial market and macroeconomic variables after monetary policy shocks.

In our sample, the correlation between the monthly NFC bond spread and the 12-month change of the EuroStoxx 50 reads -74%. The left panel of Figure 3 plots the monthly series of the two variables as used in our analysis. Although this inverse relationship is well-established and deeply-inherent in financial markets, we find that the surprise changes of bond spreads and equity markets on Governing Council dates are only weakly correlated with a correlation of -16%. This low correlation is also visible in the right panel of Figure 3 that plots the surprise change of both variables on the Governing Council dates.

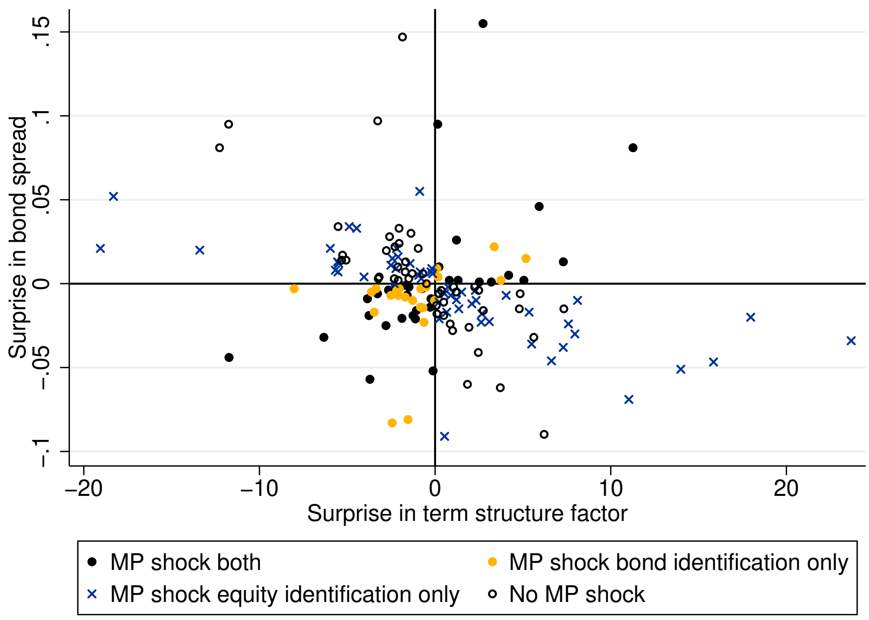


Figure 4: Monetary policy shock classification using bond spreads and stock indices

Notes: Vertical axis in percent, horizontal axis in bps. Each dot represents one ECB Governing Council meeting between April 2007 and June 2023.

As a result of the low correlation, the attribution of event dates as monetary policy shocks differs between the two approaches in about 50% of the cases. This is shown in Figure 4, where solid dots indicate events that are classified as monetary policy shocks based on a positive co-

that NFC bond spreads rise after a monetary policy tightening shock that is identified as in Jarociński and Karadi (2020) via co-movement with stock market surprises.

movement between the term structure factor and the bond spread surprises (58 out of 161). 34 of these cases are classified as a monetary policy shock both under spread-based and stock-based identification (black dots), while 24 events would be identified as a monetary policy shock only using bond spread surprises (yellow dots).

A negative co-movement between the surprise monetary policy change and the bond spread change occurred on the remaining 103 of 161 cases. In the terminology of Jarociński and Karadi (2020), these shocks could either be interpreted as noise or as central bank information shocks. 55 of these dates are, however, identified as monetary policy shocks under the stock-based approach, but not under the spread-based approach (blue Xs). Finally, 48 dates are not a monetary policy shock under both approaches (black hollow circles). As we are interested in the response of various investment fund variables to a genuine monetary policy shock, we focus in the following only on the positive co-movement shocks (solid dots), and ignore the negative co-movement shocks (Xs and hollow circles). In the VAR, the negative and positive co-movement shocks are separated by means of sign restrictions as shown in Table 2 in Appendix A. Figure 16 in the same appendix shows the appearance of monetary policy shocks over time for the term structure factor and the OIS 3-month. As in Jarociński and Karadi (2020)'s euro area examination, we add an additional sign restriction such that the monthly interest rate series that we use as the monetary policy indicator respond in the same direction as the shock for at least the initial month.

As we will show, our main results regarding the investment fund sector can be obtained both using the original stock-based and the new spread-based method. The new refined method, however, yields a much better performance for several macroeconomic and financial market variables in our models and generally allows for a more significant identification of effects.

4.2 Estimation of the Bayesian VAR

The model is estimated as a Bayesian VAR with four lags and a constant term for each variable using the Independent Normal-Wishart prior.[7] The Bayesian approach allows us to incorporate a relatively large number of endogenous variables in our analysis despite the relatively short time series of available data. Unless stated otherwise, we use the following hyperparameter values that

[7] For the estimation we use the BEAR toolbox by Dieppe et al. (2016).

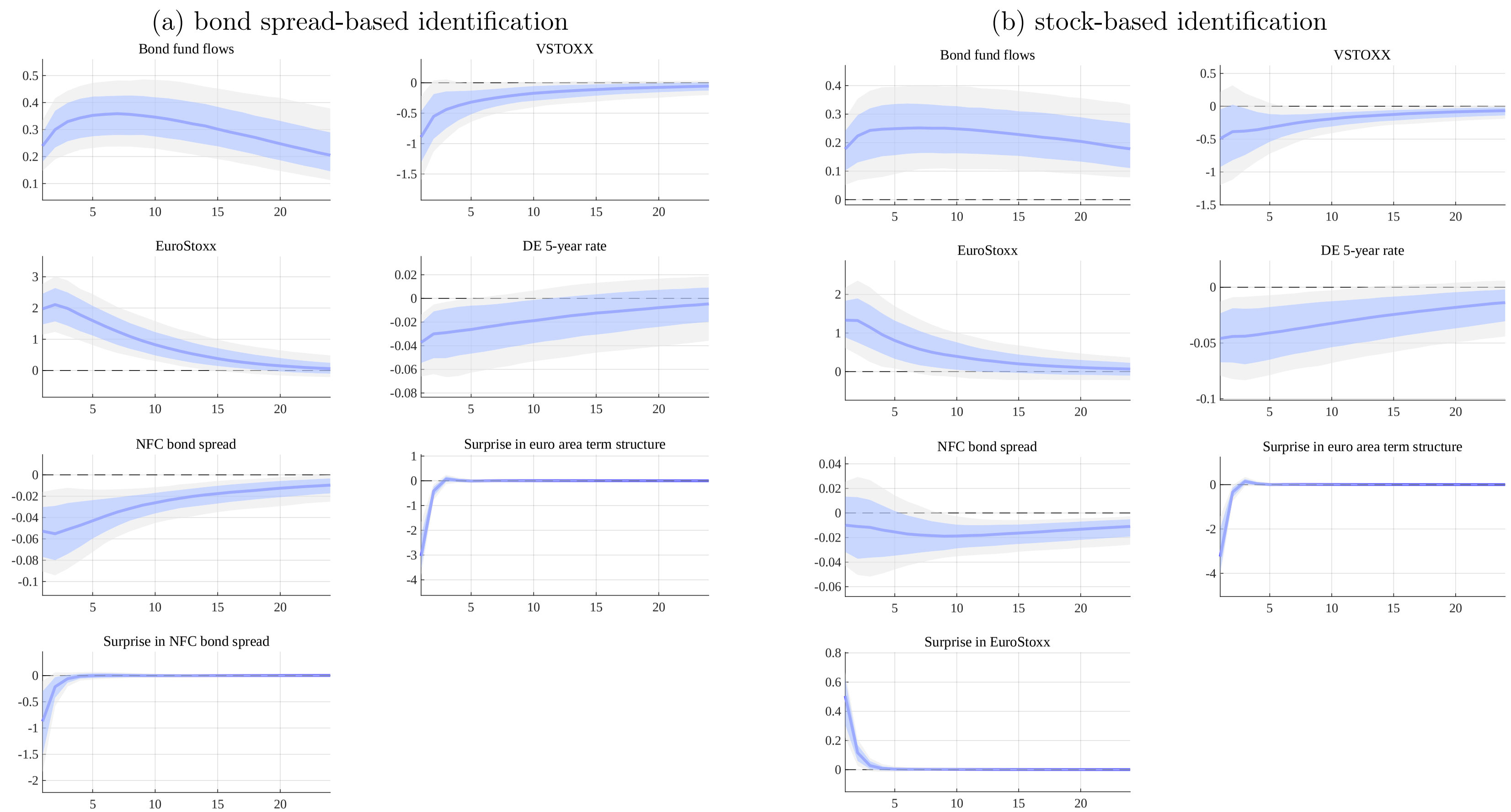
are standard in the related literature.

As a prior belief about the regression coefficients, we assume that each endogenous variable follows a unit root process in its own first lag and has zero coefficient values for all further own and cross-variable lags. The overall tightness parameter for this prior belief is assumed to be $\lambda_1 = 0.1$. The cross-variable weighting parameter that determines the tightness of the prior belief for cross-variable lags is set to $\lambda_2 = 0.5$. The lag decay parameter, determining the speed at which the lag coefficients converge to 0 with greater certainty, reads $\lambda_3 = 2$. For the constant term, a diffuse prior is implemented by setting the exogenous variable tightness to $\lambda_4 = 100$.

The total number of iterations is set to 2000 with 1000 burn-in iterations. The number of lags is set to four on the basis of comparing model marginal likelihoods. The results continue to hold with a higher number of lags. The results are robust to using other priors, including the Litterman (1986) "Minnesota" prior and a conventional Normal-Wishart prior.

Testing indicates that some but not all of our core cumulative flow series are stationary. However we ensure that all estimated models are stationary, which is not a necessary requirement for valid inference when using Bayesian methods. In practise, credibility intervals are, however, often very wide in models where not all roots of the characteristic polynomial lie inside the unit circle.

Figure 5: Impulse responses in baseline model with European focused bond fund flows



Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Panel (a): Monetary policy shocks identified as positive co-movement between high-frequency change in bond spread and term structure factor. Panel (b): Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and term structure factor.

5 Results

5.1 Investment fund flows' response to monetary policy

This section examines the risk-taking channel of monetary policy transmission, as carried out by investment fund flows. We provide evidence that euro area fund flows significantly change following monetary policy shocks. Also, we show that fund investors respond to expansionary monetary policy with clear search for yield behaviour, with funds flowing into riskier fund types and into funds with non-euro area investment focus.

Our baseline BVAR model includes the two high-frequency surprise variables: the surprises in the euro area term structure and in the NFC bond spread. We add five further endogenous variables reflecting wider conditions in euro area financial markets, namely the 5-year Bund yield, 5-year euro area NFC bond spreads, Eurostoxx price growth and its volatility, as captured by VSTOXX. The latter is added to capture changes in investor's risk sentiment (Bekaert et al., 2013). Finally we include aggregate cumulative flows to euro area domiciled bond funds buying European securities. Figure 5 (a) shows the impulse responses of bond fund flows and the further financial market variables following an expansionary monetary policy shock. The y-axis of the fund flow and the EuroStoxx responses indicates percentage changes. The y-axis of the Bund yield and NFC spread is given in percentage points, while the VSTOXX index is included in levels. The surprise changes of the term structure and the NFC bond spread are denoted in basis points.

Using our bond spread-based identification, an expansionary monetary policy shock leads the euro area term structure factor to decrease by 3 bps. This implies a reduction of the monthly German 5-year sovereign bond rate by about 0.04% on impact. The high-frequency NFC bond spread decreases by 0.9 bps, leading to a reduction in the monthly NFC bond spread by 0.05%. In this environment, investors become less risk-averse and market volatility, as proxied by the VSTOXX index, decreases by 0.9, while the price of the Eurostoxx index increases by over 2%. Euro area bond funds experience persistent and significant inflows from end-investors by 0.23% on impact, with the maximum effect of about 0.35% arising after 7 months. In other words, a 25 bps surprise decrease in the euro area risk-free yield curve drives inflows in euro area bond funds by about 2% of their net asset value. All responses are found to be highly statistically significant.[8]

For the purpose of comparison, Figure 5 (b) shows the response of fund flows using the standard stock-based identification from Jarociński and Karadi (2020). Again, we see clear and significant inflows into bond funds. However, the response of financial market variables to the monetary loosening is less coherent. For example, the VSTOXX and the bond spread responses are insignificant for the first months after impact. We also consider the reaction of macroeconomic variables, such as industrial production and inflation, under the two different identification schemes (see Figure 18 in Appendix B). Under the spread-based scheme, industrial production and inflation increase significantly after a monetary loosening and all financial market variables behave intuitively and statistically significantly. Instead, under the stock-based scheme (and in line with the original findings by Jarociński and Karadi, 2020), inflation does not react significantly. The VSTOXX and the NFC bond spread responses are insignificant as well. In addition, the bond spread tends to rise as opposed to economic intuition. We conclude that our proposed bond spread-based identification allows to identify the effects of a genuine monetary policy in a much clearer way. As a result we keep the spread-based approach as our baseline for the analysis of the investment fund sector.[9]

Next, we explore the heterogeneity of our fund flows sample to investigate potential differences across fund types. Figure 6 shows the impulse responses of flows into bond funds with a European investment focus to an expansionary monetary policy shock. We find evidence that investors' responses to accommodative monetary policy shocks are larger for riskier bond fund types. Specifically, corporate bond funds and high-yield corporate bond funds experience significant and persistent inflows of over 0.8% and 1.1% following a 3 bps decrease in the risk-free yield curve, while inflows to sovereign bond funds increase by only 0.2%.[10]

These findings point to a powerful risk-taking channel of monetary policy operating through investment funds. Figure 7 (left panel) normalises the on impact flow response across fund types

[8] Our results remain fully robust if we use 2-, 3-, 5-, or 10-day changes of the corporate bond spreads instead of the one-day change for the identification of the monetary policy shocks. This exercise is important, as in particular corporate bond yields may take longer than one day to fully adjust to news about monetary policy. See Figure 27 in Appendix B.2 for results of the baseline model using the 5-day change.

