EUROPEAN CENTRAL BANK
EUROSYSTEM

Working Paper Series

Christoph Kaufmann

Investment funds, monetary policy, and the global financial cycle

Revised December 2022

No 2489 / November 2020

Abstract

This paper examines the role of international investment funds in the transmission of global financial conditions to the euro area using structural Bayesian vector auto regressions. While cross-border banking sector capital flows receded significantly in the aftermath of the global financial crisis, portfolio flows from investors actively searching for yield on financial markets world-wide gained importance during the post-crisis "second phase of global liquidity" (Shin, 2013). The analysis presented in this paper shows that a loosening of US monetary policy leads to higher investment fund inflows to equities and debt globally. Focussing on the euro area, these inflows not only imply elevated asset prices, but also coincide with increased debt and equity issuance. The findings demonstrate the growing importance of non-bank financial intermediation over the past decade and hold important policy implications for monetary and financial stability.

JEL classification: F32; F42; G15; G23

Keywords: Monetary policy; international spillovers; capital flows; non-bank financial intermediation

Non-technical summary

As the role of investment funds in financing the global economy has grown, so has their role in capital flows and in transmitting the global financial cycle. Movements of asset prices have become more synchronised across countries since the early 1990s, indicating that a global financial cycle has emerged. US monetary policy is often considered as one of the main drivers of this cycle. Up to the mid-2000s, banks played a key role in the global synchronisation of financial conditions. Since then, portfolio flows of investment funds actively searching for yield in financial markets worldwide have increased.

Funds adjust their global asset allocation as investors respond to return differentials and fund performance or as they change their risk-taking. For example, after a loosening in monetary conditions in one region, global investors tend to reallocate away from assets there towards other regions where assets have a higher expected return. This might also imply that investment funds rebalance their portfolios towards riskier market segments. In addition, monetary conditions can affect fund returns through changes in valuations and thus influence investment fund flows, since there is evidence of a positive relationship between fund flows and past returns.

This paper investigates the role of international investment funds in the transmission of global financial conditions to the euro area. The analysis is based on a structural Bayesian vector autoregression model and uses unexpected changes in US monetary policy, obtained from a high-frequency shock identification scheme, as an illustrative example of a shock to global financial conditions.

The baseline specification of the model considers five macro-financial variables. These include: flows from global investment funds towards different segments of global and euro area bond and equity markets, the VIX volatility index as a measure of global risk aversion, the S&P 500 stock market index, the US dollar/euro exchange rate, and the ten-year US Treasury rate. This model is augmented with further variables, including the debt issuance by euro area non-financial corporations, interest rate differentials between the United States and the euro area, and indices for global bond and equity markets. The analysis is based on monthly data from April 2007 until March 2019, therefore capturing the growing importance of investment funds and market-based finance over this period.

The results provide evidence of global spill-overs to euro area financial conditions via the investment fund sector. After an easing of global financial conditions, investment funds tend to increase their purchases of bonds globally and in the euro area. These portfolio inflows are particularly strong in riskier market segments, such as corporate and high-yield bonds, while safer money market funds experience outflows. At the same time, issuance of debt securities by euro area non-financial corporations increases as well. This suggests that euro area financing conditions improve after an easing in global financial conditions.

1 Introduction

Fostered by the progress in financial integration since the 1990s, a global financial cycle emerged that has led to an increased synchronisation in the movements of risky asset prices, capital flows, and leverage across borders (Rey, 2015). This development can imply improved international risk sharing via financial markets, but it also leads to a faster and widespread contagion of economic and financial shocks globally. The monetary policy of the United States (US), as the most important centre of the global financial system, is viewed as one of the main drivers of the global financial cycle, and global banks' balance sheets are identified as the main transmitter of US financial conditions to the rest of the world – at least until the global financial crisis of 2007 (Bruno and Shin, 2015a; Bruno and Shin, 2015b; Miranda-Agrippino and Rey, 2020b; Rey, 2016).

As highlighted by Shin (2013), the banking sector's relevance in spreading global liquidity across borders receded significantly in the aftermath of the global financial crisis. Instead, portfolio flows from global investors actively searching for yield on bond and equity markets worldwide gained importance during this "second phase of global liquidity."

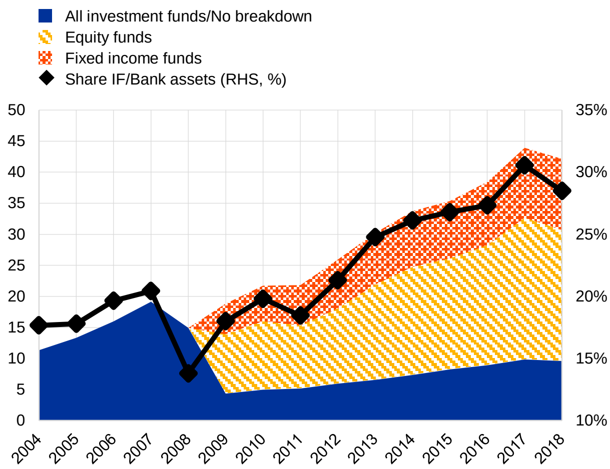


Figure 1: Total assets under management of investment funds globally

Notes: Left axis unit: USD trillion. Right axis unit: percentages. The black diamond line indicates the percentage ratio of total assets of investment funds relative to banks worldwide. *Data source:* Financial Stability Board (2020)

Figure 1 shows that the assets under management in the investment fund sector globally almost tripled between 2008 and 2019 to more than USD 42 trillion. Also, the importance of investment fund relative to bank financing increased steadily post-crisis, from a low point of 14% in 2008 to 28% at the beginning of 2019.[1] Given its internationally diversified asset holdings, the investment fund sector by now accounts for more than half of all global debt and equity

[1] As demonstrated regularly, for example by Financial Stability Board (2020), the investment fund sector comprises the largest sub-sector of the growing field of non-bank financial intermediation (NBFI) in the post-financial crisis period.

portfolio flows (see Figure 2, left panel). In the euro area (EA), the relative size of debt portfolio inflows to other investment flows, which can be attributed mainly to banks, increased from on average 65% before 2008 to 175% after the global financial crisis (see Figure 2, right panel).[2]

This paper sheds light on the investment fund sector's role in the transmission of global financial conditions during the post-financial crisis period using a structural Bayesian vector auto regression (BVAR) approach. Focussing particularly on the EA, the paper addresses the following research questions: Do investment fund flows respond systematically to changes in global liquidity, as measured by US monetary policy shocks? If yes, are these flows directed toward particularly risky segments of bond and equity markets? And, finally, can these portfolio flows be linked to changes in firms' financing conditions and real economic activity?

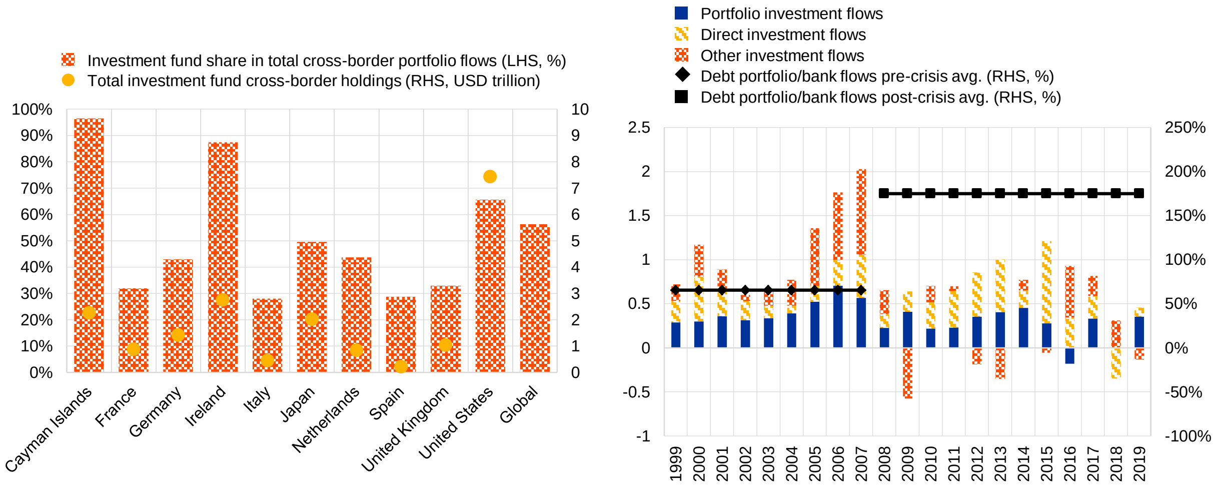


Figure 2: Investment funds' role in international portfolio flows

Notes: Left panel: Data is shown from the end of 2018. 'Global' represents the weighted average of countries cited covering approximately 80% of global investment funds' assets under management. Right panel: Left axis unit: EUR trillion. The bars indicate categories of capital inflows to the euro area. Right axis unit: percentages. The black lines indicate ratios of average debt portfolio inflows to 'Other investment flows', which mainly comprise bank sector inflows. Diamond (squared) lines denote averages from 1999 to 2007 (pre-crisis) and from 2008 to 2019 (post-crisis). *Data sources:* IMF Coordinated Portfolio Investment Survey and ECB Balance of Payments Statistics.

As discussed extensively, for example by Rey (2016), the international transmission of US monetary policy before the global financial crisis worked via global banks through the credit and the risk-taking channel of monetary policy (Borio and Zhu, 2012). According to these channels, monetary policy affects net worth, risk-taking, leverage constraints, and, thus, loan origination of globally active financial intermediaries that not only refinance themselves in US dollars, but also lend in dollars, even to non-US borrowers. While such bank-based channels still can be at work, their importance to the EA has declined in line with the reduction in bank-related capital flows (Figure 2).

[2]These aggregate developments reflect Shin's (2013) discussion about banks' diminishing role in the transmission of global financial conditions. In fact, Bruno and Shin (2015a) note that the bank-based global transmission of US monetary policy was relevant only up until the global financial crisis surfaced, mainly because of the structural change in the dynamics of global banking sector leverage at that time.

In the post-crisis era, global investment funds now transmit US monetary policy also through the following main channels: international risk-taking, searching for yield, and pro-cyclical flow-performance behaviour.

Through its effect on global risk appetite (Bekaert et al., 2013; Bruno and Shin, 2015a), looser US monetary policy affects global financial investors' risk-taking behaviour. This can imply additional inflows to the investment fund sector generally, as well as a re-balancing of investors' portfolios towards riskier asset classes.

By means of a search-for-yield channel, global investors reallocate their portfolios towards assets associated with higher comparative expected returns. This can involve fund investors re-balancing towards higher yielding, but riskier assets. This type of behaviour is well-documented, particularly for the post-crisis low-yield environment (Choi and Kronlund, 2017; Di Maggio and Kacperczyk, 2017; Becker and Ivashina, 2015). Searching for yield also has an international dimension. For example, the relatively higher interest rate differential between international and US securities after a monetary expansion by the Federal Reserve can steer investor flows away from US assets and towards international ones, including EA assets (Ammer et al., 2018, 2019; Fratzscher et al., 2018; Kroencke et al., 2015).

At the same time, a reduction in US interest rates can exert positive asset valuation effects globally, which may trigger momentum in returns from investment funds (Feroli et al., 2014). Due to pro-cyclical flow-performance behaviour by ultimate investors (Goldstein et al., 2017; Timmer, 2018), investment funds may experience further inflows as a result.

For transmission into the real economy, it is relevant to what extent these portfolio adjustments and capital flows only lead to asset price inflation and share buybacks (Acharya and Plantin, 2018), or whether improved financing conditions for non-financial corporations (NFCs) also lead to increased securities issuance and, ultimately, higher real activity and inflation.

While questions about market-based financing sources are discussed widely in policy circles, systematic empirical evidence on the role and effects of non-bank finance in the transmission of shocks to financial and real economic activity remains limited.[3] The present paper contributes in this respect by analysing the international dimension of non-bank financial intermediation for the EA.

The empirical analysis is based on 12 years of monthly data between April 2007 and March 2019. It studies the dynamic interactions between US monetary policy, investment funds, and macro-financial variables at the global level, in the US, and in the EA.

I find evidence of significant spillovers of US monetary policy into bond and equity markets via the investment fund sector. After accommodative monetary policy action by the Federal Reserve, inflows to investment funds increase on a global level. The estimates from the model imply additional inflows to global bond funds of USD 200 billion after a 25 basis point US

[3] Recent publications from policy institutions on this topic – such as Financial Stability Board (2020), European Central Bank (2020) and Adrian and Jones (2018) – provide an overview of the growing importance and potential risks emanating from this sector.

monetary policy shock. Specifically, in examining funds investing in European assets, cross-border flows towards the EA increase as well. Moreover, even investment funds domiciled within the EA receive significantly higher inflows after a monetary loosening in the US. Inflows are particularly strong into the riskier segments of financial markets, such as high-yield corporate bonds and equities with small market capitalisation. Global money market funds experience outflows instead.

My results confirm that a global financial cycle in risky asset prices continues to exist after the global financial crisis, while the related literature mainly analyses pre-crisis data. Specifically, I find that various global financial risk and uncertainty measures, such as the VIX and the Habib and Venditti (2019) global risk index, decline, while US and EA bond and equity market indices rise after a loosening of US monetary policy. These financial market effects can also be directly linked to the investment fund flows and they are transmitted to the EA firm sector, which increases its issuance of debt and equity securities. The model implies an additional debt securities issuance of about USD 16 billion, corresponding to 1% of NFC debt outstanding, after a 25 basis point shock. Industrial production, as a measure of real economic activity, and inflation increase in both currency areas.

These findings potentially hold important policy implications for monetary and financial stability. The observation that an international loosening of financial conditions leads to inflows into riskier market segments potentially raises financial stability concerns. This calls for diligent oversight of the globally active investment fund industry and possibly the introduction of additional macroprudential policy tools to control risks in this sector.[4] To the extent that the additional issuance of debt and equity by firms also leads to increased real economic activity and inflation in the EA, these international spillovers also would be relevant for monetary stability.

In terms of methods, the applied BVAR framework has the well-known advantage of avoiding problems such as overfitting, to which VAR models estimated using a frequentist approach are prone. Importantly, it allows for reliable parameter estimation even in the relatively small sample available for this study.

The monetary policy shocks are identified using the method proposed by Jarociński and Karadi (2020), which is based on a combination of high-frequency identification, as proposed by Gertler and Karadi (2015) in conventional VARs, and sign-restriction methods, as introduced by Arias et al. (2018).[5] This combined method allows for disentangling pure monetary policy shocks, defined as negative co-movements between the high-frequency change of a monetary policy indicator and a stock market index around Federal Open Market Committee (FOMC) monetary policy announcements, from central bank information shocks, defined as positive co-movements between these two variables. These information shocks are related to the concept expressed in Nakamura and Steinsson (2018). Jarociński and Karadi (2020) show that the

[4]See, for example, Portes et al. (2020) and Cominetta et al. (2018) for a discussion of possible risks and policy tools.

[5]Caldara and Herbst (2019) propose an alternative approach to implement high-frequency identified monetary policy shocks in a BVAR framework.

responses of macroeconomic and financial market variables can differ decisively under these two types of shocks. Throughout the paper, I will focus on the analysis of genuine (negative co-movement) monetary policy shocks.

Instead of using short-term innovations in US monetary policy, such as changes in three-month federal funds rate futures, as done by Jarociński and Karadi (2020), I construct a measure that captures changes in monetary policy at the longer end of the yield curve. Using the method by Gürkaynak et al. (2005), I disentangle a monetary policy "target factor" from a "term structure factor", in which the latter forms the basis of the US monetary policy shocks in my analysis. I choose this approach because the federal funds rate was set (close) to its zero lower bound for an extended period of time after the global financial crisis, which is the sample period under study. The shock variation at the short-end of the yield curve is, therefore, very limited compared with earlier decades. However, most of the monetary policy adjustments post-crisis implied changes to the longer end of the term structure, e.g. by means of central bank asset purchases or forward guidance. As I will demonstrate, the term structure monetary policy shock captures these post-crisis policy changes much better.

All main results notably are highly robust when using other identification methods, such as a conventional Cholesky decomposition, and using shocks to the shadow federal funds rate by Wu and Xia (2016) instead of the term structure shock. A distinct advantage of using high-frequency identification compared with causal ordering is that the former allows for simultaneous responses from all variables to the monetary policy shock. This is of particular importance given the paper's focus on fast-moving financial variables, such as investment fund flows and asset prices.

The rest of the paper is structured as follows. Section 2 reviews the related literature. Section 3 gives an overview of the data and the estimation methods used to study the second phase of global liquidity. All results are presented in Section 4, in which Section 4.1 focusses on the reaction of investment fund flows and securities issuance to monetary policy shocks, while Section 4.2 provides results for various macro-financial variables to analyse the transmission mechanisms in place. The results' sensitivity with respect to various changes, including alternative identification methods, is analysed in Section 5. Section 6 concludes the paper.

2 Related literature

In terms of approach and methods, the closest research to this paper is by Miranda-Agrippino and Rey (2020b), who analyse the effects of US monetary policy on US and EA macro-financial variables in a BVAR. They focus on the transmission via global banks, and their sample ends in 2010, which does not allow for examining the more market-based second phase of global liquidity, which is the focus of my paper. In parallel to my work, Miranda-Agrippino and Rey (2020a), which I discovered only recently, confirm that their earlier findings on a global financial cycle in asset prices continue to hold after the global financial crisis. Gerko and Rey (2017) perform VAR analyses of US and United Kingdom monetary policy spillovers to the rest of the world. Bruno and Shin (2015b) formulate a model of the global banking system in which an appreciation of the US dollar is associated with de-leveraging of global banks and an overall tightening of international financial conditions. In turn, Bruno and Shin (2015a) provide evidence for the predictions of this model in a small-scale VAR, linking US monetary policy to risk aversion, bank leverage and banking-sector capital flows. Compared with these papers, I explicitly consider the role and behaviour of non-bank financial intermediaries in transmitting financial conditions internationally after the global financial crisis.

