Essays on Monetary Policy, Non-Bank Financial Intermediation and Financial Stability

Doctoral Thesis
submitted to Justus Liebig University Giessen,
Department of Economics and Business Studies

1*st* Supervisor: Prof. Dr. Peter Tillmann
2*nd* Supervisor: Prof. Dr. Andreas Walter

Anisa Tiza Mimun

March 2025

Preface

This dissertation provides an empirical examination of the relationship between monetary policy and non-bank financial intermediaries, commonly referred to as non-banks. During my undergraduate studies in Frankfurt, I developed a deep interest in the then-emerging topic of shadow banks. This curiosity led me to explore further and understand how they could potentially impact the financial landscape. Could they be the catalyst for the next global financial crisis? What factors have fueled their remarkable growth over the past decade? My journey into this field began with an internship in September 2016, where I conducted my very first research on the subject. Although it was a small start, it sparked my passion and led me to continue studying this area. At that time, I often found myself explaining the concept of shadow banks to others. Fortunately, this topic has since gained significant attention, with central banks and financial institutions worldwide examining this sector in detail. This increased focus has allowed me to connect with many professionals in the field, which has influenced my research in a great way. The papers included in this dissertation present insights into how monetary policy has influenced the growth of non-banks. The first paper examines the heterogeneity within investment funds. My co-author Prof. Peter Tillmann and I analyze different investment funds types such as equity funds, bond funds, and hedge funds. Our findings reveal that monetary policy impacts these funds differently, with quantitative easing (QE) notably leading to an increase in investment funds.

In the second paper, my co-authors and I broaden our scope to include the entire financial system, including both banks and the diverse universe of non-bank financial intermediaries like investment funds, money market funds, insurance companies, and pension funds. By incorporating the element of financial stress, we present empirical evidence that monetary policy has a heterogeneous impact on banks and non-banks. For instance, after a monetary contraction, banks tend to reduce their credit activities, whereas non-banks interestingly increase their lending. This finding is particularly exciting to me, as it potentially holds substantial implications for the transmission of monetary policy within the euro area.

The third paper studies the dynamics between monetary policy and investment funds, introducing the element of macroprudential policy. We engage in the ongoing debate over whether increased banking regulation leads to increases in the total assets of investment funds. Interestingly, our observations reveal a nuanced answer: in financially conservative countries such as Germany and France, investors appear more sensitive to macroprudential policies, and as a consequence, they refrain from shifting their portfolios towards non-bank entities. Conversely, financial hubs like Ireland and Luxembourg attract investment fund inflows in response to a tightening monetary-macroprudential policy interplay.

In the forth paper, my co-author and I construct a perception index to gauge how

the ECB publicly discusses non-banks. We categorize the perception as negative when it calls for regulation and positive when it acknowledges existing regulations. Including our perception index into the analysis of non-bank monetary policy transmission, we find that while a pure monetary policy shock causes non-bank entities to decrease, a central bank information shock increases non-bank fund types. Therefore, we conclude that the ECB's negative perception of non-banks amplifies the negative impact of a monetary policy shock but is outweighed by the positive effects of a central bank information shock. This paper highlights the importance of the ECB's perception of non-banks in the transmission of monetary policy in the euro area.

I wish to conclude the preface of my dissertation with heartfelt acknowledgments. First and foremost, I extend my sincere gratitude to my supervisor, Prof. Dr. Peter Tillmann. His profound influence on my work and my journey to becoming an economist has been invaluable, teaching me to ask the right questions, to focus on details, and to take decisive action. I would also like to thank my second supervisor Prof. Dr. Andreas Walter for his helpful feedback. Finally, I also extend special thanks to my co-authors for the opportunity to work with and learn from their expertise. Additionally, I am grateful to my colleagues at the Chair of Monetary Economics of the Justus-Liebig University Giessen, as well as my colleagues at the European Central Bank. Thank you for providing a pleasant working environment filled with laughter and stimulating discussions that have made my work truly enjoyable.

Lastly, I want to express my deepest appreciation to my family and close friends, especially my mother Yamina, my father Jamil, and my sister Shahinas. Your endless support and unconditional love have always motivated me to pursue my dreams, and I owe you everything. I also carry with me the cherished memory of my grandparents, who, despite no longer being with us, continue to offer me special support and inspiration in my pursuit of my goals. This thesis is dedicated to them.

Table of Contents

The heterogeneous effects of monetary policy on investment funds in the euro area*

Peter Tillmann
Justus-Liebig University Giessen

Anisa Tiza Mimun
Justus-Liebig University Giessen

February 21, 2025

Abstract

This paper examines the effects of monetary policy on investment funds in the euro area, which is the largest part of the non-bank financial intermediation sector. We distinguish between different monetary policy shocks and estimate the effects of monetary policy surprises on the stock of fund assets of different funds types. We find that the responses of these types of funds are heterogeneous. Fund assets respond ambiguously to monetary policy that changes the short end of the yield curve. In contrast, policies that shift the long end of the yield curve are very effective and reduce the size of the investment fund sector. This suggests that the investment funds sector is particularly sensitive to news about the *path* of future monetary policy. This effect is particularly strong for more risky funds, such as hedge funds.

Keywords: Non-bank financial intermediation, monetary policy shocks, high-frequency identification, local projections

JEL classification: E44, G23

*We thank David Finck, Christoph Kaufmann, Fédéric Holm-Hadulla, Carsten Lehr, José-Luis Peydró and Erik Theissen for helpful comments that helped to improve this paper. We thank David Finck for sharing his MATLAB toolbox for the estimation of local projections. Participants at the MAGKS Doctoral Colloquium, at the Barcelona School of Economics Summer School Course in Empirical Banking, at the Annual Research Conference of the Frankfurt Institute for Risk Management (FIRM), at the 2nd Workshop on Applied Macroeconomics at University of St. Gallen, and at the ifo Dresden Workshop on Macroeconomics and International Finance provided helpful feedback. Financial support from FIRM is gratefully acknowledged.

1 Introduction

The non-bank financial intermediation sector in the euro area has gained much attention over the last decade. After the global financial crisis, concerns about its role in the massive build-up of risks and the resulting instabilities have risen. The European Systemic Risk Board routinely monitors the non-bank financial sector and evaluates potential risks. The empirical literature analyzing the link between the size of the non-bank sector and the build-up of risk, and more specifically systemic risk, tends to find evidence for a positive link (Jin and Nadal Da Simone,2020; Pellegrini et al., 2022).

Monetary policy is an important determinant of the size and properties of the non-bank financial sector[1] With investment funds accounting for the largest element of the non-bank sector, the response of the investment funds sector to changes in monetary policy is particularly interesting, as recently emphasized by Schnabel (2021). Therefore, we put our focus on investment funds and use them as a proxy for the non-bank sector in our analysis (see also Cappiello et al., 2021).

This paper contributes to the literature on monetary policy and the investment funds sector in the euro area. We build on the recent literature, i.e. Jin and Nadal De Simone (2020), Giuzio et al. (2021), Holm-Hadulla et al. (2023) and Kaufmann (2023), which we will review in separate section below, and estimate the response of investment funds assets to identified monetary policy shocks. Specifically, we extend the work by Giuzio et al. (2021) and Holm-Hadulla et al. (2023) in two directions. We differentiate between different types of investment funds, i.e. equity funds, bond funds, real estate funds, and hedge funds, among others as classified by the ESA (2010). This allows us to see whether funds with different investment strategies and risk profiles respond differently to news about monetary policy. In addition, we also differentiate the funds sector in terms of the euro area country in which funds reside. This allows us to see whether funds in different countries respond differently to a common monetary policy impulse.

We obtain two key findings. The first is that not all types of monetary policy shocks have the same effect on the investment funds sector. While the monetary shocks

[1]With regard to the specific role monetary policy could play in risk-related dynamics and hence the possible contribution to financial instabilities in financial intermediation, much work has been done (Adrian and Shin, 2010; Brunnermeier and Sannikov, 2012; Jimenez et al. 2014).

we use in this paper are all based on the high-frequency responses of bond yields around ECB decisions, they differ in the maturities of yield changes incorporated. We find that shocks derived from the change in the long end of the term structure of interest rates are more effective in driving assets compared to shocks based on the short end of the yield curve. This implies that the funds sector is particularly sensitive to shifts in the *path* of monetary policy, but not so much to shifts in the current stance of policy. A policy tightening as reflected in the change in long-term bonds or an increase in the QE factor causes a drop in fund assets. The effect of path-related policy shock, e.g. a higher QE factor, is particularly strong for more risky fund types such as hedge funds. This is consistent with the notion that expansionary monetary policy leads households to reallocate their portfolios and engage more in riskier fund types. Our finding also supports the searching-for-yield literature (Rajan, 2005), which has provided an empirical relation between loose monetary policy and investors' willingness to take risks.

In the context of unintended negative side-effects of monetary policy and potential financial instabilities, our results could be taken as an additional ground to build stronger and tailor-made macroprudential policies to specifically address the specific risks associated with different types of investment funds and the non-bank financial sector in general.

The structure of the paper is built as follows. In the second section, we survey the related literature. Section three introduces the data set and section four explains the empirical methodology. Section five discusses our main findings, while section six concludes.

2 Related literature

This paper contributes to the emerging literature on the effects of monetary policy on the non-bank financial sector. Holm-Hadulla et al. (2023) study the heterogeneous reactions of banks and non-banks to monetary policy shocks. The authors also proxy the size of the non-bank financial sector by the size of the balance sheets of investment funds. Also using high-frequency data in a local projection analysis, they find a negative impact of a monetary policy tightening on investment fund flows. However, the authors study the aggregate investment funds sector only. We

go one step further and provide evidence about the specific responses of different funds types as well as the reactions on a country-level. Kaufmann (2023) also studies the impact of monetary policy on investment funds. He studies the transmission of U.S. monetary policy on European investment funds using a structural Bayesian VAR model. His main results suggest that loose monetary policy in the U.S. contributes to higher investment funds inflows, particularly into equity and debt funds. Giuzio et al. (2021) also present an analysis of the transmission of monetary policy on euro area investment funds. This analysis differs from ours in terms of the method used as well as the investment funds included in the estimation sample. The authors employ a Bayesian VAR model combined with a monetary policy shock identification following Jarocinski and Karadi (2020) using high-frequency data. Hence, they exploit the joint reactions of stock prices and bond yields in order to identify both a conventional monetary policy shock and an information shock. Their work mainly focuses on three different investment funds sub-categories, i.e. bond funds, money market funds and equity funds. The authors find empirical evidence suggesting a link between expansionary monetary policy shocks and fund inflows. Interestingly, they also find empirical evidence suggesting that fund inflows into riskier asset classes increase more than proportionally. Jin and Nadal De Simone (2020) analyse the impact of monetary policy on systemic risk taking of investment funds in the euro area. According to their findings, bond funds, mixed funds and real estate funds are those funds that are most affected by systemic risk-taking following a monetary policy shock. Their findings support ours in the sense that different funds types do react heterogeneously to monetary policy shocks and engage more in risk following loose monetary policy. Similar results are provided by Banegas et al. (2020). These authors employ a VAR model integrating a high-frequency identification of a monetary policy shock. They find evidence supporting the view that monetary policy shocks impact fund performance and funds inflows, but also that monetary policy seems to have a heterogeneous impact across funds' investment models.[2]

[2]Turning to the euro area, Hau and Lai (2016) also present empirical evidence on the impact of euro area monetary policy on asset allocation, and more generally equity and money markets. Employing a hands-on country-level regression analysis, they found that loose monetary policy leads fund managers to reallocate their portfolios from relatively safe money market funds to riskier equity market funds.

Also related to this literature strand, Nelson et al. (2016) investigate the overall impact of the Fed's monetary policy on the NBFI sector in the U.S. Employing a time-varying VAR model using flow of funds data, they find that a contractionary monetary policy shock has a positive impact on the increase of the assets of shadow banks. The impact on the assets of conventional banks, however, is negative. Hodge and Weber (2023) also document a heterogeneous effect of monetary policy on financial institutions with different characteristics. Using high-frequency data, they show that a policy tightening reduces the assets of shadow banks reliant on long-term funding but expands assets of shadow banks reliant on short-term funding.

3 The NBFI sector in Europe

The measure of the NBFI sector in the euro area is not trivial. Therefore, we follow the definition provided by the European Stability Risk Board (ESRB, 2016), according to which the NBFI sector can be split into two main parts: investment funds and other financial institutions.

3.1 NBFI and investment funds

The investment funds sector has experienced the largest increase over the last years, therefore we decide to employ proxies reflecting this particular sector into our analysis (Cappiello et al., 2021). Concretely, we differentiate between six subcategories of the investment funds sector, i.e. bond funds, equity funds, hedge funds, real estate funds, other funds, and mixed funds.

Each sub-category allocates its investments into a particular type of assets, i.e. equity funds mainly into equities, bonds funds mainly into bonds and so on. Moreover, concerning mixed funds and hedge funds, not only the type of assets they are primarily invested in but also the specific investment strategy they follow is of particular interest and can be highly heterogeneous across specific funds. Despite the vast heterogeneity in individual fund profiles, in particular with respect to the degree of risk taking, we believe it is reasonable to study the aggregated response of hedge funds in order to gain insights into the overall dynamics following

a monetary policy shock.

3.2 Data on investment funds

The specific data we use for the investment funds sector in our analysis is obtained from the ECB's Statistical Data Warehouse (SDW) and refers to the total assets held by a specific funds type (equity funds, bond funds, hedge funds, real estate funds, other funds and mixed funds) located in the euro area. The data contains information about the stock of assets at the end of a month, referred to as stock data, and the net acquisition of assets in a given month, referred to as flow data.[3] The aggregated balance sheet of the investment funds sectors used in our analysis contains on the assets side deposits and loan claims, debt securities, equity, investment funds' shares, non-financial assets and financial derivatives. The liabilities, on the other hand, include received loans and deposits, investment funds' shares issued financial derivatives. Interestingly, bond funds hold the largest part of debt securities whereas investment funds' shares are mainly held by mixed funds. Further, mixed funds also hold the largest part in deposits and loan claims. Concerning the liability side, real estate funds hold the largest part of loans and deposits received and all three funds types, bond, equity and mixed, hold a relatively similar large part in investment fund shares issued.[4]

All series are at monthly frequency and measured in current euros.[5] Throughout the paper, we use data for the period January 2009 until December 2021, which reflects the latest available data. In our empirical analysis, we use the natural logarithm (times 100) of the stock data and the flow data in percent of the stock of assets as dependent variables. Figure (1) shows the evolution of the stocks. For each fund type, we can spot a strong increase in fund volumes over time. We use the size of the investment fund sector as a proxy for the NBFI sector. Thus, the data is consistent with a strong increase in the NBFI sector over the past decade since the global financial crisis. We also see remarkable differences in the size of

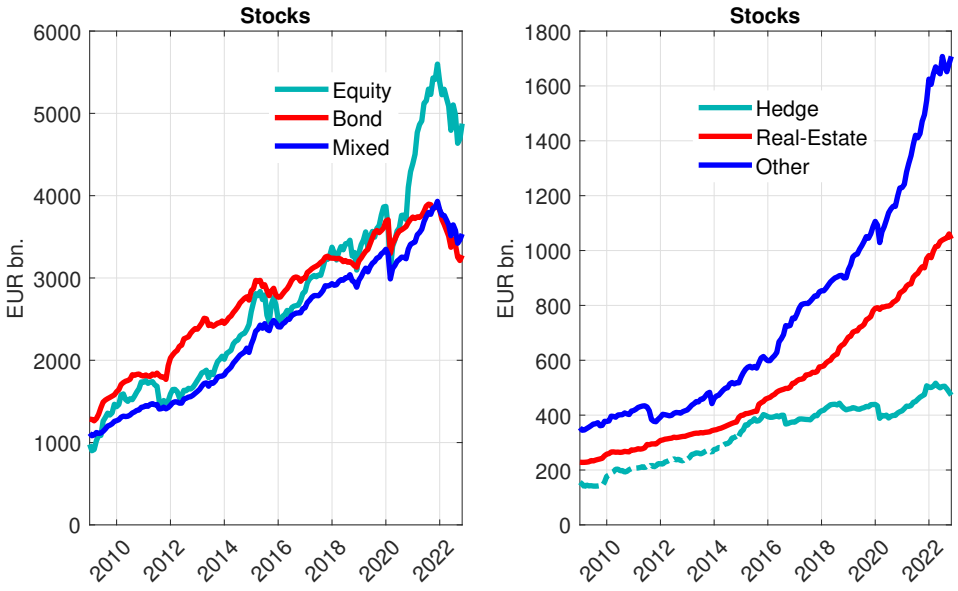
[3]The appendix to this paper contains more information on the data sources.

[4]A more detailed overview can be gained here: https://sdw.ecb.europa.eu/reports.do?node=1000003518.

[5]The stock data for hedge funds exhibits a structural shift in December 2014. We use the pre-2015 growth rates in order to construct the series backwards from the point of the structural break.

the different segments of the investment funds industry: the stocks of assets of equity, bond and mixed funds are much larger than the the assets of hedge funds, real estate funds and other funds. Figure (2) depicts the corresponding flows in percent of the stocks.

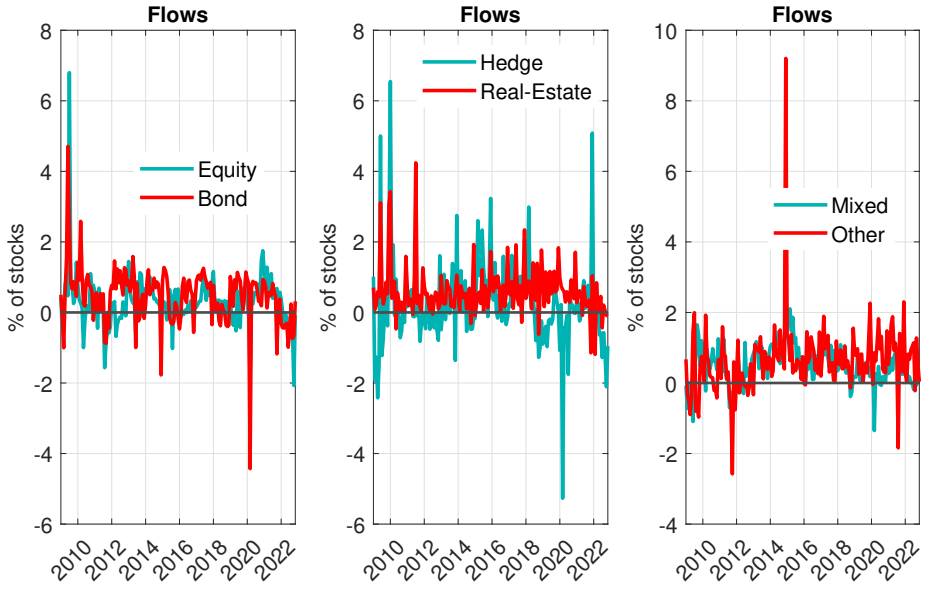
Figure 1: The stock of assets of different fund types



Notes: The figure shows the stock of assets of different types of investment funds located in the euro area. See Table (1) for the data sources. The series for hedge funds before December 2014 (dashed line) was corrected for a one-time structural shift.

Below, we also study the size of the investment fund sector at the country-level. The ECB's SDW offers monthly series on the aggregate stock of assets for all investment funds located in France, Germany, Ireland, Luxembourg, and the Netherlands. This data is shown in Figure (3). The reason why we also take a country-level perspective is that the dynamics of the fund sectors differ across euro area countries as a results differences in regulation and taxation.

Figure 2: The flow of assets into different fund types



Notes: The figure shows the flows of assets into different types of investment funds located in the euro area. See Table (1) for the data sources. The series for hedge funds before December 2014 was corrected for a one-time structural shift.

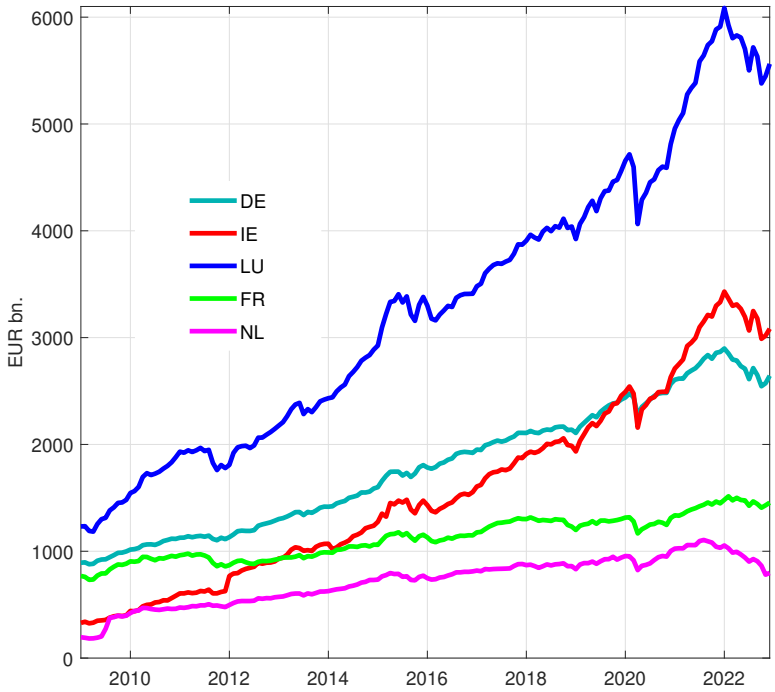
4 Econometric methodology and identification

This section introduces the empirical methodology we apply to analyse the effects of monetary policy on the size of the investment funds sector. Specifically, we follow Jordà (2005) using local projections and identify monetary policy with high-frequency information. In local projections, we regress a dependent variable y_{t+h} at different horizons $t+h$ for $h = 0, 1, \ldots, H$ on a driving variable dated t conditional on a set of control variables

$$y_{t+h} = \alpha_h + \beta_h shock_t + \gamma_h X_t + e_{t+h}, \tag{1}$$

where y_{t+h} is the variable of interest, i.e. either stocks or flows into a specific fund type, X_t is a vector of control variables, and $shock_t$ is the identified structural monetary policy shock. The residuals are e_{t+h}. We are interested in the coefficient β_h, which can be seen as the response of the respective dependent variable at $t+h$

Figure 3: The stock of assets of funds located in different countries



Notes: The figure shows the stock of assets of investment funds located in the different euro area countries. See Table (1) for the data sources.

to the shock in t. The sequence of the estimated β_h coefficients as a function of h is the impulse response function. We expect β_h to be negative, such that a monetary tightening leads to a drop in fund volumes or a fall in fund flows.

In our baseline application, the dependent variable is either the log of the fund volume (multiplied by 100) or the ratio of fund flows to fund volume. Both dependent variables are available for six different types of funds. In an extension, we also use the size of the funds sector in selected euro area countries, which we introduced before, as the dependent variable.

The set of control variables summarized in X_t includes four lags of the monetary policy shock, the dependent variable, industrial production (in logs), consumer prices measured by the Harmonized Index of Consumer Prices (in logs), stock

prices as measured by the EuroSTOXX50 index (in logs), stock market volatility reflected in the VSTOXX (in logs) and financial market stress measured by the (log) CISS index.