[9] Notably, these results are robust to various further changes to the specification, including the removal of the global financial crisis from our sample and the use of a standard high-frequency or simpler Cholesky identification method. Output can be found in Figures 28, 29 and 30 in Appendix B.2.

[10] In Figure 21 in Appendix B.1 we find quantitatively very similar results for the different bond fund types when using the stock-market based identification scheme.

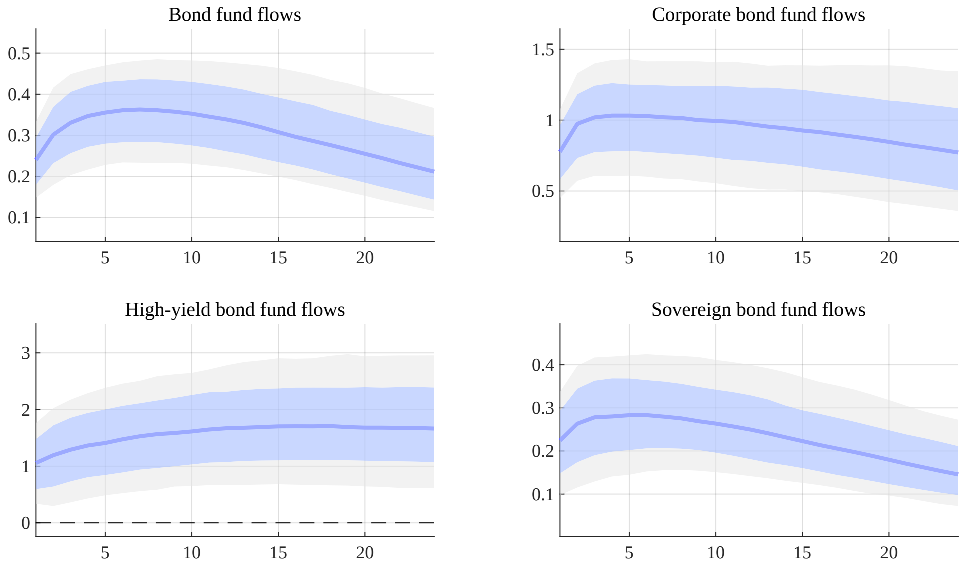


Figure 6: Response of flows to European focused funds across a range of asset classes

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in Figure 5 (a).

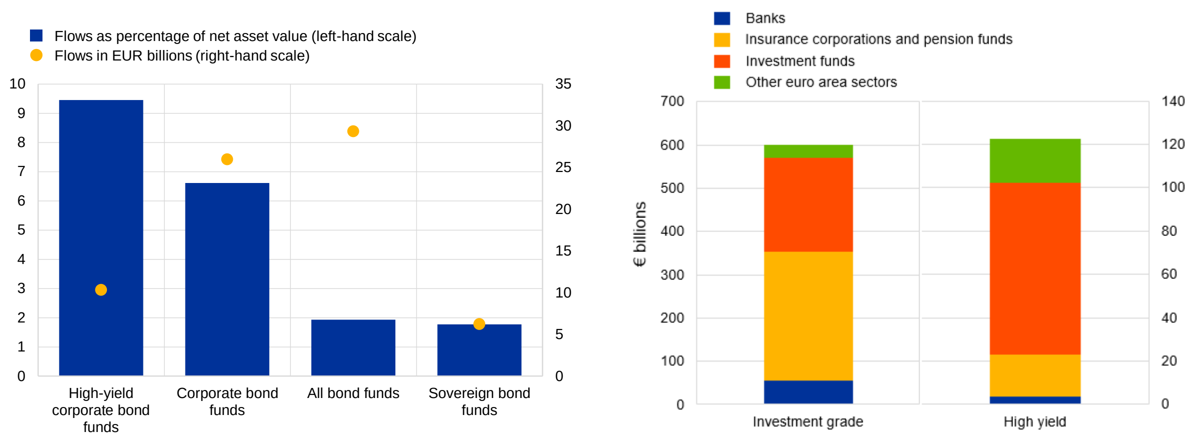


Figure 7: Flow response to 25bps monetary easing in percentage and absolute terms (left) and the role of funds in NFC bond markets (right)

Notes: Left panel: The bars are based on the impulse responses in the first month after the shock. Flows as percentage of net asset value on the left axis, and flows in EUR billions on the right axis. Right panel: Data is taken from the ECB Securities Holdings Statistics by Sector and the Centralised Securities Database. The figure excludes the volumes of securities purchased by the Eurosystem and non-euro area investors, as well as non-rated securities.

to a 25 bps loosening shock, corroborating the finding of relatively higher inflows into riskier fund types. The figure also estimates the effect in absolute terms on the basis of fund balance sheet data from April 2020.[11] The flow responses are economically significant, with bond fund categories experiencing inflows of between EUR 6 and 30 billion. This risk-taking channel may have particularly pronounced effects in market segments where the role of investment funds as well as their estimated flow response is large. Figure 7 (right panel) shows that euro area investment funds own approximately two thirds of outstanding euro area high-yield securities and approximately 40% of outstanding euro area corporate bonds. As such, aggregate inflows will translate into increased demand for high-yield and corporate bonds, thus easing financing conditions for euro area firms. The investment fund sector can in this way contribute to the transmission of monetary policy in a quantitatively meaningful way.

Our findings on the active expansion of the bond fund sector, and especially in its riskier segments, has not been documented before for European data. The results nevertheless relate to the wider literature. For example, Hau and Lai (2016) show a rotation of investor flows towards equity and away from money market funds after monetary loosening. They do not study the bond fund sector, which is of particular importance for financial stability and firms' financing conditions and, hence, the transmission of monetary policy. Daniel et al. (2021) provide evidence that after a decrease of interest rates fund investors re-balance their portfolios towards assets that yield higher income, such as high-dividend stocks and high-yield bonds. Lian et al. (2019) show that individuals also reach for yield in low interest rate environments.

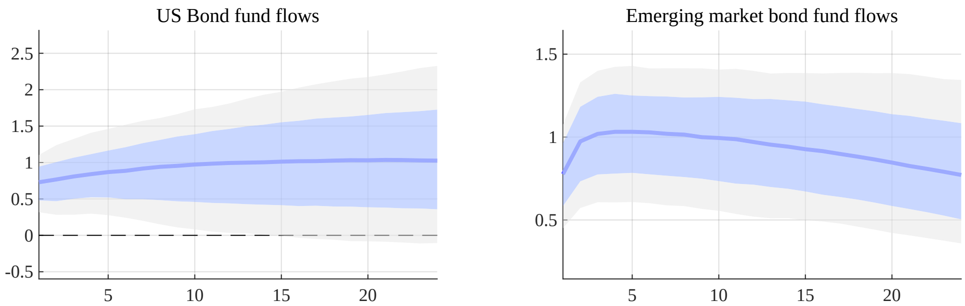


Figure 8: Response of flows to funds buying non-euro area assets across a range of asset classes

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in Figure 17.

Our finding about the rotation of investor flows towards riskier asset classes contrasts with Banegas et al. (2022), whose results are less consistent with the risk-taking channel of monetary

[11] We use the ECB IVF data to capture total sector size, given EPFR data only covers a subset of funds.

policy. For example, they find that government bond funds receive the strongest inflows after a monetary loosening, while they do not find significant responses for high-yield bond funds. Rerunning our models for a central bank information shock, we find similar results as they do (see Figures 31 and 32 in Appendix B.2).[12] Inflows to bond funds, including the main category of corporate bond funds, are insignificant with sometimes negative responses. Instead, inflows to sovereign bond funds are positive and marginally more significant, while flows towards high-yield funds are significantly negative within the first months after impact. We interpret this as evidence for the importance of separating information shocks from pure monetary policy shocks to fully understand the transmission of monetary policy through investment funds. We see this is as an additional contributions of our paper.

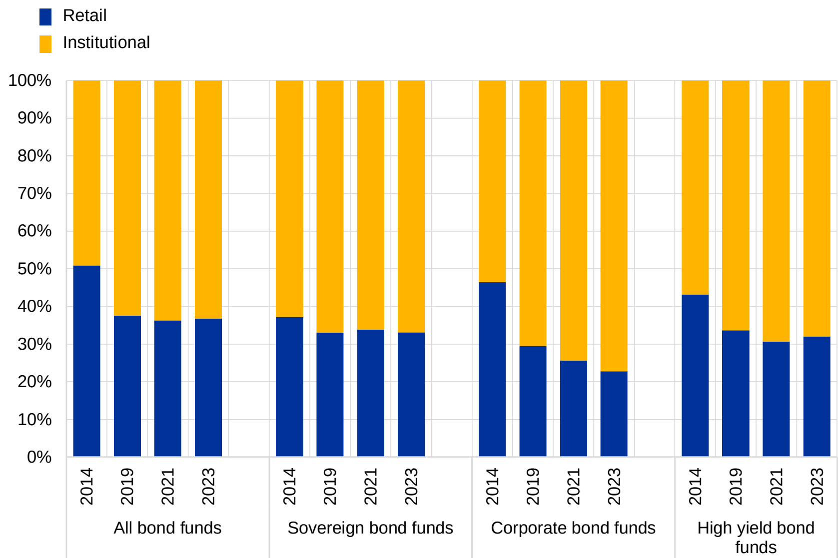


Figure 9: Investor composition across asset classes - share of total assets

Our data set also allows us to analyse the response of flows into funds buying non-euro area assets following an expansionary monetary policy shock. Where this shock type reduces the returns on euro area assets, investors may substitute towards markets with higher yields, such as the US or Emerging Markets. Due to smaller underlying fund samples in the earlier years, we can run our analysis on the high-level bond category only. To account for the international dimension in investors' portfolio decision, we enrich our model by the US Dollar/Euro exchange

[12]Consistent with the notion of Jarociński and Karadi (2020), this negative co-movement shock between the term structure factor and bond spreads leads to a widening of spreads, increased financial market volatility, and a drop in the equity market index.

rate. Figure 8 shows that bond funds buying US assets and those buying Emerging Market assets receive persistent inflows of almost 0.8% following a 3 bps decrease in the risk-free yield curve. This points towards international spillovers of monetary policy, consistent with the international risk-taking channel of monetary policy (Bruno and Shin, 2015). Our results complement findings by Kaufmann (2023), who shows that a loosening of US monetary policy also implies inflows to investment funds that focus on European assets, irrespective of their domicile.