Several papers analyse the effects of monetary policy and global factors on debt and equity portfolio flows. Habib and Venditti (2019) construct a measure of global risk based on stock market return data. They demonstrate that US monetary policy and more general financial shocks are, indeed, the main drivers of global capital flow cycles. Scheubel et al. (2019) also build a measure of the global financial cycle, which is based not only on prices, but also on quantities data, such as global bank leverage and credit volumes. They find a consistent link between their measure and extreme shifts in capital flows, such as sudden stops. Davis et al. (2021) show that two global factors, an asset price and a commodity price factor, explain about one half of gross capital flows in advanced economies.

Focussing on emerging markets, Converse et al. (2020) provide evidence that the growing presence of exchange-traded funds increased the sensitivity of capital flows to the global financial cycle. The analysis is based on micro-data for equity and bond mutual funds. Bertaut et al. (2021) examine the relationship between financial conditions and portfolio flows into emerging market government bonds. They find that US investment funds pro-cyclically withdraw their investments in emerging market local currency bonds when financial conditions deteriorate and the local currency depreciates. Kalemli-Özcan (2019) shows that changes in US monetary policy exert strong effects on capital flows, particularly for emerging market economies. These effects are driven not only by direct changes in interest rate differentials to the US, but more so by US monetary policy's effect on global investors' risk perceptions.

Fratzscher et al. (2018) find that US quantitative easing induced significant international portfolio reallocations by global investors, while Fratzscher et al. (2016) do not observe significant portfolio rebalancing in response to early unconventional monetary policy by the ECB between 2007 and 2012. Bubeck et al. (2018) examine the effect of ECB monetary policy announcements on EA fund investors' portfolio allocations. They find that these investors' portfolios mainly are affected by valuation effects from asset prices and less by active asset reallocation decisions.

A study by the International Monetary Fund (2016) examines the links between monetary policy and non-bank financial intermediation. The analysis finds some evidence that the increasing importance of non-bank financial intermediation increased monetary policy transmission in the recent past. Both banks and non-banks tend to contract their balance sheets after monetary tightening. The authors link this behaviour to a risk-taking channel, which they find to be particularly strong for the investment fund sector.

Using EA data, Hau and Lai (2016) run country-level fund flow regressions on a country-specific measure of short-term real interest rate changes as a measure of monetary policy. They also find evidence of a risk-shifting channel, in which investors rebalance their portfolios out of money market funds and towards equity funds in response to a reduction in country-specific real interest rates. Feroli et al. (2014) argue that in a search-for-yield environment, flows into an asset class can induce momentum in returns, leading to further return-chasing behaviour. Based on data on fixed-income mutual funds, they provide evidence that changes in the monetary policy stance can reverse this return-chasing behaviour rapidly, thereby inducing strong fund in- and out-flows.

Using micro-data from Turkey, Baskaya et al. (2017) show that capital inflows increase wholesale (non-deposit) funding of domestic banks, leading to higher lending. Based on firm-level data, Bruno and Shin (2017) analyse reasons for the large proportion of non-US firms' dollar-denominated bond issuance. They provide evidence that an issuance of dollar debt is more likely when a dollar carry trade is more favourable. As these firms tend to use these proceeds to accumulate financial assets in the local currency, they also can contribute to an easing of credit conditions for other domestic borrowers. Niepmann and Schmidt-Eisenlohr (2018) document that an appreciation of the dollar is associated with a reduction in US credit supply due to global mutual funds' behaviour in US secondary syndicated loan markets. Lo Duca et al. (2016) find that US quantitative easing policies exerted a significant impact on corporate bond issuance across advanced and emerging economies. Holm-Hadulla and Thürwächter (2021) analyse the role of the aggregate corporate debt structure in the transmission of monetary policy for a panel of EA countries. They f that the overall response of bank lending to monetary policy shocks is weaker in countries with a higher bond-to-bank financing ratio.

3 Analysing the second phase of global liquidity

To examine the transmission of global financial conditions in a BVAR framework, I set up a baseline model of five variables that includes nominal flows of global investment funds; the VIX volatility index as a measure of global risk aversion, which has a high co-movement with the global financial cycle (Rey, 2015); the S&P 500 stock market index; the USD/EUR nominal exchange rate; and the US 10-year Treasury rate as a measure of US monetary policy. This selection of variables is akin to the model used by Bruno and Shin (2015a), who focus on a measure of the leverage among global banks instead of investment fund flows. As in Jarociński and Karadi (2020), I add two further high-frequency variables for changes in monetary policy and in the S&P 500 stock market index on FOMC dates to the model.

Using a marginal approach, this baseline model subsequently is augmented by further macroeconomic and financial variables on the US, EA and global levels to analyse investors' risk-taking behaviour, aspects of the transmission mechanism, and the effects on the real economy.

The remainder of this section provides a description of the data set, the estimation methods, and the identification of the monetary policy shocks.

3.1 The data set

The available sample comprises 12 years of monthly data between April 2007 and March 2019, which yields 144 observations. The beginning of the sample is restricted by the limited availability of data for bond funds. The sample, nevertheless, fully covers the period of growing international importance of investment funds and market-based finance.

The data on investment funds lies at the heart of this analysis and comes from private data provider EPFR Global. Aggregated investment fund data are available in this source by fund type (i.e., equities, bonds, mixed, money market), regional investment focus (e.g., global, US, Western Europe), and domicile country. EPFR decomposes the evolution of total net assets over time into nominal flows and into valuation changes. The nominal flows' response to global liquidity shocks is the focus of this paper. As the domicile country of a fund generally is viewed as a good proxy for its investors' origin because of regulatory reasons, the data set allows for the construction of, e.g., the cross-border flows from non-EA investors into bond and equity funds with an investment focus on Europe.

The EPFR data's main advantages, compared with official investment fund statistics or balance-of-payments data, are the global coverage of investment fund data in one single source, the detailed breakdowns in different asset classes and the possibility of decomposing changes in investment funds' assets into nominal and valuation changes. Moreover, public statistics on cross-border portfolio debt and equity flows are not restricted to investment funds, but also include cross-border securities transactions of other sectors, including banks, which would complicate the identification of the funds sector's response to global financial shocks.

I use investment fund flows for different domicile/investment focus combinations. The main results are based on global-to-global investment fund flows, which are based on aggregate data for all investment foci and all domiciles. Further results are based on EA-domiciled investment funds investing in European assets (hereafter EA-to-EA flows) and globally (non-EA) domiciled funds investing in European assets (global-to-EA).[6]

Further breakdowns are available for the different fund types. In the case of bond funds, I distinguish between funds investing in corporate or sovereign bonds, and in high-yield versus investment-grade assets. For equity funds, I use a decomposition in terms of market capitalisation of the underlying corporations. These breakdowns enable me to determine whether in- and outflows are directed toward less- or more-risky market segments, such as corporate and high-yield bonds or small-cap equities.

The data from EPFR does not cover the full market capitalisation of equities and bonds. Yet, for cross-border portfolio flows, Miao and Pant (2012) and Fratzscher (2012) show that this source provides a relatively representative sample with aggregate portfolio flows from EPFR matching the patterns of those from official balance-of-payments statistics closely. Table 1

[6] To have a consistent data definition and ensure comprehensive coverage, EA-domiciled investment funds always refer to the EA-12. This country group consistently covers more than 99% of total assets from the investment fund sector in the EA over the whole sample.

Table 1: Investment fund assets under management in EPFR and official statistics

Asset type (USD trillion)	Bond	Equity	Mixed/ No breakdown	Total
2009:				
FSB	4.91	9.59	4.35	18.84
EPFR	2.14	5.71	3.83	11.67
Sample coverage	44%	59%	88%	62%
2018:				
FSB	11.46	21.09	9.59	42.14
EPFR	7.57	16.44	7.23	31.24
Sample coverage	66%	78%	75%	74%

Notes: The table provides investment fund assets under management at the global level from official government statistics, as provided by Financial Stability Board (2020) and from the sample available from EPFR Global. Numbers are in trillions of US dollars. 'Sample coverage' provides the share of the total investment fund asset universe that is available in EPFR. 'Mixed/No breakdown' refers to the category 'Other funds' in FSB data and includes mixed funds and money market funds in the EPFR data.

compares investment fund assets under management at the global level from official government statistics, as provided by Financial Stability Board (2020), with the sample available from EPFR Global. The comparisons are made for 2009 and 2018, the earliest and latest available breakdowns that allow for a comparison. The sample coverage in EPFR increased over time from, on average, 62% in 2009 to 74% in 2018, in which the data set includes USD 31 trillion of the USD 42 trillion provided in official statistics. The coverage generally is somewhat better for equity than for bond funds, e.g. 78% versus 66%, respectively, in 2018. These observations give confidence that the analysis in this paper covers the relevant developments in the fund sector in a comprehensive way.

This paper's focus lies in the analysis of nominal flows, instead of the evolution of assets under management, which also include valuation changes. Changes in flows reflect investors' direct buying and selling decisions, while valuation changes also affect existing portfolios. Analysing flows, therefore, allows for examining investors' actual responses to changes in global financial conditions.

Figures 18 and 19 in Appendix A.2 depict the evolution of the cumulative flows for all asset classes available since the starting point of the sample in April 2007. During the whole sample period, bond funds by far experienced the strongest cumulative inflows of over USD 2.64 trillion, while cumulative flows into equity funds ended up close to the level from the beginning of the sample. The strong growth of assets under management in equity funds, which is also visible in Figure 1 and Table 1, mainly was driven accordingly by increases in stock valuations.

In the regression models from Section 4, I use the cumulative flows as a percentage of lagged assets under management. Time series for the different asset class breakdowns of the global investment fund series, as used in the BVAR models, can be found in Figures 20 and 21 in

Appendix A.2. The construction of these series follows the methodology by EPFR Global, which allows for a straightforward interpretation in percentage terms.

All other data used in this paper are relatively standard financial and macroeconomic time series from various private and public data providers, as well as from other academic works. An overview of all variables used in the analysis, together with their sources and applied transformations, is given in Appendix A.1.

3.2 Estimation method and identification

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] Unless stated otherwise, I use the following hyperparameter values that are standard in the related literature.

As a prior belief about the regression coefficients, I 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, which determines 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 at 2,000, with 1,000 burn-in iterations. The number of lags in the model is set on the basis of comparing model marginal likelihoods and deviance information criteria. The results continue to hold with a smaller and higher number of lags. The results are robust to using other priors, including the Litterman (1986) "Minnesota" prior and a conventional Normal-Wishart prior. I 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 in which not all roots of the characteristic polynomial lie inside the unit circle.

The monetary policy shocks are identified using the approach introduced by Jarociński and Karadi (2020), which is based on a combination of high-frequency identification and sign restrictions methods. Jarociński and Karadi (2020) show that surprise changes of federal funds rate futures in a 30-minute window around FOMC announcements do not always coincide with stock market movements in the opposite direction. Such a negative co-movement between a monetary policy indicator and stock markets is, however, the expected result of a monetary policy shock in conventional economic theory. The approach by Jarociński and Karadi (2020) allows for disentangling these pure negative co-movement monetary policy shocks from positive co-movement shocks that the authors interpreted as central bank information shocks, in which the central bank conveys additional information to market participants. For example, an increase in equity markets after a monetary policy tightening could be the result when the central

[7] For the estimation, I use the BEAR toolbox, Version 4.2, by Dieppe et al. (2016).

bank reveals information that tightening of monetary conditions was required to prevent the economy from overheating, which financial markets can interpret as positive economic news. The authors show that the responses from macroeconomic and financial market variables can differ decisively under these two types of shocks.

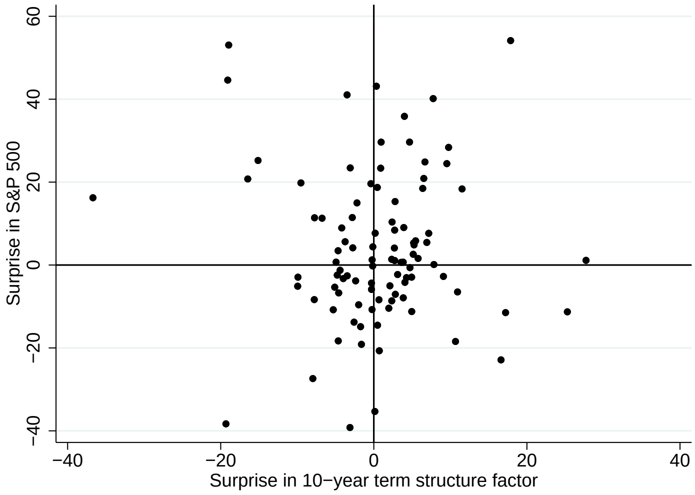


Figure 3: Term structure factor and stock price surprises at FOMC announcements

Notes: Horizontal axis in basis points, vertical axis in index points. Each dot represents one FOMC announcement between April 2007 and March 2019.

Table 2: Comparison of US monetary policy surprise alternatives

	Mean	Std. Dev.	Nr. of obs. with negative co-movement	Nr. of obs. with positive co-movement
Term structure factor	0.55	8.81	41	56
Target factor	0.97	4.68	50	47
3-month FFR future	-0.30	2.96	24	22

Notes: The table provides summary statistics on US monetary policy surprise measures from the 97 FOMC announcements between April 2007 and March 2019. An increase in the term structure (target) factor by one unit reflects a 100bps increase of the 10-year US Treasury (current month federal funds) rate. Mean and standard deviations (std. dev.) are given in bps. The third and fourth column count the observations with negative and positive correlations with the change in the S&P 500 stock market index. The change in the three-month federal funds rate (FFR) is zero for 51 observations.

The method is implemented in a VAR framework by aggregating the daily observations of monetary policy and stock market changes on FOMC announcement dates to monthly frequency. These two time series then are added alongside the other variables in the VAR model. The negative and positive co-movement shocks to these two surprise measures are disentangled by means of sign restrictions, as shown in Table 3 in Appendix A.3.

While Jarociński and Karadi (2020) use surprise changes in three-month federal funds rate futures around the FOMC announcements, I construct a measure that also captures changes in the monetary policy stance at the longer end of the yield curve. I generate this monetary policy term structure surprise measure using the method by Gürkaynak et al. (2005). To this end, I use end-of-day data on federal funds rate futures with maturities of up to four months and eurodollar futures with maturities of six, nine and 12 months. To capture effects from monetary policy at the longer end of the yield curve, I add US Treasury rates with maturities of two, five and 10 years to this set. Following the procedure by Gürkaynak et al. (2005), I calculate the first two principal components of this data set. 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. I normalise the term structure factor such that an increase in the factor by one unit is equivalent to an increase in the 10-year Treasury rate of 100 basis points (bps). The resulting variable comprises my measure of yield surprise changes at US monetary policy announcements for the analysis in Section 4.

Figure 3 plots the surprise changes in the term structure factor and stock prices from FOMC announcements. Table 2 provides summary statistics on the surprises, as well as a comparison between term structure factor, target factor and the three-month federal funds rate future. Altogether, there are 97 FOMC announcements between April 2007 and March 2019, of which 41 are events with negative co-movements with the stock market (to be found in the upper left and lower right quadrants of Figure 3), while 56 events feature a positive co-movement (lower left and upper right quadrants).

Comparing the standard deviations for the different measures also exemplifies the importance of using changes over the whole term structure. As the federal funds rate was kept (close) to zero for an extended period of time after the global financial crisis, the variation at the short-end of the yield curve is very limited compared with earlier decades. However, most of the monetary policy adjustments post-crisis implied changes at the longer end of the term structure, e.g., through central bank asset purchases or forward guidance. As a result, the standard deviation of the term structure factor is almost twice as high as for the target factor and almost three times as high as for the three-month federal funds rate future (Table 2).[8] In fact, at more than 50% (51 out of 97) of the FOMC announcements in this post-financial crisis sample, the surprise changes in the three-month federal funds rate are zero. Using shocks to this variable would, therefore, make it very difficult to identify effects from monetary policy. This highlights the importance of using monetary policy surprise changes over the whole term structure. Since I am interested in the effects from a genuine monetary policy on global financial conditions in this paper, I will focus on shocks with negative co-movement between the monetary policy surprise and equity markets throughout the rest of the analysis.

[8]See also Figures 24 and 25 in Appendix A.3 for scatter plots of the target factor and the three-month federal funds rate future against stock market changes.

4 Results

In this section, I show impulse response functions to US monetary policy shocks, identified as in Jarociński and Karadi (2020), and to fund flow shocks, identified via Cholesky ordering. After discussing the baseline model used throughout the whole analysis, Section 4.1 describes the reaction of investment fund flows for different asset classes and domicile/investment focus combinations. The flows are analysed at the global and EA levels. Section 4.2 show impulse responses for several financial and macroeconomic variables. The results provide evidence that US monetary policy shocks continue to be an important driver of global asset prices after the global financial crisis. The section also discusses how the findings from the investment fund flows can be linked to the transmission channels discussed in the introduction. The responses from all variables shown behave intuitively and in line with economic theory. This provides further support for the identification scheme's reliability.

4.1 Investment fund flows and securities issuance

Figure 4 presents impulse responses from the variables in the baseline model to study the transmission of a loosening in global financial conditions, induced by US monetary policy, through the investment fund sector. The blue lines always provide the median response of the variables' posterior distribution. The blue-shaded areas indicate 68% credibility intervals, and the grey-shaded areas indicate 90% credibility bands. The responses from all variables are given in percentages, except for those from the VIX index that is used in levels. The surprise changes to the term structure and the S&P index are given in basis points and index points, respectively. The x-axis denotes the number of months after the shock.