The monetary policy shock reflects unexpected changes in monetary conditions. We use the Euro Area Monetary Policy Database (EA-MPD) introduced by Altavilla et al. (2019). This dataset includes intraday changes of asset prices on monetary policy announcement days, i.e meeting days of the ECB's Governing Council. Thus, our analysis is based on policy surprises reflecting the new information revealed on the meeting day. The underlying identification assumption here is that during a relatively tight time window causality goes from monetary policy announcements to asset price changes. The EA-MPD includes interest rate changes around the ECB press release, i.e. between 13:25 and 14:10 CET ("press release window"), and around the post-meeting press conference, i.e. between 14:15 to 15:50 CET ("press conference window"). The "monetary event window" encompasses the two other smaller windows and lies between 13:25 and 15:50 CET. Further, Altavilla et al. (2019) conduct a factor rotation in order to extract this information which allows us to grasp different dimensions of monetary policy decisions. Their first factor is the target factor that has the highest loading on the very short end of the yield curve, i.e. one-month OIS rates, during the press release window. Thus, this factor reflects the immediate policy measures announced in the release, but not announcements about the future policy stance. The timing factor is present only in the press conference window and has the highest loading on one-year OIS rates. It summarizes the new information about the policy in the near future. The forward guidance factor, in contrast, has the larges effect on maturities between two and five years in the press conference window. This factor does not reflect news about the ECB's forward guidance policy only, i.e. the attempt to steer market expectations at the zero lower bound adopted by the ECB in 2013. Instead, this factor reflects all news that drive yields in the intermediate maturity spectrum, whether they result from forward guidance policies since 2013 or not. Put differently, this factor is also present before 2013. The fourth factor, which is also present in the press conference window, is the Quantitative Easing (QE) factor. It summarizes news about large-scale asset-purchase programs and has the highest impact on long-term OIS rates. It is important to stress that all

four factors, i.e. all dimensions of the policy surprises, are normalized such that a positive value is a policy tightening. We will present impulse response for all four alternative factors.

All policy surprises mentioned so far are measured on meeting days of the ECB's Governing Council. Beginning in 2015, the Governing Council changed its meeting frequency from monthly meetings to eight meetings per year. The policy shock, $shock_t$, used in the estimated local projections is either the surprise in a month with a meeting or zero in a month without a meeting, i.e.

$$shock_t = \begin{cases} surp_{t,d} & \text{if Governing Council meeting in month } t \\ 0 & \text{if no Governing Council meeting in month } t \end{cases}$$

where t and d indicate the month and the day of the press conference following meetings of the Governing Council.

5 Results

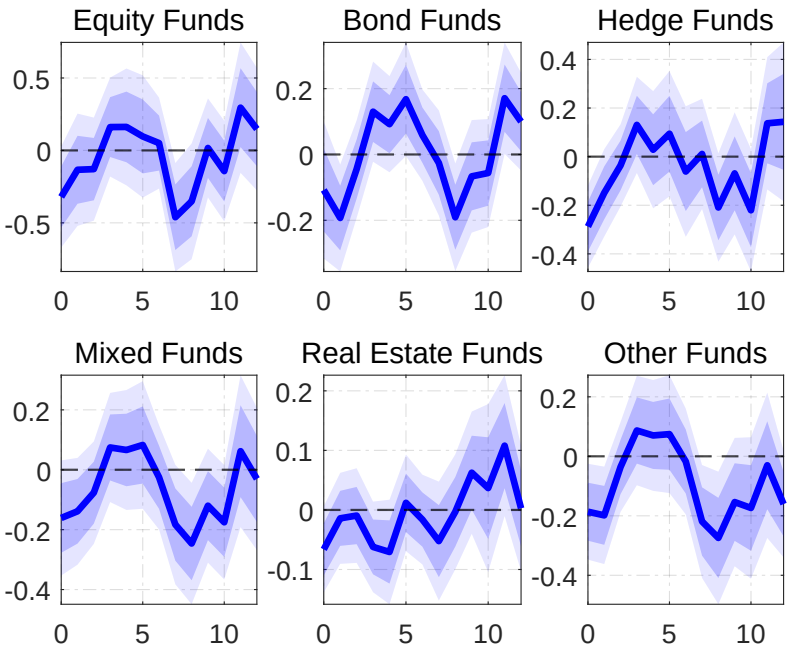
This section presents the results of our estimations where we place a special focus on the responses of the different fund types to monetary policy shocks. The figures show the impulse response functions of total assets or flows for the four different policy factors as the monetary policy shock. Therefore, they plot the estimated β_h coefficients with 68% and 90% confidence bands.

5.1 Fund type-specific responses

We observe that the different funds types react heterogeneously to a monetary policy tightening. The responses of equity and bond funds are ambiguous. Assets increase within five months after the shock and decrease thereafter. This is in line with the effects of the policy tightening being unclear a priori. A similar reaction is observable for mixed funds, which is reasonable since they do invest in the same assets like equity funds and bond funds.

We obtain the most interesting results for hedge funds and real estate funds. Tighter monetary conditions lead to a decline in the size of the hedge funds industry as measured by the size of its balance sheet. However, the effect is significant

Figure 4: Response of total assets to a target surprise



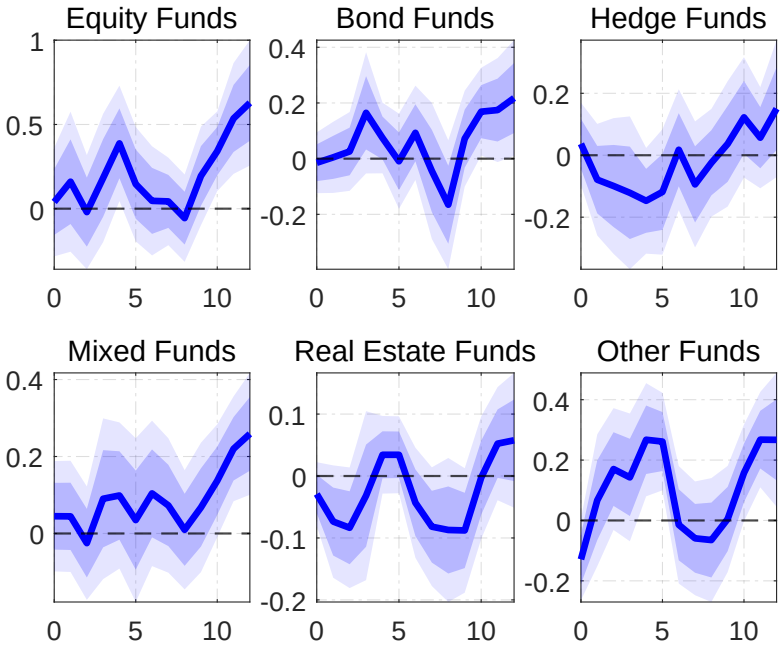
Notes: The figure shows the estimated β_h coefficients when the target factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

only at the 68% level. The real estate fund sector also shrinks as a results of the policy shock. As for the hedge fund sector, however, this response is not statistically significant.

The impulse response functions to a target surprise, see Figure (4), show a consistent reaction of all funds types in the first few months after the shock. The reaction is negative and statistically significant, where equity funds show the strongest reaction at around -0.4%. After about five months, most response become indistinguishable from zero.

The response of the funds types in our sample to a timing surprise is shown in Figure (5). Here, we observe that equity funds, bond funds as well as hedge funds do not react on impact at all. While equity funds and bond funds increase slightly, the reaction of hedge funds decreases constantly within the first five months. A similar negative reaction is observable for real estate funds but this reaction is barely significant. In contrast, other funds react negatively on impact but show a relatively strong increase in assets within the first five months and reaching a peak at round 0.3%. However, few of the responses are statistically significant.

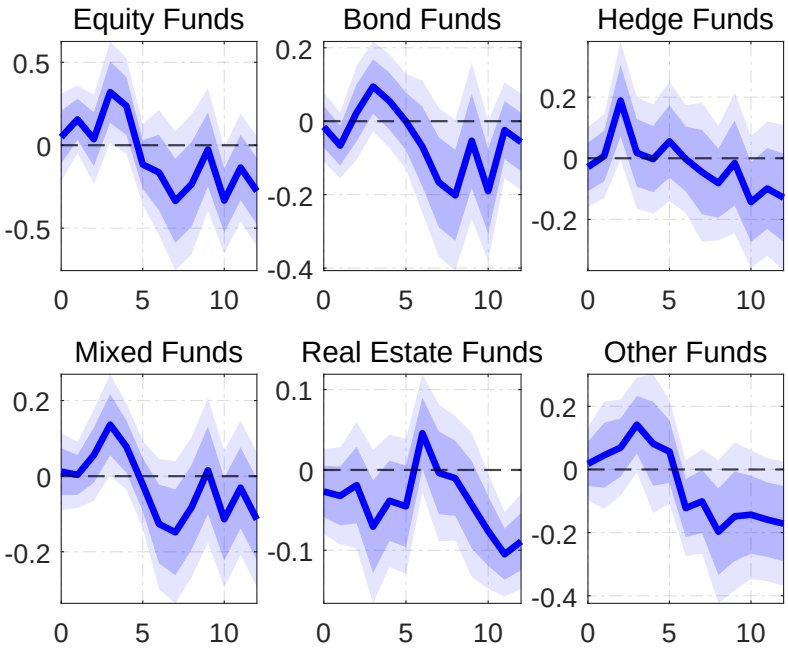
Figure 5: Response of total assets to a timing surprise



Notes: The figure shows the estimated β_h coefficients when the timing factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Similarly, the impulse responses to a forward guidance surprise, see Figure (6), show also a relatively consistent, though rarely significant, reaction. Except real estate funds and bond funds, all remaining funds types show an increase within the first few months. Another consistent reaction is observable for equity funds, bond funds as well as mixed funds. They all show a relatively strong decrease in assets after five months.

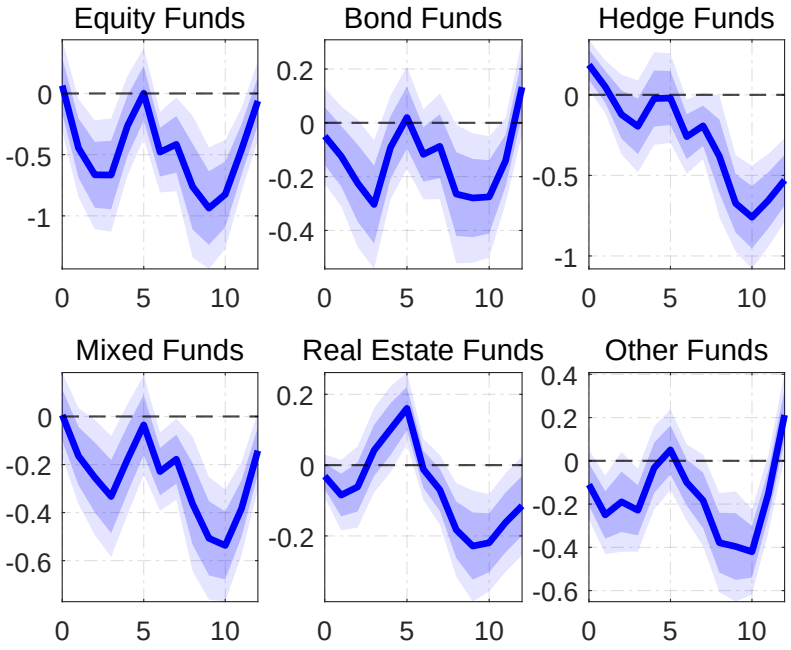
Figure 6: Response of total assets to a forward guidance surprise



Notes: The figure shows the estimated β_h coefficients when the forward guidance factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

The response to the fourth factor, the QE factor, are shown in Figure (7). As expected, this factor, which reflects surprise changes in the long-run policy path, has the clearest and also largest effects on the fund sector. A policy tightening causes a drop in the assets of equity, bond and mixed funds of about 0.2% to 0.5%. For hedge funds, real estate funds and other funds, the fall in assets occurs somewhat later. In each case, however, the shock has the largest impact 10 months after the policy tightening. All these effects are highly statistically significant. Put differently, the ECB impacts the funds' sector not so much through changing the policy rate in the immediate future, but through adjusting the long-term path of monetary policy.

Figure 7: Response of total assets to a QE surprise

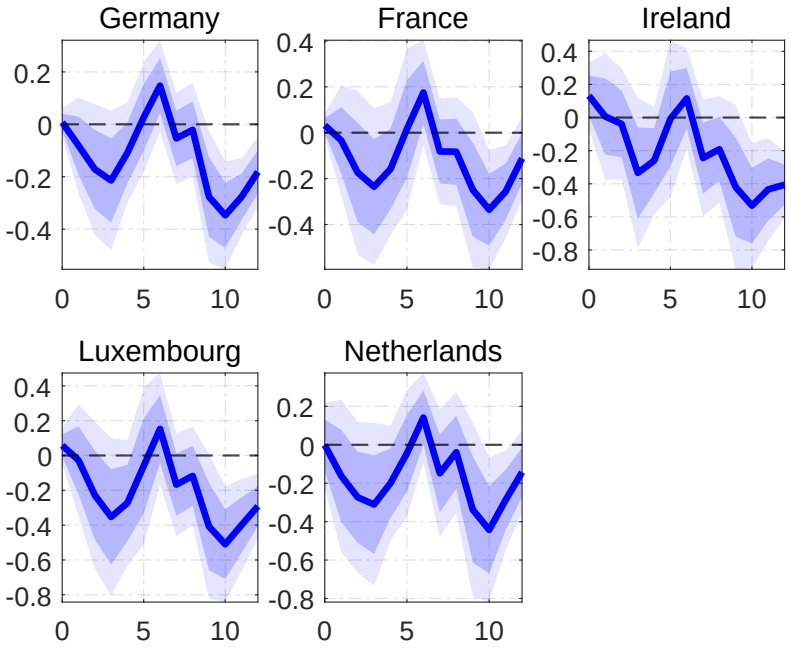


Notes: The figure shows the estimated β_h coefficients when the QE factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

5.2 Country-specific responses

We now shift our focus to the country-level analysis. In line with the fund type-specific responses discussed before, QE surprise also have the largest effect on the country-specific asset series, see Figure (8). Across all five countries, a strong decrease in assets is observable within the first five months. While Germany and France experience a strong drop of around 0.2%, Ireland, Luxembourg, and the Netherlands show an even stronger decrease by about 0.4%, respectively. These results suggest that a surprise shift in the long-end of the yield curve as reflected in QE surprises have asymmetric effects across euro area countries. The results do not, however, allow us to judge whether these difference in the country-specific responses are statistically significant.

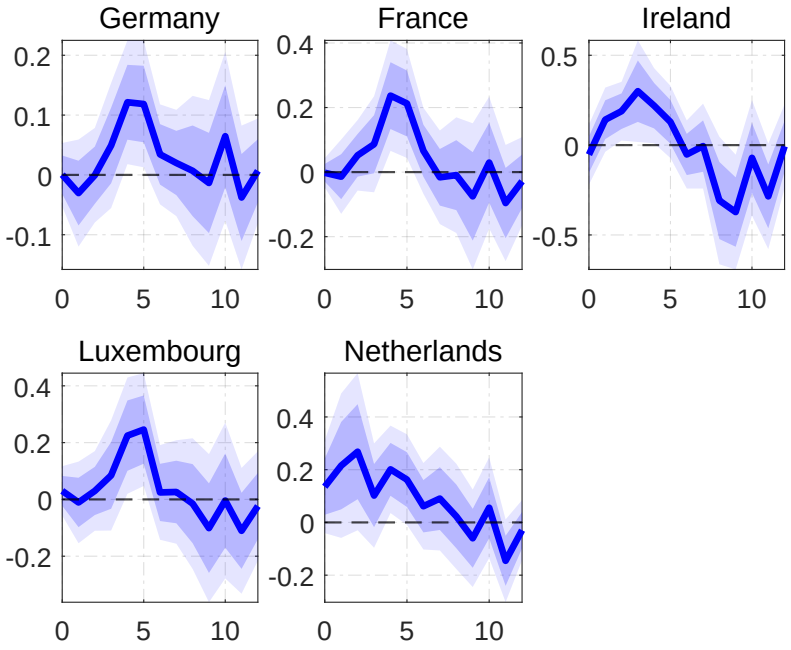
Figure 8: Response of total assets managed in different countries to a QE surprise



Notes: The figure shows the estimated β_h coefficients when the change in the QE factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Interestingly, the impact of forward guidance surprises, see Figure (9), is almost completely flipped compared to the results presented before. We observe an increase in assets across all five countries. Again, Germany shows the weakest reaction in terms of magnitude, while Ireland's reaction is strongest.

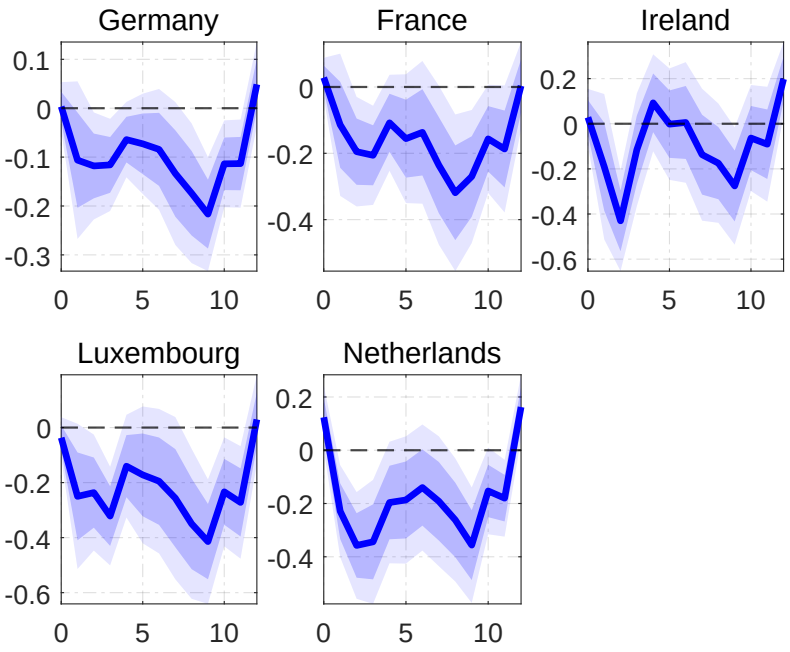
Figure 9: Response of total assets managed in different countries to a forward guidance surprise



Notes: The figure shows the estimated β_h coefficients when the change in the forward guidance factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

The country-level impulse responses to a target surprise, see Figure (10), are relatively similar to those following a QE surprise. This is surprising since the type-specific responses to a surprise at the short-end of the yield curve discussed before remained ambiguous. Ireland, Luxembourg and the Netherlands experience the strongest decrease in assets of about 0.4%. Germany and France, on the other hand, exhibit a drop in investment fund assets that is half as strong.

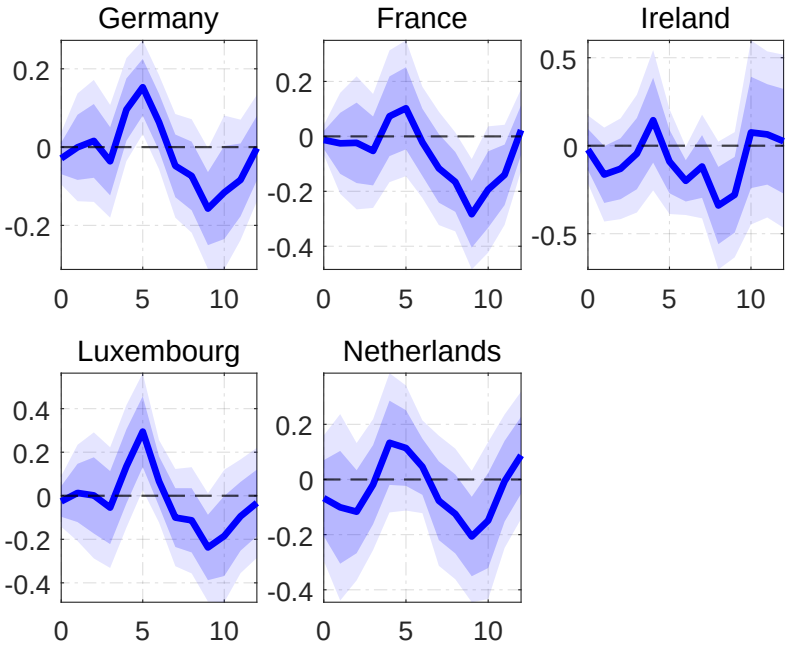
Figure 10: Response of total assets managed in different countries to a target surprise



Notes: The figure shows the estimated β_h coefficients when the target factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Finally, the impulse response functions of our country-level analysis to a timing surprise, Figure (11), show a similar picture as on the funds-level, see Figure (5). Here, we are also not able to observe any clear statistically significant or consistent response.

Figure 11: Response of total assets managed in different countries to a timing surprise



Notes: The figure shows the estimated β_h coefficients when the timing factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

6 Conclusions

This paper aims to quantify empirically the impact of ECB monetary policy on the euro area investment funds sector. In a series of local projections, we estimate the response of various funds types to ECB policy shocks.

Our first key result is that the investment funds sector is particularly sensitive to news about the *path* of monetary policy. A policy tightening that is reflected in a shift in the long-term expectations of the policy path reduces the asset size of the investment funds sector. Surprises reflected in the short end of the yield curve, in contrast, have an ambiguous impact on funds assets. Our second finding is that the impact of monetary policy is heterogeneous on different investment funds types. Therefore, we conclude that investment funds themselves are heterogeneous.

Building on our results, we can draw a few relevant policy implications. First, our results imply that loose monetary policy such as the decade of unconventional monetary policy before 2022, contributes to the expansion on the non-bank financial sector. If this expansion of less regulated sectors of the financial system or sectors with aggressive risk-taking behavior such as the hedge funds industry, the overall riskiness of the financial system could rise. Hence, central banks and supervisory institutions might want to closely monitor the side-effects of expansionary monetary policy in non-banks. However, it should be kept in mind that an expansion of non-bank financial intermediation and risk-taking is an intended consequence of expansionary monetary policy. It remains to spot the fine line between an intended expansion and excessive expansion of non-bank activities.

Therefore, additional instruments such as macroprudential policies might be needed in order to maintain financial stability. For instance, macroprudential instruments that limit excessive liquidity risks or help to mitigate the build-up of risks in the overall investment funds sector could be employed. Further, the interconnectedness of the non-bank sector to the remaining parts of the financial system parts should be monitored since an increase in risk in the non-bank sector could be transmitted to other financial agents and to the real economy.[6]

[6]The literature on investment funds detects some first-round and second-round effects implying potentially larger effects on financial stability (Fricke and Wilke, 2020). However, these articles do not directly analyse the impact of monetary policy and therefore, we do not consider them in this paper.

References

[1] Adrian, T., Shin, H. (2010): Financial Intermediaries and Monetary Economics, Handbook of Monetary Economics, Volume 3, 601-650.

[2] Altavilla, C., Brugnolini, L., Gürkaynak, R., Motto, R., Ragusa, G. (2019): Measuring euro area monetary policy, Journal of Monetary Economics, Volume 108, 162-179.

[3] Bekaert, G., Hoerova, M., Lo Duca, M. (2013): Risk, uncertainty and monetary policy, Journal of Monetary Economics, Volume 60, Issue 7, 771-788.

[4] Banegas, A., Montes-Rojas, G., Siga, L. (2022): The effects of U.S. monetary policy shocks on mutual fund investing, Journal of International Money and Finance, Volume 123, 102595.

[5] Brunnermeier, M., Sannikov, Y. (2014): A Macroeconomic Model with a Financial Sector, American Economic Review, 104 (2), 379-421.

[6] Cappiello, L., Holm-Hadulla, F., Maddaloni, A., Mayordomo, S., Under, R., Arts, L., Meme, N., Asimakopoulo, I., Migiakis, P., Behrens, C., et al. (2021): Non-Bank Financial Intermediation and Key Vulnerabilities. Occasional Paper Series 270, European Central Bank.

[7] EU Shadow Banking Monitor, No 2, May 2017, European Systemic Risk Board, European Central Bank.

[8] EU Non-bank Financial Intermediation Risk Monitor 2022, European Systemic Risk Board (ESRB), July 2022, European Central Bank.