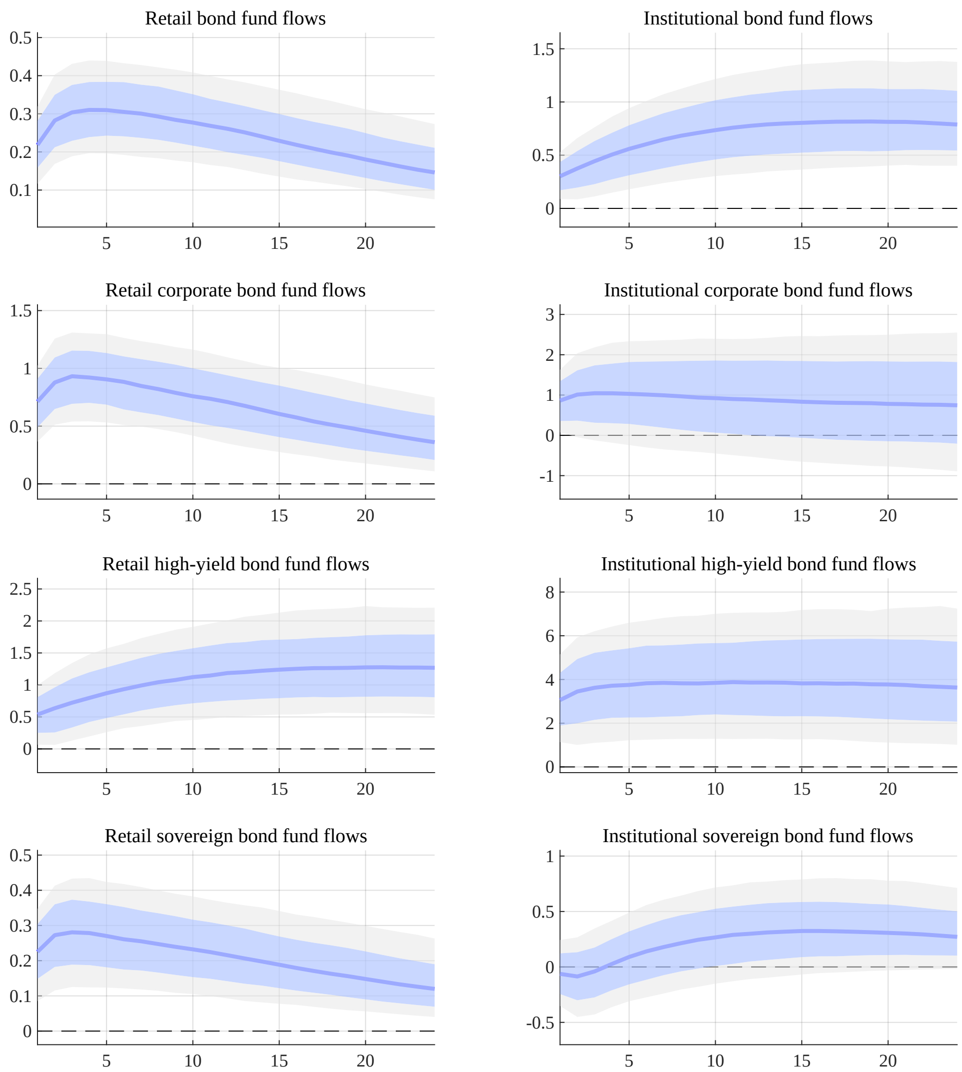


Figure 10: Response of flows from retail and institutional investors across a range of asset classes

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in Figure 5.

Finally, we examine the response of flows across funds with predominantly retail or institutional investor bases. This allows us to understand where inflows are coming from and how monetary policy shocks could affect the risk exposures of different types of financial agents. Figure 9 shows the split between institutional and retail funds in total asset terms over time. We document a growing role of institutional investors across all asset classes and by 2019 institutional investors make up the majority within all asset classes.

Figure 10 shows that the response to an expansionary monetary policy shock varies noticeably across institutional and retail investors. Overall, institutional investors are relatively more sensitive to monetary policy changes than retail investors. This is consistent with a notion that professional investors monitor financial market developments more actively. For aggregate bond funds, the response of institutional investors' cumulative flows peaks at around 0.8% compared to 0.3% among retail investors. There is again evidence of search for yield across both investor types, with sovereign bond funds receiving proportionately lower inflows than riskier categories, such as the high-yield bond funds.

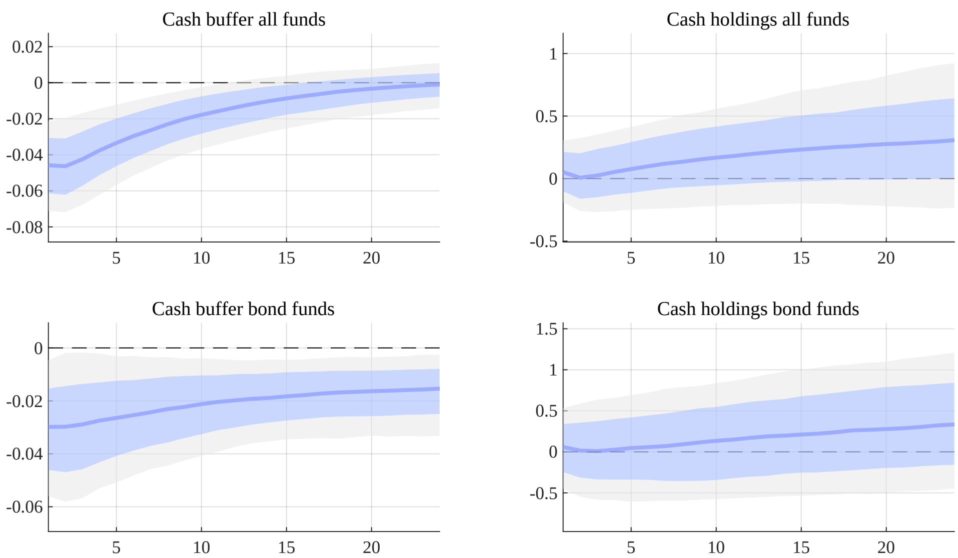


Figure 11: Response of fund cash holdings across a range of asset classes

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in Figure 19.

5.2 Investment fund cash buffers' response to monetary policy

While responses suggest that fund *investors* change the size and composition of the investment fund sector following monetary policy shocks, fund *managers* may also play an additional role. Managers typically cannot influence the overall size of their fund but they can make portfolio allocation decisions following market shocks. By increasing their demand for risky assets they may decrease funding costs for the real economy. However, where this is done by reducing the share of liquid asset holdings, this may also result in the build-up of liquidity risk in the sector.

We add a simple measure of the liquidity or riskiness of fund assets to our baseline model: The share of total assets held as cash.[13] All remaining aspects of the specification are kept the same as in our baseline. The left panels of Figure 11 show the response of this simple liquidity measure to an expansionary monetary policy shock. On aggregate fund managers respond by decreasing their cash buffers by over 0.045% after a -3 bps monetary policy shock. The same dynamic can be seen among bond funds.

In the right panels of Figure 11, we report the results obtained using another measure of fund liquidity, i.e. the absolute amount of cash in euros held by different fund types. This is to ensure that results are not driven by the positive valuation effects of the monetary policy shock on funds' non-cash assets. In theory this could lead to a declining cash to assets ratio even as fund managers attempt to maintain cash buffers by increasing absolute cash holdings. However, responses are negligible in absolute terms. This suggests that as managers receive new inflows following monetary policy shocks these are used in their entirety to purchase new assets, reducing the relative size of funds' cash buffers.[14]

The decision by managers to reduce cash holdings can be understood in relation to both conventional and unconventional monetary policy tools. First, holding cash becomes more expensive in a low/negative interest rate environment and riskier securities are more attractive to improve fund profitability. Second, quantitative easing programmes improve the liquidity conditions in bond markets, which makes it easier for investment funds to liquidate the securities in their portfolios in the event of outflows, reducing their perceived need to hold cash. In either case, the

[13] These cash holdings usually take the form of bank deposits, which include call accounts as well as secured and unsecured money market instruments, such as repurchase agreements and short-term certificates of deposits.

[14] All results concerning the liquidity measures are robust to using the stock market-based identification (see Figures 22 and 23, Appendix B.1).

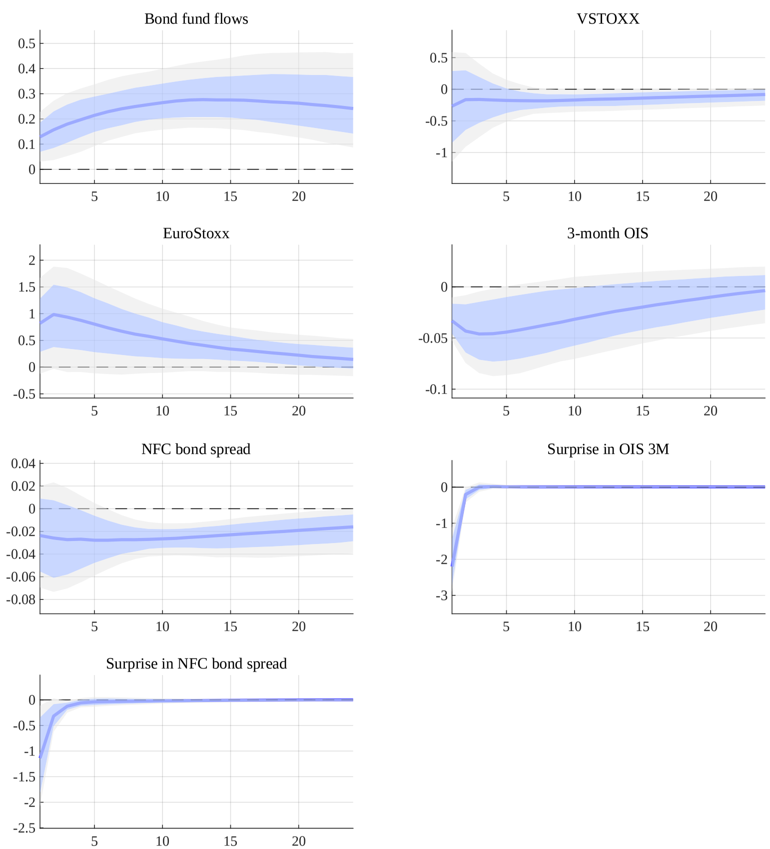
increased demand for risky assets by the fund sector will contribute to easing funding conditions in the real economy.

However, lower cash buffers also widen the liquidity mismatch between funds' assets and liabilities and can increase the risk of procyclical selling in market downturns. In the event of a sudden and abrupt repricing of financial assets, funds may experience large outflows. This is likely to happen in conjunction with a sharp reduction in wider market liquidity. Where funds do not hold enough cash and liquid securities, they may be forced to sell illiquid assets, thereby amplifying downward movements in asset prices. This could have broad financial stability implications with potential spillovers to the real economy, such as increasing the cost of bond financing. This problem is likely to be most acute in markets for less-liquid assets and markets where funds own a large share of outstanding securities, such as corporate and high-yield bond markets.

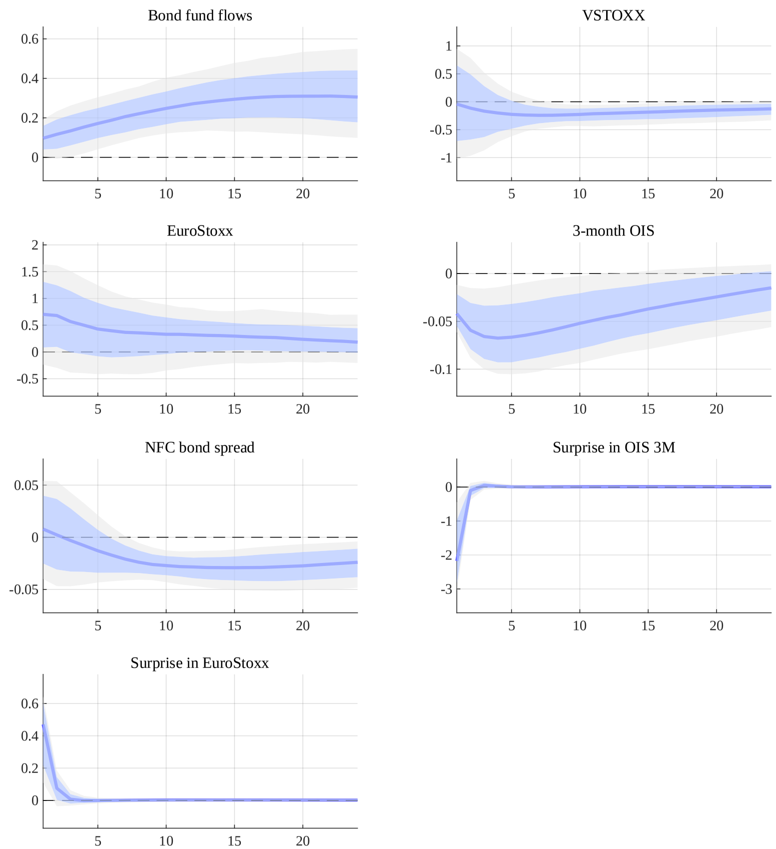
Indeed, European Central Bank (2020) and Financial Stability Board (2020) note that insufficient cash buffers prior to the coronavirus crisis may have resulted in forced sales by investment funds, which ultimately exacerbated the original shock. Outflows experienced by euro area corporate and high-yield funds exceeded liquid asset holdings for the majority of funds. To meet these outflows the fund sector was forced to sell illiquid assets, during a period of extreme market illiquidity. Empirical studies carried out before March 2020 also found that cash holdings are not generally sufficient to fulfil redemptions (Chernenko and Sunderam, 2016; Wang, 2015) and that asset managers fail to anticipate outflows well in advance (Morris et al., 2017). While funds hold cash and liquid instruments to manage their liquidity needs under normal conditions, they may lack incentives to internalise the costs of large asset sales and therefore to reduce risk-taking preemptively (see for example Ryan, 2022). This finding is also supported by the existing literature on fund managers' tendency to reach for higher yielding assets during periods of accommodative monetary policy. For example, Choi and Kronlund (2017) examine reach for yield among US corporate bond funds and find that this type of activity increases in periods when the yield curve is flatter.