The surprises in the US term structure and in the S&P 500 are the high-frequency measures that identify a US monetary policy shock as a negative co-movement between the two variables. As a result of the monetary shock, the US term structure factor decreases by about 4 bps, which translates into a reduction in the monthly US 10-year Treasury rate by about 5 bps on impact. Simultaneously, the high-frequency S&P 500 increases by 10 index points, translating into a 0.8% increase in the monthly S&P 500 series.

This expansionary monetary shock leads to increased risk appetite among global financial investors, as proxied by the VIX (Rey, 2015). After a short-lived initial increase for one month, risk aversion declines persistently and statistically significantly.

The loosening of US monetary policy leads to an immediate depreciation of the US dollar relative to the euro, which lasts about a year. This is in line with the results in Miranda-Agrippino and Rey (2020b). The result does not display a "delayed overshooting" of the exchange rate, which is often found in recursively identified VAR models, for example by Bruno and Shin (2015a).

The nominal flows from international investors to global investment funds increase significantly and persistently. In response to the about 5 bps reduction in the US 10-year rate, the

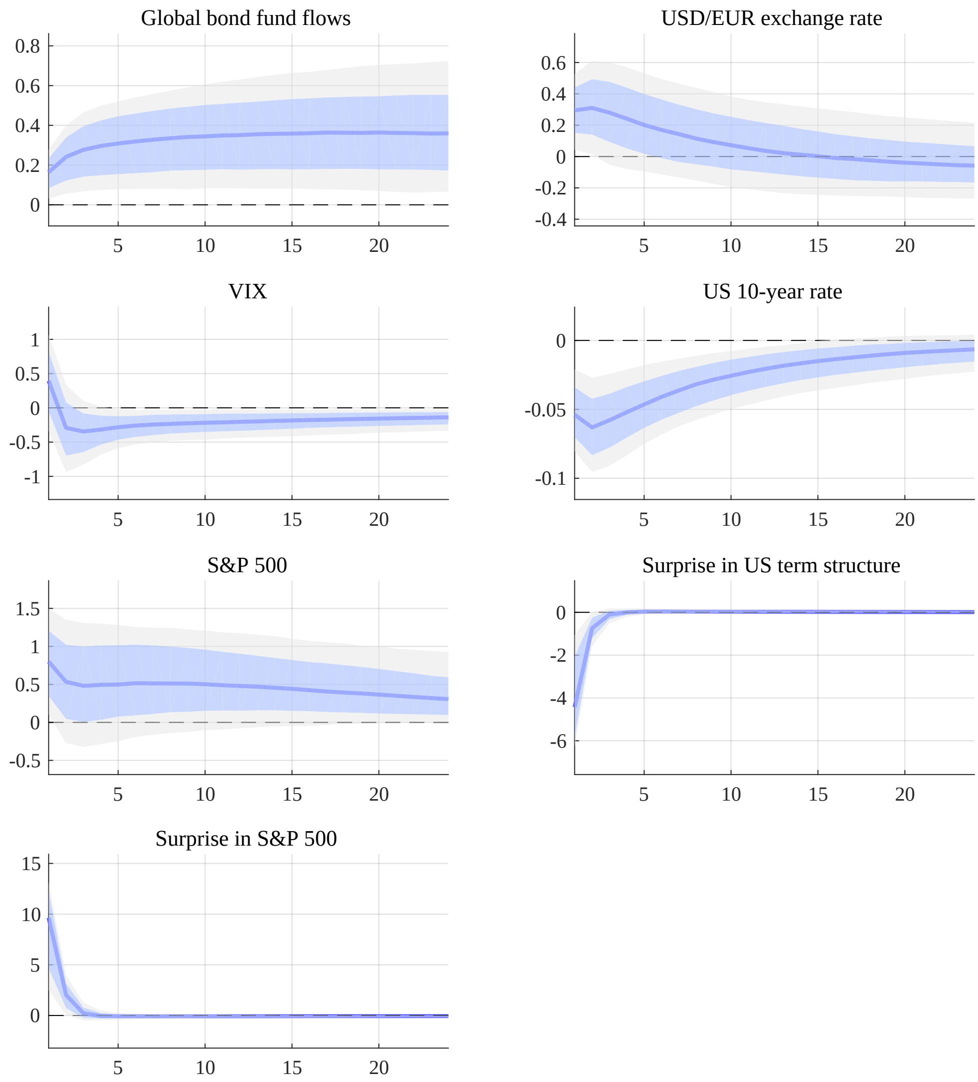


Figure 4: Impulse responses in baseline model with global bond fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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.

flows to bond funds increase by up to 0.4%, with the maximum effect arising after 12 months. This finding provides the first line of evidence that the investment fund sector responds systematically at the international level to changes in US monetary policy, thereby transmitting this change in financial conditions globally.

Figure 5 provides results for breakdowns of investment fund flows in a wide range of different asset classes. While the response from the bond fund flows is repeated in the upper left panel to facilitate comparison, all other variables shown in the figure are added one by one to the baseline model of Figure 4 instead of the bond fund flows.[9]

[9]The responses from the other variables in the baseline model that are not shown again are very close to those displayed in Figure 4 and are available upon request.

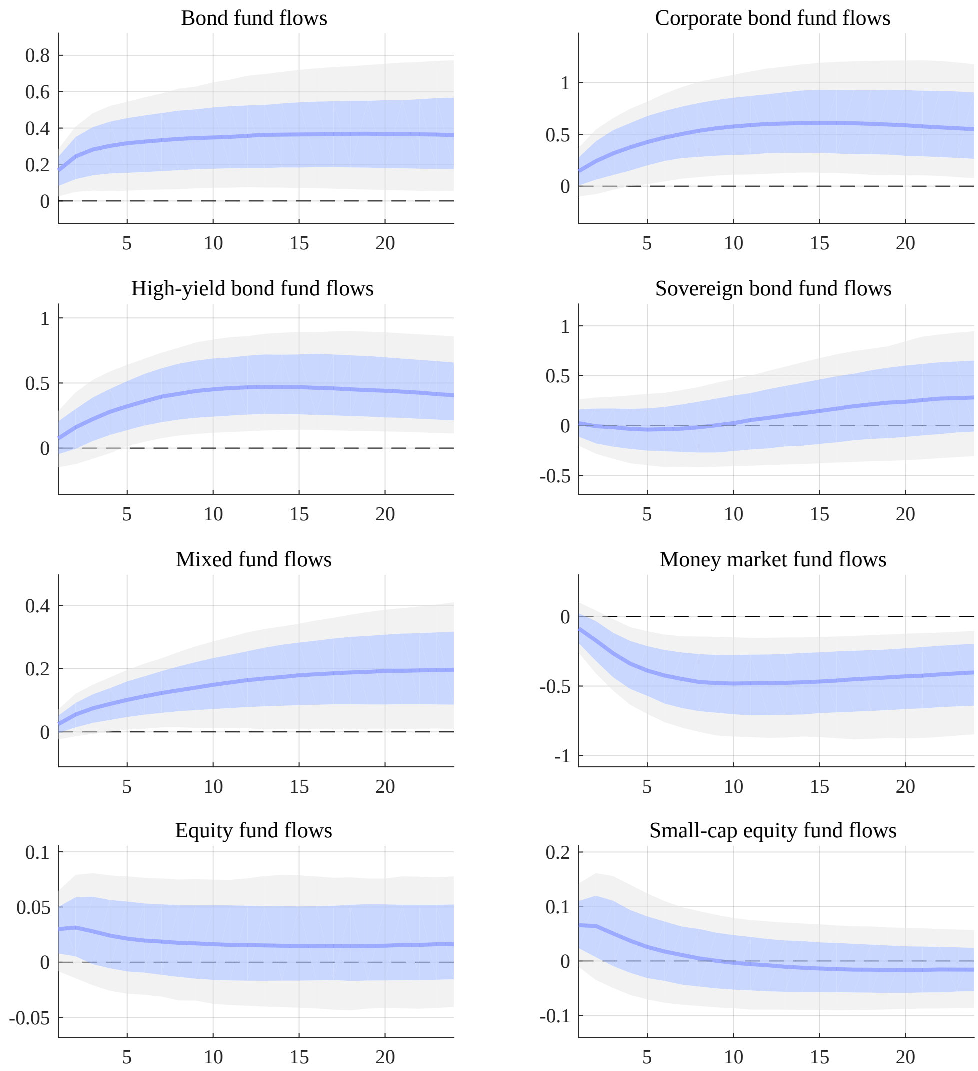


Figure 5: Impulse responses of global investment fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4.

The impulse responses show that the investor flows to global corporate (Panel 2) and high-yield (Panel 3) bond funds also increase after the expansionary shock. In fact, flows to both categories increase by more than the overall global bond fund flows. The peak responses from these two asset classes read 0.6% and 0.5%, respectively, compared with 0.4% for the overall flows. By contrast, flows to sovereign bond funds (Panel 4) are insignificant, while money market funds (Panel 6) experience significant outflows at the global level. Accordingly, investors increase their investments in global bond markets, and they re-balance from less risky sovereign and money market funds to riskier corporate and high-yield bond funds.

The economic significance of these results can be gauged when the percentage flows are transformed into USD flows. According to the data by Financial Stability Board (2020), displayed in Figure 1, bond funds had about USD 11.5 trillion in assets under management globally in 2018. Using the median coefficient of 0.4% for bond funds from the model and scaling the monetary policy shock up to 25 bps implies that global investor flows into bond funds increase persistently by about USD 200 billion.

In examining further asset classes beyond bonds, mixed funds (Panel 5), which invest both in equity and debt securities, also experience significant inflows after the shock. Inflows to equity funds (Panel 7) are positive. The impact effect of 0.03% is relatively small and turns insignificant after a few months. Besides the response from overall equity fund flows, I show the response for flows to equities issued by firms with a relatively small market capitalisation between USD 300 million and 2 billion (Panel 8). This market segment is viewed as riskier than the "large cap" segment. Small caps' price and return volatility usually are found to be larger than for large caps. The percentage increase in small caps is significantly more pronounced than the overall increase in equity flows. This finding again indicates a rebalancing to riskier segments of financial markets after a global monetary loosening.

Comparing the percentage coefficient to the assets under management from equity funds globally, which stood at USD 21 trillion in 2018, implies that equity funds experience inflows of about USD 33 billion in response to a 25 bps loosening of US monetary policy.[10]

As it is a special focus of the paper to analyse the transmission of global financial conditions to the EA, I examine the flows of global (i.e., non-domestic) investors towards funds that invest in European assets in Figure 6. Overall, these results are in line with those presented in Figure 5 earlier. Global funds investing in European assets experience significant inflows after a global monetary loosening.

Again, there is evidence of a re-balancing towards riskier asset classes, such as corporate bonds, while flows to European money market funds are declining.[11] Mixed funds are found to experience inflows after the shock. While global investors' flow response to European equity funds is insignificant, the relatively riskier small-cap equity funds have strong significant inflows.

The results in Figure 6 indicate that European asset markets can obtain additional funding from international investment funds after a loosening of global financial conditions. In this way, these funds can contribute to the transmission of the global financial cycle to the EA.

To assess investment funds' role in the transmission of global financial conditions to the EA fully, it is also important to study the behaviour of investors that are domiciled within the EA. EA-domiciled investment funds hold about 30% of total investment fund sector assets globally.[12]

[10] The relatively smaller absolute response from equity funds compared with bond funds is hardly surprising when examining the underlying raw data. As Figure 18 in Appendix A.2 shows, cumulative flows to bond funds were much higher and fluctuated more widely than those for equity funds during the sample period.

[11] Assets under management and flows of internationally domiciled sovereign and high-yield bond funds with a European investment focus are very small in the EPFR data. Results are therefore not provided for these two categories, but are consistent broadly with the findings in Figure 5.

[12] See Figure 22 in Appendix A.2 for an overview of the growth of the EA investment fund sector since the global financial crisis ended.

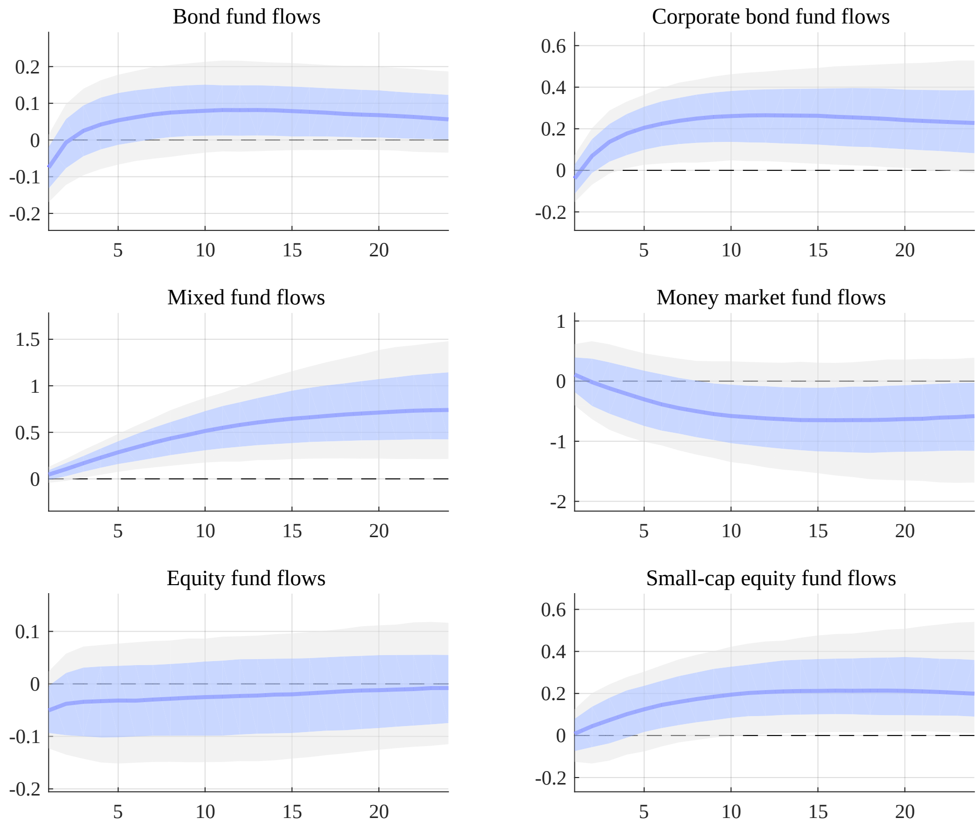


Figure 6: Impulse responses of global-to-EA investment fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 26.

Figure 7 provides flow responses from EA-domiciled investors to funds investing in European assets. To take into account that these fund flows stem from domestic investors, I add a BBB bond spread to the underlying model instead of the exchange rate (see Figure 27 in Appendix B). Jarociński and Karadi (2020) use this variable as a measure of financial frictions in the EA and find that it is important for explaining macroeconomic dynamics after monetary shocks. Figure 7 shows that EA investors increase their flows to funds with a European investment focus significantly across all asset classes. European corporate and high-yield bond funds obtain persistently higher inflows of more than 0.7% and 1%, respectively, while flows to mixed funds increase by about 0.5%. Flows to equity funds increase by about 0.1%. The riskier small-cap equity category obtains additional inflows of 0.5%.

This indicates that domestic EA investors increase their exposure to riskier asset classes in their home markets in response to a loosening of financial conditions abroad. This finding could be interpreted as searching for yield behaviour among EA investors when European assets offer relatively more attractive returns than US (or more broadly, international) assets after the US monetary accommodation.

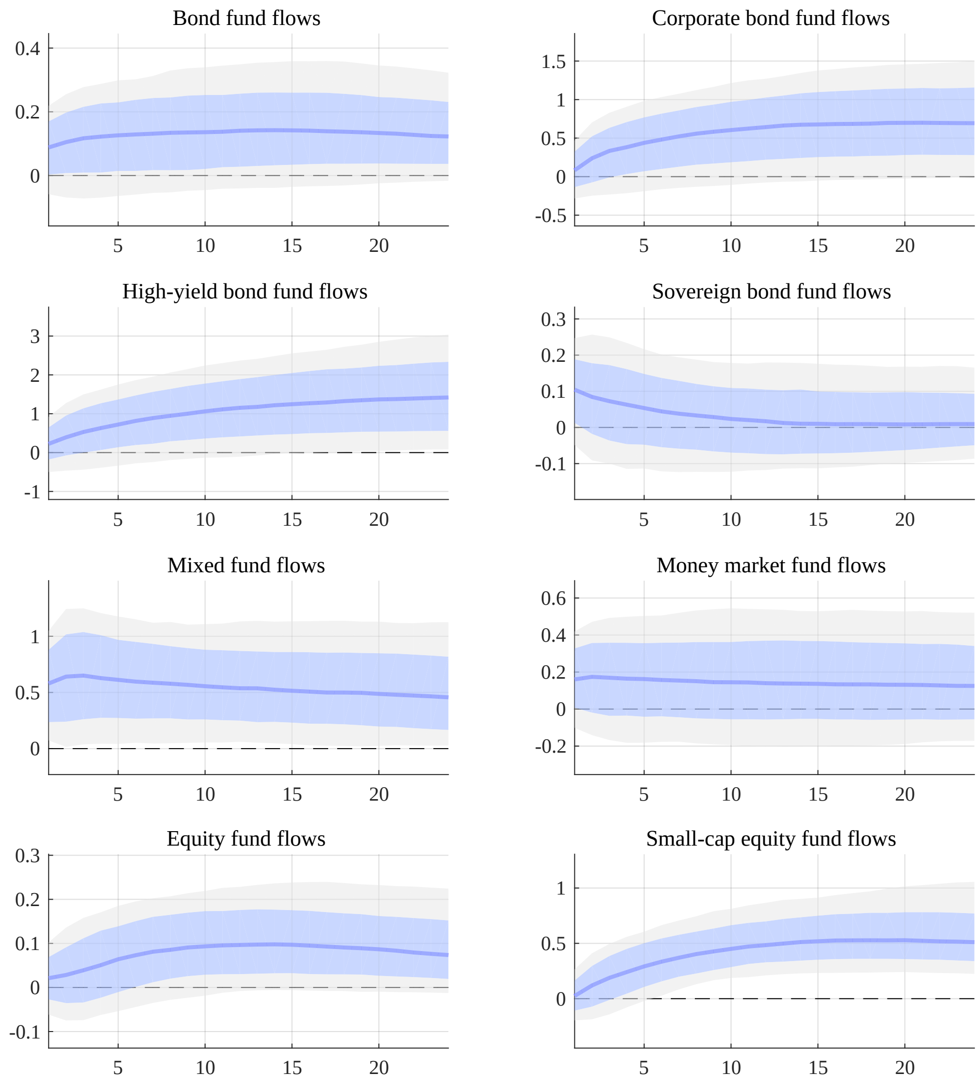


Figure 7: Impulse responses of EA-to-EA investment fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 27.