[9] Fricke, D., Wilke, H. (2020): Connected Funds, Deutsche Bundesbank Discussion Paper No. 48/2020.

[10] Giuzio, M., Kaufmann, C., Ryan, E., Cappiello, L. (2021): Investment Funds, Risk-Taking, and Monetary Policy in the Euro Area, ECB Working Paper No. 2021/2605.

[11] Hau, H., Lai, S. (2016): Asset allocation and monetary Policy: evidence from the eurozone, Journal of Financial Economics, Volume 120, Issue 2, 309-329.

[12] Hodge, A., Weber, A. (2023): The Heterogeneous Effects of U.S. Monetary Policy on Non-Bank Finance", IMF Working Paper, No. 23/55, International Monetary Fund.

[13] Holló, D., Kremer, M., Lo Duca, M. (2012): CISS - A Composite Indicator of Systemic Stress in the Financial System, ECB Working Paper Series, No 1426, European Central Bank.

[14] Holm-Hadulla, F., Mazelis, F., Rast, S. (2023): Bank and non-bank balance sheet responses to monetary policy shocks, Economics Letters, Volume 222, 110918.

[15] Jarocinski, M., Karadi, P. (2020): Deconstructing Monetary Policy Surprises – The Role of Information Shocks, American Economic Journal: Macroeconomics, 12 (2), 1-43.

[16] Jimenez, G., Ongena, S., Peydrò, J., Saurina, J. (2014): Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking?, Econometrica, Volume 82, Issue 2, 463-505.

[17] Jordà, Ò. (2005): Estimation and Inference of Impulse Responses by Local Projections, American Economic Review, 95(1), 161-182.

[18] Kaufmann, C. (2023): Investment Funds, Monetary Policy, and the Global Financial Cycle, Journal of the European Economic Association, 21(2), 593–636.

[19] Jin, X., Nadal de Simone, F. (2020): Monetary policy and systemic risk-taking in the Euro area investment fund industry: A structural factor-augmented vector autoregression analysis, Journal of Financial Stability, Volume 49, 100749.

[20] Nelson, B., Pinter, G., Theodoridis, K. (2017): Do contractionary monetary policy shocks expand shadow banking?, Journal of Applied Econometrics, Volume 33, Issue 2, 198-211.

[21] Pellegrini, C., Cincinelli, P., Meoli, M., Urga, G. (2022): The role of shadow banking in systemic risk in the European financial system, Journal of Banking and Finance, Volume 138, 106422.

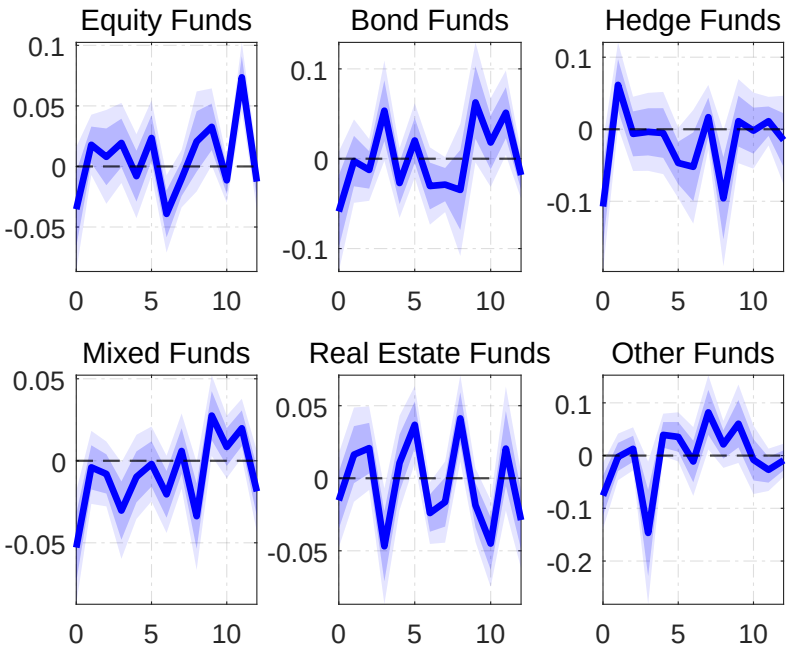
[22] Rajan, R. (2006): Has Finance Made the World Riskier?, European Financial Management, Volume 12, Issue 4, 499-533.

[23] Schnabel, I. (2021): The rise of non-bank finance and its implications for monetary policy transmission, speech at the Annual Congress of the European Economic Association, https://www.ecb.europa.eu/press/key/date/2021/html/ecb.sp210824~9ab47b501b.en.html.

Appendix A: additional results

Figures (12) to (15) show the resulting impulse responses of the investment funds flows as a share of total assets. In line with the procedure above, we use different monetary policy surprises.
In general, the responses are much more volatile than the estimates based on the level of assets presented in the main part of the paper. Following a target shock, Figure (12), we observe a consistent negative reaction on impact across all funds types. However, the responses remain ambiguous over most of the projection horizon.

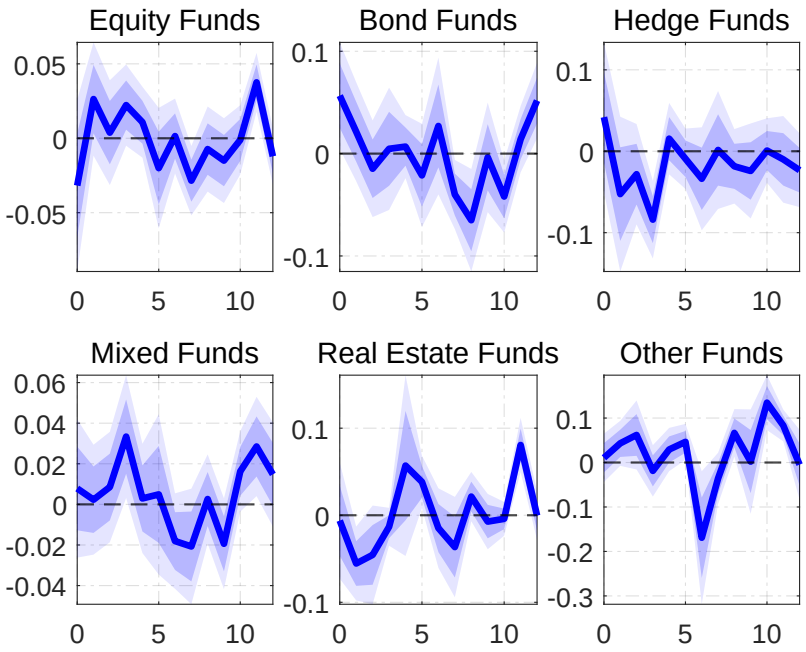
Figure 12: Response of flows as a share to total assets to a target surprise



Notes: The figure shows the estimated β_h coefficients when the target factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Concerning a timing shock shown in Figure (13), we gain different responses. Bond funds and hedge funds react both in the same way, i.e. on impact positively, while equity funds react negatively. Further, real estate funds do not react on impact but experience a decrease in flows in the first few months after the shock.

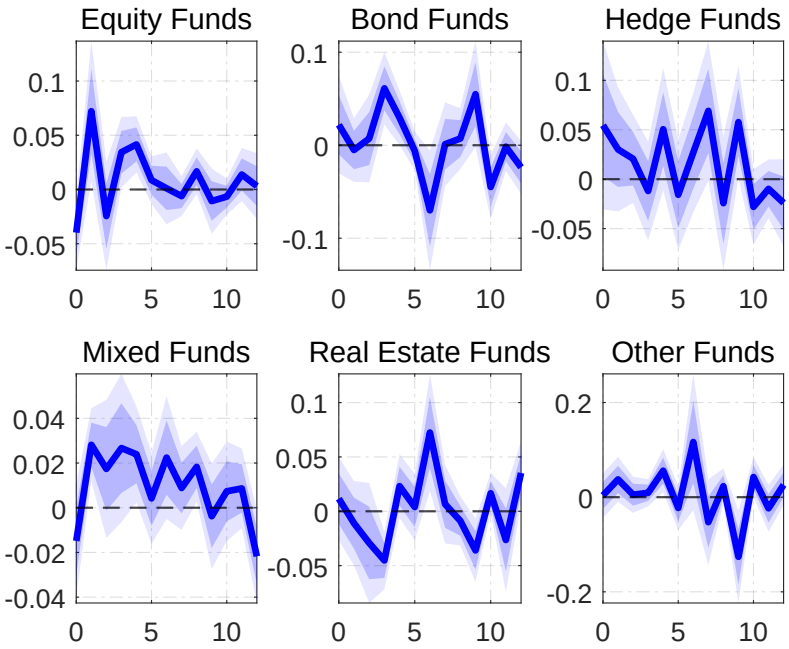
Figure 13: Response of flows as a share to total assets to a timing surprise



Notes: The figure shows the estimated β_h coefficients when the timing factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

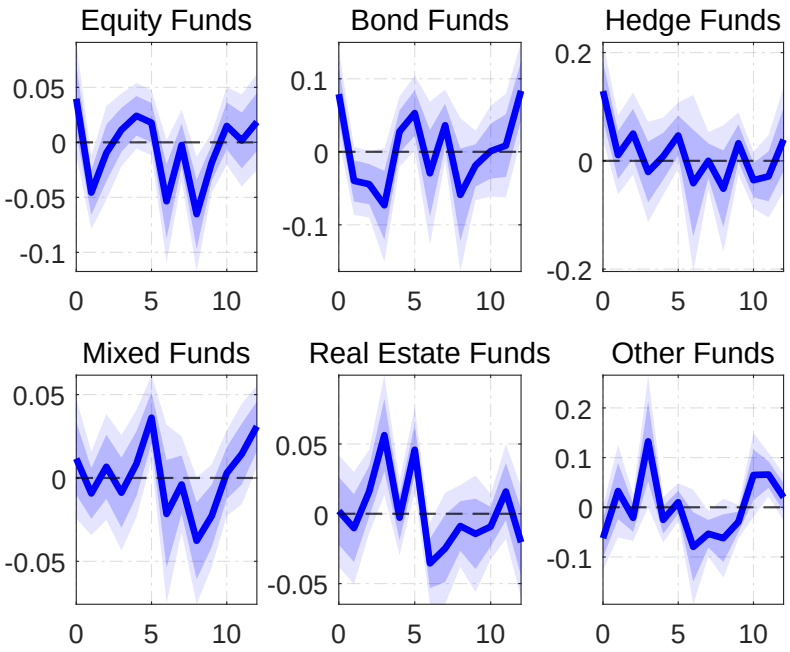
A forward guidance shock, Figure (14), leads also to different reactions across our funds types. For equity, hedge and mixed funds, flows increase initially, though these responses remain inconclusive and often insignificant.

Figure 14: Response of flows as a share to total assets to a forward guidance surprise



Notes: The figure shows the estimated β_h coefficients when the forward guidance factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Figure 15: Response of flows as a share to total assets to a QE surprise



Notes: The figure shows the estimated β_h coefficients when the QE factor is used as the policy shock. The figure also shows 68% and 90% confidence bands.

Finally, a QE surprise, see Figure (15), tends to lead to a decline in flows into equity funds and bond funds over the projection horizon.

Appendix B: data sources

Table (1) shows the mnemonics in the ECB's Statistical Data Warehouse of our main dependent variables.

Table 1: Sources of the investment fund data

Series	Statistical Data Warehouse ID
Stocks	
equity funds	IVF.M.U2.N.10.L30.A.1.Z5.0000.Z01.E
bond funds	IVF.M.U2.N.20.L30.A.1.Z5.0000.Z01.E
hedge funds	IVF.M.U2.N.50.L30.A.1.Z5.0000.Z01.E
real estate funds	IVF.M.U2.N.40.L30.A.1.Z5.0000.Z01.E
mixed funds	IVF.M.U2.N.30.L30.A.1.Z5.0000.Z01.E
other funds	IVF.M.U2.N.60.L30.A.1.Z5.0000.Z01.E
Flows	
equity funds	IVF.M.U2.N.10.L30.A.4.Z5.0000.Z01.E
bond funds	IVF.M.U2.N.20.L30.A.4.Z5.0000.Z01.E
hedge funds	IVF.M.U2.N.50.L30.A.4.Z5.0000.Z01.E
real estate funds	IVF.M.U2.N.40.L30.A.4.Z5.0000.Z01.E
mixed funds	IVF.M.U2.N.30.L30.A.4.Z5.0000.Z01.E
other funds	IVF.M.U2.N.60.L30.A.4.Z5.0000.Z01.E
Countries	
Germany	IVF.M.DE.N.T0.L30.A.1.Z5.0000.Z01.E
France	IVF.M.FR.N.T0.L30.A.1.Z5.0000.Z01.E
Netherlands	IVF.M.NL.N.T0.L30.A.1.Z5.0000.Z01.E
Ireland	IVF.M.IE.N.T0.L30.A.1.Z5.0000.Z01.E
Luxembourg	IVF.M.LU.N.T0.L30.A.1.Z5.0000.Z01.E

Notes: More information on the data series is available at https://www.ecb.europa.eu/stats/financial_corporations/investment_funds/html/index.en.html.

The effects of monetary policy on banks and non-banks in times of stress *

Anisa Tiza Mimun
Justus-Liebig University Giessen

Gabor Fukker

Matthias Sydow
European Central Bank

February 21, 2025

Abstract

This paper examines the effects of monetary policy on banks and non-banks in times of stress. We employ high-frequency identified monetary policy shocks and use state-dependent local projections to detect the potentially heterogeneous effects of monetary policy depending on different levels of financial stress. Exploiting different balance sheet positions across banks and non-banks, i.e. total assets, debt securities, and total loans, we find that high levels of financial stress do influence the response of our variables of interest to monetary policy shocks. We also find heterogeneity across the responses. Key observations include an opposite reaction of total assets of banks and investment funds. Also, lending activities of money market funds and investment funds increase after a monetary policy shock. Our results are relevant in understanding the different dynamics in the different parts of the financial system, as well as the roles of monetary policy and financial stress.

Keywords: Non-bank financial intermediaries, non-bank lending activities, monetary policy identification, state-dependent local projections

JEL classification: E52, G23

*We thank David Finck for sharing his MATLAB toolbox for the estimation of state-dependent local projections. We thank Peter Tillmann for his helpful comments. We thank the ECB's DG-MF seminar series participants and participants of the ChaMP Workshop in Dublin for their helpful feedback. We thank Alexander Schifrin for his helpful assistance.

1 Introduction

The effects of monetary policy on the banking sector have been quite well studied (Kashyap and Stein (2000), Ehrmann et al. (2002), Altunbas et al. (2009)). The literature provides broad evidence, for instance, on how lending conditions are affected by a tighter monetary policy stance. However, we find that the effects of monetary policy on the remaining financial system, i.e. the non-bank financial intermediaries sector, including investment funds, money market funds, insurance companies, and pension funds, remain subject to research. With our work, we aim to provide a broader view on the response of banks and non-banks to monetary policy shocks. We argue that this question is instinctively interesting but also highly relevant, not only for policy-makers but also for supervisory authorities. By including different levels of financial stress, we further aim to provide an answer to the question on what role financial stress ultimately plays within these dynamics. For instance, the effects of monetary policy could be and likely are heterogeneous in the presence of financial stress because of the nature of different financial sectors. Taking investment funds as an example, we would anticipate that loose monetary policy generally can be associated with an increase in total assets, in both value and transactions. However, in times of higher financial stress, investors might in accordance with a flight-to-safety behavior either only invest (or re-invest) in relatively safer investment funds' types, such as bond funds, or keep their investments as deposits in the banking sector. Therefore, we build our work on several narratives. First, we expect banks and non-banks to react heterogeneously to monetary policy due to their nature, i.e. their main operating models. Second, we also expect different balance sheet positions to react differently, i.e. to react stronger. For instance, we expect lending activities to react stronger in the banking sector than in the non-bank sector, with potentially some underlying substitution effects. Third, we argue that financial stress plays a pivotal role in the transmission of monetary policy to banks and non-banks due to several reasons. For instance, the non-bank sectors such as money market funds and investment funds might react on impact to financial stress. While insurance companies and pension funds might react stronger in the long run.

This paper is structured as follows. In chapter two, we provide a literature review

putting our work into overall context. Chapter three and four introduce and explain the data and econometric approach we use. Baseline results as well as state-dependent results are presented in chapter five and six. Chapter seven includes our results for interconnections. Finally, chapter 8 concludes.

2 Related literature

The literature strand studying the effects of monetary policy on the banking sector is relatively conclusive. In the last decade, most of research efforts have been made to quantitatively estimate the effects of monetary policy on the banking sector. Elliott et al. (2019) present evidence that lending activities following a tightening in the monetary policy stance leads banks to decrease their lending and non-banks to actually increase them. This particular result can be observed in our loans-based estimation as well. Cucic and Gorea (2024) provide similar results, primarily showing that a monetary policy contraction positively impacts non-bank credit lending. This result is therefore also in line with ours.
Regarding the effects of monetary policy on non-bank financial intermediaries, though, the literature is still on a growing path. Tillmann and Tiza Mimun (2023) study the effects of monetary policy on investment funds, and their sub-categories, i.e. equity funds, bonds funds, hedge funds, real estate funds. Applying high-frequency identified shocks in local projections, one of their main findings suggest that loose monetary policy leads the investment funds sector to increase. Their findings suggest also strong heterogeneity across different investment fund segments. Holm-Hadulla et al. (2023) also study the heterogeneous effects of monetary policy on banks and non-banks. Using high-frequency identified monetary policy shocks in a local projection estimation, they find a negative impact of a monetary policy tightening on investment fund flows. Kaufmann (2023) estimates the response of European investment funds to monetary policy shocks of the Fed using a structural Bayesian VAR model. He finds that loose monetary policy in the U.S. can be associated with higher investment funds inflows, particularly into equity and debt funds. Giuzio et al. (2021) analyse the effects of monetary policy on euro area investment funds, with a particular focus on bond funds, equity funds, and money market funds. Using a Bayesian VAR model combined with a mone-

tary policy shock identification following Jarocinski and Karadi (2020), the authors find evidence for a positive link between expansionary monetary policy shocks and fund inflows. Concerning the effects of monetary policy on insurance companies, Pelizzon and Sottocornola (2018) present evidence for a positive relation between loose monetary policy and movement in stock prices. Further, Kubitza, Grochola, and Gründl (2022) study mainly the relation between surrender rates of insurance companies and monetary policy. Using a calibrated model, one of the authors' main findings suggest that tightening monetary policy conditions leads to higher surrender rates. In addition, Kaufmann, Leyva, and Storz (2024) study the effects of monetary policy on insurance companies' balance sheet dynamics and compositions. Findings suggest that loose monetary policy leads the sector to increase. Turning to pension funds now, Boubaker et al. (2018) estimate the effects of US (unconventional) monetary policy on pension funds, and their risk incentives. Using a structural VAR approach, the authors find evidence for a positive relation between loose monetary policy and an increase in pension funds' allocation in equity assets. Further, they find evidence for a positive relation between low interest rates and pension fund risk-taking. Lu et al. (2019) study the risk-taking behavior of pension funds in a low interest rate environment. Applying a theoretical model and identifying different transmission channels of monetary policy, the authors find consistent evidence for a direct relation between more risk-taking when risk-free rates and funding ratios are lower. Finally, regarding the effects of monetary policy on money market funds, Bua et al. (2019) study the effects of monetary policy on money market funds and come to the conclusion that when policy is easing, money market funds experience outflows. Also, Aldasoro et al. (2024) find that prime-MMF assets rise after a monetary policy tightening.

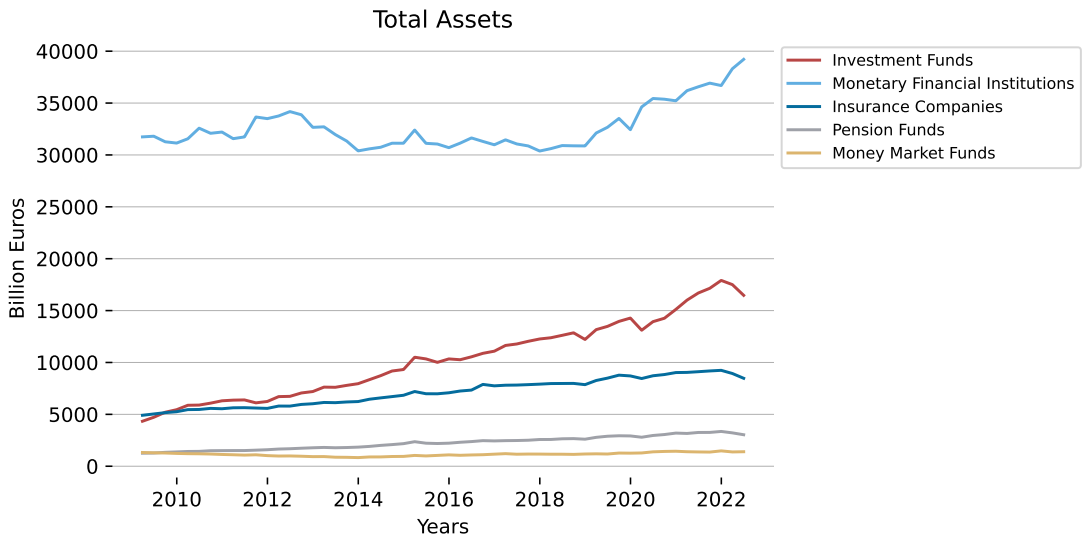
With our analysis, we aim to contribute to the literature in several ways. First, we present a *joint* analysis of all financial sectors and their reaction to changes in the monetary policy stance. By including different balance sheet positions, we further aim to deepen our understanding of how the effects of monetary policy impact different asset types of different financial segments. Moreover, in addition to our baseline estimations, we also include non-linearity, concretely we include financial stress. We argue that financial sectors are sensitive to financial stress, and therefore, we provide additional insights to deepen our understanding of the

dynamics between monetary policy, banks and non-banks, and financial stress. In that context, we argue that also clients of financial intermediaries may be sensitive to stress, e.g. depositors, loan takers, and investors.

3 Data

We split the financial system in the euro area into its two main parts: banks and non-bank financial intermediaries (NBFIs). With this approach, we follow the ESA 2010 definition, and therefore, include investment funds (IF), money market funds (MMF), pension funds (PF), and insurance companies (IC) representing the NBFI universe into our estimation. The data we use for our analysis is obtained by the Data Portal of the ECB and includes aggregated data for different balance sheet positions for banks and non-banks on a monthly and quarterly basis. Concretely, we aim to study the cross-sectional relation of banks and non-banks, and therefore, identify three balance sheet positions, i.e. total assets, debt securities, and loans. Our sample covers the time horizon between January 2009 and October 2022.

Figure 1: Total assets of banks and non-banks



Figures (1), (2), and (3) present an overview of the aggregated balance sheet positions we include in our analysis for banks and non-bank financial institutions between 2009 and 2022, focusing on total assets, total debt securities, and total loans. Concretely, Figure (1) shows the total assets of banks and non-bank entities, including investment funds, monetary financial institutions, insurance companies, pension funds, and money market funds. The data indicate a continuous increase in total assets over the period, with MFIs holding the largest share. Investment funds also show a substantial rise in total assets, particularly after 2015. Pension funds, insurance companies, and money market funds display comparatively lower asset volumes, with minor fluctuations observed over time.