Figure 12: Impulse responses in baseline model with European focused bond fund flows and short-end shocks

(a) spread-based identification



(b) stock-based identification



Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Panel (a): Monetary policy shocks identified as positive co-movement between high-frequency change in bond spread and 3-month OIS. Panel (b): Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and 3-month OIS.

5.3 Role of monetary policy instrument selection

Since the global financial crisis the range of tools available to policy makers have proliferated, with central banks adding policies such as quantitative easing to their toolkit. The use of these unconventional methods is likely to continue into the future, highlighted by their use in tackling the crisis emanating from the coronavirus pandemic. Thus it is important to understand whether the funds sector responds differently to different instruments. A central difference between conventional and unconventional tools is the part of the yield curve directly affected by policy. Interest rate changes directly affect the short-end of the yield curve, with transmission to the longer-end occurring via financial markets. However, policies such as quantitative easing directly affect the long-end of the curve, due to central bank intervention in markets for these assets.

As discussed in Section 4, unconventional policy was used extensively over the period we examine but conventional measures were also present. We proxy the response to conventional (interest rate) and unconventional (quantitative easing) policies using shocks to the short and long-end of the yield curve. Following Jarociński and Karadi (2020), we use shocks to 3-month OIS rates at the short-end and continue to use our term structure variable as a long-end measure. Of course the two ends of the yield curve do not operate independently from each other and we would expect, for example, an interest rate shock to also affect the long-end of the curve. Figure 2 shows that our two shock types, while correlated, are sufficiently different for us to measure the impact of different policy types.

Panel (a) of Figure 12 shows the response of bond fund flows and the other baseline variables following a short-end monetary policy shock. Our overall findings hold, with bond funds receiving positive and consistent inflows. Compared to the Eurostoxx identification method (Panel (b) of Figure 12), our NFC spread identification again provides more intuitive and significant responses.

Figure 13 documents impulse responses for the different bond fund types after a shock to the short-end of the yield curve. While we find again inflows to all components, flows into high-yield funds are mostly statistically insignificant. Next we repeat our liquidity analysis using the short-end shock. Figure 14 shows the results for cash holdings as percentage of total assets and in absolute amounts, for which our overall finding that expansionary shocks are followed by decreased fund liquidity continues to hold. In fact, cash holdings in levels now also tend to fall

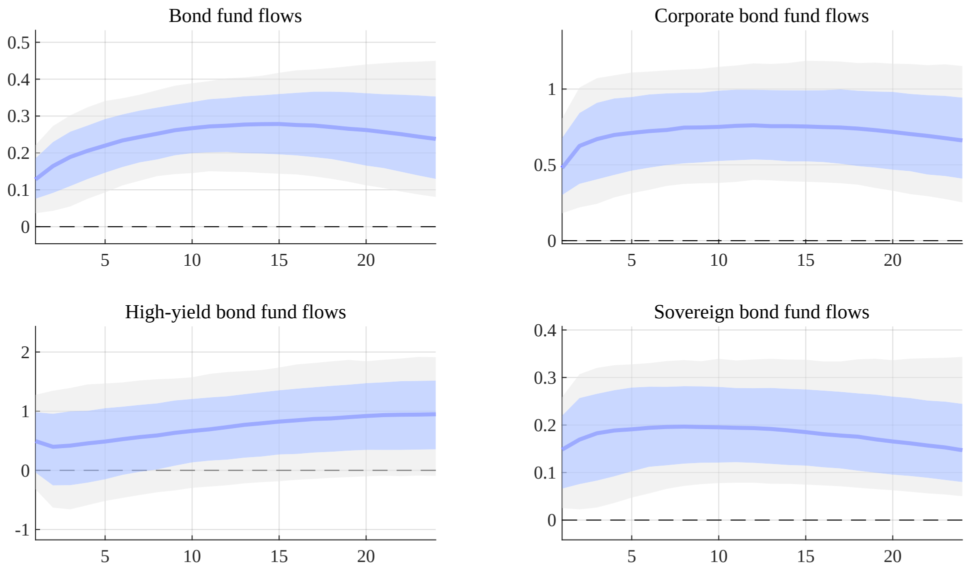


Figure 13: Response of flows to European focused funds across a range of asset classes following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in the left panel of Figure 12.

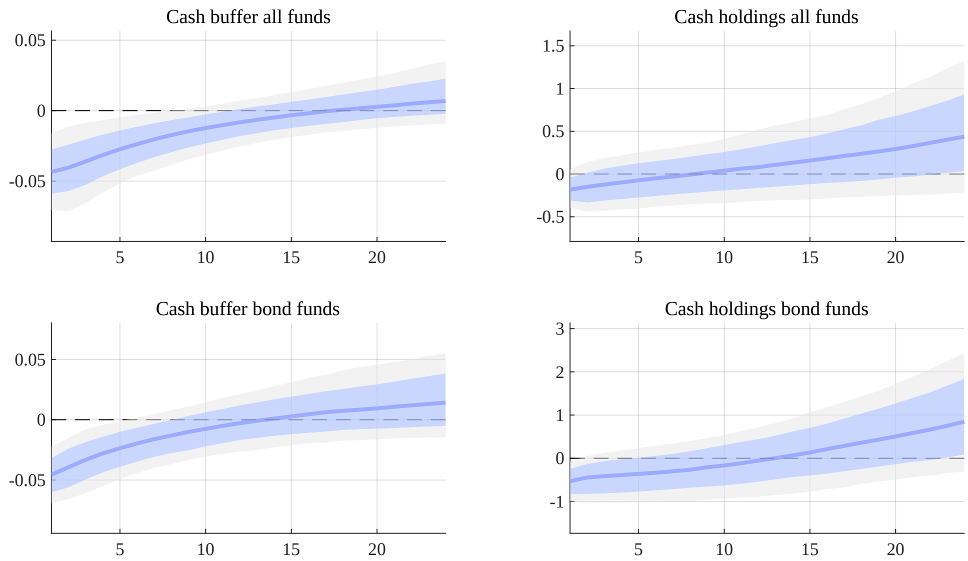


Figure 14: Response of fund cash holdings across a range of asset classes following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the model in Figure 20.

as compared to the long-end shock.[15]

Figure 15 (left panel) compares proportional flow responses following short and long-end shocks of -25bps. Inflows to bond funds amount to similar amounts after shocks of the same size, with moderately larger effects for long-end shocks. There are considerable differences at the asset class level, though. Specifically, there is less evidence of risk-taking after short-end shocks. High-yield funds do not receive statistically significant inflows while the flow response for sovereign funds is broadly similar.

Finally, Figure 15 (right) examines the response of liquidity buffers to both shock types. Previously we explained funds' decision to lower cash buffers in two ways: It is more expensive for funds to hold cash and market liquidity increases. Short-end shocks directly affect the amount of money banks have to pay for holding reserves in the central bank deposit facility, a cost which is then passed on to funds via interest on their deposit accounts. Long-end shocks instead directly affect the liquidity of markets for longer-term assets, where the central bank is directly intervening. The latter may be particularly the case for bond markets. The effect of the short-end shock on fund liquidity is larger than the long end shock, particularly in the case of bond funds. This suggests that for these funds it is the cost of holding cash which drives liquidity decisions following monetary policy shocks.

[15] Again, we can document quantitatively very similar results when using the stock market-based identification (see Figures 24, 25 and 26 in Appendix B.1).

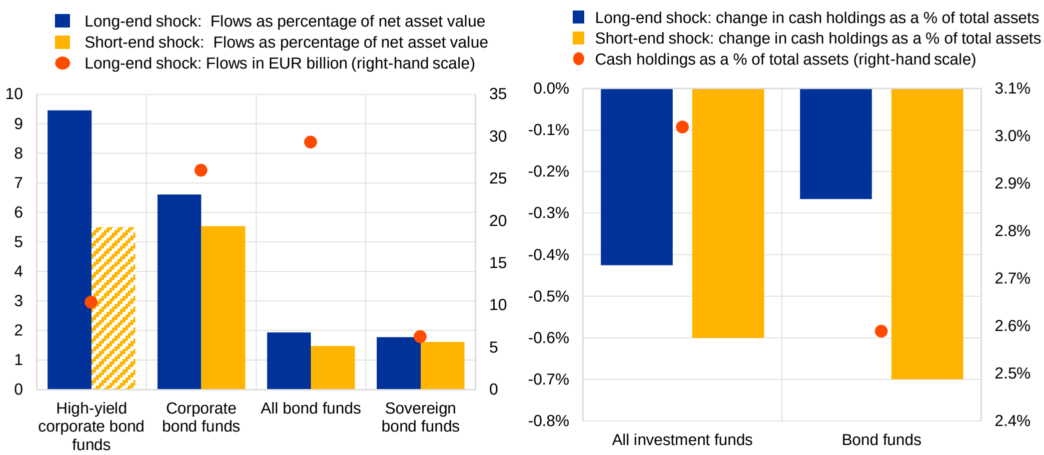


Figure 15: Comparing the response of flows (left) and liquidity (right) to long and short-end shocks

Notes: The bars are based on the impulse responses in the first month after the shock, normalised to a monetary loosening of 25 bps. The underlying impulse response functions for the long-end shock can be found in Figures 6 and 11. Those for the short-end shock can be found in Figures 13 and 14. Shaded area indicates statistical insignificance. Red dots in the right chart indicate cash holdings in December 2020.

6 Conclusion

The continued rise of the investment fund sector represents a challenge to how we think about monetary policy, given the traditionally bank-focused euro area financial system. As a first step we need to have a thorough understanding of how the sector responds to monetary policy shocks, including implications for transmission and possible unintended consequences for financial stability. The sample period covers both the low-yield environment and the subsequent rate hikes, as well as the introduction and the phase-out of unconventional monetary policy tools.

We have shown that the investment fund sector represents an active avenue for the transmission of monetary policy, with expansionary shocks followed by a clear growth of the sector that allows to provide more financing to the real economy. We provide evidence of search for yield from fund investors, who flow into riskier fund types in response to accommodative monetary policy shocks. This is particularly the case following monetary policy shocks that directly target the long-end of the yield curve, such as quantitative easing policies. Some of this search for yield may result in flows into funds investing outside of the euro area. This suggests that fund flows play a role in transmitting quantitative easing policies beyond the markets where central banks directly intervene. Search for yield by investors is amplified by asset allocation decisions of managers, who tend to rebalance their portfolios away from increasingly low yielding cash assets.

As long as the fund sector continues to grow and increases its credit to the real economy, the importance of the risk-taking channel of monetary policy will also increase. While this may support the transmission of policy, it does not come without a cost. Increased demand for risky assets may improve financing conditions for the real economy but may also result in a build-up of risk within the fund sector. Increased liquidity risk-taking by fund managers may be a particular cause for concern, as this may decrease the sector's capacity to deal with large investor redemptions during a crisis scenario and provide stable credit to the real economy.

The implications of extended accommodative monetary policy for financial stability is a topic that has been discussed extensively in relation to the banking system. One policy solution is the use of macroprudential policies that can increase the resilience of the financial system in a targeted way (see de Guindos, 2021 and Martin et al., 2021 for discussions). This should allow for monetary policy to focus on price stability while macroprudential policy focuses on the resilience of the financial system.

In the case of investment funds, suitable policies are not currently available. However, the expansion of macroprudential frameworks beyond the banking system has been a priority of policy makers for a number of years. Suitable macroprudential tools could be limits on illiquid asset holdings or minimum liquidity buffers. Also, restrictions on redemption frequency and minimum notice periods could help align the liquidity of funds' assets and liabilities. These tools could be implemented in a countercyclical fashion, tightening during periods of exuberance, when markets are liquid and fund managers may otherwise reduce liquidity. This would ensure sufficient liquidity in crisis periods, at which point requirements may be relaxed to allow for funds to support real economy financing, market functioning and the transmission of monetary policy.

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Appendix

A Monetary policy shock identification

Table 2: Identifying restrictions in the VAR model

	Shock type		
	Monetary policy	CB information	other
Variables	(positive co-movement)	(negative co-movement)	
High-frequency:			
Interest rate measure	+	+	0
Bond spread	+	-	0
Low-frequency:			
Interest rate measure	•/(+)	•	•
Investment fund flows etc.	•	•	•

Notes: Table shows restrictions on the contemporaneous responses of variables to shocks to implement the refined version of the identification method by Jarociński and Karadi (2020), where we use high-frequency changes of bond spreads instead of stock indices. +, -, and 0 denote sign and zero restrictions, while • denotes unrestricted responses.