As opposed to global investors, EA investors also increase their flows to less-risky sovereign bond and money market funds. Both responses in Figure 7 are only statistically significant at the 68% credibility band for the first few months, but the median responses stay positive for about one year for sovereign bond funds and longer than two years for money market funds. This behaviour also could be rationalised by searching for yield motives amid the reduction in risk-free rates in the US. EA investors that aim to invest a certain share of their portfolios in safe assets might be incentivised to reduce their holdings of safe international assets, such as US Treasuries, and move to European sovereign bonds if the latter offer a relatively higher return. Section 4.2 provides results that support such reasoning.

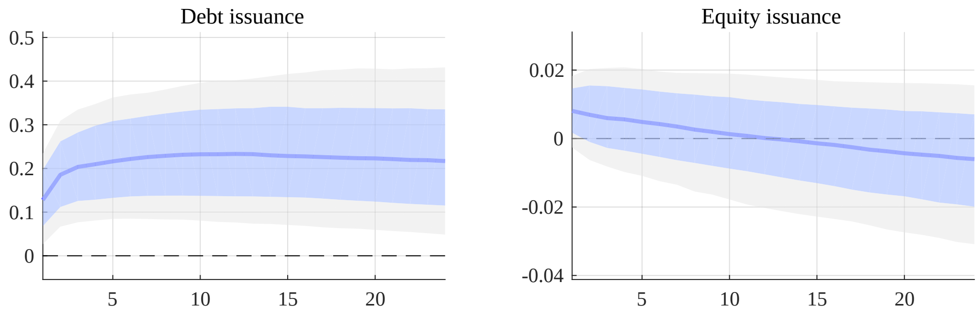


Figure 8: Impulse responses of EA securities issuance

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4.

The analysis so far has focussed on investment fund flows and, thus, the demand-side reaction on securities markets after a global financial loosening. To assess to what extent this leads not only to higher asset prices or share buybacks (Acharya and Plantin, 2018), it also is important to study the supply side of debt and equity markets. Figure 8 provides the responses of the outstanding amounts of debt and equity from EA non-financial corporations.

The issuance of debt securities increases significantly by about 0.2%. Given the total amount outstanding of euro area NFC debt of EUR 1.4 trillion in 2019, this implies an increase of about EUR 14 billion after a 25 bps monetary policy shock. Parallel to the much smaller inflows to equity funds, listed shares outstanding increase by 0.01% only, corresponding to about EUR 3 billion. Compared with the effect of debt outstanding, this impulse is relatively short-lived and becomes insignificant after two months.

According to the ECB Securities Holding Statistics, domestic and foreign investment funds held up to 50% of debt securities issued by euro area NFCs in 2019, while EA banks only held about 8%.[13] Therefore, by absorbing a large share of any newly issued debt, investment funds are likely to contribute significantly to improving financing conditions for EA firms after a global monetary loosening. In this way, firms will be relatively less reluctant to finance new investments and expand their operations. Increased investment fund flows may, hence, also affect real macroeconomic activity, which will be analysed in the next section.

4.2 Financial transmission and macroeconomic effects

This section presents results for several financial market variables to assess whether the investment fund flow responses can be rationalised with the transmission channels discussed in the introduction – the international risk-taking channel, the search-for-yield channel, and pro-

[13]See Figure 23 in Appendix A.2 for an overview of the investor base of debt issued by euro area NFCs. Euro area NBFIs in total held about 70% of euro area NFC debt, of which investment and money market funds were the largest individual sector, responsible for about one third of the total. Foreign (non-euro area) investors held another 17% that, as argued earlier, also mainly comprise investment funds (see Figure 2).

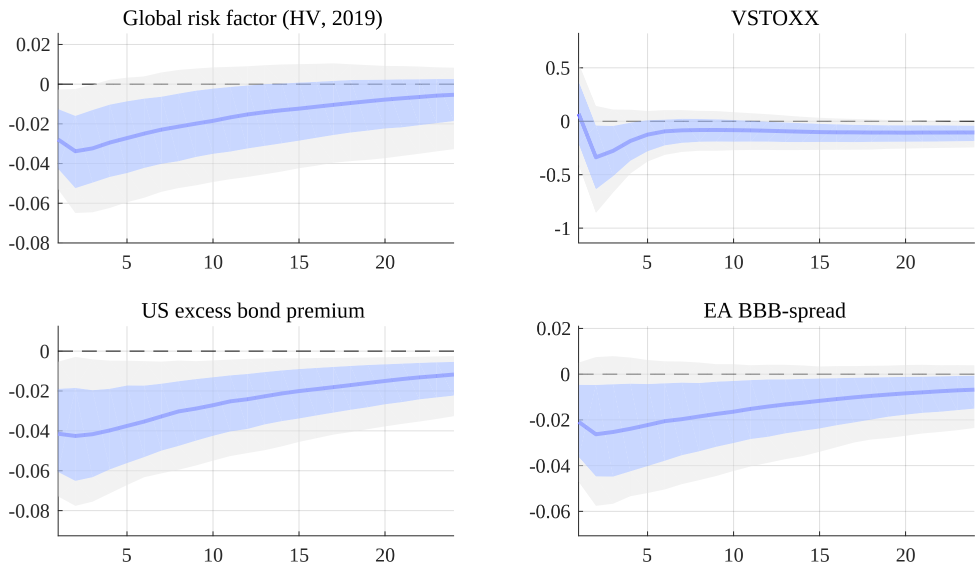


Figure 9: Impulse responses of global risk and uncertainty

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4. "HV, 2019" denotes the global risk factor by Habib and Venditti (2019). The US excess bond premium is taken from Gilchrist and Zakrajšek (2012).

cyclical flow-performance relations. It also analyses to what extent these financial effects spill over into the macroeconomy of the US and the EA during the post-global financial crisis era. Again, all variables shown are added one by one using the marginal approach to the baseline model presented in Figure 4.

Figure 9 analyses the effects from the US monetary policy shock on global risk sentiment, financial uncertainty and frictions. The baseline model indicated that the VIX, as a measure of investor risk sentiment, declines after the loosening of US monetary policy. This finding is corroborated by the global risk factor of Habib and Venditti (2019), which also declines significantly and persistently on impact. This index represents the global component of expected stock returns and provides a further concise measure for the global financial cycle. A decline in the variable indicates less global financial risk. Next, the figure also shows that the VSTOXX, the volatility index for the Euro Stoxx 50, declines in response to US monetary easing, suggesting that expected market volatility and risk aversion also decline in the EA. In sum, these responses provide a clear indication for increased global risk appetite among investors after a loosening of monetary policy in the US. In line with an international risk-taking channel of monetary policy, this is one explanation for the higher investment fund flows – particularly to riskier market segments – that were discussed in the previous section.

While the volatility indices and the global risk factor focus on equity markets, I analyse credit spread variables to study changing conditions in US and EA bond markets as well. For the US, I use the excess bond premium by Gilchrist and Zakrajšek (2012), which is an average corporate bond spread from which default risk is removed. For this reason, Gertler and Karadi (2015) argue that it can be interpreted as a measure for financial frictions in the economy. Moreover, the excess bond premium is shown to have excellent properties in forecasting economic activity. Caldara and Herbst (2019) show that it improves the reliability and forecasting performance of macro-VAR models significantly. For the EA, I follow Jarociński and Karadi (2020) in using the spread between BBB-rated bonds of non-financial corporations and the Bund yield, in which the latter serves as the measure for the EA risk-free rate. The impulse responses in Figure 9 indicate that the bond risk spreads decrease significantly in both regions. The US excess bond premium reacts relatively stronger by -4 bps on impact, while the euro area BBB spread declines by 2 bps. Financial frictions and financing conditions for NFCs in both regions, accordingly, ease after the monetary shock.

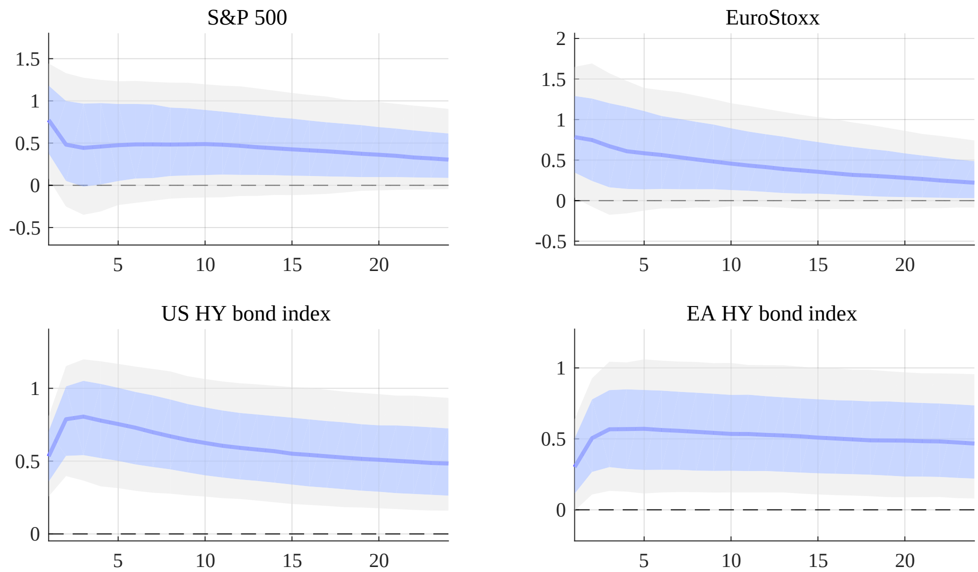


Figure 10: Impulse responses of equity and bond market indices

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4.

In Figure 10, I present the results from examining the reaction and international co-movement of risky assets' prices in the US and EA further. The figure provides the impulse responses of the S&P 500 and the EuroStoxx 50 equity indices, as well as indices for the high-yield segments of EA and US bond markets. In both regions, the measures increase persistently after the interest rate decline. This implies more attractive conditions for firms who seek (additional) funding on bond and equity markets. As they also imply higher investment returns, the higher asset prices also may reinforce the investor flows visible in Section 4.1 due to pro-cyclical flow-performance behaviour (Timmer, 2018; Goldstein et al., 2017; Feroli et al., 2014). Overall, the findings in Figure 9 and 10 are consistent with the observation of the literature initiated by Rey (2015) on a global financial cycle in risky asset prices. While this literature so far mainly analysed the period before the global financial crisis, I can confirm that these findings also extend to the post-crisis period.

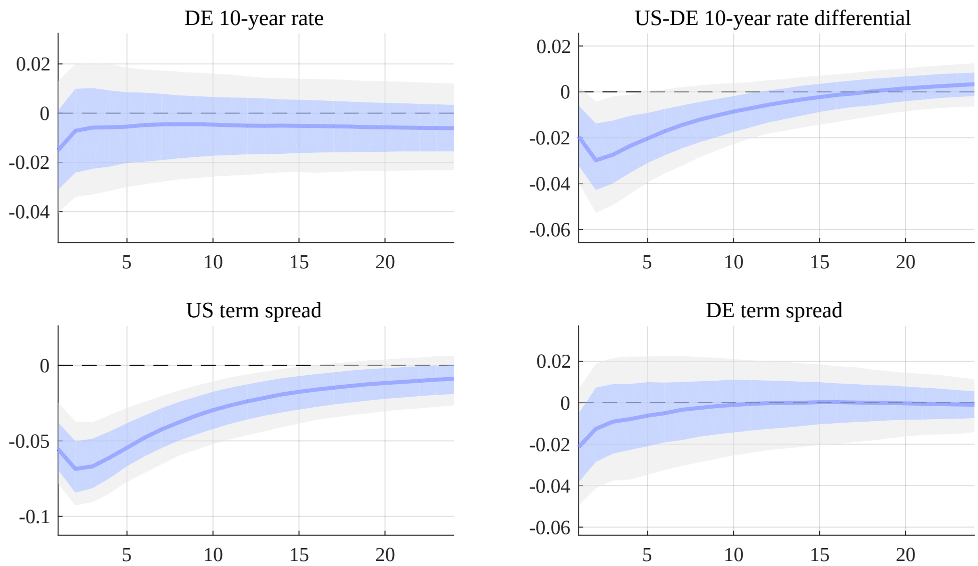


Figure 11: Impulse responses of interest rate differentials

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4. Term spreads are calculated as the difference between 10- and one-year US Treasury and German Bund (DE) rates, respectively.

Figure 11 provides results from analyses of interest rates and their differentials in the two currency areas. The figure shows that a monetary expansion in the US is not followed by a statistically significant loosening of the EA monetary policy stance, as measured by the 10-year German Bund rate. This finding differs from Miranda-Agrippino and Rey (2020b), who find that the ECB adjusts its policy systematically after US monetary policy changes in their pre-crisis sample – be it for reasons related to a "fear of floating" or due to endogenous economic developments in the EA. As a consequence, the interest rate differential between the 10-year US and EA interest rates (the latter again proxied by the German Bund rate) decreases significantly. This observation is consistent with the hypothesis that global investors adjust their portfolios towards relatively higher yield in international, such as European, assets after the shock (Ammer et al., 2019), as shown in Figures 5, 6, and 7.

Figure 11 also finds that the term spread in the US, measured as the difference between 10- and one-year Treasury rates, declines significantly by about 5 bps and thus by the same amount as the 10-year rate itself. The shock accordingly implies a flattening of the yield curve. This provides a consistency check of the construction of the shock, which aims to capture monetary policy effects in the longer end of the term structure. It is also in line with the fact that monetary policy for the largest part of my sample predominantly aimed to control the yield curve's steepness, while its short end remained at relatively low levels. Consistent with the small, insignificant response of the German 10-year rate, the Bund term spread only reacts mildly as well. The yield curve flattens by 2 bps on impact, but the response turns statistically insignificant after only two months.

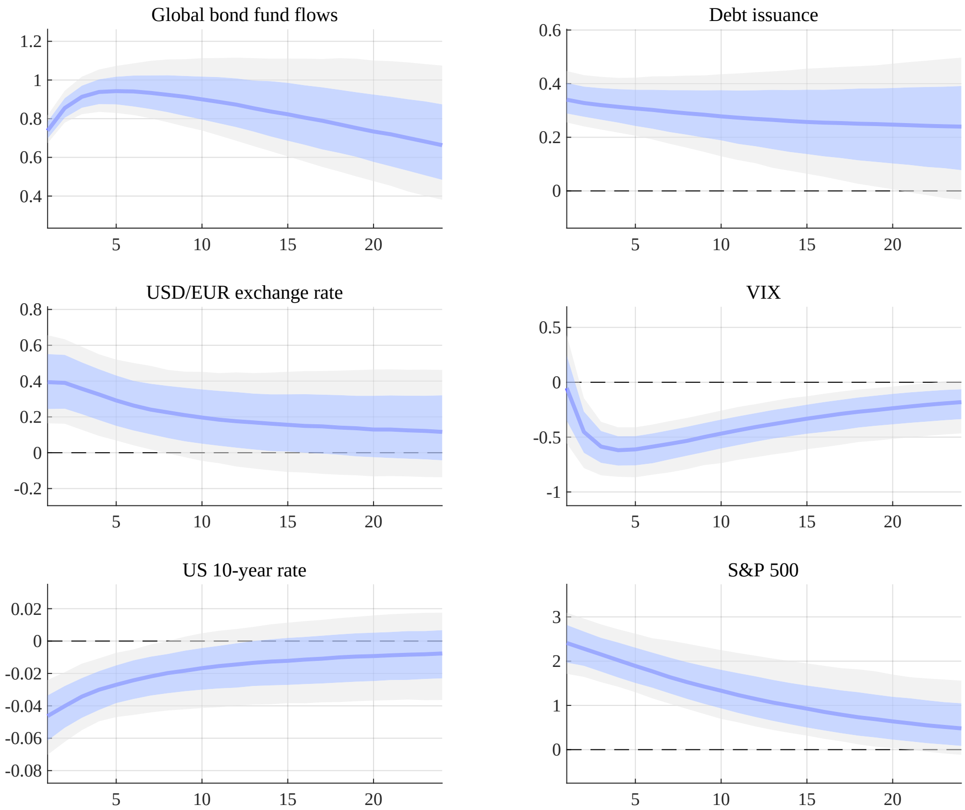


Figure 12: Impulse responses in the baseline model to a global bond fund flow shock

Notes: Impulse responses to an inflow shock to global bond funds (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with Cholesky recursive identification. Global bond fund flows are ordered first.

The results so far document that investment fund flows respond systematically to changes in US monetary policy and that these flows can be explained with a variety of transmission channels. In a next step, I examine to what extent the investment fund flows themselves contribute to the demonstrated improvement in financing conditions.