Figure 2: Total debt securities of banks and non-banks

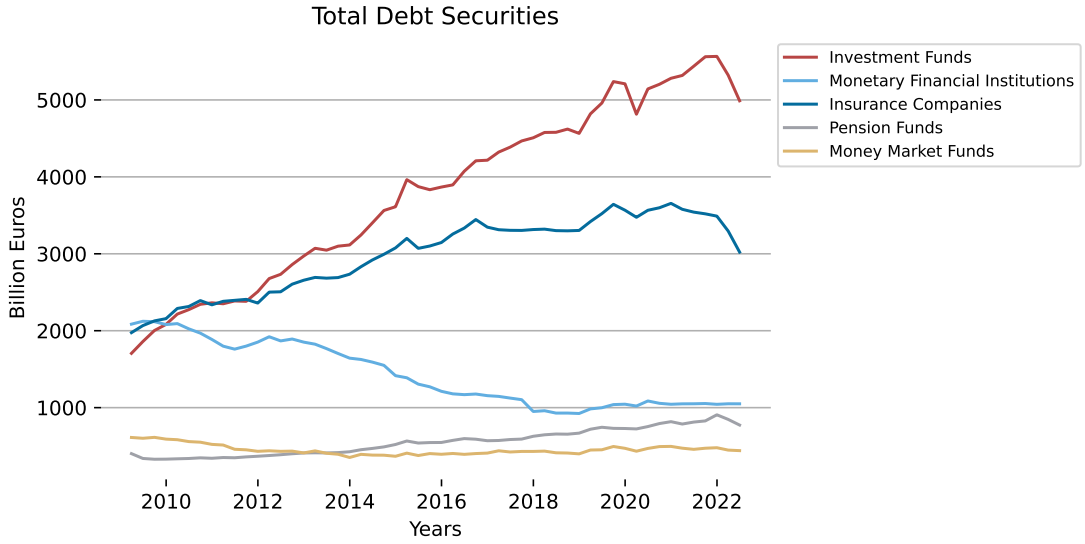


Figure (2) illustrates the total debt securities held by banks and non-bank entities. Investment funds and insurance companies display the largest levels of debt securities, while the holdings of MFIs and pension funds remain at lower levels throughout the period. The overall trend shows a gradual increase in total debt securities, with some fluctuations occurring between years.

Figure 3: Total loans of banks and non-banks

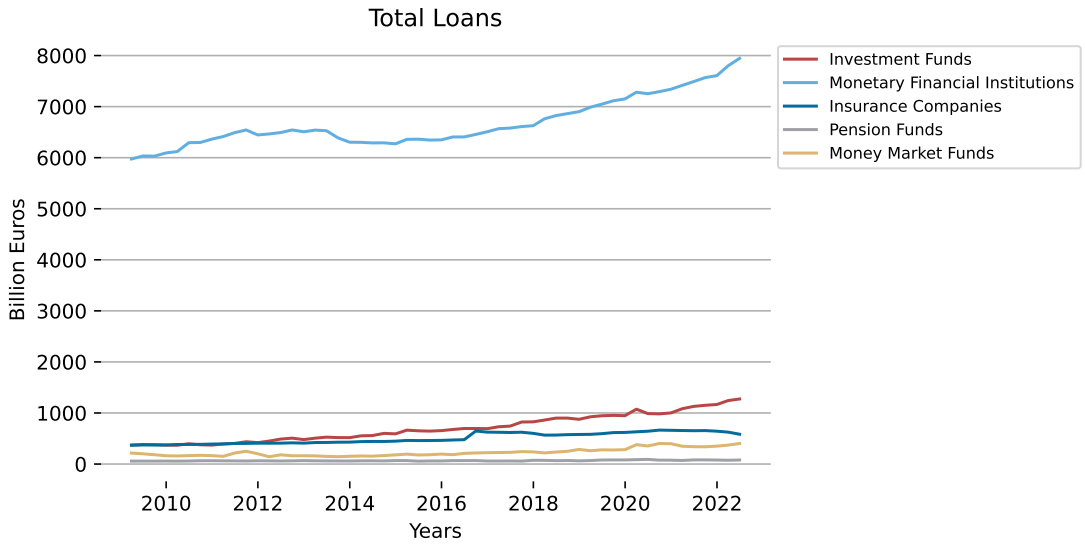
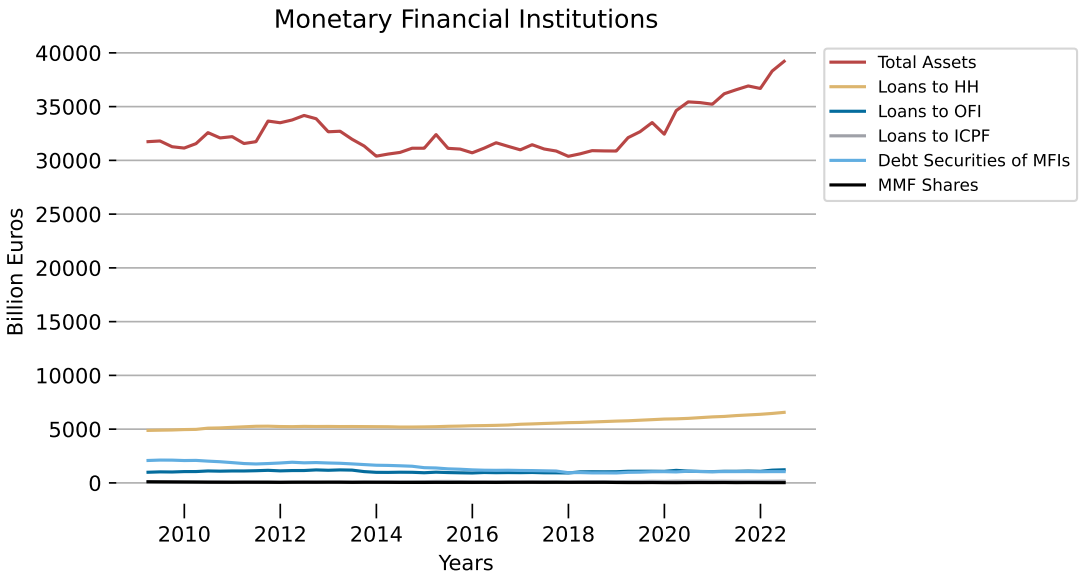


Figure (3) depicts the total loans issued by banks and non-bank entities from 2009 to 2022. MFIs hold the largest share of total loans throughout the period, with a consistent upward trend. However, investment funds also display an increase in total loans, however, at a significantly lower scale. Insurance companies, pension funds, and money market funds maintain relatively lower levels of loan issuance with fluctuations visible at certain points.

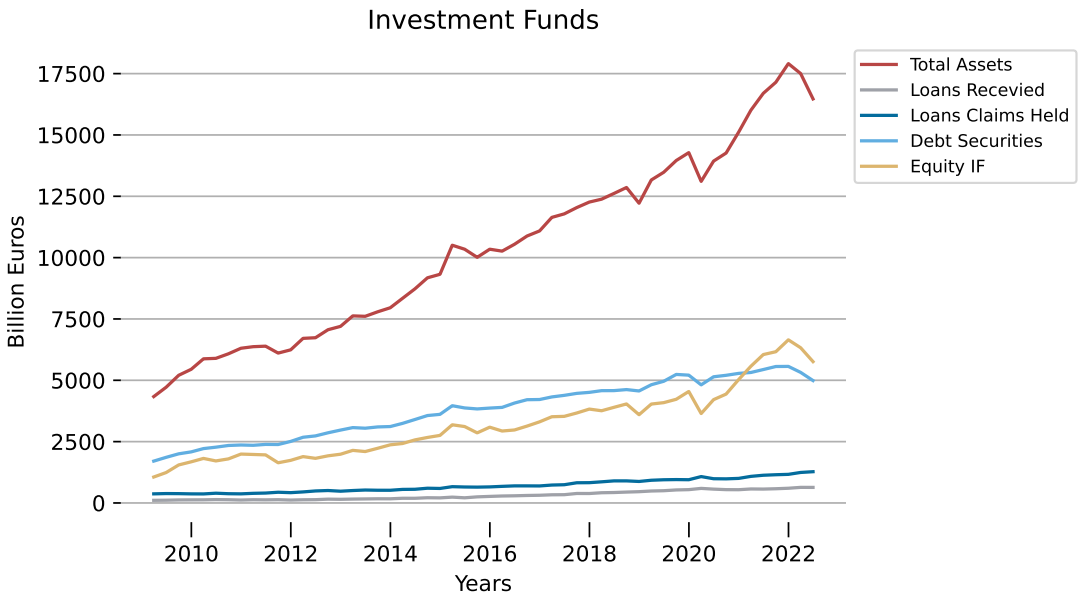
Figures (4) through (8) provide a detailed view of the aggregated balance sheets of specific financial institutions, illustrating the composition of assets and liabilities over time. Concretely, Figure (4) presents the aggregated balance sheet of banks and includes total assets, loans to households (HH), loans to other financial institutions (OFI), loans to insurance corporations and pension funds (ICPF), debt securities of MFIs, and money market fund (MMF) shares. The data shows an overall increase in total assets, with loans to households and financial institutions forming a significant portion. Debt securities and MMF shares are also present in the balance sheet composition.

Figure 4: Aggregated balance sheet of banks



Notes: The figure shows the aggregated balance sheet of banks.

Figure 5: Aggregated balance sheet of investment funds

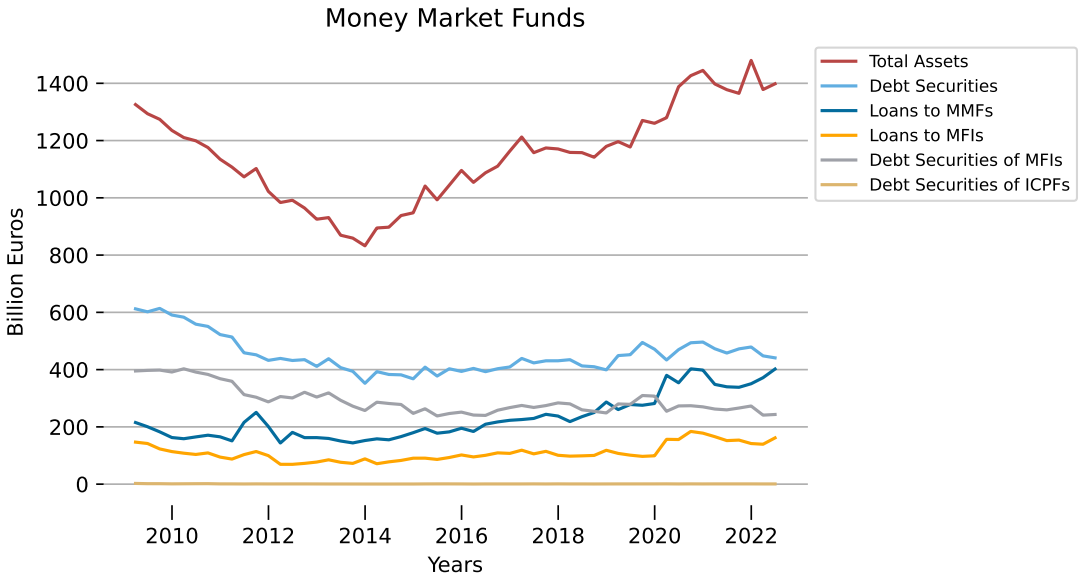


Notes: The figure shows the aggregated balance sheet of investment funds.

Figure (5) displays the aggregated balance sheet of investment funds, showing total assets, loans received, loan claims held, debt securities, and equity investments in investment funds. The data indicate an increase in total assets over time. Debt securities and equity holdings represent major components of the balance sheet, while loan claims held and loans received are also included.

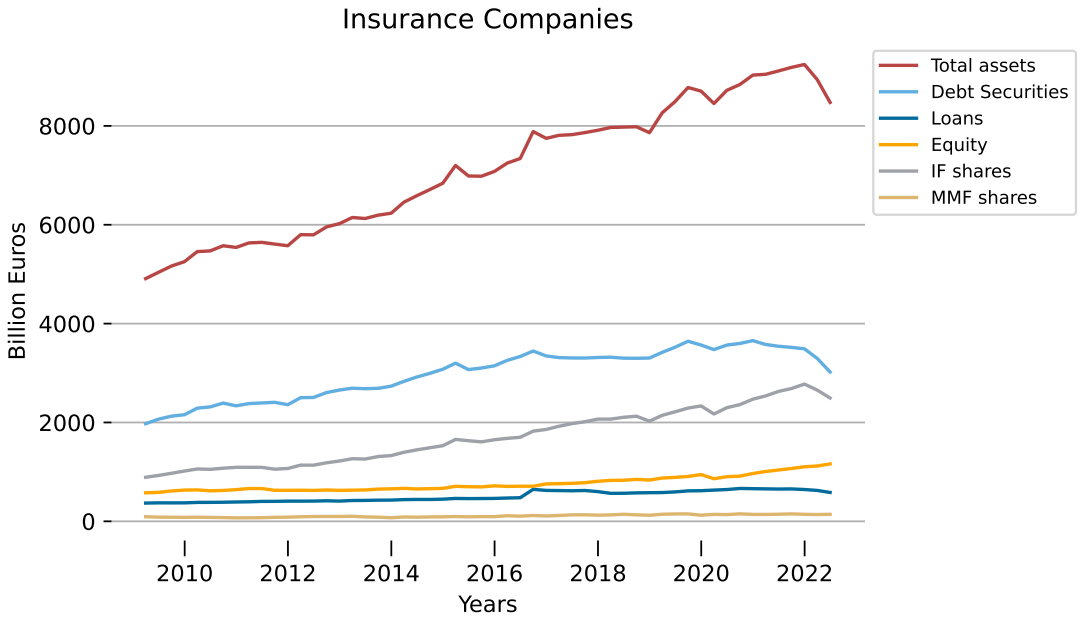
Figure (6) illustrates the aggregated balance sheet of money market funds (MMFs), including total assets, debt securities, loans to MMFs, loans to MFIs, and debt securities issued by MFIs and ICPFs. The graph shows that MMFs hold a lower level of total assets compared to other financial entities. Debt securities represent a significant proportion of MMF balance sheets, with loans to MFIs and other MMFs also being relatively high.

Figure 6: Aggregated balance sheet of money market funds



Notes: The figure shows the aggregated balance sheet of money market funds.

Figure 7: Aggregated balance sheet of insurance companies

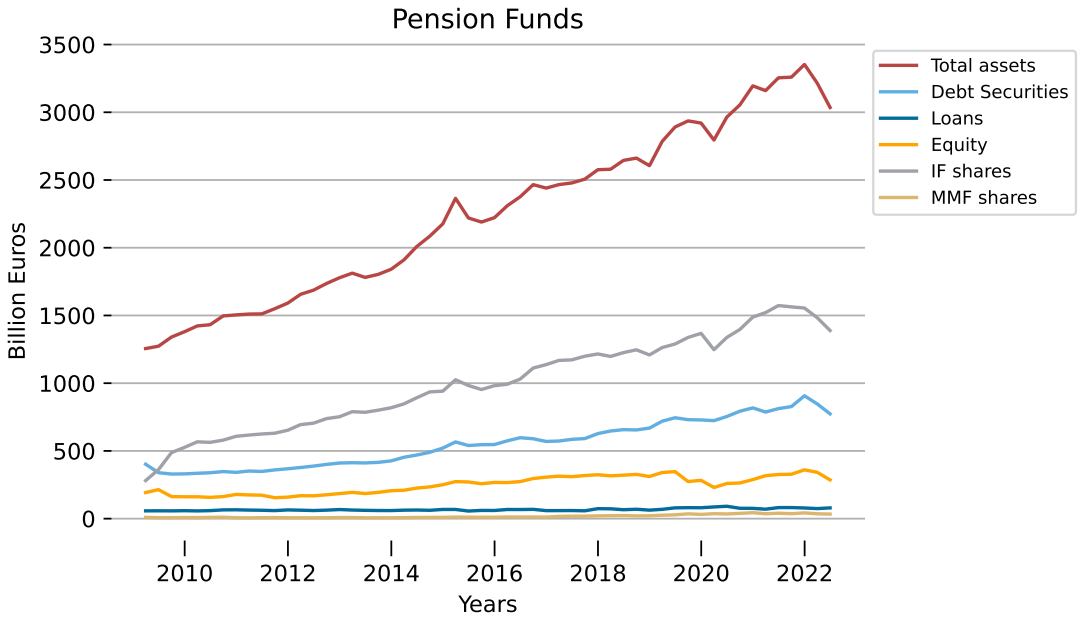


Notes: The figure shows the aggregated balance sheet of insurance companies.

Figure (7) presents the aggregated balance sheet of insurance companies, showing total assets, debt securities, loans, equity, investment fund shares, and money market fund shares. The data indicates an increase in total assets over the sample period. Debt securities form a significant part of the balance sheet, while holdings of equity, loans, and investment fund shares are also included.

Finally, Figure (8) provides the aggregated balance sheet of pension funds, including total assets, debt securities, loans, equity, investment fund shares, and money market fund shares. The data indicates that total assets have increased over time. Further, IF shares account for a substantial portion of the balance sheet. Debt securities, MMF shares, loans, and equity are also included.

Figure 8: Aggregated balance sheet of pension funds



Notes: The figure shows the aggregated balance sheet of pension funds.

Finally, the data we use for our baseline model as additional endogenous variables include euro area industrial production (IP), euro area harmonised index for consumer prices (HICP), and stock market volatility measured by the Vstoxx. For our monetary policy proxies, we make use of the Euro Area Monetary Policy Database (EA-MPD) provided by Altavilla et al. (2019). This dataset provides the intra-day changes of asset prices around the ECB's Governing Council press conferences. We provide more details on the monetary policy shock identification and its underlying narrative in the next section.

4 Econometric methodology and identification

This section introduces the empirical methodology we apply to analyse the effects of monetary policy. We follow Jordà (2005) using local projections and identify monetary policy with high-frequency identified monetary policy shocks. In local

projections, we regress a dependent variable y_{t+h} at different horizons $t+h$ for $h = 0, 1, \ldots, H$ on a driving variable dated t conditional on a set of control variables. Formally, the equation takes the following form:

$$y_{t+h} = \alpha_h + \beta_h shock_t + \gamma_h X_t + e_{t+h}, \tag{1}$$

where y_{t+h} includes our variable of interest, $\beta_h shock_t$ is the monetary policy shock, and X_t includes our control variables, i.e. gross domestic product (in logs), consumer prices measured by the Harmonized Index of Consumer Prices (in logs), and stock market volatility measured by the Vstoxx.

For our state-dependent analysis, we further follow Tenreyro and Thwaites (2016) and employ state-dependent local projections. The advantage of this approach is that we can estimate the effects of monetary policy in different states of the economy. In this paper, we include different states of financial stress. Concretely, we include the CISS indicator reflecting different states of financial stress into our estimations.
Hence, our state-dependent analysis takes the following form:

$$y_{t+h} = F(z_t)(\beta_s^h \epsilon_t + \gamma_s' x_t) + (1 - F(z_t))(\beta_c^h \epsilon_t + \gamma_c' x_t) + u_t \tag{2}$$

where y_t is our variable of interest, $F(z_t)$ reflects the different regimes, i.e. stress (s) and calm (c) both reflected by the CISS index, x_t is a vector of control variables, and u_t is the policy shock. The coefficients β_j^h measure the average effect of a shock as a function of the state of the economy when the shock hits, and therefore encompasses the average effect of the shock on the future change in the economy's state.

In particular, $F(z_t)$ is a smooth increasing function of an indicator of the state of the economy z_t. Following Granger and Teraesvirta (1993), we employ the following logistic function:

$$F(z_t) = \frac{exp(\theta \frac{z_t - c}{\sigma_z})}{1 + exp(\theta \frac{z_t - c}{\sigma_z})} \ , \tag{3}$$

where c is a parameter that controls for what proportion of the sample the economy spends in either state and σ_z is the standard deviation of the state variable z. The parameter θ determines how violently the economy switches from one regime to the other when z_t changes. In our estimation, we assign the value of 3 for θ. The parameter c is set to 0.5, essentially capturing (very) high and (very) low levels of financial stress.

Our identification of monetary policy shocks follows the approach introduced by Altavilla et al. (2016). Concretely, we use the surprise series for the German 10Y asset for our estimations. The main idea of this approach consists of capturing the surprise component in the change of the monetary policy stance, and including the resulting identified monetary policy shocks into our estimation. Concretely, we build a surprise time series including the change of the yield of a specific asset around the ECB's press conference. Therefore, we assign to each month the surprise change, and in each month where the Governing Council did not take any decision, the value of zero, respectively. Since our estimations include quarterly data, we transform further the time series in a way where we sum up the monthly changes around the actual Governing Council meetings.
Technically, our times series is built in the following way:

$$shock_t = \begin{cases} surp_{t,d} & \text{if Governing Council meeting in quarter } t \\ 0 & \text{if no Governing Council meeting in quarter } t \end{cases}$$

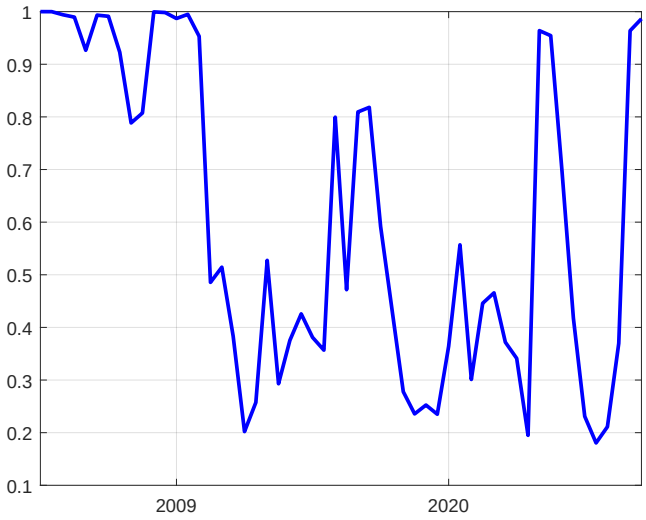
where t and d indicate the quarter and the day of the press conference following meetings of the Governing Council.

Finally, we choose financial stress as our state variable for several reasons. First, we argue that in times of financial stress, financial markets participants, and therefore whole financial sectors, do behave differently. It follows that our study would

not provide a full overview and in-depth understanding of the effects of monetary policy on banks and non-banks, without including different financial stress regimes. In other words, the effects of monetary policy could be and likely are heterogeneous in the presence of financial stress because of the nature of different financial sectors. Taking investment funds as an example, we would anticipate that loose monetary policy can be associated with an increase in total assets, in both value and inflows. However, in times of higher financial stress, investors might in accordance with a flight-to-safety behavior either only invest (or re-invest) in relatively safer investment funds' types, such as bond funds, or keep their investments as deposits in the banking sector. Second, according to a recently published speech by ECB Board Member Isabel Schnabel [1] (unconventional) monetary policy does indeed have a particularly powerful impact on the financial system in periods of stress. It is argued that the effects of asset purchases particularly work well through a liquidity channel in times of financial stress in the NBFI sector. Hence, it is reasonable for us to study the concrete role of financial stress for the overall transmission of monetary policy to the whole financial system. Third, in order to capture potential financial stability threats, it is reasonable to not only study the effects of monetary policy on non-bank sectors, such as insurance companies or pension funds, but also to include financial stress into this perspective in order to anticipate potential sources of instability, e.g. liquidity mismatches or maturity mismatches. Finally, the CISS index includes all relevant dimensions of the euro area's financial sector contribution to systemic stress. Therefore, it is an adequate candidate to help us study not only the underlying uncertainty displayed by various volatility indices, but also the (potential) build-up of systemic stress.

[1] https://www.ecb.europa.eu/press/key/date/2024/html/ecb.sp240528 a4f151497d.en.html

Figure 9: Transition function $F(z_t)$



Notes: The figure shows the estimated transition function $F(z_t)$ of the CISS indicator.