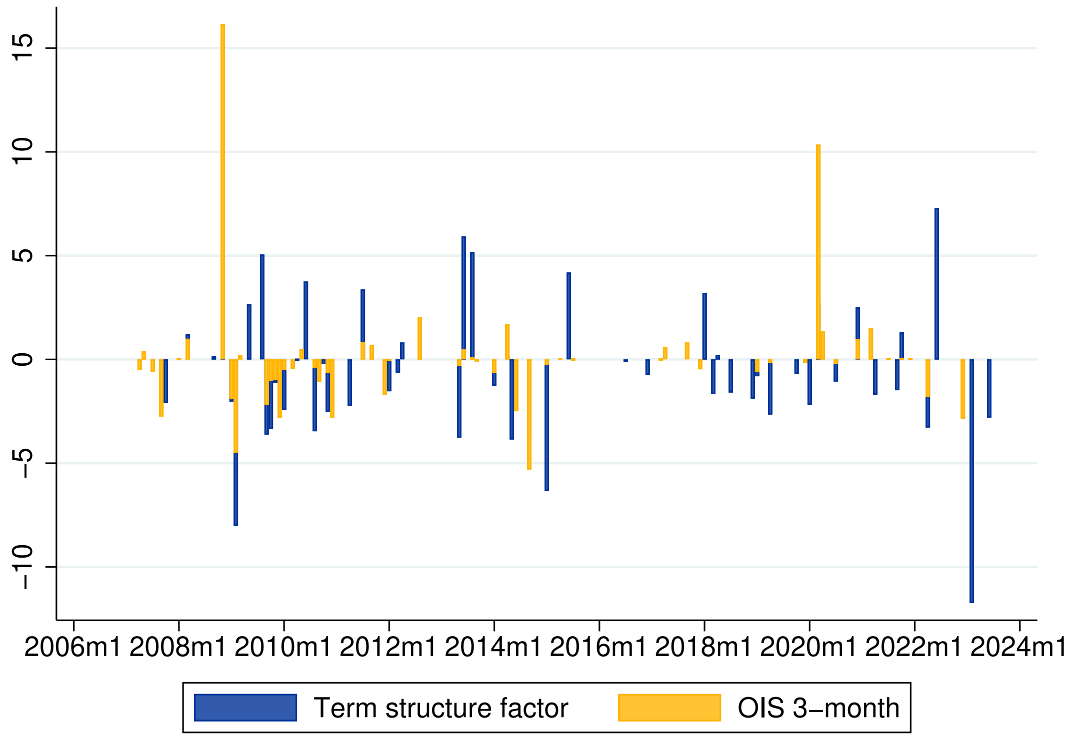


Figure 16: Monetary policy shocks over time

Notes: Vertical axis in bps. Shocks are identified using co-movements with bond spreads.

B Additional results

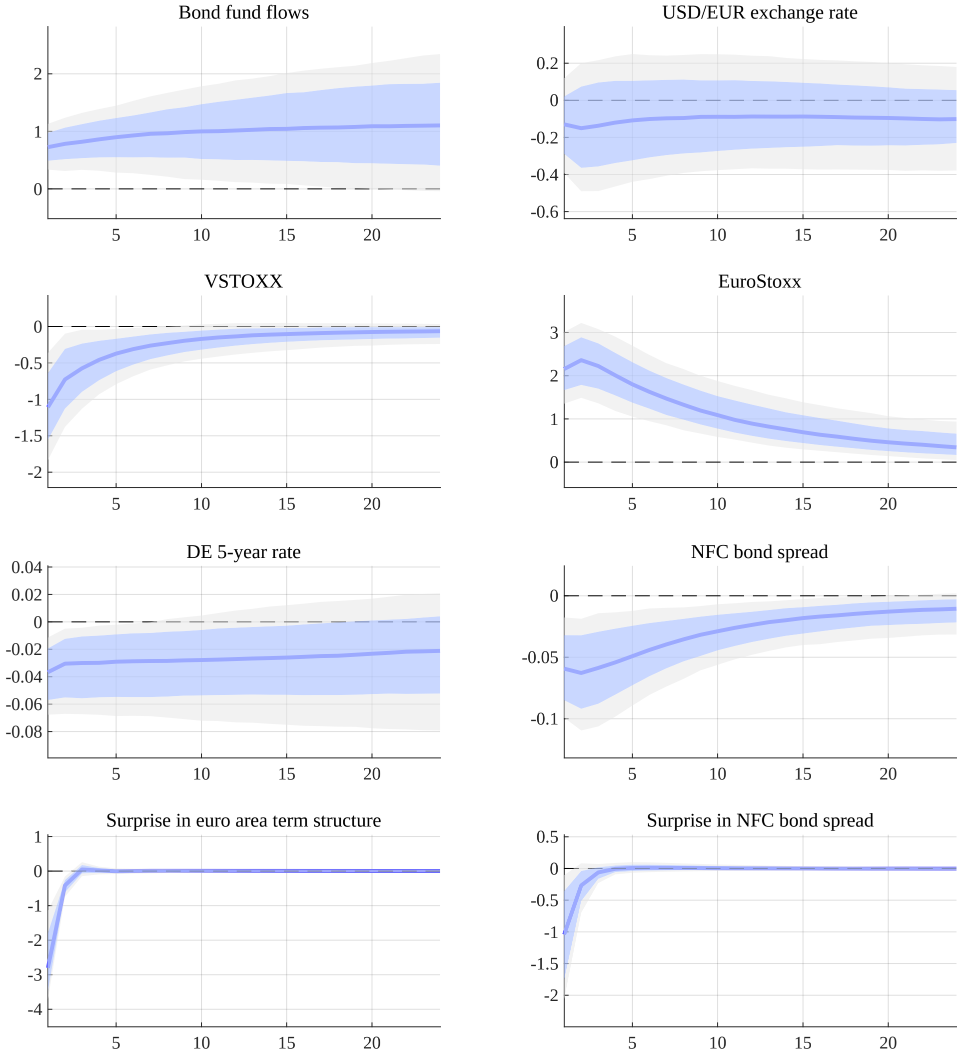
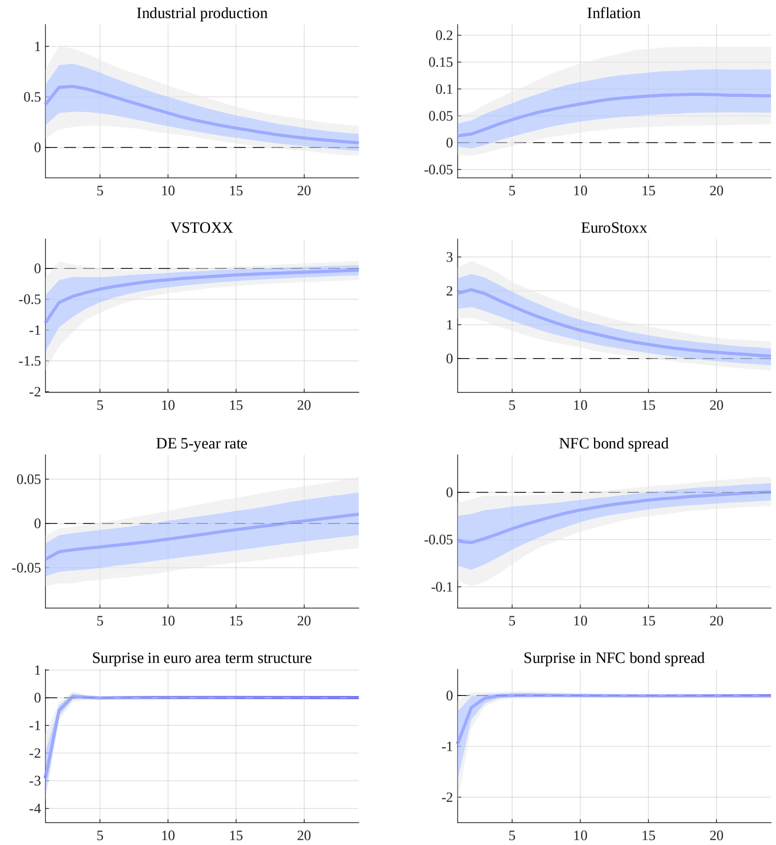


Figure 17: Impulse responses in baseline model with US focused bond fund flows

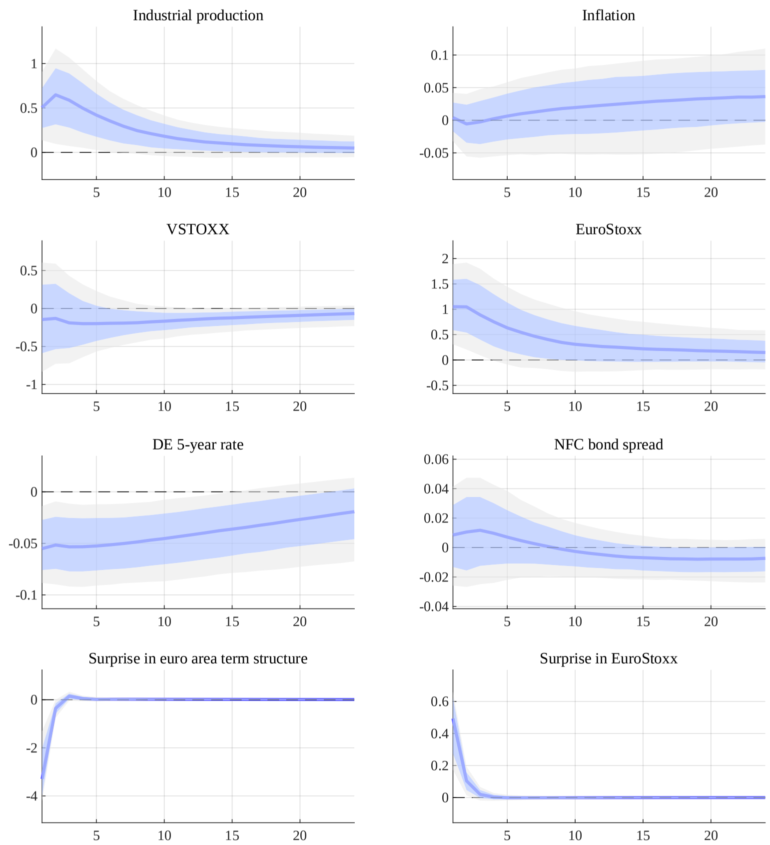
Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification.

Figure 18: Impulse responses in baseline model with macroeconomic variables

(a) spread-based identification



(b) stock-based identification



Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Panel (a): Monetary policy shocks identified as positive co-movement between high-frequency change in bond spread and term structure factor. Panel (b): Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and term structure factor.

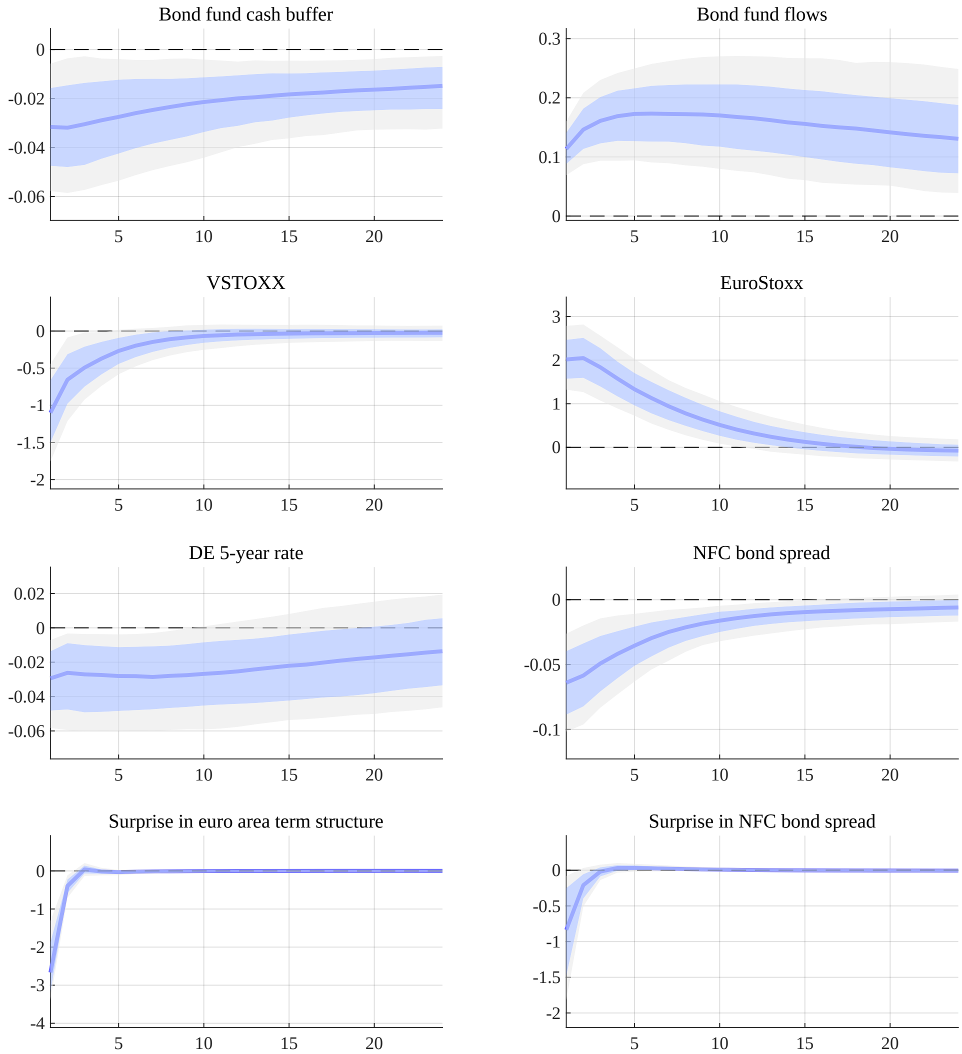


Figure 19: Impulse responses in baseline model with bond fund cash holdings as percentage of total assets

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification.