To this end, I re-run the baseline model from Figure 4, as well as several marginal extensions – this time focussing on shocks to the investment fund flows. The model features the same variables as before, except for the two high-frequency measures needed to identify the monetary policy shocks. The fund flow shocks are identified using a Cholesky approach, with the fund flows ordered first. Under this ordering, all variables can respond immediately to changes in the fund flows, while fund flows can only respond with a lag to the other variables, reflecting a notion that quantities move slower than prices.

The responses to the fund flow shock in the baseline model, extended by the debt issuance of EA NFCs, are provided in Figure 12.[14] The responses of all variables are fully consistent with the findings from the monetary policy shock in Figure 4. Specifically, the shock implies that inflows to global investment funds increase immediately by almost 0.8% and increase further in subsequent months before decaying slowly. In response, the VIX drops strongly, by more than 0.5 points. The US 10-year rate falls by 4 bps, while the S&P 500 increases markedly, by more than 2%. The debt issued by EA NFCs increases by 0.35%, indicating that EA firms use the additional financing offered by the investment fund sector.

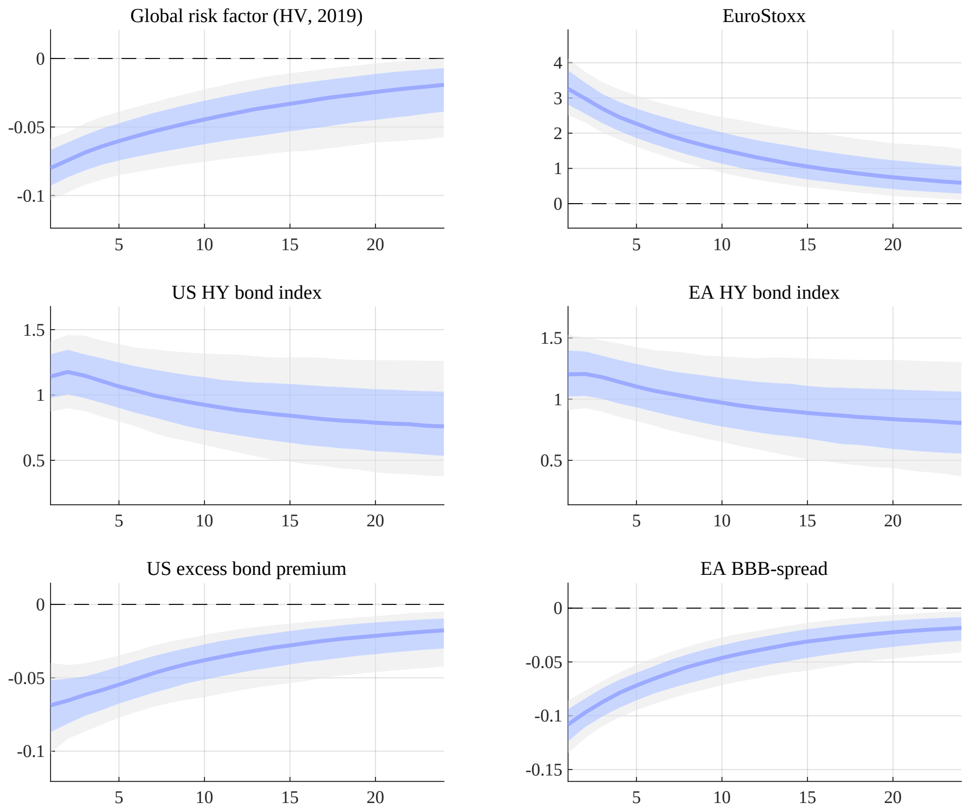


Figure 13: Impulse responses of financial market variables to a global bond fund flow shock

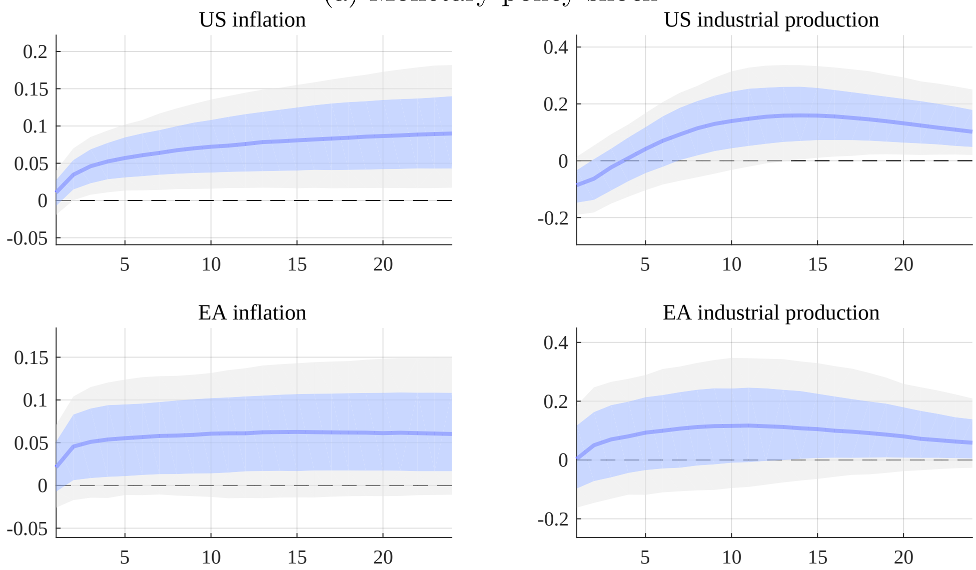
Notes: Impulse responses to an inflow shock to global bond funds (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with Cholesky recursive identification. Global bond fund flows are ordered first. Each variable is added separately to the baseline model in Figure 32.

The responses of global risk, as well as stock and bond market indicators to the fund flow shock are presented in Figure 13. The results show that fund inflows lead to a reduction in global financial risk and a loosening of financial conditions both in the US and EA. Fund inflows

[14] All results remain virtually unchanged without the debt issuance variable (see Figure 32 in Appendix B). The results also are unaffected if an additional variable as a basis for a monetary policy shock, such as the surprise in the term structure factor or the Wu and Xia (2016) shadow federal funds rate, is added and ordered first. Bertaut et al. (2021) use the same ordering between monetary policy, investment fund flows, and financial variables in a Cholesky-identified VAR. Results for monetary policy shocks identified in such a way are discussed in Section 5.

can, accordingly, amplify the easing of financial conditions that was documented in Figures 9 and 10 after a monetary policy shock.

(a) Monetary policy shock



(b) Fund flow shock

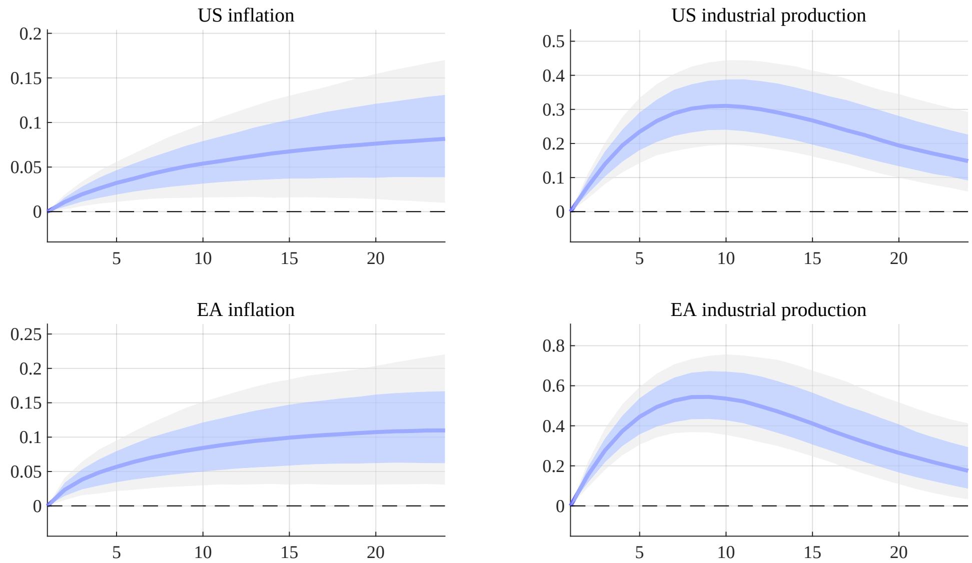


Figure 14: Impulse responses of macro-variables

Notes: Panel (a): Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 (b): Impulse responses to an inflow shock to global bond funds obtained with Cholesky recursive identification. Global bond fund flows are ordered first. Each variable is added separately to the baseline model in Figures 4 and 32, respectively. Models with US (EA) macro-variables additionally include the excess bond premium (BBB spread).

The question of whether the financial spillovers also affect the EA macroeconomy is examined next. Figure 14 provides responses from macro-variables for the US and EA to both monetary policy and fund flow shocks. The US and EA variables again are added jointly with the excess bond premium or BBB spread, respectively. For the identification of the fund flow shock, the macro-variables are ordered first, while the bond market spreads are ordered among the other financial variables.

Industrial production increases in both regions after the US monetary shock (Panel (a)), which is in line with the findings by Miranda-Agrippino and Rey (2020b). The response of US industrial production turns significant after seven months and reaches a peak of almost 0.2% after about a year. The response from EA industrial production is estimated less precisely. It turns significant after 13 months, when it also reaches its peak of about 0.1%. Consumer price inflation also rises in both the US and EA, in which, again, the effects are stronger and more significant in the US.

While several transmission channels contribute to these monetary spillovers, the role of investment funds in this is analysed further in Panel (b) of the figure. Industrial production and inflation increase pronouncedly and statistically significantly in both regions after inflows to global bond funds. This clear link between fund flows and the macroeconomy is in line with Ben-Rephael et al. (2021), who find that indicators based on bond fund flows have strong predictive power on GDP and unemployment. Taken together, Figure 14 illustrates that investment funds, indeed, can play a meaningful role in the transmission of global monetary loosening to real economic conditions along the narrative developed in Section 4: Monetary easing in the US leads to higher asset prices and improved financing conditions globally, which are supported by inflows to the investment fund sector. The better access to finance, in turn, stimulates firms to raise additional funding, particularly via higher debt securities issuance. This allows the corporate sector to finance investments and create new jobs that ultimately can lead to an increase in real economic activity and inflation.

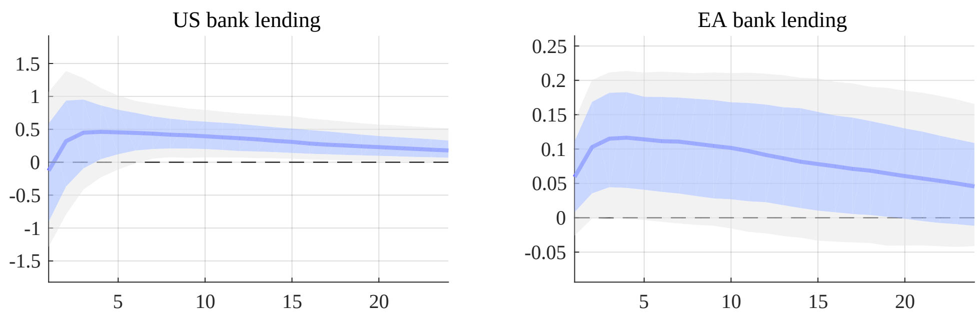


Figure 15: Impulse responses of bank lending to a US monetary policy shock

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 4. The model with US (EA) bank lending additionally includes the excess bond premium (BBB spread).

At the same time, the (international) bank lending channels discussed by Rey (2016) continue to play a role in the macro-spillovers. Consistent with Miranda-Agrippino and Rey (2020b),

Figure 15 indicates that domestic bank lending increases significantly not only in the US, but also in the EA, after a monetary loosening in the US. US banks increase their loan origination significantly with a peak response of 0.5%. The effect on EA bank lending is much smaller than in the US, with a peak response of about 0.1%, and it remains significant at the 68% credibility level for one-and-a-half years. However, compared with debt portfolio flows that predominantly are driven by investment funds, the size of bank-related capital inflows to the EA fell significantly after the global financial crisis (see Figure 2) – a point already made by Shin (2013). Thus, the relative importance of channels related to international banks' behaviour is likely to have declined compared with the more market-based investment fund channels that stand in the focus of the present analysis.

5 Sensitivity analysis

This section discusses a series of robustness checks for the paper's main results.

First, I analyse the main results' sensitivity with respect to the identification scheme of the VAR. Figure 16 provides results from the baseline model, using a standard high-frequency identification instead of the more involved Jarociński and Karadi (2020) approach. In the standard approach, the high-frequency monetary surprise factor continues to be part of the model, but the surprise change in the S&P 500 index is left out. The model then is identified through the Cholesky decomposition, in which the high-frequency variable is ordered first.[15] This implies that all other variables in the VAR can respond contemporaneously to the monetary policy shock, while monetary policy responds to all further variables only with a lag. Given the high speed with which all the financial variables used in the model react to news, this ordering is very plausible. Moreover, it also mirrors "the periodic decision making process at the Federal Reserve and the slowly evolving implementation of monetary policy", as argued by Bruno and Shin (2015a).

Figure 16 makes it clear that all variables' responses in the baseline from Figure 4 are highly robust when using the standard high-frequency approach, both qualitatively and quantitatively. Figure 28 in Appendix B confirms that this also holds for all investment fund flow types depicted in Figure 5.

To prove that the results do not depend on the selection of the specific monetary policy surprise indicator and the high-frequency approach in general, I demonstrate that similar results also can be obtained using a conventional Cholesky identification of the monetary policy shock without using high-frequency data. To this end, I add the Wu and Xia (2016) shadow federal funds rate as the monetary policy indicator to the model. This variable is an adjusted federal funds rate that takes into account the effects from the unconventional measures conducted while the effective federal funds rate was close to its zero lower bound. Figure 17 provides results

[15] This procedure is related closely to the external instruments approach proposed by Gertler and Karadi (2015), and it also is used by Jarociński and Karadi (2020) for comparison purposes.

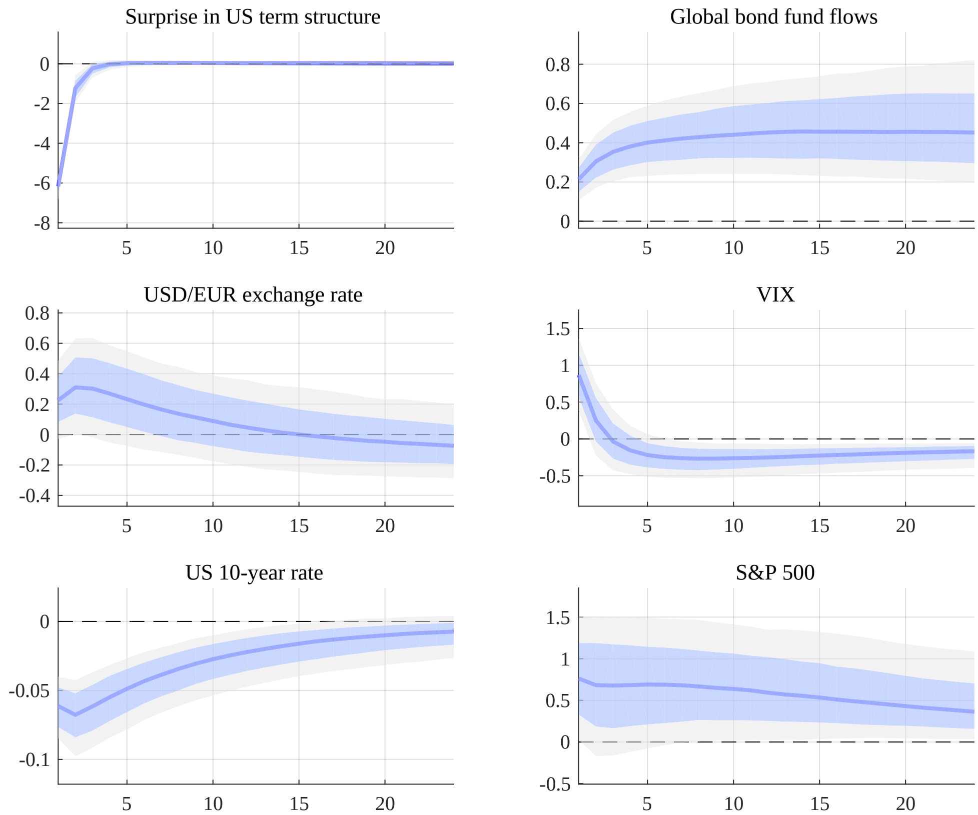


Figure 16: Impulse responses in the baseline model with standard high-frequency identification

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 6 bps decrease in the 10-year US Treasury 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. The high-frequency monetary policy indicator (a surprise in US term structure) is ordered first.

from the baseline model. The shadow federal funds rate decreases by 13 bps on impact. As with the high-frequency methods, this leads to a depreciation in the US dollar relative to the euro, a reduction in the VIX, an increase in the S&P 500 index, and inflows to global bond funds. Figure 29 in Appendix B demonstrates that the results also are robust for the further investment fund flow categories.