Figure (9) displays the transition function $F(z_t)$. We can observe that prior to the global financial crisis, so right before 2009, financial stress levels were highly elevated. Also in the context of euro area sovereign crisis, in the years 2012-2014, financial stress was relatively high. Finally, we can also observe very high levels of financial stress after the beginning of the COVID-19 pandemic.

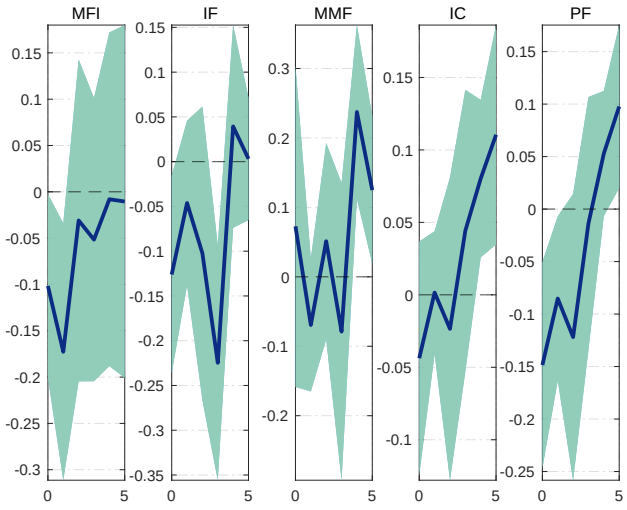
5 Baseline results

This section presents our baseline results. As stated above, we estimate the responses of different balance sheet positions of banks and non-banks to a monetary policy shock. [2]

[2]The baseline impulse response functions of the aggregated balance sheets positions of each sector can be found in the appendix.

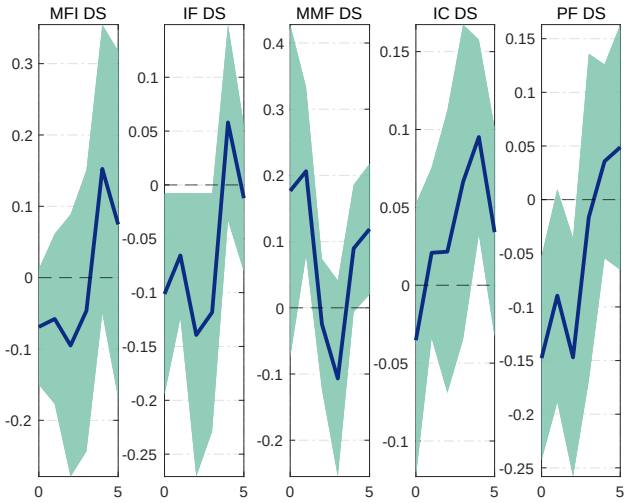
Figure (10) shows our baseline estimation, i.e. the responses of total assets of banks and non-banks to a high-frequency identified shock, respectively. We observe that a tightening shock leads to a negative response of all our variables of interest, except for MMFs. Interestingly, the magnitudes of banks, investment funds, and pension funds are relatively similar, while insurance companies display a relatively small decline. Further, the path of the response of insurance companies and pension funds looks very similar, while banks and investment funds, although both reacting negatively on impact, show results with the opposite direction. Although banks and investment funds both initially respond negatively, their longer-term responses diverge, which may reflect differences in their operational strategies or regulatory constraints. In contrast, the similar response patterns of insurance companies and pension funds suggest comparable strategic or asset composition characteristics.

Figure 10: Impulse response functions of total assets



Notes: The figure shows the estimated β_h coefficients within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

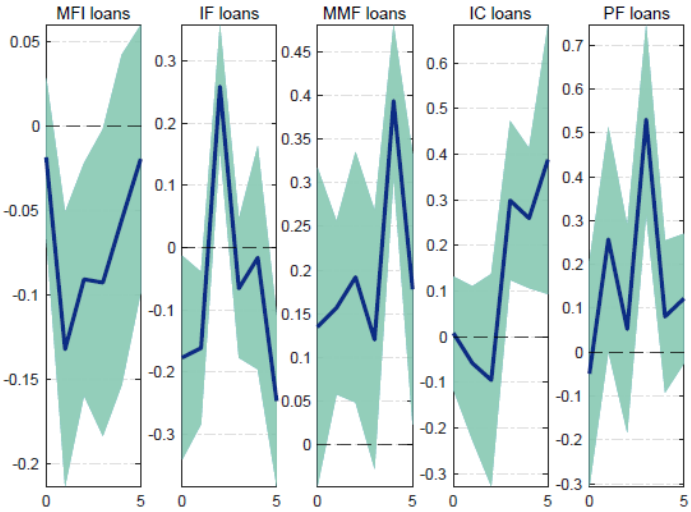
Figure 11: Impulse response functions of debt securities



Notes: The figure shows the estimated β_h coefficients within 68% confidence bands.The x-axis displays quarters, and the y-axis represents percentage points.

Taking a look at the responses of debt securities of banks and non-banks (Figure (11), we also observe a negative response to a tightening monetary policy shock. As in the case of total assets, the responses of banks, investment funds, and pension funds display a similar pattern and magnitude. This suggests that higher interest rates or reduced liquidity lead to a decline in the value or issuance of debt securities. Consistent with the total assets response, banks, investment funds, and pension funds exhibit similar patterns and magnitudes in their reactions, indicating that these institutions may have comparable sensitivities to interest rate changes and similar strategies for managing their debt portfolios under tightening conditions.

Figure 12: Impulse response functions of loans



Notes: The figure shows the estimated β_h coefficients within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (12) shows the responses of total loans of our variables of interest, respectively. Interestingly, and different from the responses of total assets and debt securities, here we observe a more heterogeneous dynamic following a tightening monetary policy shock. As expected, loans of banks react negatively on impact. On the other hand, loans of investment funds react also negatively on impact, but increase relatively strongly after one quarter, reaching a peak of about 0.25%. Money market funds, again similar as for total assets and debt securities, are the only ones to react positively on impact following a tightening monetary policy shock. In terms of magnitude, their response shows a relatively strong increase, which remains positive within our projection window of five quarters. The observed dynamics suggest that banks' continued loan contraction reflects the immediate effects of higher borrowing costs and tighter credit conditions consistent in a tightening monetary policy. Investment funds, after an initial downturn, may have adjusted their strategies to profit from opportunities or shifts in demand, leading to a subsequent increase in loan activity. The overall positive response of money market funds highlights their role as a haven for liquidity-seeking investors during periods of monetary tightening. It underscores their attractiveness due to

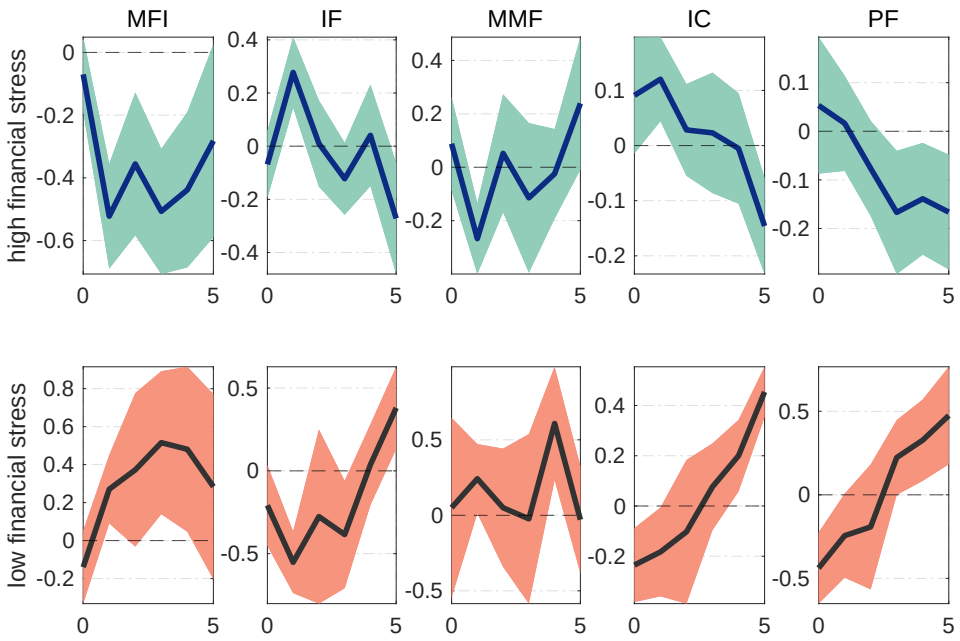
short-term, lower-risk investment profiles.

6 State-dependent results

This section presents our results including different states of financial stress. Generally, we try to identify the responses of different variables representing banks and non-banks to identified monetary policy shocks. In addition, we differentiate between two different financial stress states in order to understand the effectiveness of monetary policy across those different regimes.

Figure (13) shows the impulse responses to a monetary policy shock including states of high levels of financial stress and low levels of financial stress, respectively. First of all, and most importantly, we observe a strong heterogeneity of our variables of interest, indicating that financial stress has a varying degree of impact for different parts of the financial system. For instance, total assets of banks experience a strong decline on impact, showing they are quite vulnerable to tighter monetary conditions, especially when stress levels are high. Investment funds react in the exact opposite direction following a monetary policy tightening shock (see the first two figures before) suggesting they can adjust or even take advantage of the situation. Furthermore, in times of heightening financial stress, a monetary policy tightening shock leads total assets of insurance companies as well as those of pension funds to decrease over time, reflecting their sensitivity to tough market conditions. As expected, the responses of all variables in our estimation react in an opposite direction in the state of low financial stress, indicating that, for example, total assets of investment funds decrease following a tightening monetary policy shock. This result is particularly of interest, since it is in line with the broader literature in this field.

Figure 13: Impulse response functions of total assets

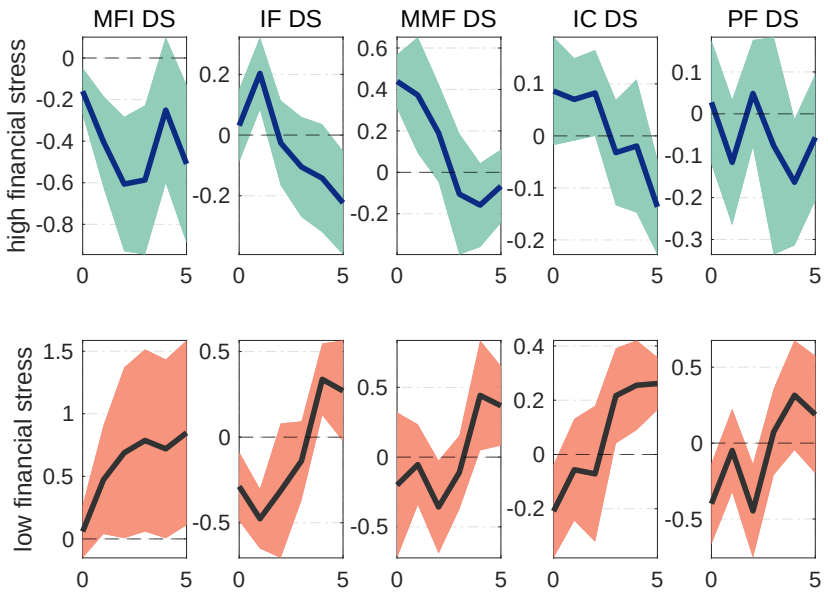


Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (14) shows the response of debt securities of banks and non-banks to a monetary policy shock. Here, we observe again a relatively strong heterogeneity across banks and non-banks, and some similarities to the estimation including total assets as dependent variable. Concretely, we observe debt securities of banks to react negatively on impact, and continue to further decrease for at least three quarters. Investment funds, on the other hand, react minimally positive on impact, and further increase for the first two quarters in the state of high financial stress. The opposite is the case in a regime including low financial stress. This observation is interesting in several ways. First, financial stress seems to have a significant influence on the behavior of investment funds. Second, the impulse response of debt securities to a monetary policy shock in times of stress shows that, in contrast to our baseline estimation, i.e. without distinguishing between

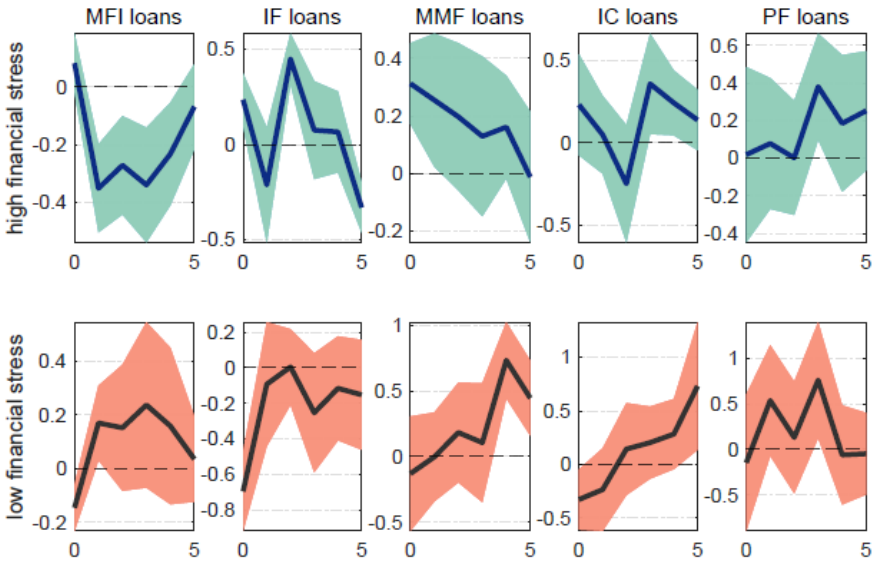
different financial stress levels, a tightening stance of monetary policy actually *increases* debt securities. Money market funds, in addition, show the strongest positive reaction on impact in terms of magnitude, but decrease constantly over time. This suggests that while they may initially benefit from a shift towards safer, short-term investments, their appeal diminishes as stress persists. Interestingly, insurance companies as well as pension funds do not show a significant reaction to a monetary policy shock when financial stress is present. But on the other hand, when financial stress is relatively low, both sectors react negatively on impact. This indicates that these sectors might be more stable or less reactive under stress, but they adjust more when conditions are calmer.

Figure 14: Impulse response functions of debt securities



Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure 15: Impulse response functions of loans



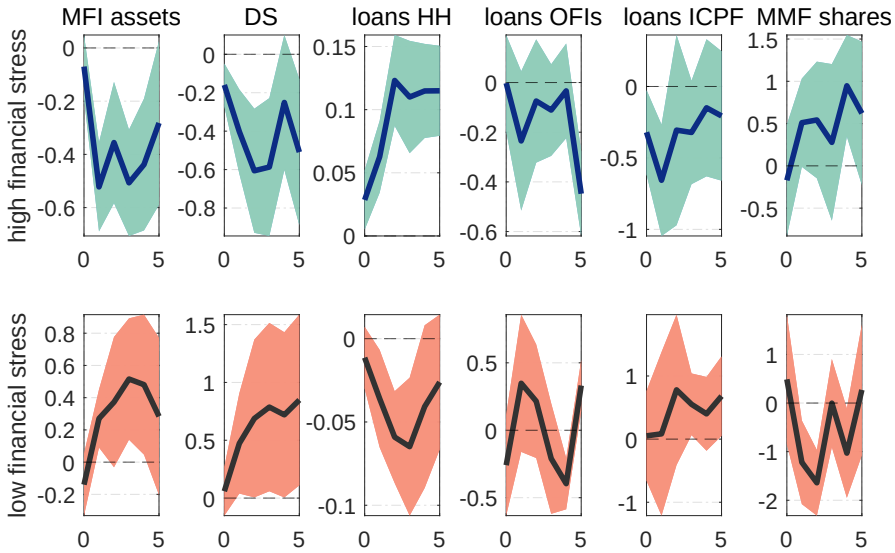
Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (15) shows the responses of total loans of our variables of interest to a monetary policy shock. As expected and in line with the literature, banks' loans decrease following a monetary policy shock. This response is strong in terms of magnitude and highly significant. However, in times of low financial stress, the response is also negative on impact but increases afterwards. Further, loans of investment funds react slightly positive on impact, and although they show a decline afterwards, they continue to increase strongly afterwards. In addition, money market funds show a strong and statistically significant positive reaction. This result is particularly interesting since it suggests that in times of stress and following a tightening shock, money market funds might step in and provide (likely) short-term loans. Finally, insurance companies and pension funds again do not show a significant response to a monetary policy shock in times of financial stress. However, loans of insurance companies in the state of low financial stress do react negative on impact but only with very limited statistical significance.

7 State-dependent results for interconnections

In this chapter, we try to capture interconnected responses among banks and non-banks.

Figure 16: Impulse response functions of Monetary Financial Institutions

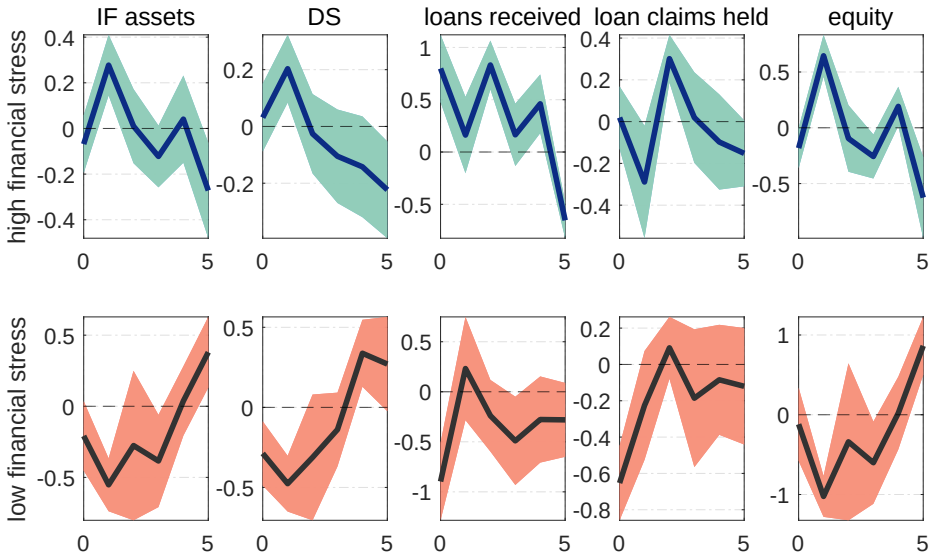


Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (16) includes, for example, the loans issued by euro area banks to households (HH), other financial intermediaries (OFIs), and insurance companies and pension funds (ICPF), respectively. These impulse responses deliver an interesting insight. In times of relatively high financial stress, loans to households respond positively and further increase in the first two quarters approximately, while loans to OFIs and to ICPFs react negatively on impact and continue to decrease over time. Interestingly, the results for the state including low financial stress, the

opposite can be observed. These results allow the conclusion that bank lending activities are potentially also driven by financial stress. Moreover, financial stress concretely leads to an increase of loans to households, while loans to non-bank financial intermediaries overall are being reduced.

Figure 17: Impulse response functions of Investment Funds



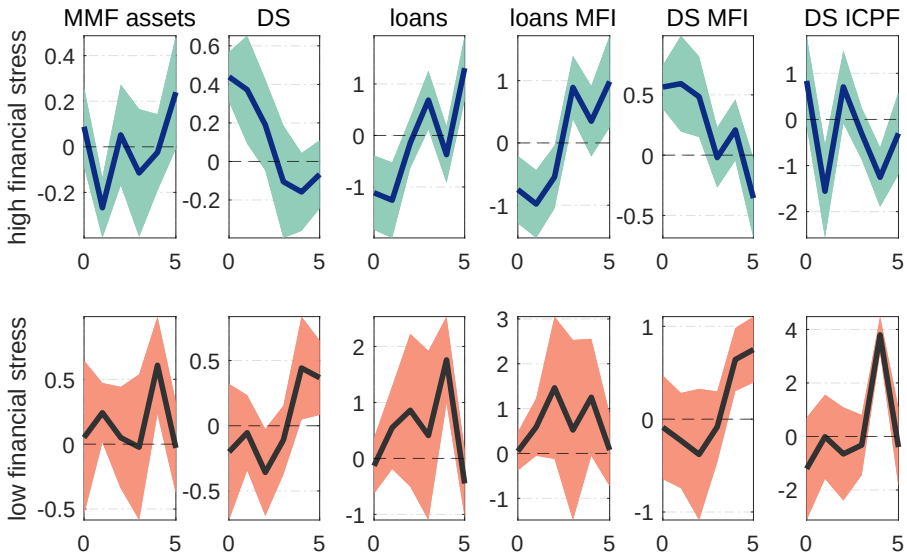
Notes: The figure shows the estimated β_h coefficients to a 1bp tightening shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (17) shows the responses of the aggregated balance sheet positions of investment funds included in our analysis. We observe, for instance, that they accept more loans in times of stress, but apparently, they reduce the loans claims they hold. Equity hold, in addition, increases strongly within the first two quarters.

Figure (18) displays the impulse responses of all available balance sheet positions of money market funds. We obtain the impulse response of loans issued to MFIs

(banks), and debt securities hold of MFIs and of ICPFs, respectively. We learn from these impulse responses that in times of high financial stress, loans to banks react negatively on impact but increase after roughly one quarter strongly, reaching a peak at 1%. Regarding the debt securities of MFIs, we observe a positive reaction on impact but a gradual decrease afterwards. Finally, debt securities of ICPF experience a strongly emphasized volatility. First, they react positively on impact but experience a gradual strong decline right afterwards. After one quarter approximately, the reaction is reversed.

Figure 18: Impulse response functions of Money Market Funds

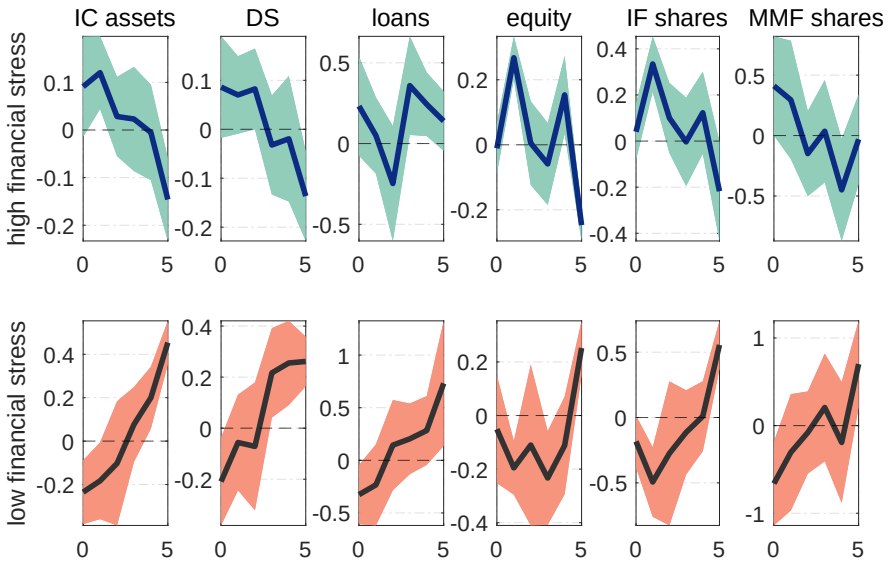


Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (19) shows mainly the interconnections between insurance companies, investment funds, and money market funds. Concretely, we obtain the response of investment funds shares' holdings and holdings of money market funds shares.

We observe that both balance sheet positions increase after a tightening monetary policy shock. However, money market funds shares hold decrease over time.