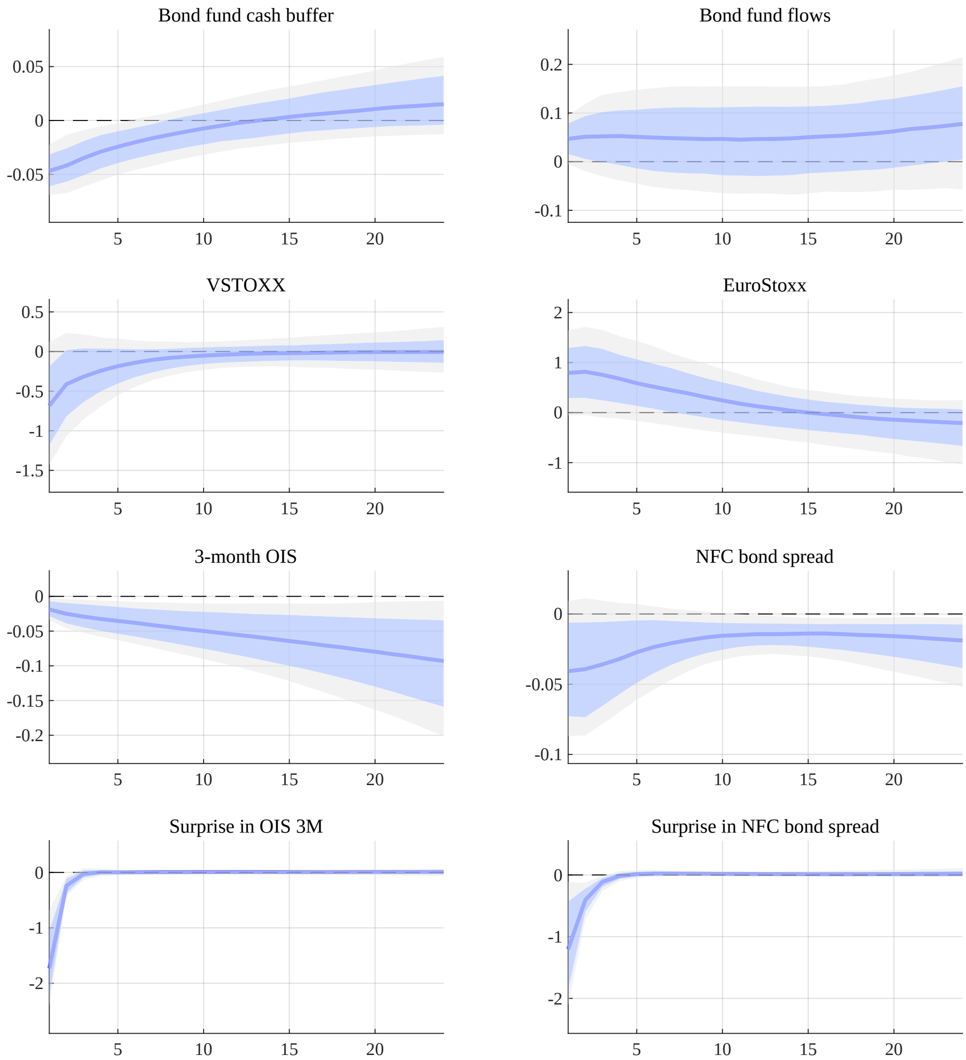


Figure 20: Impulse responses of bond fund cash holdings following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification.

B.1 Stock market-based identification

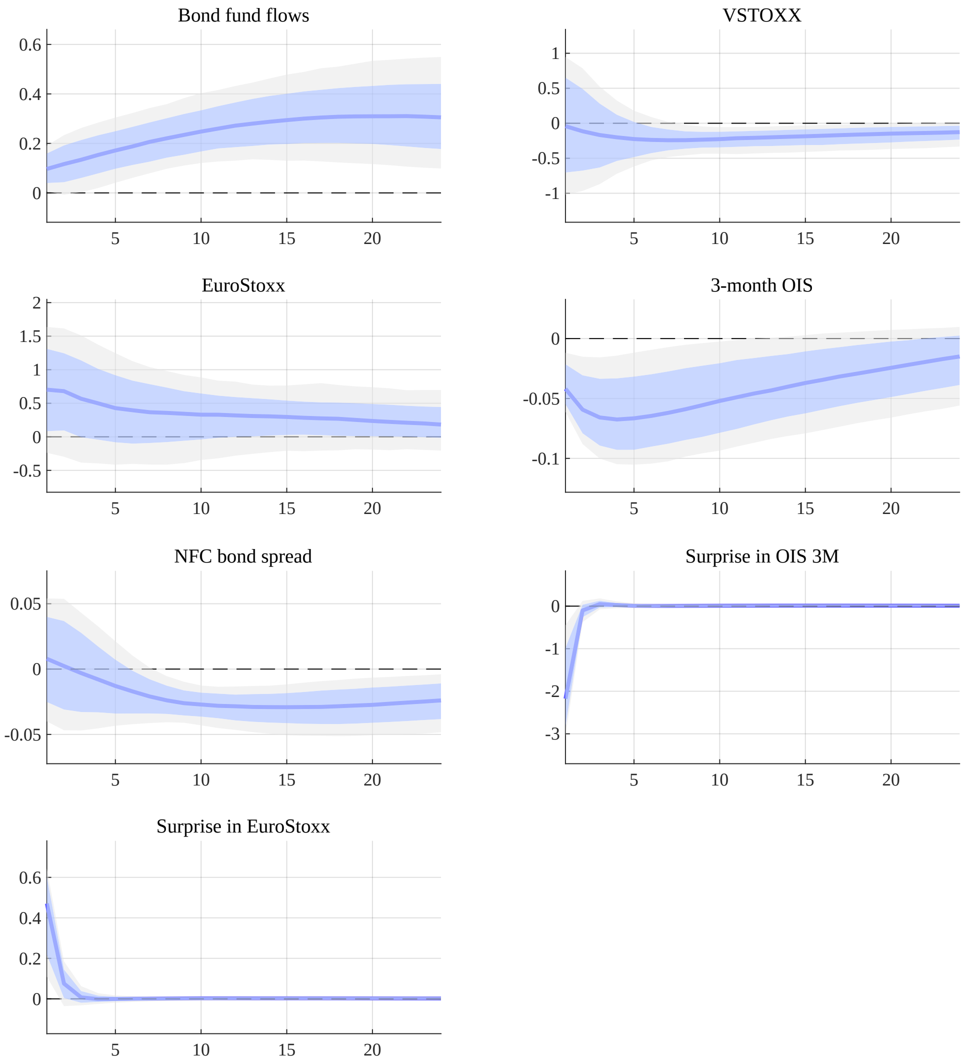


Figure 21: Impulse responses of flows to European focused bond funds using stock-market based identification

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and term structure factor. Each variable added separately to the model in Figure 5 (b).

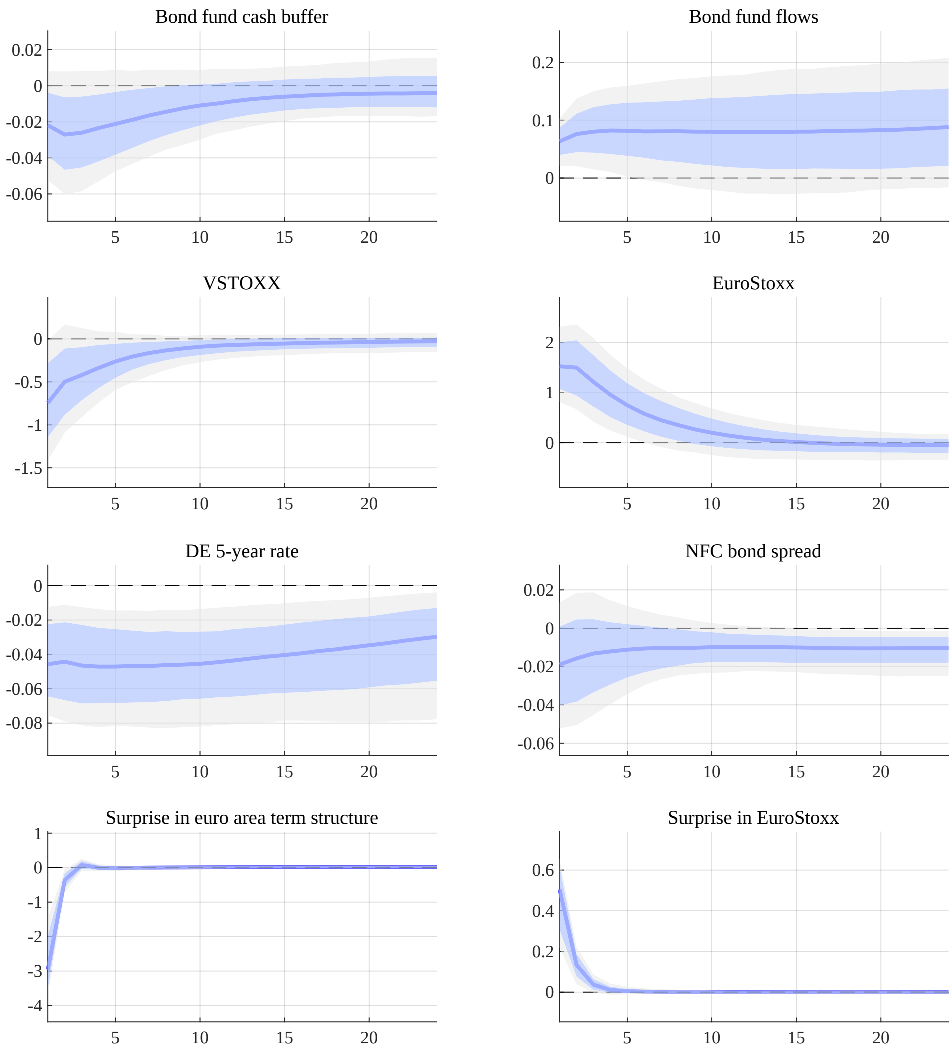


Figure 22: Impulse responses in baseline model with bond fund cash holdings as percentage of total assets using stock-market based identification

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and term structure factor.

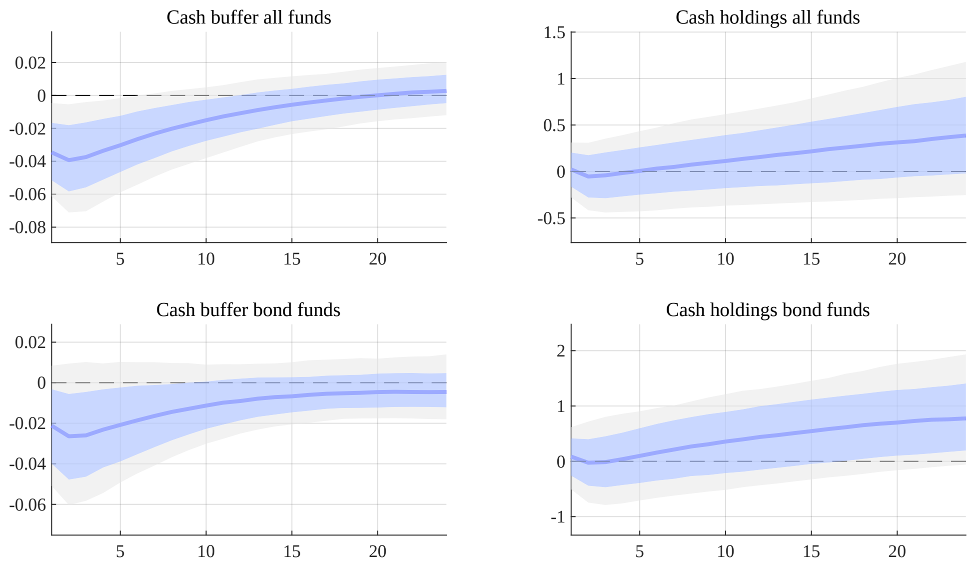


Figure 23: Response of fund cash holdings across a range of asset classes using stock-market based identification

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Monetary policy shocks identified as negative co-movement between high-frequency change in stock index and term structure factor. Each variable added separately to the baseline model in Figure 22.