As a final check, I analyse the results' robustness in a sample that starts in June 2009 when the US recession resulting from the global financial crisis was declared to be over. This reduces the sample size further to only 118 observations. Results can be found in Figures 30 and 31 in Appendix B. The responses of the exchange rate and the S&P 500 index are now mostly insignificant. The VIX still decreases after the shock, but the initial positive spike now lasts six months. Nevertheless, all bond fund flows maintain the correct signs and remain highly significant. In line with the rebalancing to riskier assets, sovereign bond funds now also are found to experience outflows. However, equity fund flows are estimated to be insignificant, and they even become negative in the case of small-cap flows. This last somewhat odd finding is related to the negative insignificant response of the S&P equity index, which weighs down on

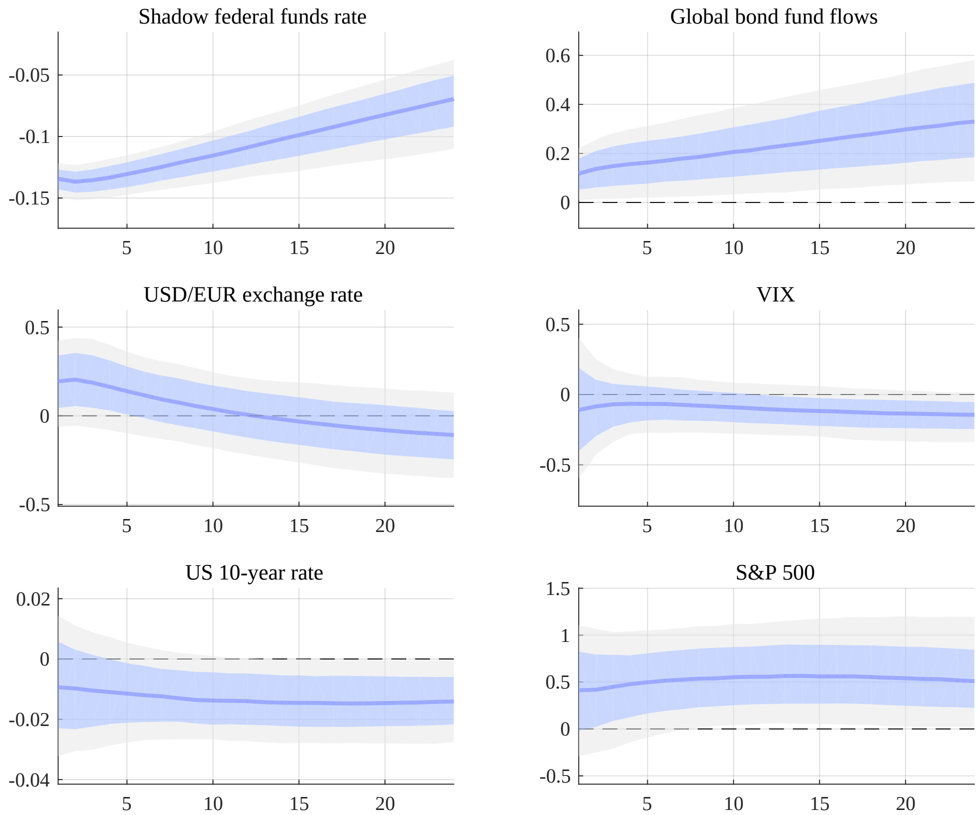


Figure 17: Impulse responses in the baseline model with recursive identification

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 1 bps decrease in the 10-year US Treasury 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 Wu and Xia (2016) shadow federal funds rate is used as the monetary policy indicator and is ordered first.

the response of the fund flows.

6 Conclusion

This paper provides empirical evidence of substantial spillovers from changes in global liquidity induced by US monetary policy into the EA during the 2007–2019 period. The results show that a loosening in US monetary policy leads to inflows to the investment fund sector globally and within the EA, particularly in corporate bond markets. These inflows are particularly strong for riskier segments of financial markets, and they also can be linked with improving financing conditions and an increased securities issuance by EA non-financial corporations. In this way, the results indicate that the investment fund sector emerged as a new additional channel through which financial spillovers also can affect the real economy. The findings demonstrate the growing importance of non-bank financial intermediation over the past decade and hold potentially important policy implications for monetary and financial stability.

References

Acharya, V. V. and G. Plantin (2018). Monetary Easing, Investment and Financial Instability. Discussion Paper 13072, Centre for Economic Policy Research.

Adrian, T. and B. Jones (2018). Shadow Banking and Market-Based Finance. Departmental Paper 18/14, International Monetary Fund.

Ammer, J., S. Claessens, A. Tabova, and C. Wroblewski (2018). Searching for Yield Abroad: Risk-Taking Through Foreign Investment in U.S. Bonds. Discussion Paper 1224, Board of Governors of the Federal Reserve System.

Ammer, J., S. Claessens, A. Tabova, and C. Wroblewski (2019). Home Country Interest Rates and International Investment in U.S. Bonds. *Journal of International Money and Finance 95*, 212 – 227.

Arias, J. E., J. F. Rubio-Ramírez, and D. F. Waggoner (2018). Inference Based on Structural Vector Autoregressions Identified With Sign and Zero Restrictions: Theory and Applications. *Econometrica 86*(2), 685 – 720.

Baskaya, Y. S., J. di Giovanni, S. Kalemli-Özcan, J.-L. Peydro, and M. F. Ulu (2017). Capital Flows and the International Credit Channel. *Journal of International Economics 108*, S15 – S22.

Becker, B. and V. Ivashina (2015). Reaching for Yield in the Bond Market. *The Journal of Finance 70*(5), 1863 – 1902.

Bekaert, G., M. Hoerova, and M. Lo Duca (2013). Risk, Uncertainty and Monetary Policy. *Journal of Monetary Economics 60*(7), 771 – 788.

Ben-Rephael, A., J. Choi, and I. Goldstein (2021). Mutual Fund Flows and Fluctuations in Credit and Business Cycles. *Journal of Financial Economics 139*(1), 84 – 108.

Bertaut, C., V. Bruno, and H. S. Shin (2021). Original Sin Redux. Mimeo.

Borio, C. and H. Zhu (2012). Capital Regulation, Risk-taking and Monetary Policy: A Missing Link in the Transmission Mechanism? *Journal of Financial Stability 8*(4), 236 – 251.

Bruno, V. and H. S. Shin (2015a). Capital Flows and the Risk-taking Channel of Monetary Policy. *Journal of Monetary Economics 71*, 119 – 132.

Bruno, V. and H. S. Shin (2015b). Cross-Border Banking and Global Liquidity. *The Review of Economic Studies 82*(2), 535 – 564.

Bruno, V. and H. S. Shin (2017). Global Dollar Credit and Carry Trades: A Firm-Level Analysis. *The Review of Financial Studies 30*(3), 703 – 749.

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.

Caldara, D. and E. Herbst (2019). Monetary Policy, Real Activity, and Credit Spreads: Evidence from Bayesian Proxy SVARs. *American Economic Journal: Macroeconomics 11*(1), 157 – 192.

Choi, J. and M. Kronlund (2017, 11). Reaching for Yield in Corporate Bond Mutual Funds. *The Review of Financial Studies 31*(5), 1930 – 1965.

Cominetta, M., C. Lambert, A. Levels, A. Rydén, and C. Weistroffer (2018). Macroprudential Liquidity Tools for Investment Funds - A Preliminary Discussion. Macroprudential Bulletin 6, European Central Bank.

Converse, N., E. Levy-Yeyati, and T. Williams (2020). How ETFs Amplify the Global Financial Cycle in Emerging Markets. Discussion Paper 1268, Board of Governors of the Federal Reserve System.

Davis, J. S., G. Valente, and E. van Wincoop (2021). Global Drivers of Gross and Net Capital Flows. *Journal of International Economics 128*, 103397.

Di Maggio, M. and M. Kacperczyk (2017). The Unintended Consequences of the Zero Lower Bound Policy. *Journal of Financial Economics 123*(1), 59 – 80.

Dieppe, A., R. Legrand, and B. van Roye (2016). The BEAR toolbox. Working Paper 1934, European Central Bank.

European Central Bank (2020, November). Financial Stability Review.

Feroli, M., A. Kashyap, K. Schoenholtz, and H. S. Shin (2014). Market Tantrums and Monetary Policy. Working Paper 101, Chicago Booth.

Financial Stability Board (2020). Global Monitoring Report on Non-Bank Financial Intermediation 2019.

Fratzscher, M. (2012). Capital Flows, Push Versus Pull Factors and the Global Financial Crisis. *Journal of International Economics 88*(2), 341 – 356.

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

Fratzscher, M., M. Lo Duca, and R. Straub (2018). On the International Spillovers of US Quantitative Easing. *The Economic Journal 128*(608), 330 – 377.

Gerko, E. and H. Rey (2017). Monetary Policy in the Capitals of Capital. *Journal of the European Economic Association 15*(4), 721 – 745.

Gertler, M. and P. Karadi (2015). Monetary Policy Surprises, Credit Costs, and Economic Activity. *American Economic Journal: Macroeconomics 7*(1), 44 – 76.

Gilchrist, S. and E. Zakrajšek (2012). Credit Spreads and Business Cycle Fluctuations. *American Economic Review 102*(4), 1692 – 1720.

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

Gürkaynak, R. S., B. Sack, and E. T. Swanson (2005). Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking 1*(1), 55 – 93.

Habib, M. M. and F. Venditti (2019). The Global Capital Flows Cycle: Structural Drivers and Transmission Channels. Working Paper 2280, European Central Bank.

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

Holm-Hadulla, F. and C. Thürwächter (2021). Heterogeneity in Corporate Debt Structures and the Transmission of Monetary Policy. *European Economic Review 136*, 103743.

International Monetary Fund (2016). Monetary Policy and the Rise of Nonbank Finance. Global Financial Stability Report, Chapter 2, pp. 49 – 80.

Jarociński, M. and P. Karadi (2020). Deconstructing Monetary Policy Surprises—The Role of Information Shocks. *American Economic Journal: Macroeconomics 12*(2), 1 – 43.

Kalemli-Özcan, S. (2019). U.S. Monetary Policy and International Risk Spillovers. Working Paper 26297, National Bureau of Economic Research.

Kroencke, T., M. Schmeling, and A. Schrimpf (2015). Global Asset Allocation Shifts. Working Paper 497, Bank for International Settlements.

Litterman, R. (1986). Forecasting with Bayesian Vector Autoregressions - Five Years of Experience. *Journal of Business and Economic Statistics 4*(1), 25 – 38.

Lo Duca, M., G. Nicoletti, and A. Vidal Martínez (2016). Global Corporate Bond Issuance: What Role for US Quantitative Easing? *Journal of International Money and Finance 60*, 114 – 150.

Miao, Y. and M. Pant (2012). Coincident Indicators of Capital Flows. Working Paper 12/55, International Monetary Fund.

Miranda-Agrippino, S. and H. Rey (2020a). The Global Financial Cycle After Lehman. *AEA Papers and Proceedings 110*, 523 – 528.

Miranda-Agrippino, S. and H. Rey (2020b). US Monetary Policy and the Global Financial Cycle. *Review of Economic Studies 87*(6), 2754 – 2776.

Nakamura, E. and J. Steinsson (2018). High-Frequency Identification of Monetary Non-Neutrality: The Information Effect. *Quarterly Journal of Economics 133*(3), 1283 – 1330.

Niepmann, F. and T. Schmidt-Eisenlohr (2018). Global Investors, the Dollar, and U.S. Credit Conditions. Discussion Paper 13237, Centre for Economic Policy Research.

Portes, R., T. Beck, W. Buiter, K. Dominguez, D. Gros, C. Gross, S. Kalemli-Ozcan, T. Peltonen, and A. Sánchez Serrano (2020). The Global Dimensions of Macroprudential Policy. Reports of Advisory Scientific Committee 10, European Systemic Risk Board.

Rey, H. (2015). Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence. Working Paper 21162, National Bureau of Economic Research.

Rey, H. (2016). International Channels of Transmission of Monetary Policy and the Mundellian Trilemma. *IMF Economic Review 64*(1), 6 – 35.

Scheubel, B., L. Stracca, and C. Tille (2019). The Global Financial Cycle and Capital Flow Episodes: a Wobbly Link? Working Paper 2337, European Central Bank.

Shin, H. S. (2013, November). The Second Phase of Global Liquidity and its Impact on Emerging Economies. Remarks at the 2013 Federal Reserve Bank of San Francisco Asia Economic Policy Conference.

Timmer, Y. (2018). Cyclical Investment Behavior Across Financial Institutions. *Journal of Financial Economics 129*(2), 268 – 286.

Wu, J. C. and F. D. Xia (2016). Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound. *Journal of Money, Credit and Banking 48*(2-3), 253 – 291.

Appendix

A Data

A.1 Data sources and description

This appendix gives a brief description of all variables used in the analysis together with their source and the transformation applied.

- Investment fund variables: Monthly nominal net portfolio flows of investment funds calculated as cumulative percentage flows of lagged assets under management relative to sample starting point in April 2007.

  Asset classes used:

  - All bond funds
  - Corporate / sovereign bond funds
  - High-yield bond funds
  - Money market funds
  - Mixed funds, which consists of all multi asset funds
  - All equity funds
  - Small cap equity, which includes equities of firms with a market capitalisation between USD 300 million and 2 billion

  Investment focus-domicile combinations:

  - Global investment focus, global domicile
  - Regional investment focus "Western Europe", domiciled in the euro area (EA-12)
  - Regional investment focus "Western Europe", domiciled outside the euro area (EA-12)

  Source: EPFR Global

- Debt securities issuance: Notional stocks of all securities issued by euro area non-financial corporations. Source: ECB Securities Statistics; data set mnemonic [SEC]. Transformed to logs.

- Equity issuance: Notional stocks of all equity shares issued by euro area non-financial corporations. Source: ECB Securities Statistics; data set mnemonic [SEC]. Transformed to logs.

- DE government bond rates: German 1, 3, 10-year government benchmark bond yield. Source: ECB Financial Market Data; data set mnemonic [FM]. No further transformations.

- US Treasury rates: 1, 10-year treasury constant maturity rate. Source: FRB of St. Louis FRED; mnemonic [GS]. No further transformations.
- Shadow federal funds rate. Source: Wu and Xia (2016). No further transformations.
- US Dollar/Euro exchange rate: ECB reference exchange rate, US dollar/Euro, 2:15 pm (C.E.T.). Source: ECB Exchange Rates; data set mnemonic [EXR]. Transformed to logs.
- Eurostoxx stock index: Dow Jones Euro Stoxx 50 Index - Historical close. Source: ECB Financial Market Data; data set mnemonic [FM]. Transformed to annual growth rates.
- S&P 500 stock index: Standard and Poors 500 Index - Historical close. Source: ECB Financial Market Data; mnemonic [FM]. Transformed to annual growth rates.
- VIX volatility index. Source: Datastream; mnemonic [CBOEVIX]. No further transformations.
- VSTOXX volatility index. Source: Datastream; mnemonic [VSTOXXI]. No further transformations.
- Global risk factor. Source: Habib and Venditti (2019). No further transformations.
- Excess bond premium: Financial friction index for the United States. Source: Gilchrist and Zakrajšek (2012). No further transformations.
- EA BBB-spread: Spread between iBoxx Euro BBB-rated non-financial corporates yield index; residual maturity 3-5 years; and 3-year German government benchmark bond yield. Source: ECB Financial Market Data; data set mnemonic [FM]. No further transformations.
- European HY bond index: Bloomberg Barclays Pan-European High Yield (Euro) TR Index Value Unhedged EUR. Source: Bloomberg; mnemonic [LP02TREU:IND]. Transformed to logs.
- US HY bond index: Bloomberg Barclays US Corporate High Yield Total Return Index Value Unhedged USD. Source: Bloomberg; mnemonic [LF98TRUU:IND]. Transformed to logs.
- EA industrial production: Industrial production for the euro area; total industry (excluding construction) - NACE Rev2; monthly index. Source: ECB Short-Term Statistics; data set mnemonic [STS]. Transformed to annual growth rates.
- US industrial production: Industrial production index; monthly index 2012=100. Source: FRB of St. Louis FRED; mnemonic [INDPRO]. Transformed to annual growth rates.
- EA inflation: HICP - overall index, monthly index. Source: ECB Indices of Consumer Prices; mnemonic [ICP]. Transformed to annual growth rates.

- US inflation: Consumer Price Index for All Urban Consumers: All Items; monthly index 1982-1984=100. Source: FRB of St. Louis FRED; mnemonic [CPIAUCSL]. Transformed to annual growth rates.

- US bank lending: Commercial and Industrial Loans, All Commercial Banks; outstanding amounts in US Dollar. Source: FRB of St. Louis FRED; mnemonic [BUSLOANS]. Transformed to annual growth rates.

- EA bank lending: Loans reported by monetary financial institutions excluding ESCB in the euro area; outstanding amounts in EUR. Source: ECB Balance Sheet Item Statistics; data set mnemonic [BSI]. Transformed to annual growth rates.

High-frequency data used to construct monetary policy surprise measures:

- 30-day federal funds rate futures: continuous contract for the front month and for delivery in 2, 3, 4 months; daily frequency; basis points. Source: Bloomberg; mnemonic [FF Comdty].

- Eurodollar futures: continuous contract for delivery in 6, 9, 12 months; daily frequency; basis points. Source: Bloomberg; mnemonic [ED Comdty].

- US Treasury rates: 2, 5, 10-year treasury constant maturity rate; daily frequency. Source: FRB of St. Louis FRED; mnemonic [DGS].

- S&P 500 equity stock index: daily frequency. Source: Bloomberg; mnemonic [SPX:IND].