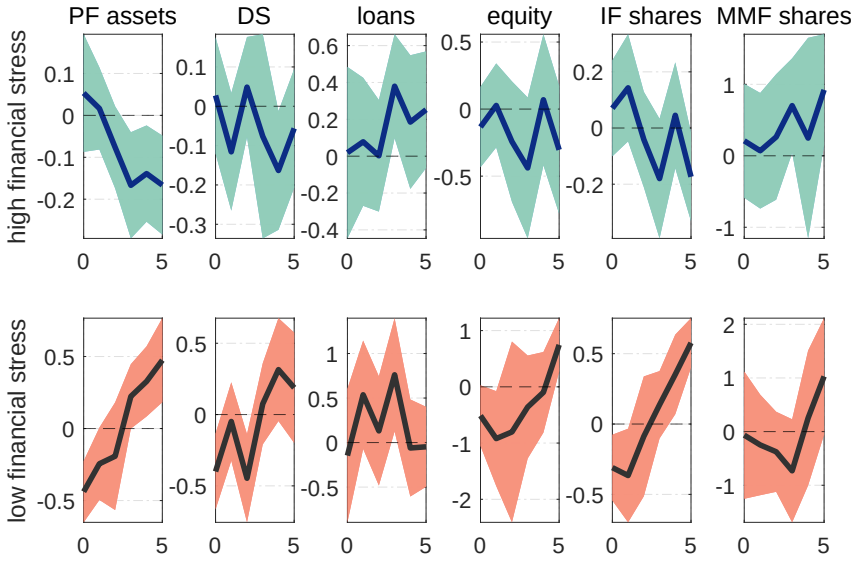
Figure 19: Impulse response functions of Insurance Companies



Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (20) sheds light on the interconnections between pension funds, investment funds, and money market funds. Similar to insurance companies (19), both positions react positively. But, in contrast, money market funds shares hold continue to increase over time.

Figure 20: Impulse response functions of Pension Funds



Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

8 Conclusions

This paper studies the effects of monetary policy on banks and non-banks, and includes in addition the role of financial stress in the transmission of monetary policy to these different sectors. In our analysis, we include total assets, debt securities, and total loans as aggregated balance sheet positions to understand how, for example, lending activities of banks directly compared to those of non-banks react to changes in the monetary policy stance, as well as to those changes in times of stress. We contribute to the literature in several ways. First, we present empirical evidence on a *joint* response of banks and non-banks to monetary policy shocks, providing evidence on different sectors, as well as their different balance sheet positions. Moreover, we present evidence not only for the heterogeneity

across different financial sectors, but also regarding specific types of financial assets, such as debt securities and loans. Regarding loans, we present evidence that parts of non-banks increase their lending activities when monetary conditions are being tightened. This observation is crucial since it might suggest a potential undesired side-effect. Second, we study the role of financial stress, which provides a better understanding on how the transmission of monetary policy is potentially affected by financial risks. Our results show that the effects of monetary policy are partly highly heterogeneous. For instance, we observe that different balance sheet positions react more sensitive than others. We also observe that different parts of the financial system appear to be more sensitive to financial stress than others. Our work contributes to a better understanding of the NBFI transmission channel of monetary policy. We show how the *entire* NBFI universe responds to monetary policy shocks. Additionally, we also provide evidence on the role of financial stress. Therefore, we show that financial stress seems to be a relevant player in the transmission of monetary policy.

References

[1] Adrian, T., Shin, H. (2010): Financial Intermediaries and Monetary Economics, Handbook of Monetary Economics, Volume 3, 601-650.

[2] Aldasoro, I., Cornelli, G., Ferrari Minesso, M., Gambacorta, L., Habib, M. (2024): Stablecoins, money market funds and monetary policy, BIS Working Papers No 1219.

[3] Auer, S., Bernhardini, M., Cecioni, M. (2021): Corporate leverage and monetary policy effectiveness in the euro area, European Economic Review, Volume 140, 103943.

[4] Alpanda, S., Zubairy, S. (2019): Household debt overhang and the transmission of monetary policy, Journal of Money, Credit and Banking, Volume 51, Issue 5, 1265-1307.

[5] Altavilla, C., Brugnolini, L., Gürkaynak, R., Motto, R., Ragusa, G. (2019): Measuring euro area monetary policy, Journal of Monetary Economics, Volume 108, 162-179.

[6] Altunbas, Y., Gambacorta, L., Marquez-Ibanez, D. (2009): Securitisation and the bank lending channel, European Economic Review, Volume 53, Issue 8, November 2009, Pages 996-1009.

[7] Bekaert, G., Hoerova, M., Lo Duca, M. (2013): Risk, uncertainty and monetary policy, Journal of Monetary Economics, Volume 60, Issue 7, 771-788.

[8] Banegas, A., Montes-Rojas, G., Siga, L. (2022): The effects of U.S. monetary policy shocks on mutual fund investing, Journal of International Money and Finance, Volume 123, 102595.

[9] Boubaker, S., Gounopoulos, D., Nguyen, D., Paltalidis, N. (2018): Reprint of: Assessing the effects of unconventional monetary policy and low interest rates on pension fund risk incentives, Journal of Banking and Finance, Volume 92, July 2018, Pages 340-357.

[10] Brunnermeier, M., Sannikov, Y. (2014): A Macroeconomic Model with a Financial Sector, American Economic Review, 104 (2), 379-421.

[11] Bua, G. and Dunne, P. (2019): Monetary Policy and Money Market Funds, Central Bank of Ireland Economic Letter, Volume 2019, No. 8.

[12] Cucic, D. and Gorea, D. (2024): Non-bank lending and the transmission of monetary policy, BIS Working Papers No. 1211.

[13] Ehrmann, M., Gambacorta, L., Martínez Pagés, J., Sevestre, P., Worms, A. (2002): Financial Systems and the Role of Banks in Monetary Policy Transmission in the Euro Area. Available at SSRN: https://ssrn.com/abstract=356660 or http://dx.doi.org/10.2139/ssrn.356660

[14] Elliott, D., Meisenzahl, R., Peydrò, J.-L., Turner, B. (2019): Nonbanks, Banks, and Monetary POlicy: U.S. loan-level evidence since the 1990s, Proceedings of Paris December 2019 Finance Meeting EUROFIDAI - ESSEC, Available at SSRN.

[15] Giuzio, M., Kaufmann, C., Ryan, E., Cappiello, L. (2021): Investment Funds, Risk-Taking, and Monetary Policy in the Euro Area, ECB Working Paper No. 2021/2605.

[16] Granger, C. and Terasvirta, T. (1993): Modelling Non-Linear Economic Relationships Oxford University Press, Oxford, December 1993.

[17] Holló, D., Kremer, M., Lo Duca, M. (2012): CISS - A Composite Indicator of Systemic Stress in the Financial System, ECB Working Paper Series, No 1426, European Central Bank.

[18] Holm-Hadulla, F., Mazelis, F., Rast, S. (2023): Bank and non-bank balance sheet responses to monetary policy shocks, Economics Letters, Volume 222, 110918.

[19] Jarocinski, M., Karadi, P. (2020): Deconstructing Monetary Policy Surprises – The Role of Information Shocks, American Economic Journal: Macroeconomics, 12 (2), 1-43.

[20] Jordà, Ò. (2005): Estimation and Inference of Impulse Responses by Local Projections, American Economic Review, 95(1), 161-182.

[21] Kaufmann, C. (2023): Investment Funds, Monetary Policy, and the Global Financial Cycle, Journal of the European Economic Association, 21(2), 593–636.

[22] Kaufmann, C., Leyva, J., Storz, M. (2024): Insurance Corporations' Balance Sheets, Financial Stability and Monetary Policy, Available at SSRN.

[23] Kashyap, A., and Stein, J. (2000): "What Do a Million Observations on Banks Say about the Transmission of Monetary Policy?" American Economic Review, 90 (3): 407–428.

[24] Kubitza, C. Grochola, N., Gründl, H. (2022) : Life insurance convexity, ECONtribute Discussion Paper, No. 154, University of Bonn and University of Cologne, Reinhard Selten Institute (RSI), Bonn and Cologne.

[25] Lu, L., Pritsker, M. G., Zlate, A., Anadu, K., Bohn, J. (2019): Reach for Yield by U.S. Public Pension Funds, FRB of Boston Supervisory Research and Analysis Unit Working Paper No. RPA 19-2, Available at SSRN.

[26] Plagborg-Moller, M., Wolf, C. K. (2021): Local projections and WARs estimate the same impulse responses, Econometrica, Volume 89, Issue 2, 955-980.

[27] Pelizzon, L. and Sottocornola, M. (2018): The Impact of Monetary Policy Interventions on the Insurance Industry, SAFE Working Paper No. 204, Available at SSRN.

[28] Ramey, V.A., Zubairy, S. (2018): Government spending in good times and in bad: Evidence from U.S. historical data, Journal of Political Economy 126, 850-901.

[29] Tillmann, P. and Tiza Mimun, A. (2023): The heterogeneous effects of monetary policy on investment funds in the euro area, Forthcoming.

Appendix A: Additional results

Figure 21: Impulse response functions of MFIs (baseline)

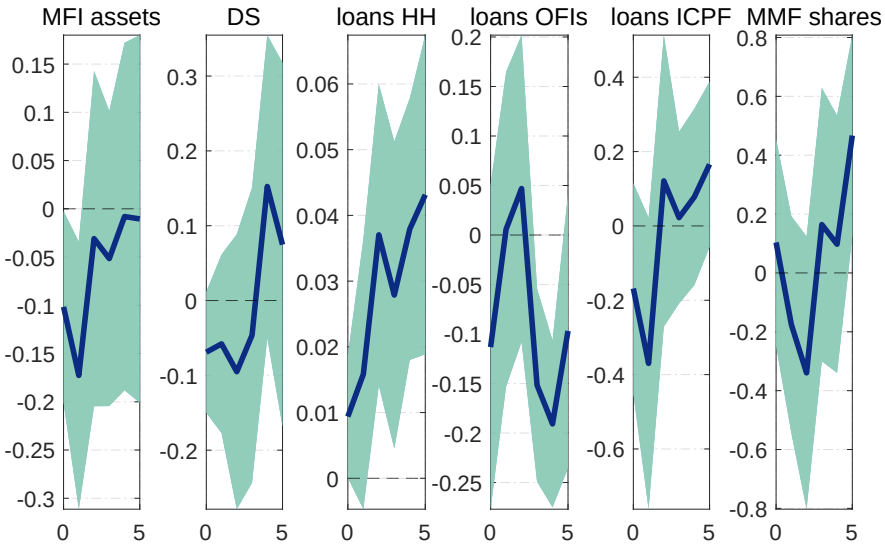


Figure 22: Impulse response functions of Investment Funds (baseline)

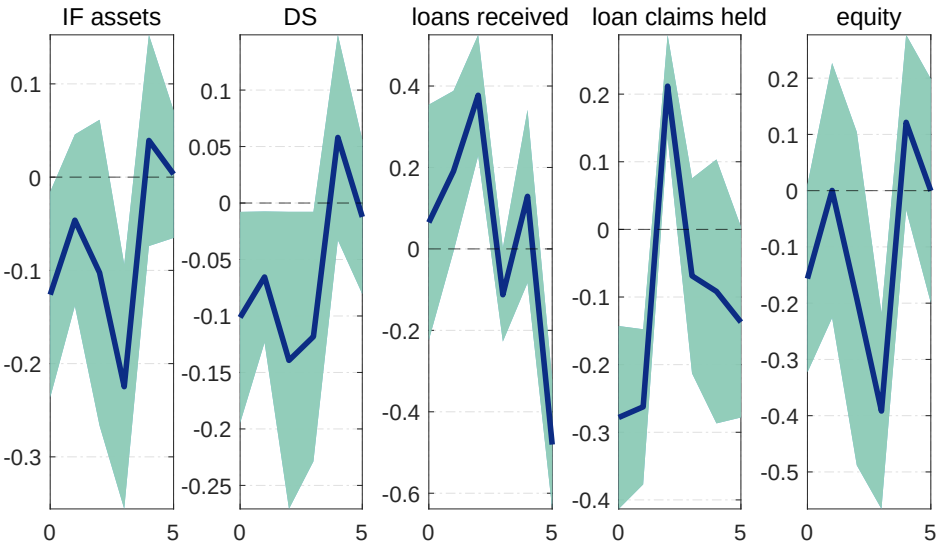


Figure 23: Impulse response functions of MMFs (baseline)

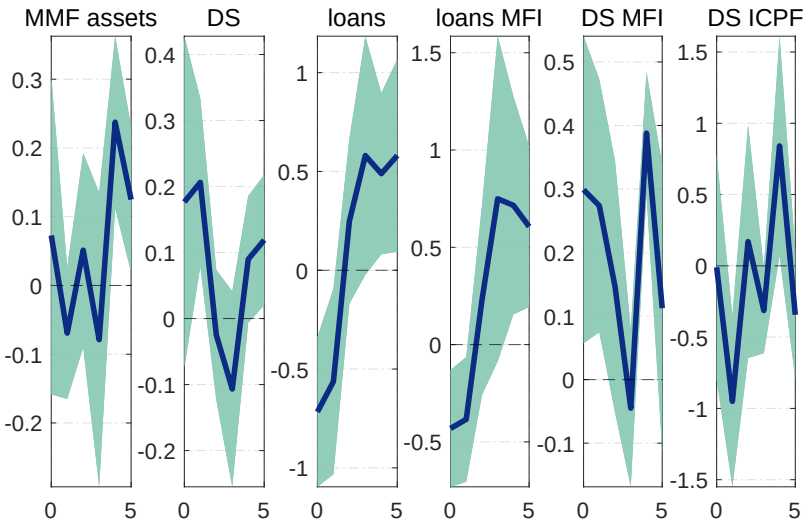


Figure 24: Impulse response functions of ICs (baseline)

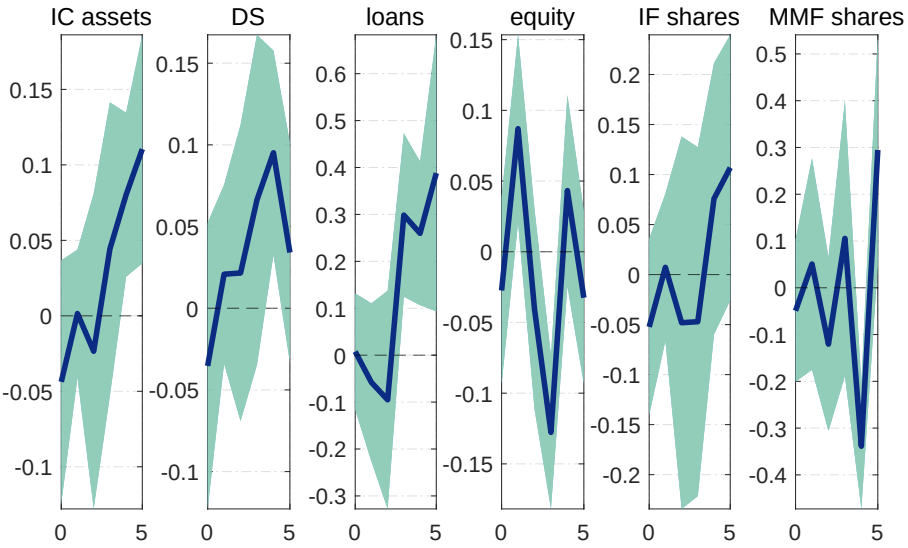
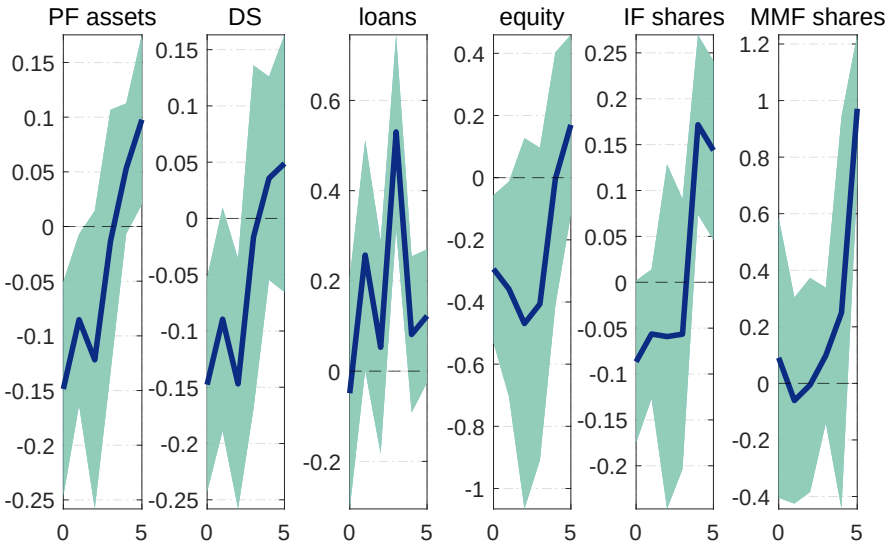


Figure 25: Impulse response functions of PFs (baseline)



Investment Funds and the Monetary-Macroprudential Policy Interplay*

Martin Hodula[1] and Anisa Tiza Mimun[2]

[1]Czech National Bank
[2]Justus-Liebig University Giessen

February 21, 2025

Abstract

Is there an undesired side-effect of banking regulation on the non-bank sector? How effective is the non-bank financial intermediaries' transmission channel of monetary policy in the presence of macroprudential policy? Using a state-dependent local projection approach and a rich dataset capturing macroprudential tightening across euro area countries, we uncover strong cross-country heterogeneity. In financially conservative markets (Germany, France, the Netherlands), tight monetary policy combined with stricter macroprudential measures significantly contracts investment fund assets. Conversely, financial hubs (Luxembourg, Italy, Ireland) experience counterintuitive expansions under the same policy mix, driven by regulatory arbitrage and global capital flows. Further disaggregation shows that equity funds are more vulnerable to joint tightening in conservative systems, while bond funds partly offset contractionary forces in global hubs through higher yields. Overall, our findings underscore the pivotal role of policy coordination and suggest that macroprudential measures can both stabilize and reshape non-bank financial intermediation.

*We thank David Finck for sharing his MATLAB toolbox for the estimation of state-dependent local projections. We thank Peter Tillmann for his very helpful feedback. We are also grateful for helpful comments of participants of Barcelona School of Economics' summer course on banking regulation. The views expressed are those of the authors and not necessarily those of the Czech National Bank or the European Central Bank.

Keywords: Non-bank financial intermediaries, macroprudential policy, monetary policy, state-dependent local projections
JEL Codes: E58, G21, G28, G51

1 Introduction

The past decade has witnessed significant growth in the investment fund sector, with assets under management almost tripled, reaching unprecedented levels globally. This expansion has been driven by various factors, including increased investor demand for diversified financial products [Greenwood and Scharfstein, 2013, Barber et al., 2016], regulatory shifts [Aiyar et al., 2014, Bengui and Bianchi, 2022, Gebauer and Mazelis, 2023], and the search for yield in a prolonged low-interest-rate environment [Martinez-Miera and Repullo, 2017, Malovaná et al., 2023]. Investment funds have evolved into essential players in financial markets, not only providing liquidity but also influencing asset prices and financial stability. As a result, the role of these funds in financial intermediation and their potential impact on systemic risk have garnered considerable attention from policymakers and researchers alike.

Building on this context, this paper investigates the interplay between monetary policy and macroprudential policy in shaping the growth in investment funds assets, a key segment of non-bank financial intermediaries (NBFIs). Specifically, we study the heterogeneous responses of investment funds (IFs) to monetary policy shocks under different macroprudential policy regimes. Using a state-dependent local projection methodology and a rich country-level dataset capturing macroprudential tightening across euro area countries, we provide new evidence on the extent to which monetary policy and macroprudential policy jointly affect the investment fund sector. Our analysis considers both financially conservative markets [1], such as Germany, France, and the Netherlands, and financial hubs like Luxembourg, Italy, and Ireland, offering a comprehensive view of cross-country differences. While panel estimates provide a valuable overview of the general response of investment funds across a group of countries, they can mask significant cross-country heterogeneity driven by differences in financial structures, regulatory environments, and economic conditions. Therefore, analyzing individual country responses is crucial because the transmission of monetary policy shocks through the financial sector is highly context-dependent. Investment fund markets in Europe differ significantly in terms of size, investor base, asset composition, and the degree of integration into global capital markets. For example, financial hubs like Ireland and Luxembourg are characterized by large, internationally oriented investment fund sectors that may attract capital flows even when domestic monetary and macroprudential conditions are tight. In contrast, more domestically focused markets like Germany may exhibit greater sensitivity to local economic and regulatory shocks, leading to more persistent declines in fund growth.

[1] We define financially conservative markets as those that do not show, or only little, of searching for yield behaviour, i.e. whenever financial conditions tighten, we expect to observe a decline in total assets outside of the regulated banking sector.

Furthermore, macroprudential policies can have different effects depending on how they interact with local financial market conditions and the broader regulatory framework. Germany, France, and the Netherlands have well-developed and resilient financial systems that may dampen or quickly absorb shocks, but even in these countries, the nature of the impact can differ based on the specific macroprudential policy measures in place.

The interplay between monetary policy and macroprudential policy holds significant implications for the investment funds sector due to its unique positioning within the financial system. Unlike banks, which are subject to stricter regulatory frameworks, investment funds operate primarily in capital markets and have benefited from regulatory arbitrage, often bypassing constraints imposed on traditional banking activities. For instance, Kaufmann [2023] show that global financial cycles amplify the effects of monetary policy loosening, with investment funds channeling inflows into equities and debt, thereby influencing asset prices and financial stability globally. This dynamic is particularly relevant in the context of monetary policy adjustments, where low-interest-rate environments have historically fueled risk-taking and asset reallocations among investors, as highlighted by Leduc and Natal [2018]. Meanwhile, macroprudential policy measures, typically designed to curb systemic risks in the banking sector, can inadvertently shape the behavior of investment funds by altering the relative attractiveness of non-bank intermediation. The interaction between monetary policy and macroprudential policy can create feedback loops between asset prices and economic activity, necessitating careful policy coordination to avoid destabilizing side effects [Malovana and Frait, 2017, Van der Ghote, 2021]. Understanding how monetary policy and macroprudential policy jointly influence the investment funds sector is crucial for assessing potential spillovers, regulatory gaps, and risks to financial stability, especially as the boundaries between banking and non-banking activities continue to blur.

The effects of monetary policy shocks can vary depending on the relative tightness of the macroprudential policy regime. For instance, Altavilla et al. [2020] argue that tighter prudential policy can mitigate the risk-taking channel of monetary policy. This implies that monetary policy easing, when combined with macroprudential tightening, may suppress investment fund sector growth by dampening the risk-taking incentives of economic agents. However, as highlighted by Gebauer and Mazelis [2023] and Hodula and Ngo [2024], tighter macroprudential policy can also induce regulatory arbitrage, where financial activity shifts to less-regulated sectors. This could lead investment funds to expand, contrary to the expected contraction under monetary policy easing, illustrating a potentially divergent path for the sector despite monetary policy shocks.

Our results highlight significant heterogeneity in the effects of monetary policy and macroprudential policy on investment funds. In conservative markets, the combination

of tight monetary policy and macroprudential policy leads to substantial contractions in funds total assets, suggesting that stricter regulatory environments amplify the contractionary effects of monetary tightening. Conversely, financial hubs display counterintuitive increase in assets under the same conditions, potentially driven by regulatory arbitrage and the global integration of their financial markets. These findings underscore the dual role of monetary policy and macroprudential policy in influencing financial stability and the challenges posed by fragmented regulatory regimes within an integrated market.

Beyond the aggregate effects, our analysis provides nuanced insights into how different types of investment funds and macroprudential policies interact with monetary policy shocks. We find that equity and bond funds respond differently to monetary tightening under varying macroprudential policy regimes. Equity funds, particularly in conservative financial systems such as Germany and France, experience sharper contractions in growth when monetary policy tightening coincides with stricter macroprudential policy, reflecting higher sensitivity to risk-based regulatory measures. Bond funds, on the other hand, show a more mixed response: while monetary tightening generally reduces fund inflows, the associated increase in yields can attract investors, leading to a partial offset of the contractionary impact. This behavior is more pronounced in financial hubs like Luxembourg and Ireland, where bond funds benefit from global capital flows and regulatory arbitrage.