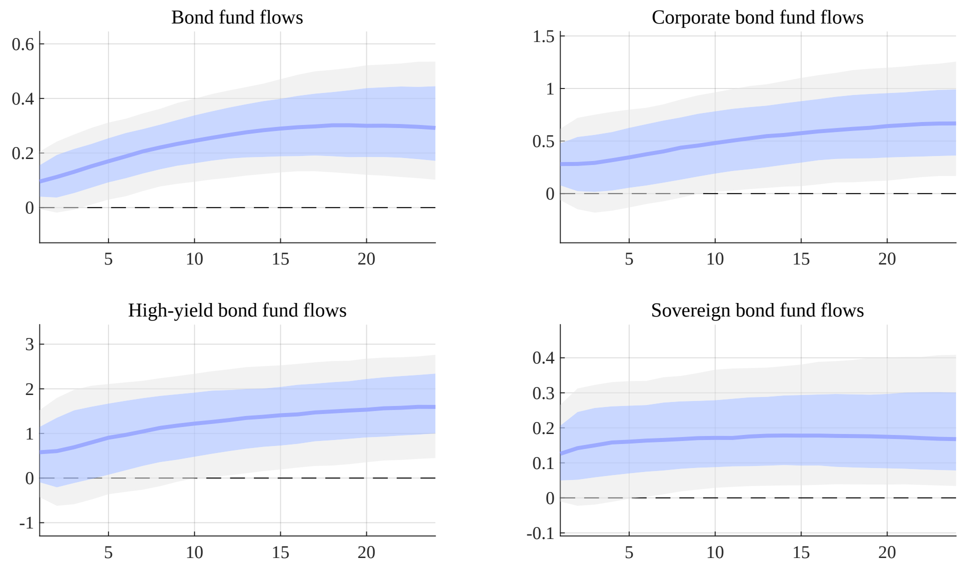


Figure 24: Response of flows to European focused funds across a range of asset classes following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the baseline model in the left panel of Figure 12.

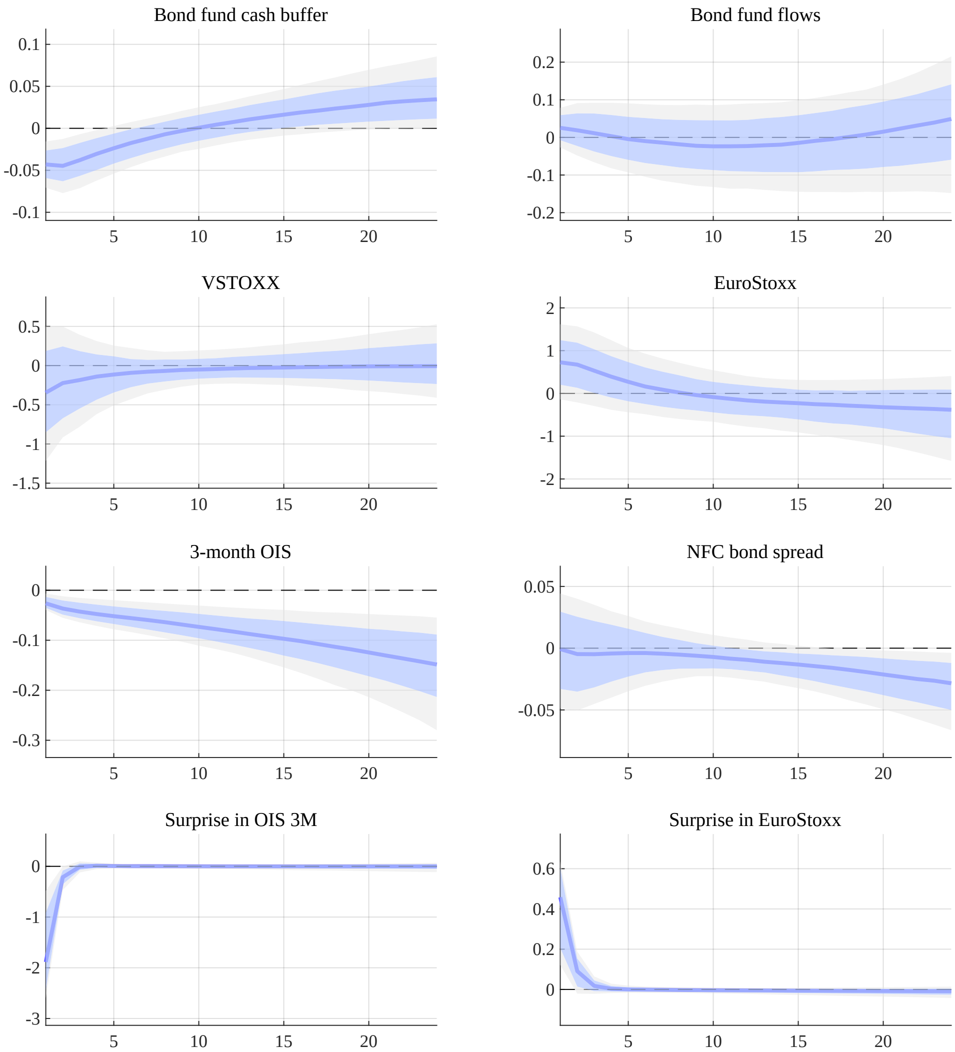


Figure 25: Impulse responses of bond fund cash holdings following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification.

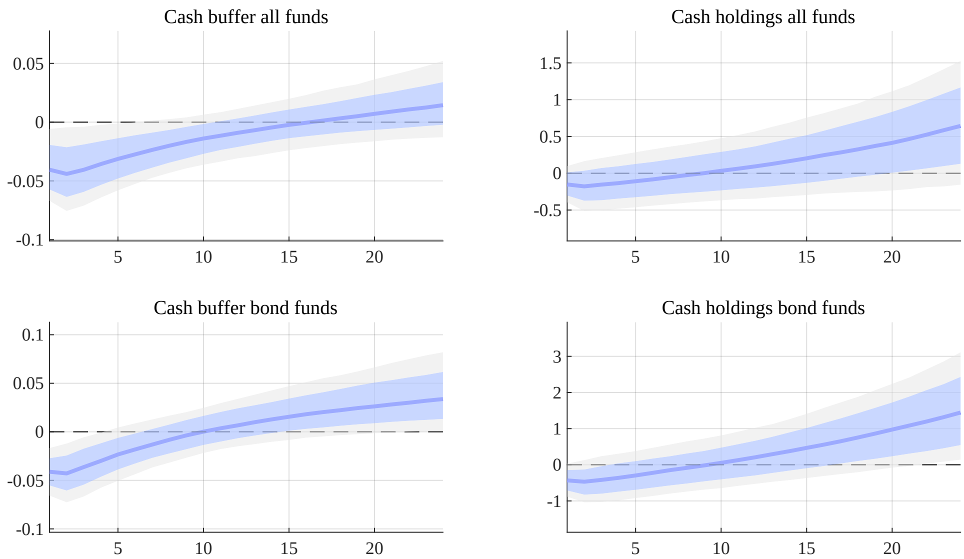


Figure 26: Response of fund cash holdings across a range of asset classes following short-end shock

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 3-month OIS rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Each variable added separately to the model in Figure 25.

B.2 Sensitivity analysis

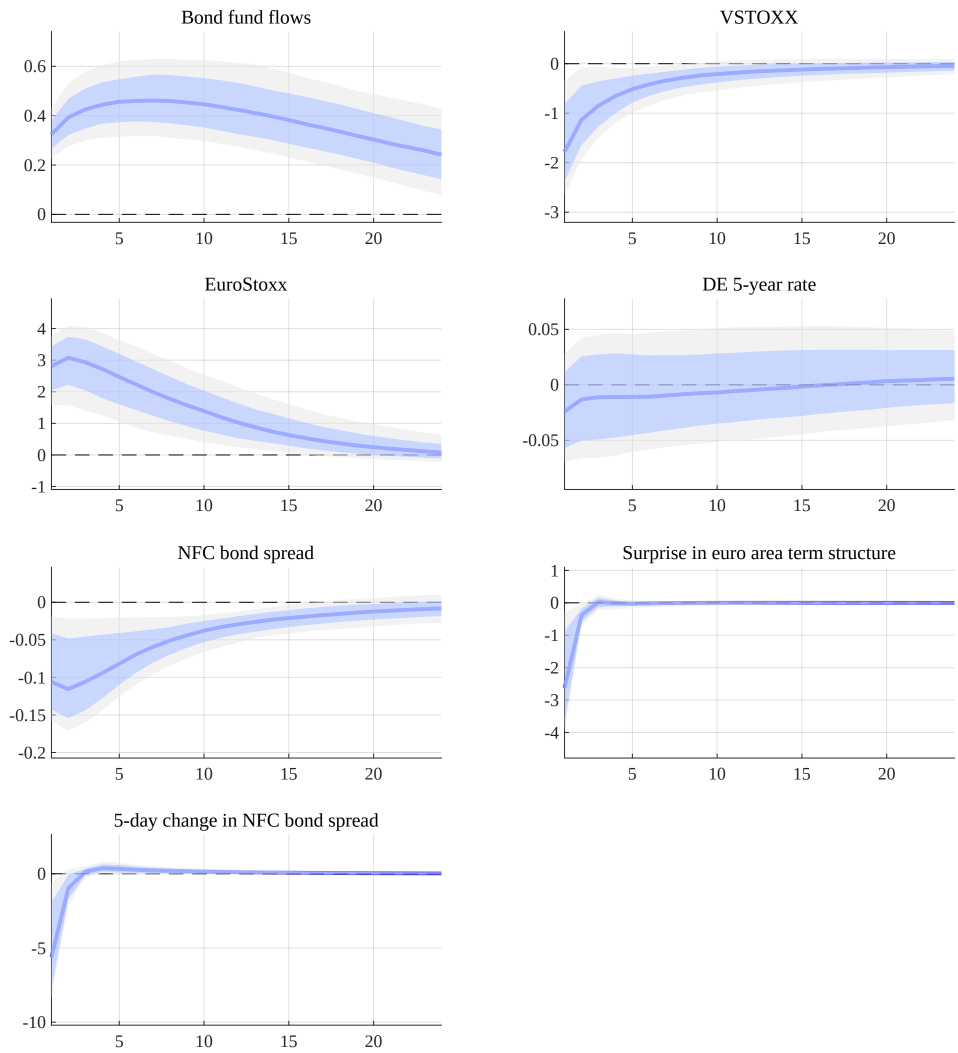


Figure 27: Impulse responses in baseline model using 5-day corporate bond spread changes

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. For the shock identification 5-day instead of one-day corporate bond spread changes are used.

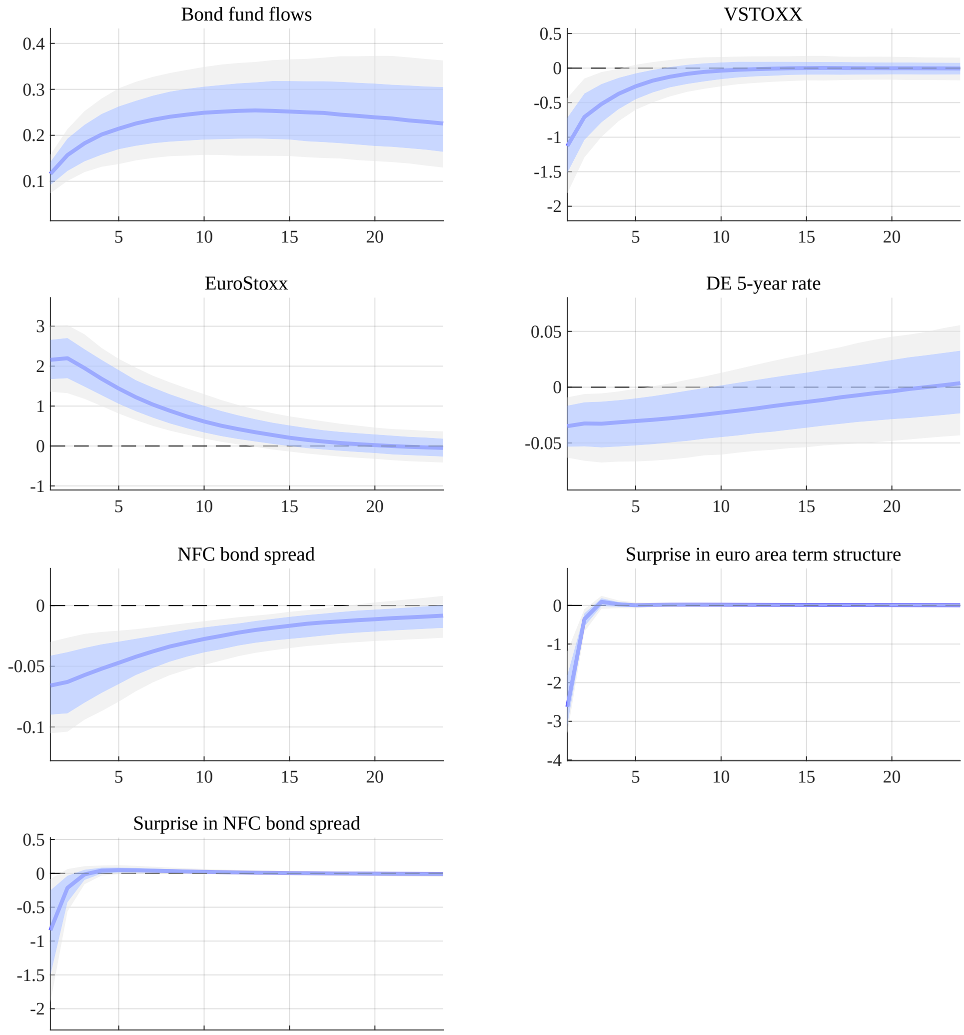


Figure 28: Impulse responses in baseline model with European focused bond fund flows using a sample without the global financial crisis

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Sample starts after-end of the recession around the global financial crisis (June 2009).