A.2 Additional overview charts

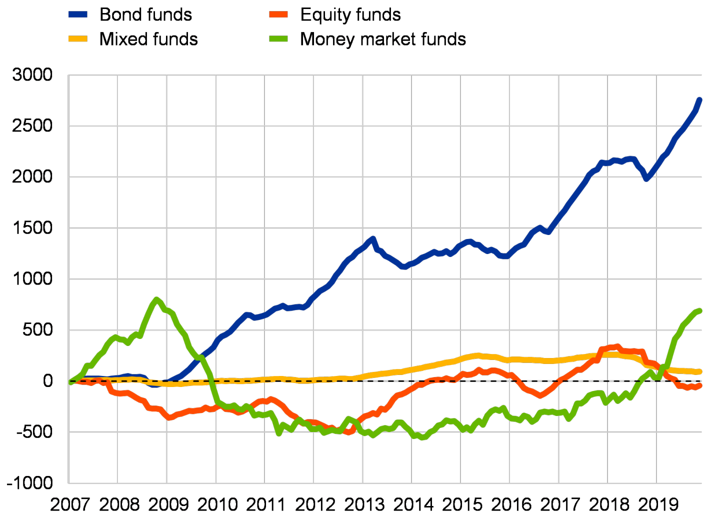


Figure 18: Cumulative global investment fund flows

Notes: Cumulative nominal monthly global flows into different investment fund classes relative to April 2007. Axis unit: USD billion.

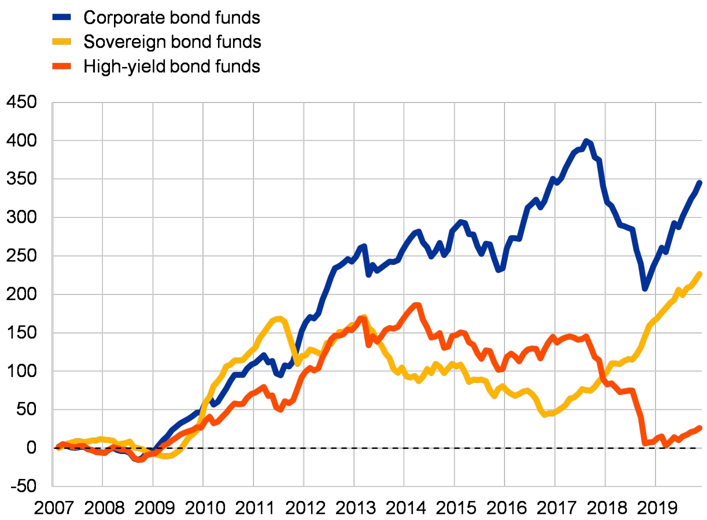


Figure 19: Cumulative global bond investment fund flows

Notes: Cumulative nominal monthly global flows into different bond fund classes relative to April 2007. Axis unit: USD billion.

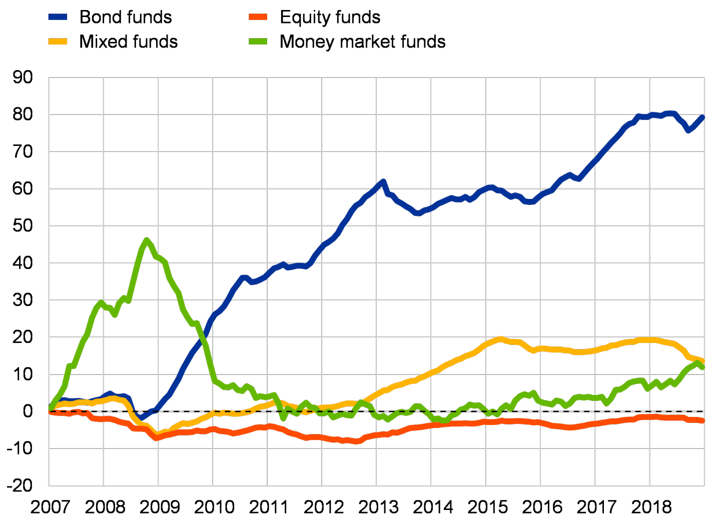


Figure 20: Cumulative percentage global investment fund flows

Notes: Cumulative monthly global flows into different investment fund classes as a percentage of lagged assets under management relative to April 2007. Construction follows methodology by EPFR Global. Variables as used in BVAR models in Section 4. Axis unit: percentages.

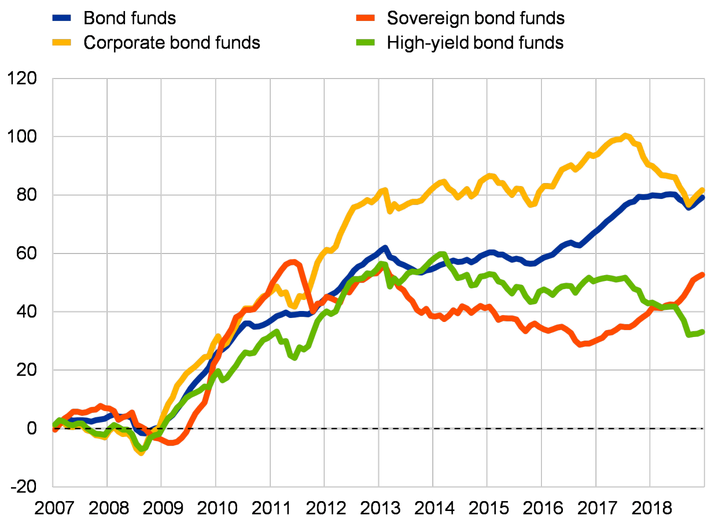


Figure 21: Cumulative percentage global bond investment fund flows

Notes: Cumulative monthly global flows into different bond fund classes as a percentage of lagged assets under management relative to April 2007. Construction follows methodology by EPFR Global. Variables as used in BVAR models in Section 4. Axis unit: percentages.

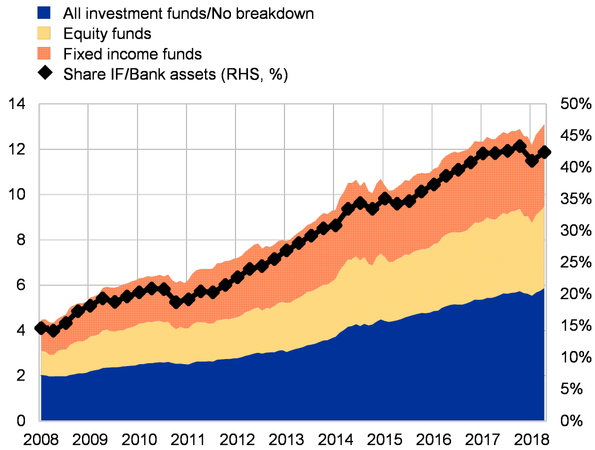


Figure 22: Total assets under management of euro area investment funds

Notes: Left axis unit: EUR trillion. Right axis unit: percentages. Black diamond line shows percentage ratio of total assets of investment funds relative to banks in the euro area.

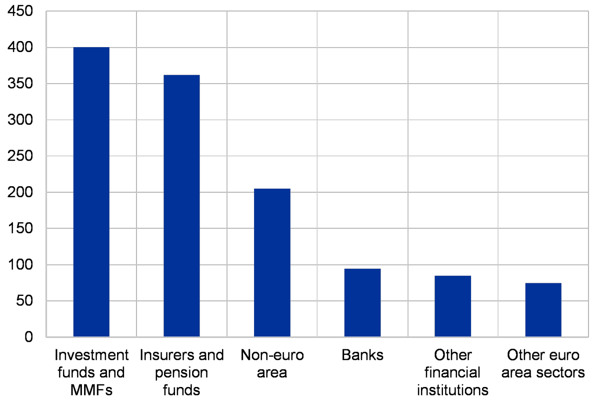


Figure 23: Investor base of bonds issued by euro area non-financial corporations

Notes: Axis unit: EUR billion. Data is shown from the end of 2019.

Data source: ECB Securities Holding Statistics

A.3 Monetary policy shock identification

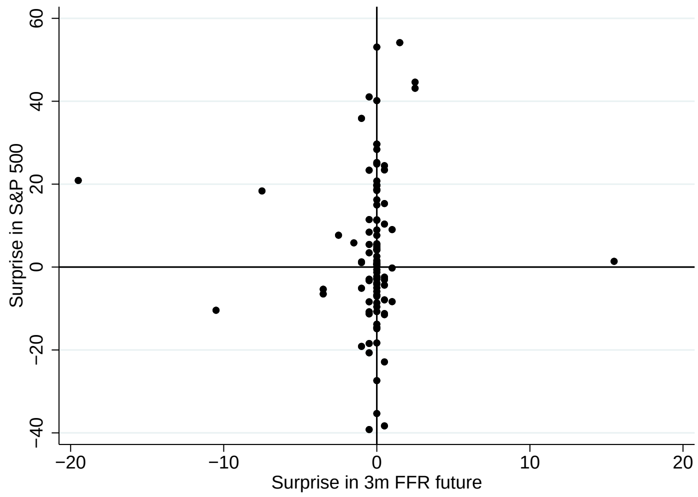


Figure 24: 3-months federal funds rate future and stock price surprises at FOMC announcements

Notes: Horizontal axis in basis points, vertical axis in index points. Each dot represents one FOMC announcement between April 2007 and March 2019.

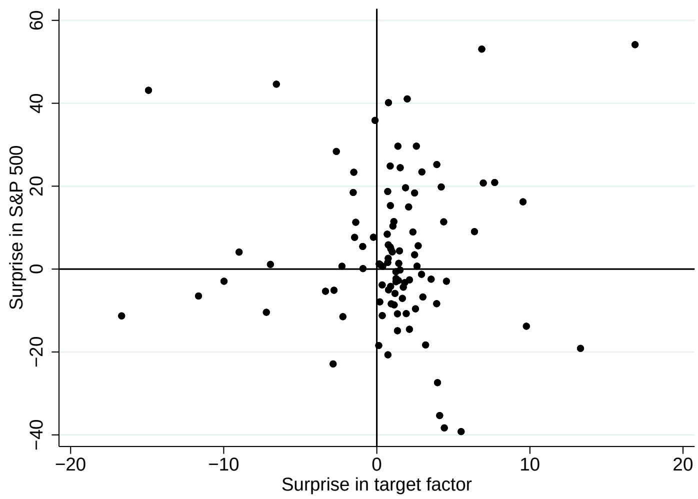


Figure 25: Target factor and stock price surprises at FOMC announcements

Notes: Horizontal axis in basis points, vertical axis in index points. Each dot represents one FOMC announcement between April 2007 and March 2019.

Table 3: Identifying restrictions in VAR model under Jarociński-Karadi method

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

Notes: The table shows restrictions on the contemporaneous responses of variables to shocks to implement the identification method by Jarociński and Karadi (2020). +, -, and 0 denote sign and zero restrictions, while • denotes unrestricted responses.

B Additional results

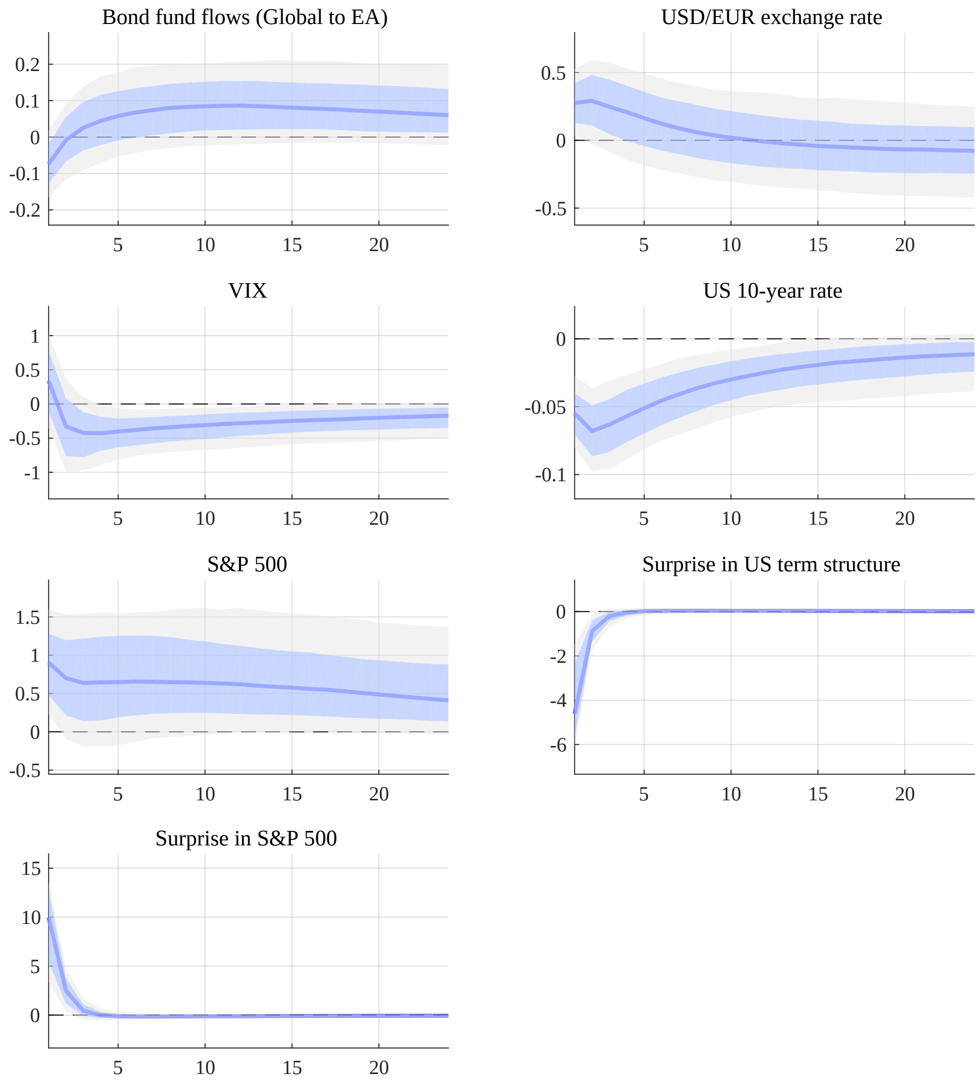


Figure 26: Impulse responses in baseline model for global-to-euro-area investment fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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.

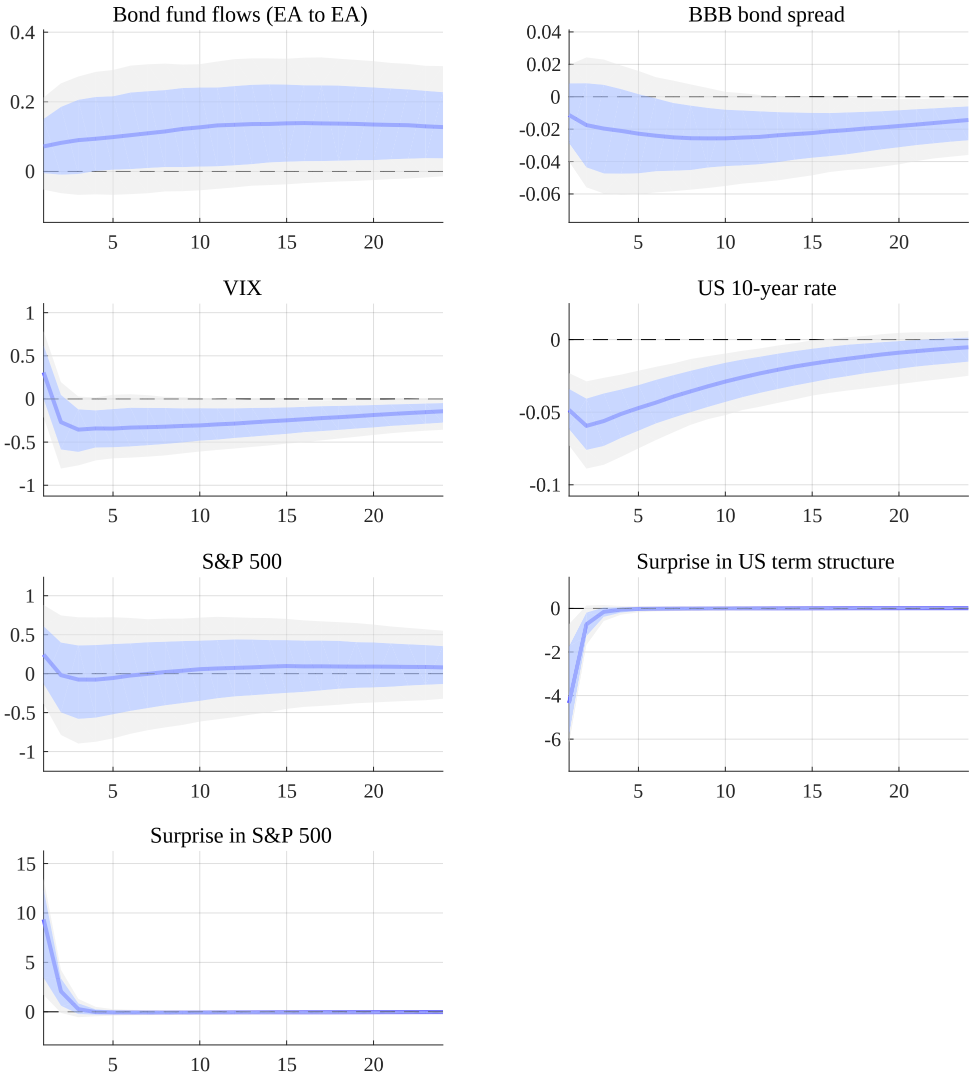


Figure 27: Impulse responses in baseline model for euro-area-to-euro-area investment fund flows

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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.