Furthermore, we differentiate between the effects of capital-based and liquidity-based macroprudential policy. [2] Capital-based policies amplify the contractionary effects of monetary tightening by limiting risk-taking capacity, whereas liquidity-based measures exhibit more heterogeneous outcomes, with financial systems that are more diversified recovering faster. These findings highlight the importance of considering both fund types and regulatory measures when assessing the interplay between monetary and macroprudential policies, as they reveal varied channels through which financial stability may be influenced.

This paper contributes to the growing literature on the interplay between monetary policy and macroprudential policy by extending the focus beyond the banking sector to include non-bank financial intermediaries, specifically investment funds. Countries worldwide have increasingly utilized macroprudential policies to mitigate the build-up of systemic risks during favorable economic conditions and to limit the amplification of shocks during downturns. While existing research demonstrates the success of macroprudential policy in achieving domestic objectives, such as curbing credit growth or foreign currency-denominated borrowing, it also highlights significant spillovers and leakages that

[2] Capital-based measures include requirements such as risk weights, systemic risk buffers, and minimum capital requirements. Liquidity-based measures encompass policies targeting systemic liquidity and funding risks, such as liquidity coverage ratios, liquid asset ratios, and net stable funding ratios.

shift risks outside the regulated banking system, often to bond markets and the broader shadow financial system. Our paper builds on this body of work by focusing on the responses of investment funds to the combined effects of monetary policy and macroprudential policy, providing insights into a previously underexplored area. When building on the presumption that non-banks have increased, at least partly, due to regulatory arbitrage, i.e. because of a shift from regulation of the banking sector, we contribute to the literature strand including the work by [Acharya et al., 2013], [Rendon et al., 2024], [Gopal and Schnabl, 2022], and [Irani et al., 2021]. These articles study different aspects of this mechanism. For instance, [Acharya et al., 2013] present evidence on how banking regulation led to increased issuance of asset-backed commercial papers. More recent work by [Buchak et al., 2024] shows that regulation has significantly contributed to an increase of non-banks engaging in residential mortgages. Finally, one of the closest papers to ours has been recently published by [Coman, 2023]. Her paper essentially studies the impact of monetary policy on investment funds and banks in the euro area, including foreign monetary policy shocks of the Federal Reserve, Bank of England, and European Central Bank. In terms of methodological approach, she runs a panel local projection approach including interaction terms of monetary policy and macroprudential policies. Concretely, she studies the impact of monetary policy on bank credit and house prices. Therefore, we can complement her work, and provide new evidence focusing on the effects of monetary policy on investment funds, including macroprudential policies as well. We differentiate from her work and run state-dependent estimations which allow us to directly estimate the impact of monetary policy on non-banks **conditional** on the state of tightening of macroprudential policies.

We add to the literature by examining how different types of investment funds (e.g., equity and bond funds) react to monetary policy shocks under varying macroprudential policy regimes. Importantly, we distinguish between capital-based and liquidity-based macroprudential policy measures and show that their interaction with MP produces heterogeneous effects across fund types and countries. These findings align with evidence that tighter macroprudential policy may curb financial intermediation in some cases [Altavilla et al., 2020], while simultaneously inducing regulatory arbitrage, redirecting financial activity to less-regulated sectors ([Gebauer and Mazelis, 2023];[Hodula and Ngo, 2024]). By focusing on investment funds, our study highlights a potential channel through which macroprudential policy can generate spillovers into non-bank financial intermediaries, shifting financial activity beyond the reach of traditional banking regulations.

Moreover, our work contributes to understanding how the joint effects of monetary policy and macroprudential policy vary across financial systems. For example, we document that conservative markets such as Germany, France, and the Netherlands expe-

rience pronounced contractions in investment funds total assets under tight monetary policy and macroprudential policy, whereas financial hubs like Luxembourg, Italy, and Ireland demonstrate an increase in total assets, driven by their roles as global financial centers. These results provide new evidence on the extent to which regulatory environments influence the transmission of monetary policy and macroprudential policy to non-bank financial sectors, underscoring the dual role of these policies in both stabilizing and reshaping financial intermediation.

In doing so, we provide evidence supporting the need for tailored macroprudential policy design that accounts for spillovers, leakages, and the vulnerabilities of non-bank financial intermediaries. While our findings suggest that tighter macroprudential policy can shift financial activity to the investment fund sector, this does not imply a need to dilute such regulations. Instead, it calls for a comprehensive approach to policy design that balances the resilience of the banking system with the risks posed by shifts in financial intermediation outside the regulated sector.

The rest of the paper is structured as follows. Section 2 presents the data. Section 3 lays down the methodological framework. Section 4 shows and discusses the obtained results and Section 5 concludes.

2 Data

Our analysis primarily relies on monthly, country-specific aggregated data for euro area investment funds, sourced from the European Central Bank's dataportal. The dataset includes total assets of investment funds at the country level (Figure (1)) and further disaggregates these into total assets of equity funds and bond funds (Figure (2)). The country sample comprises six euro area countries: Germany, France, the Netherlands, Luxembourg, Ireland, and Italy. Our sample covers the time period January 2009 until December 2021.[3] Finally, this sample captures both financially conservative systems and global financial hubs, enabling robust cross-country comparisons.

[3] See summary statistics in the appendix.

Figure 1: Investment Funds in Selected EA Countries

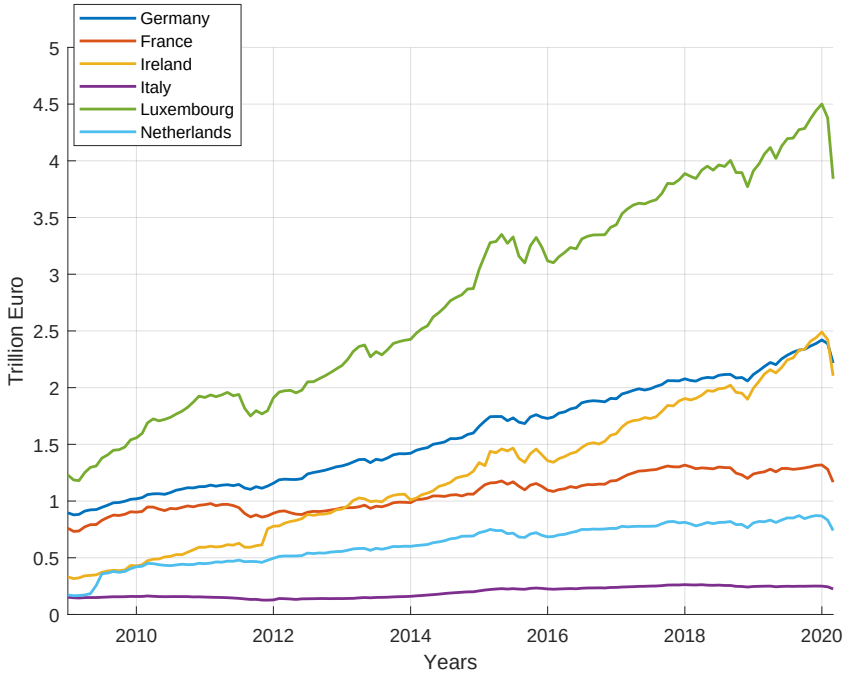
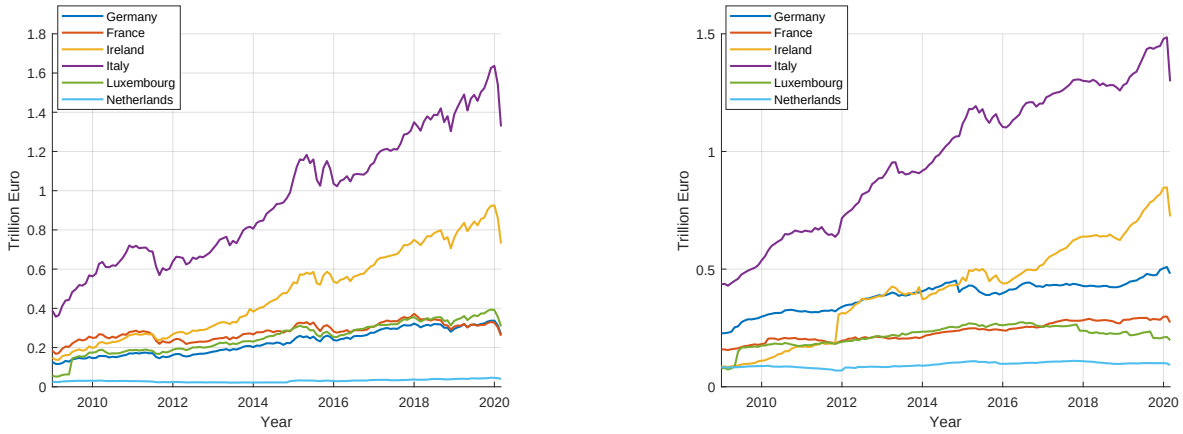


Figure 2: Investment Funds in Selected EA Countries: Fund Type Breakdown

(A) Equity Funds (B) Bond Funds



Note: Panel A shows the total assets of equity funds in different euro area countries, while Panel B illustrates the total assets of bond funds.
Source: ECB Dataportal, own calculation.

To capture the influence of macroprudential policies on investment funds behavior, we incorporate a state-dependent analysis using a dummy variable that reflects macroprudential policy tightening over time for each country. This variable takes the value of

one in months when a macroprudential policy tightening occurs and zero otherwise. In cases where multiple macroprudential policy measures are implemented within a single month, we consolidate the data by transforming the value to one, maintaining the binary structure of the dummy variable. The data for the macroprudential policy stance is obtained from the Integrated Macroprudential Policy (iMaPP) database developed by the International Monetary Fund (IMF). This database provides detailed information on macroprudential measures, enabling us to track the regulatory environment over time.

In addition to including the overall effects of macroprudential policy, we differentiate further between two specific categories of macroprudential measures: capital-based and liquidity-based regulations. Capital-based measures include requirements such as risk weights, systemic risk buffers, and minimum capital requirements. Liquidity-based measures encompass policies targeting systemic liquidity and funding risks, such as liquidity coverage ratios, liquid asset ratios, and net stable funding ratios. By isolating these categories, we estimate the impulse responses of investment funds to monetary policy shocks under distinct macroprudential conditions.

3 Econometric methodology

For our analysis, we adopt the state-dependent local projection methodology introduced by Ramey and Zubairy [2018]. This approach provides a flexible framework to estimate the dynamic effects of monetary policy shocks while accounting for different states of macroprudential policy. The primary advantage of this method lies in its ability to accommodate non-linearities by distinguishing between states with tightening macroprudential policy measures and those without any macroprudential tightening, allowing us to directly assess the heterogeneous effect of monetary policy shocks across these regimes.

$$\begin{aligned} y_{t+h} = I_{t-1}[\alpha_{A,h} + \theta_{A,h}(L)z_{t-1} + \beta_{A,h}shock_t] + \\ (1 - I_{t-1})[\alpha_{B,h} + \theta_{B,h}(L)z_{t-1} + \beta_{B,h}shock_t] + \varepsilon_t \end{aligned} \tag{1}$$

In our model, y_t represents the variable of interest, which can be the total assets of country-level investment funds, equity funds, or bond funds. The estimation also includes z_{t-1}, a vector of control variables such as the (log) euro area industrial production, (log) harmonized index of consumer prices, and (log) CISS, capturing broader macroeconomic and financial conditions. To account for the role of macroprudential policy, we include I, a dummy variable that indicates the macroprudential policy state, where $I = 1$ denotes macroprudential tightening and $I = 0$ reflects the absence of such measures. This setup allows us to estimate two distinct regimes: A includes a macroprudential tightening mea-

sure and B does not include any (macroprudential tightening) measure, and therefore, reflects the isolated response to a monetary policy shock.

The identification of monetary policy shocks follows the methodology introduced by [Altavilla et al., 2020], which captures the surprise component of monetary policy changes. Specifically, we construct a monetary policy shock series using the unexpected changes in the German 10-year yield around the ECB's monetary event window, which includes the press release window and the press conference window, respectively. The shock series assigns to each month the change in the yield within the press conference window. For months without an ECB Governing Council decision, the surprise value is set to zero. This high-frequency identification strategy isolates monetary policy surprises, enabling a more precise estimation of their impact.

Technically, the time series for monetary policy shocks is constructed as follows:

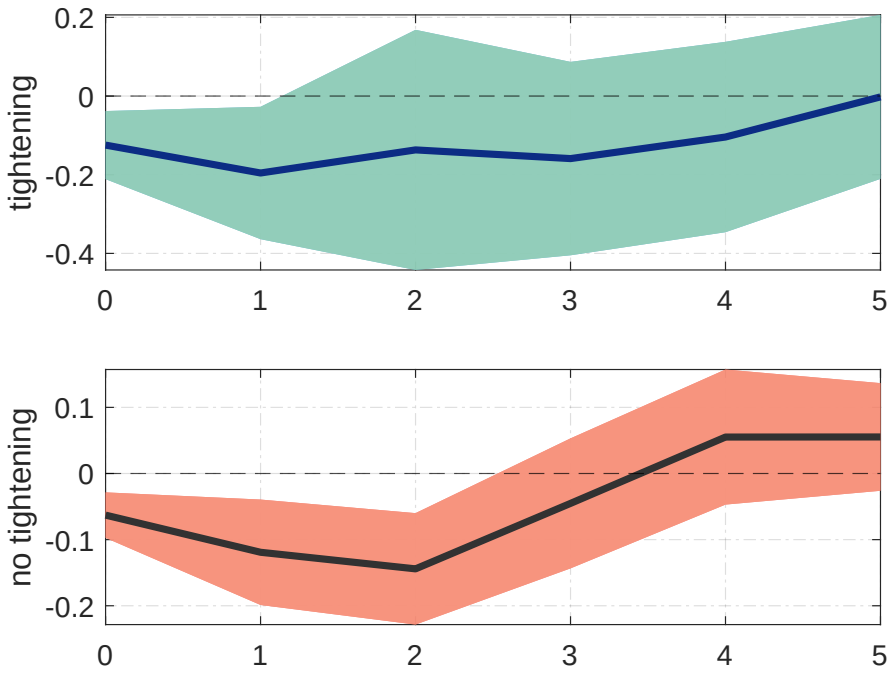
$$shock_t = \begin{cases} surp_{t,d} & \text{if Governing Council meeting in month } t \\ 0 & \text{if no Governing Council meeting in month } t \end{cases}$$

where t and d indicate the month and the day of the press conference following meetings of the Governing Council. Further, $surp_{t,d}$ indicates the change of a specific asset price within the monetary event window.

4 Results

By looking at country-specific responses, we can better understand how factors such as investor behavior, market liquidity, and regulatory stringency potentially influence the adjustment dynamics of investment funds to changes in the monetary policy stance as well as to macroprudential policy tightening measures. This approach allows policymakers to tailor the monetary and macroprudential policy mix more effectively to the needs of individual economies, rather than applying a one-size-fits-all strategy based on average effects observed in panel estimates, see Figure (3). It is crucial to keep in mind that we only distinguish between tightening and no tightening macroprudential policy, but we do not present results on the stance, i.e. loose or tight macroprudential policy stance.

Figure 3: Impulse responses of Euro area investment funds



Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

4.1 Country-Level Responses

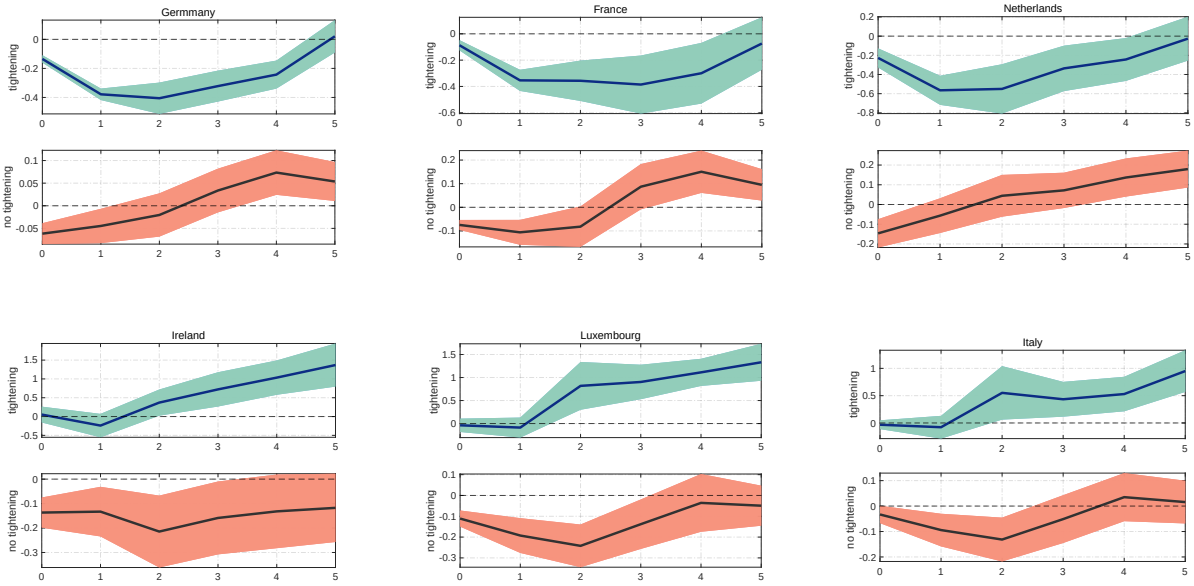
Figure 4 illustrates the impulse responses of the investment funds sector in several European countries to monetary policy shocks, under both tightening and no tightening macroprudential policy regimes. Specifically, it shows the estimated β_h coefficients, representing the effect of a monetary policy shock on the investment funds assets. In the no tightening macroprudential policy regime, our analysis reveals that monetary policy tightening leads to a decrease in investment fund sector across all countries studied. The immediate impact varies, with Germany experiencing a modest decline of -0.05% and the Netherlands facing a larger decrease of -0.15%. Notably, in Germany, France, and the Netherlands, the negative response is short-lived, the investment fund sector reverts to its pre-shock levels within five months. This quick reversion suggests that the investment fund sector in these countries absorbs the monetary policy shocks rather quickly, possibly due to robust economic fundamentals, efficient financial systems, and strong investor confidence. Conversely, Ireland, Italy, and Luxembourg exhibit a more persistent nega-

tive response to the monetary policy tightening. This prolonged effect may stem from structural vulnerabilities, less diversified financial markets, or heightened investor risk aversion, making their fund sectors more sensitive to monetary policy tightening when macroprudential policy is not tightening.

When we introduce the tight macroprudential policy regime, the effects of monetary policy shocks become even more heterogeneous. In Germany, France, and the Netherlands, monetary policy shocks under macroprudential tightening lead to a more pronounced decrease in investment fund sector total assets compared to the effects of a monetary policy shock alone. This suggests that tight macroprudential policy amplifies the contractionary effects of monetary tightening in these countries. The stricter regulatory environment may constrain financial activities further, exacerbating the negative impact on fund flows.

In contrast, Luxembourg, Italy, and Ireland experience an increase in the investment fund sector under tight macroprudential policy following a monetary policy shock. This counterintuitive result could be due to these countries' roles as global financial hubs. Investors might redirect capital to these countries to circumvent tighter regulations elsewhere or to seek higher returns, leading to increases in their investment fund sectors despite overall monetary tightening. We refer to this, also in accordance with the literature, as regulatory arbitrage. Concretely, total assets of investment funds in Luxembourg do not react at all on impact, and after one month, they strongly increase by more than one percentage point. Similarly, Ireland's investment funds neither react on impact, and also similarly to Luxembourg's investment funds, they start to increase after approximately one month strongly by more that 1.5 percentage points.

Figure 4: Impulse Responses of Selected Investment Funds Sectors

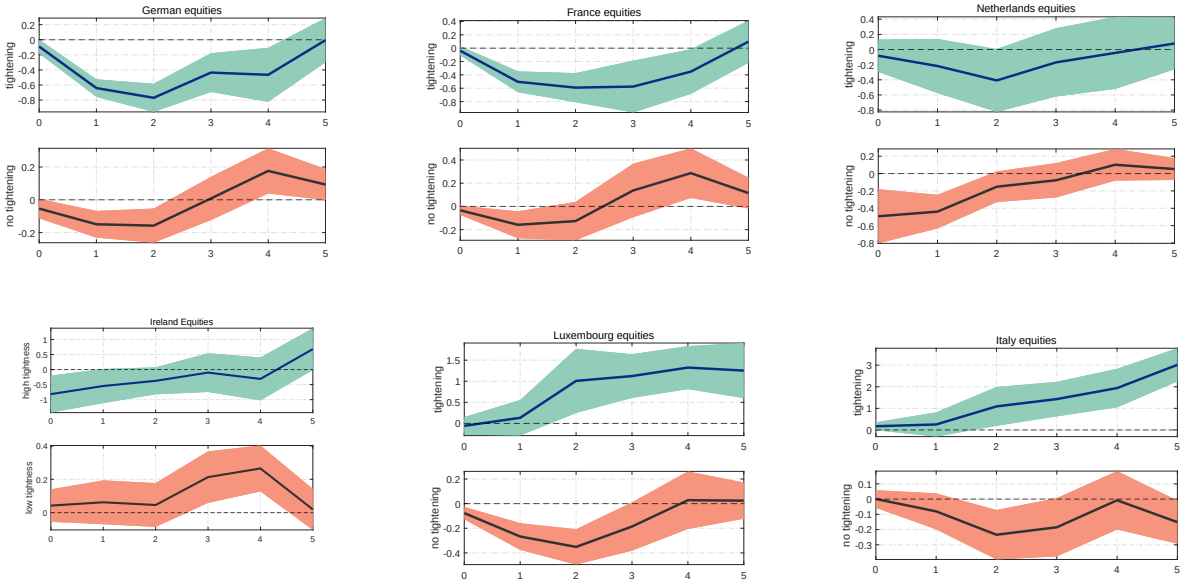


Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

5 Responses of country-level equity funds and bonds funds

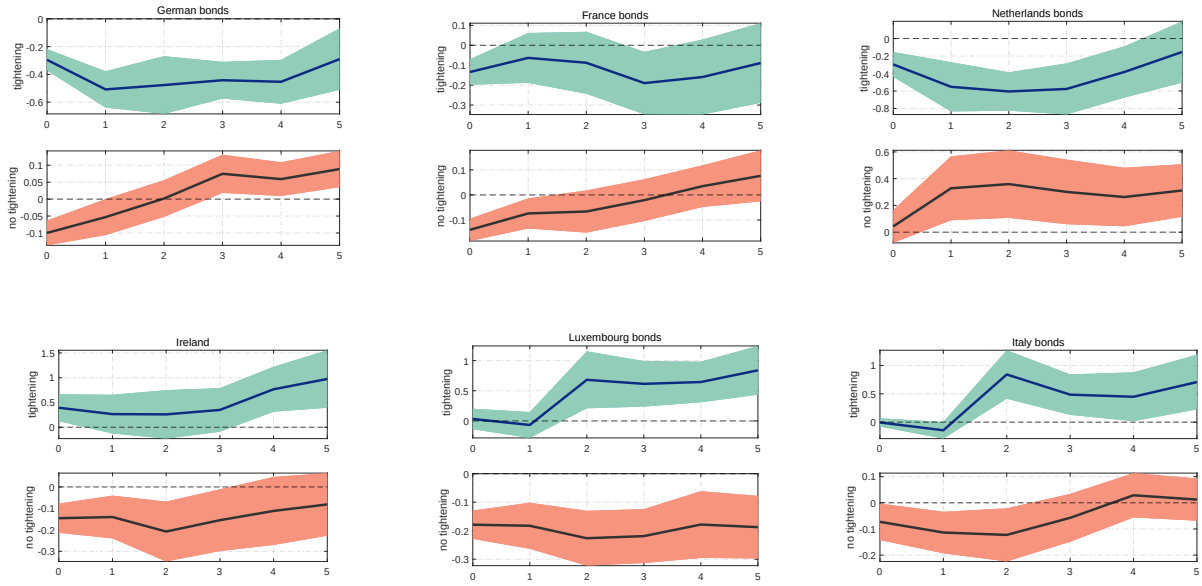
Figures (5) and (6) display the responses of country-level equity funds and bonds funds, respectively. We observe that under the no macroprudential policy regime, monetary policy tightening leads to a decline in both equity funds and bond funds across all countries, but the severity and recovery dynamics vary based on asset class and country-specific factors. Equity funds in Germany, France, and the Netherlands experience a sharp contraction, which is relatively short-lived, with recovery occurring within three to five months. This pattern suggests that while equity markets are initially sensitive to higher borrowing costs and reduced risk appetite, they quickly rebound due to strong economic fundamentals and investor confidence in these well-developed financial systems. In contrast, bond funds in these countries show a more moderate decline. Ireland and Luxembourg are less affected overall, reflecting their global integration and the potential for capital inflows from international investors seeking favorable yields or opportunities, even when monetary conditions tighten. Italy, however, shows persistent declines for both equity and bond funds, highlighting structural weaknesses, such as higher sensitivity to economic shocks and limited diversification within the financial sector, which amplify the impact of monetary policy tightening. In the tightening macroprudential policy regime, the negative effects of monetary policy tightening become more pronounced, particularly for equity funds in Germany, France, and the Netherlands. The amplified contraction in equity funds total assets can be attributed to stricter regulatory constraints, such as limits on leverage or higher risk buffers, which exacerbate risk aversion among investors and restrict the ability of financial institutions to quickly adjust their portfolios. This leads to a deeper and more persistent impact on the equity market. Bond funds in these countries also experience prolonged declines, as the combination of higher interest rates and capital constraints makes it difficult for funds to attract and manage inflows effectively. However, the higher yields on bonds still provide some stabilization over time. Ireland and Luxembourg present a unique case: both equity funds and bond funds in these financial hubs display resilience or even benefit from inflows under tight macroprudential policy. This counterintuitive result likely reflects their status as international investment destinations, where global investors may see these markets as safer or more attractive due to the perceived stability offered by strict regulations, drawing in capital even in a tighter monetary environment. In Italy, the combined stress of monetary policy tightening and strict macroprudential policy exacerbates the decline across both asset classes, underscoring ongoing economic fragilities and the limited capacity of the Italian financial market to adapt to compounded shocks.