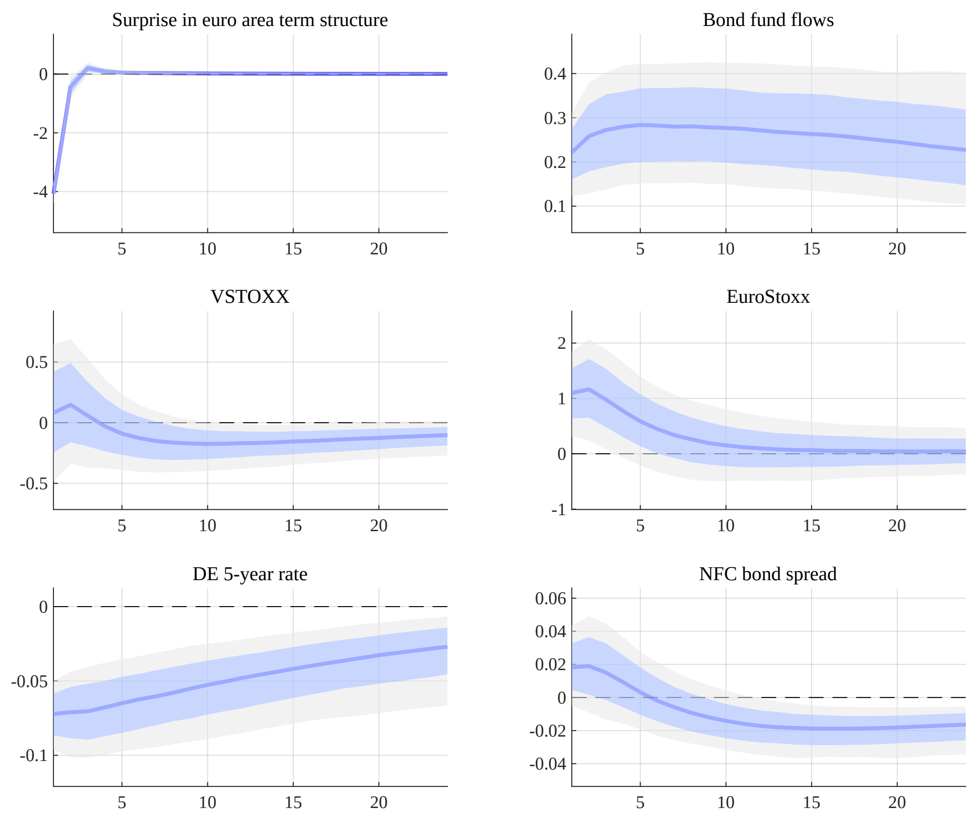


Figure 29: Impulse responses in baseline model with standard high-frequency identification

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency Cholesky identification. High-frequency monetary policy indicator (surprise in euro area term structure) ordered first.

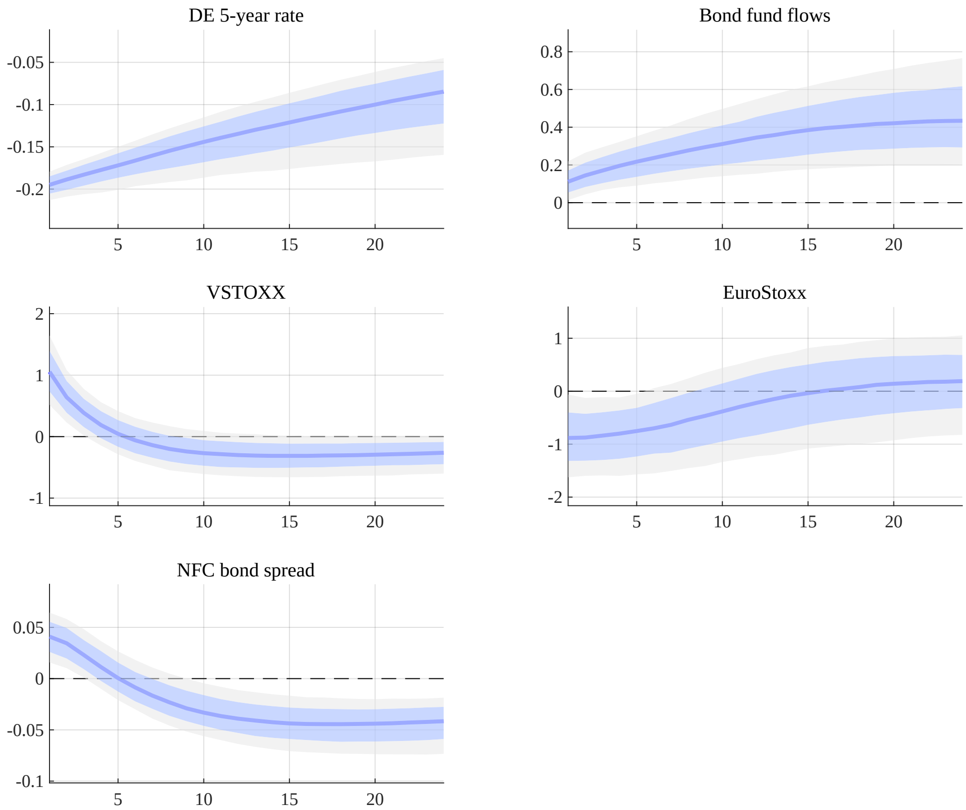


Figure 30: Impulse responses in baseline model with recursive identification

Notes: Impulse responses to an expansionary euro area monetary policy shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with Cholesky recursive identification. The monetary policy indicator (monthly 5-year German Bund rate) is ordered first.

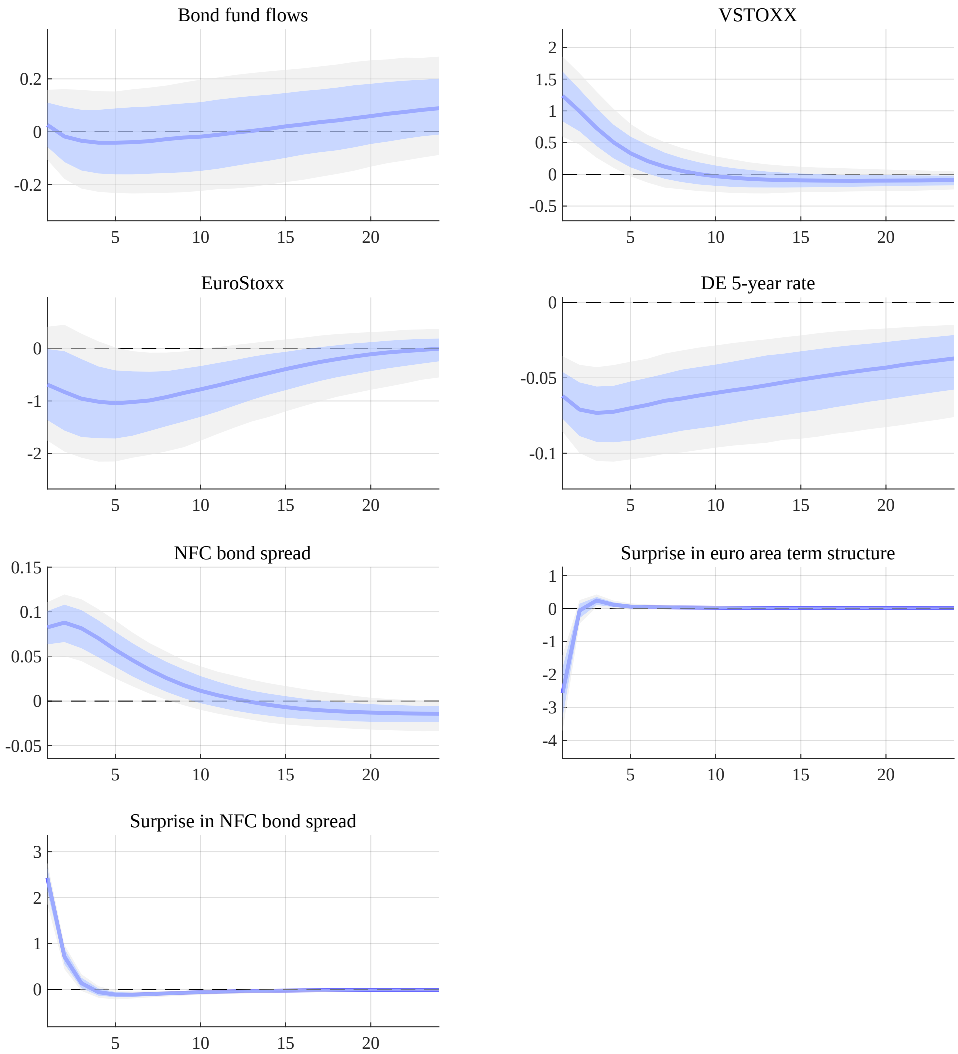


Figure 31: Impulse responses in baseline model with European focused bond fund flows to a central bank information shock

Notes: Impulse responses to an expansionary euro area central bank information shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Central bank information shock identified as negative co-movement between high-frequency change in bond spread and term structure factor.

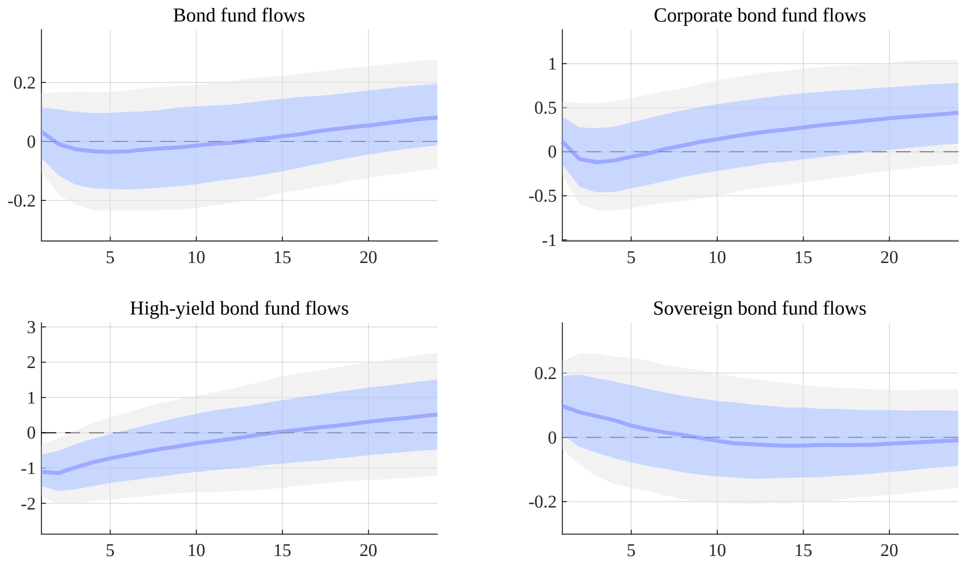


Figure 32: Impulse responses of flows to European focused bond funds to a central bank information shock

Notes: Impulse responses to an expansionary euro area central bank information shock inducing a decrease of the 5-year German Bund rate (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with high-frequency sign restriction identification. Central bank information shock identified as negative co-movement between high-frequency change in bond spread and term structure factor. Each variable added separately to the model in Figure 31.

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The views expressed in this paper are those of the authors only and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

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