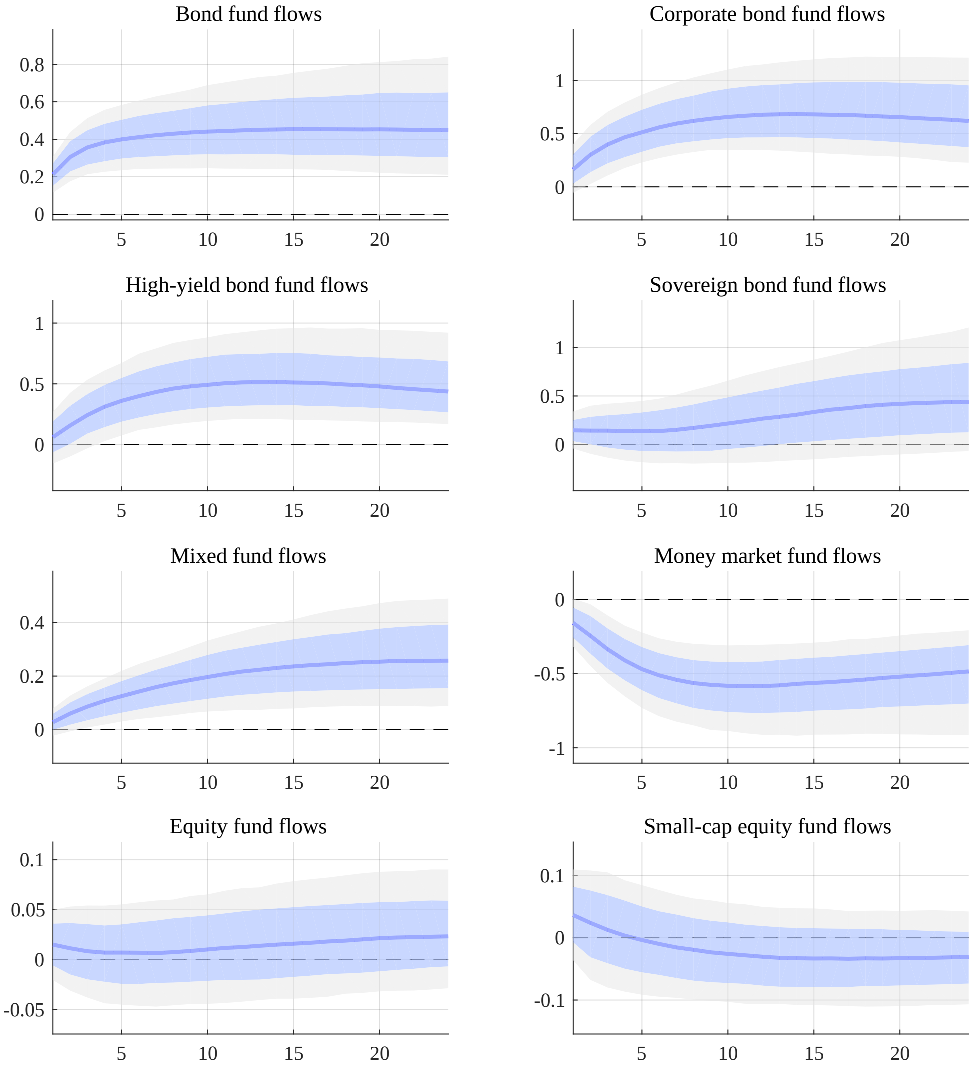


Figure 28: Impulse responses of global investment fund flows with standard high-frequency identification

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 6 bps decrease in the 10-year US Treasury 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. The high-frequency monetary policy indicator (a surprise in US term structure) is ordered first. Each variable is added separately to the baseline model in Figure 16.

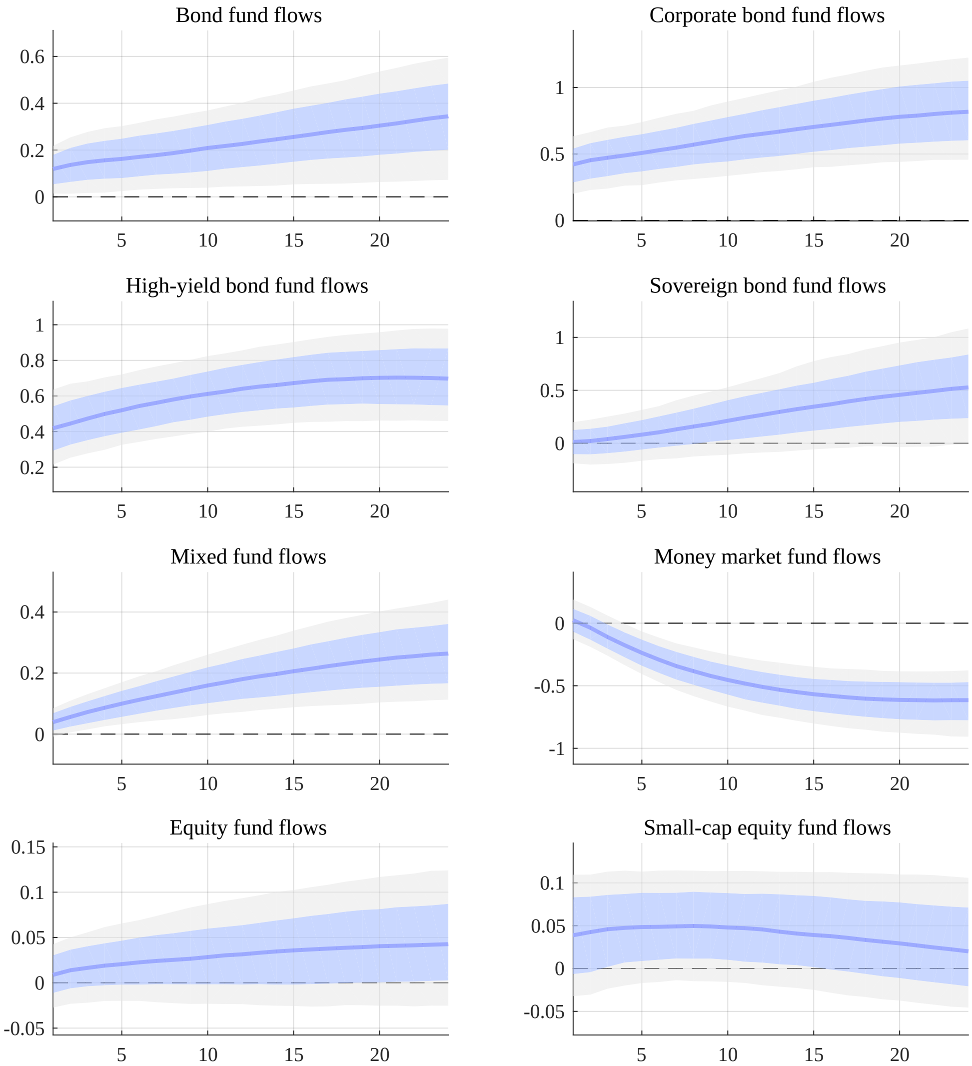


Figure 29: Impulse responses of global investment fund flows with recursive identification

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 1 bps decrease in the 10-year US Treasury 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 Wu and Xia (2016) shadow federal funds rate is used as the monetary policy indicator and is ordered first. Each variable is added separately to the baseline model in Figure 17.

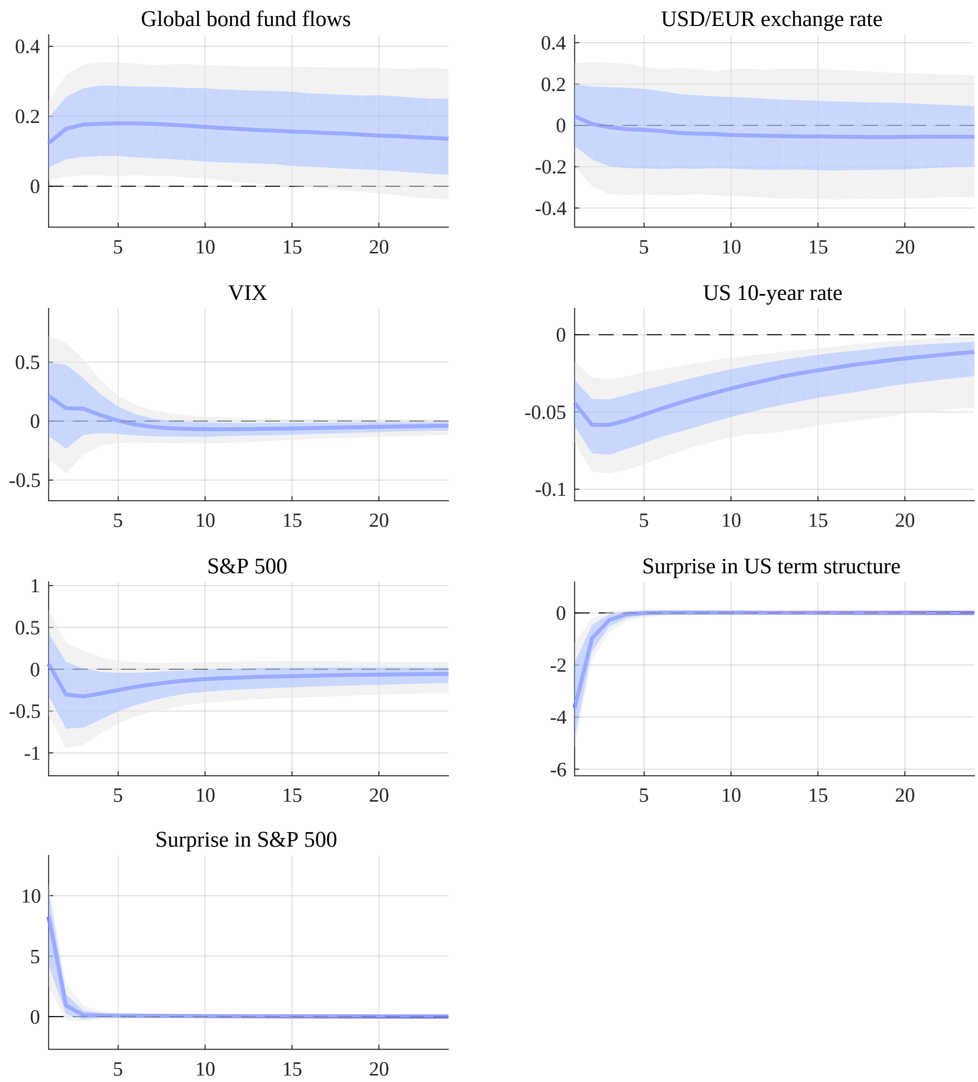


Figure 30: Impulse responses in baseline model using sample without global financial crisis

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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. The sample starts in June 2009 when the US recession resulting from the global financial crisis was declared to be over.

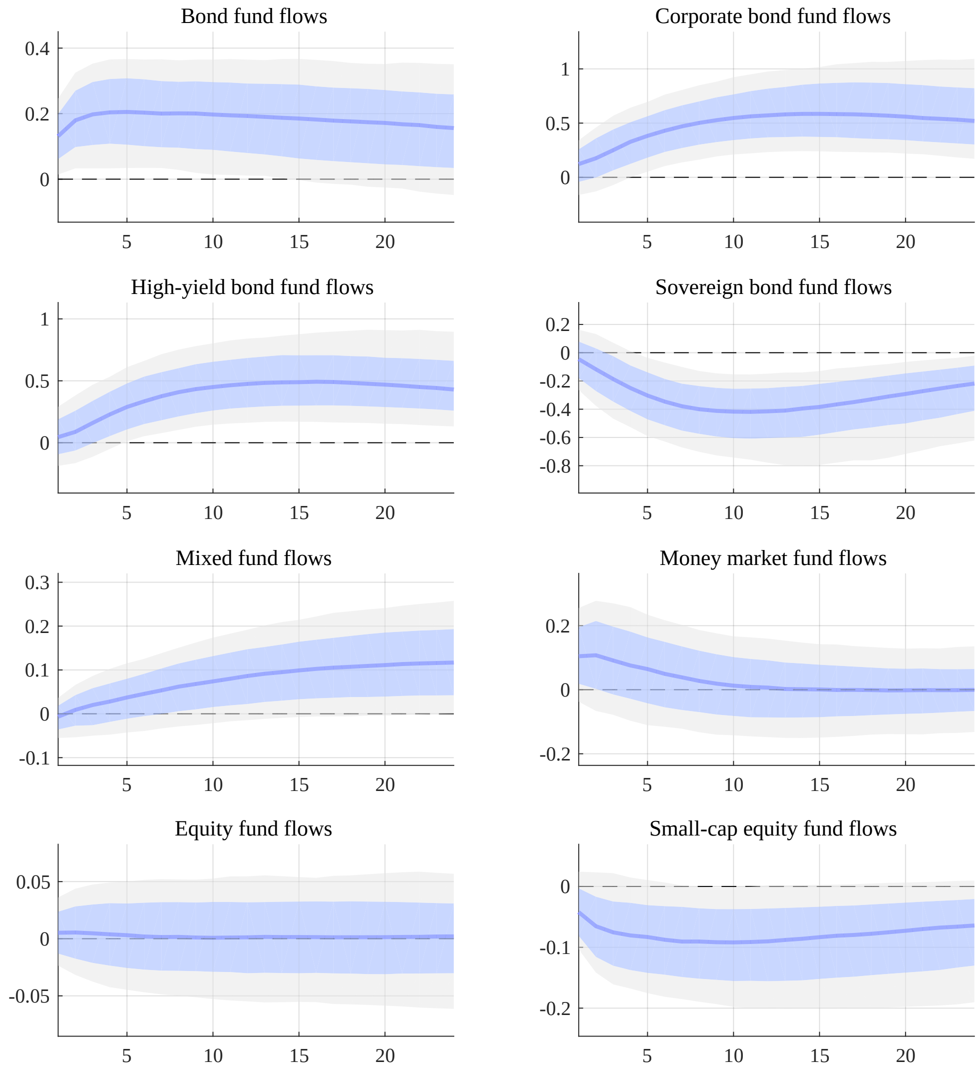


Figure 31: Impulse responses of global investment fund flows using sample without global financial crisis

Notes: Impulse responses to an expansionary US monetary policy shock inducing a 5 bps decrease in the 10-year US Treasury 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 is added separately to the baseline model in Figure 30. The sample starts in June 2009 when the US recession resulting from the global financial crisis was declared to be over.

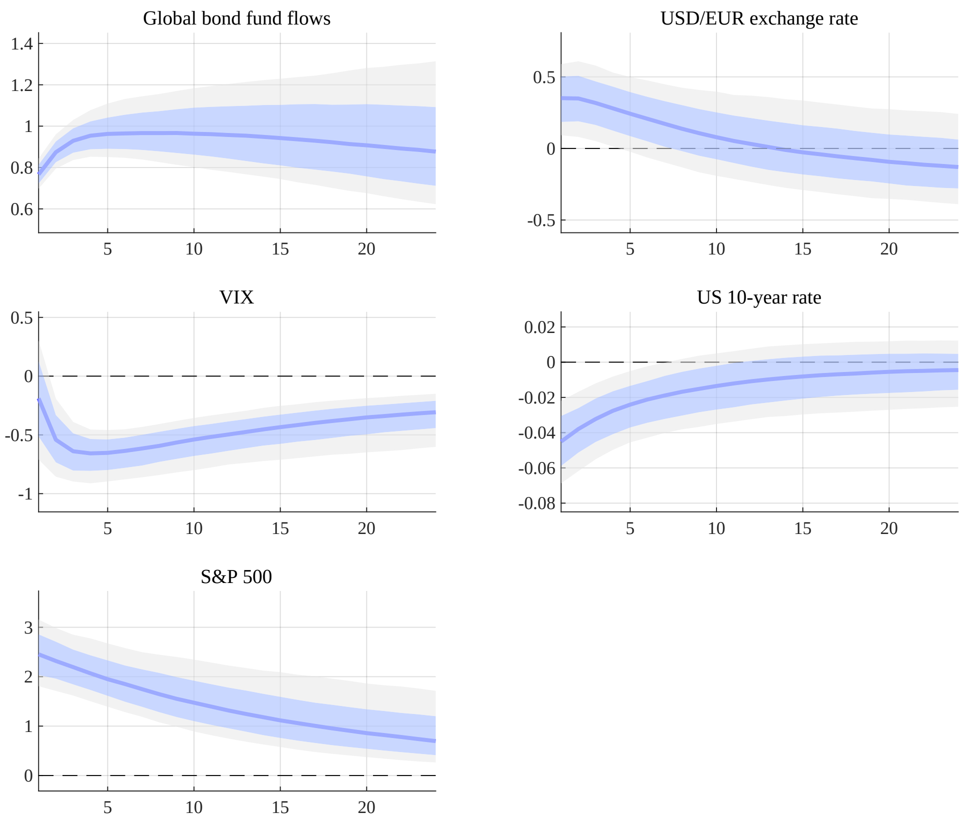


Figure 32: Impulse responses to a global bond fund flow shock in the baseline model

Notes: Impulse responses to an inflow shock to global bond funds (blue lines) with 68% (blue-shaded areas) and 90% (grey-shaded areas) credibility intervals obtained from a structural BVAR with Cholesky recursive identification. Global bond fund flows are ordered first.

Acknowledgements

I wish to thank Lorenzo Cappiello, Sujit Kapadia, Benedetta Bianchi (discussant), Katharina Cera, Marek Jarociński, Daniel Kapp, Angela Maddaloni, Giulio Nicoletti, Katharina Plessen-Matyas, Björn van Roye, Fabrizio Venditti, Carolina Villegas-Sanchez, Christian Weistroffer, and an anonymous referee, as well as conference and seminar participants at the European Central Bank, the European Economic Association Annual Congress 2020, the German Economic Association (VfS) Annual Congress 2020, the ESCB IRC Expert Network on Financial Flows 2019, and the Econometric Society European Winter Meeting 2019 for helpful comments and suggestions. The views expressed in this paper are those of the author only and do not necessarily reflect the views of the European Central Bank or the Eurosystem.

Christoph Kaufmann

European Central Bank, Frankfurt am Main, Germany; email: christoph.kaufmann@ecb.europa.eu

Postal address 60640 Frankfurt am Main, Germany
Telephone +49 69 1344 0
Website www.ecb.europa.eu

PDF ISBN 978-92-899-4406-9 ISSN 1725-2806 doi:10.2866/493883 QB-AR-20-141-EN-N