Figure 5: Impulse Responses of Selected Investment Funds Sectors: Equity funds



Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

Figure 6: Impulse Responses of Selected Investment Funds Sectors: Bond funds



Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

6 Results for liquidity- and capital-related macroprudential policies

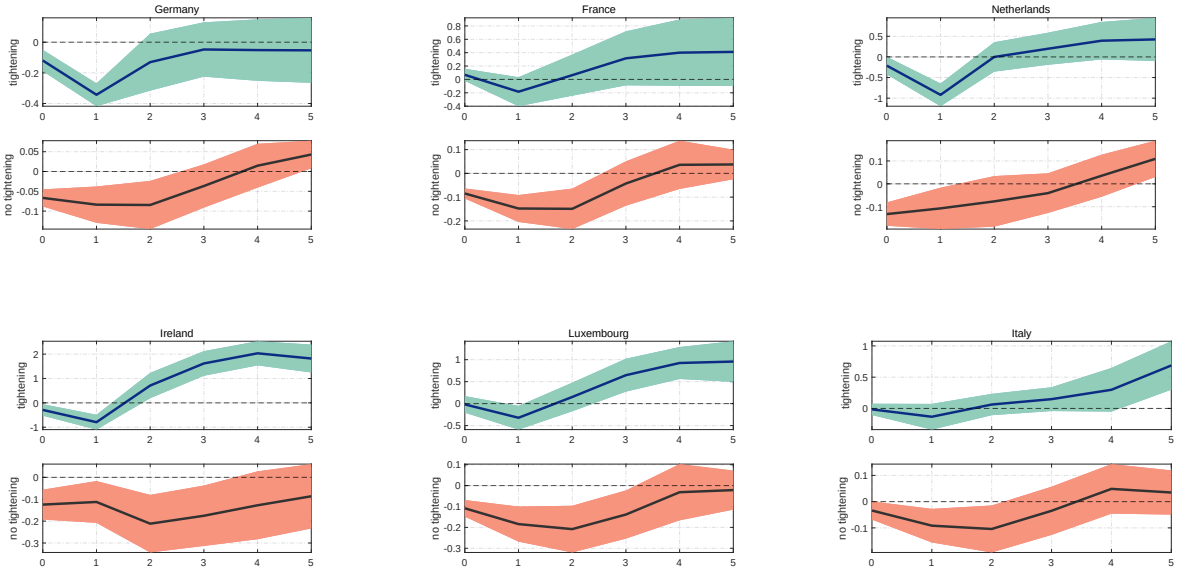
Our analysis reveals distinct dynamics in the investment funds sector's response to monetary policy shocks under liquidity-based (Figure (7)) and capital-based (Figure (8)) macroprudential policies. By comparing the responses, we can identify the mechanisms driving these differences and their economic implications. The initial impact of monetary policy shocks under liquidity-based macroprudential policy is significant and pronounced across most countries, reflecting the immediate tightening of liquidity constraints. These policies restrict the ability of financial intermediaries to manage short-term funding efficiently, thereby exacerbating the reduction in investment funds flows. As a result, countries like Germany, France, and the Netherlands experience a sharp decline, albeit with a relatively quick recovery, as markets adjust to the new conditions. Recovery under liquidity-based macroprudential policy is quicker in countries with robust and well-diversified financial markets. In Germany, France, and the Netherlands, the sector starts to rebound within two to three months. This suggests that once the immediate liquidity constraints are absorbed, these markets can regain stability through effective portfolio rebalancing and investor confidence. However, in Italy, the recovery remains subdued, indicating structural inefficiencies that prevent a swift reversion. In contrast, capital-based macroprudential policy produces an even more substantial initial negative impact that persists longer. This is because capital-based measures, such as higher capital requirements, directly restrict the risk-taking and credit-provisioning capacity of financial institutions. The prolonged contraction seen in Germany, France, and the Netherlands suggests that these measures create a deeper and more persistent drag on fund sector total assets, highlighting their more enduring dampening effect on financial activity. Recovery under capital-based macroprudential policy is more sluggish. The responses demonstrate a longer-lasting negative effect, especially in Germany and France, where the fund sector struggles to return to its pre-shock levels. The persistence of these effects can be attributed to the binding nature of capital constraints, which eventually limit financial institutions' flexibility to respond to monetary policy shocks. In Italy, this persistence is even more pronounced, exacerbating the structural challenges of its financial system. Both liquidity-based and capital-based macroprudential policy produce less severe or even positive responses to monetary policy shocks in financial hubs. Under liquidity-based macroprudential policy, the quicker recovery may be driven by global investors seeking safer assets or liquidity buffers. Under capital-based macroprudential policy, the muted negative response or slight increase could stem from these countries' roles as attractive destinations for capital in search of well-capitalized and highly regulated investment en-

vironments. This behavior highlights the global nature of their financial markets, where international capital flows can counterbalance domestic policy effects.

7 Policy implications

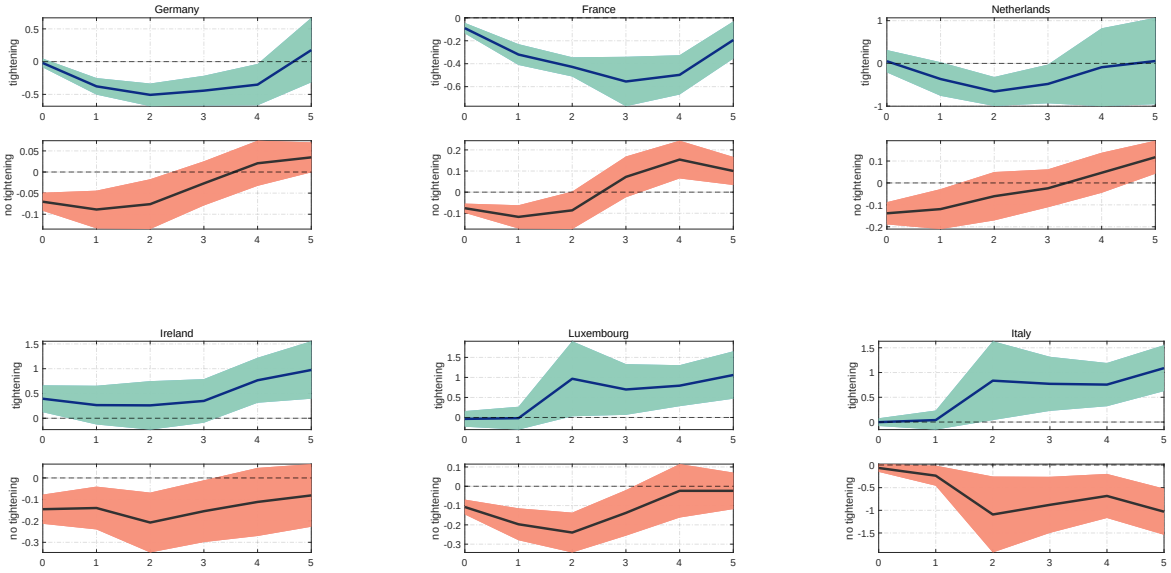
Macroprudential policies are helpful and important in order to safeguard our financial system. After the global financial crisis, it was necessary to integrate strict rules for banks, and therefore, help to prevent further crises. Roughly at the same time, the non-bank financial intermediaries sector has grown significantly. In a global comparison, non-banks are now almost as large as banks. However, observing an increase in unregulated segments such as non-banks, the question whether and if yes how to also regulate non-banks naturally arises. Especially in the context of rising interconnections between banks and non-banks ([Tiza Mimun et al., 2025]). Therefore, it might be necessary to either increase the macroprudential tools targeted for banks and include investment funds, or to closely monitor dynamics following certain monetary and macroprudential policies. In our analysis, we find that a mix of tightening monetary policy and macroprudential tightening has relevant implications for investment funds. On one hand, we observe that Germany, France and the Netherlands, which are considered as relatively financially conservative investment funds countries, experience a strong decline after the monetary-macroprudential policy tightening interplay. On the other hand, however, the reaction of investment funds in Luxembourg, Ireland, and Italy display a different dynamic. They *increase* after a tightening monetary policy shock *and* macroprudential policy tightening. We argue that this is a clear hint of regulatory arbitrage, and further, potentially also a source of financial instability.

Figure 7: Impulse Responses of Selected Investment Funds Sectors: Liquidity-based policies



Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

Figure 8: Impulse Responses of Selected Investment Funds Sectors: Capital-based policies



Notes: The figure shows the estimated β_h coefficients in a tight macroprudential policy state (upper panel) and in a state without any macroprudential policy measures included (lower panel). The figure also shows 68% confidence bands.

8 Conclusions

This paper investigates the interplay between monetary policy (MP) and macroprudential policy (MaPP) and their joint impact on the investment fund sector in the euro area. Using state-dependent local projections, we uncover significant heterogeneity in the responses of investment funds across different regulatory and economic environments. Our findings highlight the importance of understanding how MP and MaPP interact in shaping the behavior of non-bank financial intermediaries, particularly investment funds, which play an increasingly critical role in financial intermediation.

We show that in conservative financial systems, such as Germany, France, and the Netherlands, the combination of tight MP and MaPP amplifies contractionary effects on investment funds, reflecting the dampening impact of stricter regulatory regimes. In contrast, financial hubs like Luxembourg and Ireland demonstrate growth in their investment fund sectors under similar conditions, likely driven by regulatory arbitrage and their integration into global financial markets. These divergent responses underscore the dual role of MP and MaPP as both stabilizing forces and potential sources of systemic risks, depending on the specific context.

Our findings contribute to the growing literature on the monetary-macroprudential policy nexus, extending its application to non-bank financial intermediaries. By focusing on investment funds, we highlight a key area where regulatory gaps and policy spillovers may undermine financial stability. These results suggest that a one-size-fits-all approach to monetary and macroprudential policies may be insufficient in an integrated financial market. Instead, policymakers should consider the cross-sector and cross-border implications of their actions, particularly as the boundaries between banks and non-banks continue to blur.

Future research could build on our work by exploring additional dimensions of the monetary-macroprudential policy interaction, such as the role of cross-border capital flows, market-specific characteristics, or the potential for coordination between jurisdictions. As non-bank financial intermediaries grow in size and influence, understanding their behavior under different policy regimes will be crucial for safeguarding financial stability in an increasingly interconnected world.

References

Viral V. Acharya, Philipp Schnabl, and Gustavo Suarez. Securitization without risk transfer. *Journal of Financial Economics*, 107:515–536, 2013.

Shekhar Aiyar, Charles W Calomiris, and Tomasz Wieladek. Does macro-prudential regulation leak? evidence from a UK policy experiment. *Journal of Money, Credit and Banking*, 46(s1):181–214, 2014.

Carlo Altavilla, Luc Laeven, and José-Luis Peydró. Monetary and macroprudential policy complementarities: evidence from European credit registers. 2020.

Brad M Barber, Xing Huang, and Terrance Odean. Which factors matter to investors? evidence from mutual fund flows. *The Review of Financial Studies*, 29(10):2600–2642, 2016.

Julien Bengui and Javier Bianchi. Macroprudential policy with leakages. *Journal of International Economics*, 139:103659, 2022.

Greg Buchak, Gregor Matvos, Tomasz Piskorski, and Amit Seru. Aggregate lending and modern financial intermediation: Why bank balance sheet models are miscalibrated. *NBER Macroeconomics Annual 2023*, 38, 2024.

Andra Coman. Monetary policy spillovers and the role of prudential policies in the european union. *ECB Working Paper*, 2023/2854, 2023.

Stefan Gebauer and Falk Mazelis. Macroprudential regulation and leakage to the shadow banking sector. *European Economic Review*, 154:104404, 2023.

Manasa Gopal and Philipp Schnabl. The rise of finance companies and fintech lenders in small business lending. *The Review of Financial Studies*, 35, 2022.

Robin Greenwood and David Scharfstein. The growth of finance. *Journal of Economic perspectives*, 27(2):3–28, 2013.

Martin Hodula and Ngoc Anh Ngo. Does macroprudential policy leak? evidence from shadow bank lending in eu countries. *Economic Modelling*, 132:106657, 2024.

Rustom M. Irani, Rajkamal Iyer, Ralf R. Meisenzahl, and Jose-Luis Peydro. The rise of shadow banking: Evidence from capital regulation. *The Review of Financial Studies*, 34:2181–2235, 2021.

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

Sylvain Leduc and Jean-Marc Natal. Monetary and macroprudential policies in a leveraged economy. *The Economic Journal*, 128(609): 797–826, 2018.

Simona Malovana and Jan Frait. Monetary policy and macroprudential policy: Rivals or teammates? *Journal of Financial Stability*, 32:1–16, 2017.

Simona Malovaná, Josef Bajzík, Dominika Ehrenbergerová, and Jan Jank. A prolonged period of low interest rates in europe: Unintended consequences. *Journal of Economic Surveys*, 37(2):526–572, 2023.

David Martinez-Miera and Rafael Repullo. Search for yield. *Econometrica*, 85(2):351–378, 2017.

Valerie A Ramey and Sarah Zubairy. Government spending multipliers in good times and in bad: evidence from us historical data. *Journal of political economy*, 126(2): 850–901, 2018.

Juan F. Rendon, Lina M. Cortes, and Javier Perote. Basel iii countercyclical bank capital buffer estimation and its relation to monetary policy. *Journal of Economics and Business*, 130, 2024.

Anisa Tiza Mimun, Gabor Fukker, and

Matthias Sydow. The effects of monetary policy on banks and non-banks in times of stress. *ECB Working Paper, forthcoming*, 2025.

Alejandro Van der Ghote. Interactions and coordination between monetary and macroprudential policies. *American Economic Journal: Macroeconomics*, 13(1):1–34, 2021.

A Appendix

The data we use representing the monthly country-level investment funds total assets are obtained by the ECB's dataportal. All units are in millions euro. Figure (A1) shows the summary statistics for the time period January 2009 until December 2021.

Metric	Germany	France	Ireland	Italy	Luxembourg	Netherlands
Count	135	135	135	135	135	135
Mean	1,577,020	1,065,183	1,230,373	194,472	2,779,466	623,711
Std Dev	442,339	162,947	602,812	46,631	936,545	173,413
Min	878,343	732,521	316,219	126,360	1,179,980	165,172
25th Percentile	1,142,322	933,036	621,755	150,727	1,935,996	474,238
50th Percentile	1,550,014	1,045,290	1,164,438	189,123	2,766,822	666,948
75th Percentile	1,984,428	1,230,880	1,721,394	243,807	3,623,038	776,466
Max	2,420,942	1,318,090	2,490,018	262,828	4,500,492	872,484

ECB perception of non-banks and monetary policy transmission: A machine learning-based approach*

Ami Dalloul
Leibniz University Hannover

Anisa Tiza Mimun
Justus-Liebig University Giessen

March 28, 2025

Abstract

This paper investigates how the public European Central Bank (ECB) perception of the non-bank financial intermediaries sector (NBFI) influence the transmission of monetary policy. To address this, we construct a deep learning-based natural language processing (NLP) perception index that captures the views of the ECB towards NBFIs. The index is developed by analyzing the sentiment of sentences referring to NBFIs using our fine-tuned pre-trained large language model. Our econometric analysis, employing local projections, includes a pure monetary policy shock and a central bank information shock. Our findings suggest that the perception of the ECB of non-banks matters for the transmission of monetary policy to this sector.

Keywords: Non-bank Financial Intermediation, Monetary Policy Shocks, Machine Learning, Sentiment Analysis, Large Language Models.

JEL classification: E44, E52, C80

*We thank Lena Dräger, Moritz Pfeifer, Peter Tillmann for their helpful comments, questions and discussions.

1 Introduction

The non-bank financial intermediaries (NBFI) sector - also known as non-banks - has grown significantly in the last decade. Notably, investment funds display the largest part in the non-bank financial intermediaries universe. With the huge increase in total assets, so has the importance of this heterogeneous and complex sector grown as well. Researchers and policy-makers have started studying this sector in detail to understand the main dynamics, the transmission of monetary policy, as well as the potential financial stability risks that may arise from them, for example see Holm-Hadulla et al. (2023), Jin and Nadal De Simone (2020), Kaufmann (2023), Giuzio et al. (2021) and Tiza Mimun et al. (2025).

Interestingly, we have little to no knowledge about how institutions, especially ones with policy-making mandates, actually *perceive* non-banks. Our work aims to fill this gap which we believe is an important one in order to understand how the *general* publicly communicated perception of non-banks might also have an influence on the growth, the investment decision by market participants. For this purpose, we introduce a machine learning-based index which reflects the perception of the ECB about non-banks.

This paper uses publicly available ECB speeches to construct an index of the perception of the NBFI sector by the ECB from 1998 until 2024. To capture the information contained in these public speeches, we classify the sentiment of all sentences referring to the NBFI sector using a pretrained large language model that we fine-tuned using our own set of manually labeled data. We find that speeches discussing the NBFI sector generally cover a broad range of topics, including regulation, market integration, growth, diversification, securitization, risk, financial stability, innovation, credit, and monetary policy. Within these topic categories, we observe that the tone can vary, ranging from neutral to either negative or positive. For example, some speeches highlight the positive impact of implemented regulatory frameworks on financial stability, reflecting a positive perception. In contrast, other speeches focus on the need for additional regulation due to the yield-seeking behavior of NBFIs and the increased risks associated with them, which suggests a more negative perception. Our constructed perception index is predominantly negative, suggesting that the ECB publicly expresses a gener-

ally unfavorable view of the NBFI sector. Over the 26-year period analyzed, we measure a few brief positive spikes in perception, notably in the early 2000s and following the implementation of new regulatory frameworks. However, for most of the period, including the years leading up to the 2008 financial crisis, during the crisis itself, and more recently with the surge in cryptocurrencies, inflation and the subsequent economic downturn, the perception remains largely negative. We then proceed by including our constructed perception index into an econometric analysis to further study the role of the perception of the ECB in the transmission of monetary policy to investment funds. We argue it makes sense to study the potential influence of ECB's perception of non-banks on the transmission of monetary policy to non-banks for several reasons. First, in case of a negative perception, investors may react stronger to the *additional* information received by the ECB through the speeches on non-banks than only to changes in the monetary policy stance. Second, we assume that, on the other hand, investors that are more engaged in risky segments might rather react positively to a negative perception because they might expect higher risk premia. Applying local projections and making use of two different monetary policy shocks introduced by Jarocinski and Karadi (2020), we present evidence that our index amplifies the effects of monetary policy.

Overall, we contribute to the literature in several ways. First and foremost, we construct a unique index measuring the perception of the ECB of non-banks. To the best of our knowledge, there is no comparable index in the literature. Second, we study the role of the index in the transmission of monetary policy, i.e. we examine whether the perception of the ECB of non-banks might influence *further* the reaction of non-banks to changes in the monetary policy stance. We present evidence that the perception of the ECB on non-banks does have an amplifying effect. In other words, our findings show that while a pure monetary policy shock leads non-bank entities to decrease, a central bank information shock leads to increases in the different funds types. When in addition including our perception index, we observe that the (negative) perception of the ECB of non-banks indeed affects the transmission of monetary policy to and through non-banks. However, this observation happens only when we estimate the responses to a pure monetary policy shock. In that case, the perception of the ECB amplifies the already

observable negative response. On the other hand, the central bank information shock somehow seems to be stronger than the negative influence of the negative response.

The paper is structured in the following way. Chapter 2 revisits the related literature. On one hand, we discuss the literature on machine-learning-based indices, on the other hand the literature related to central bank communication as well as the empirical effects of monetary policy on non-banks, and in particular, on investment funds. Chapter 3 presents the text dataset and the fine-tuning process and the perception index construction. In section 4 we introduce our econometric approach. Results will be presented in chapter 5. Chapter 6 concludes.

2 Related Literature

Following the first and second wave of increased central bank communication (Haldane et al., 2020), a large body of literature on its effects has emerged. A significant portion of this research focuses on two primary target audiences: market participants and the general public comprising households and firms. Studies concerning households and firms have found that although these agents stand to benefit from receiving central bank information (Dräger and Nghiem, 2023, Nghiem et al., 2024) empirical evidence suggests that their responsiveness is limited (Coibion et al., 2018), despite functioning media transmission channels (Munday and Brookes, 2021, Dalloul, 2024). In contrast, market participants demonstrate a higher degree of attentiveness and reactivity in response to central bank communications. High-frequency financial markets and asset prices have been proven to react to news coming from central banks about monetary policy decisions, forecasts and forward guidance. (Cai et al., 2021, Born et al., 2014, Ehrmann and Talmi, 2020, Gürkaynak et al., 2005, Gómez-Cram and Grotteria, 2022, Mumtaz et al., 2023, Schmeling and Wagner, 2024).

A substantial portion of the literature on central bank communications has increasingly relied on computational linguistic methods. Early contributions in this area employed dictionary-based approaches and manual coding to quantify the tone and sentiment of policy statements (Ehrmann and Fratzscher, 2007, Gürkaynak et al., 2005). Building on these initial efforts, more recent studies have integrated ad-

vanced natural language processing techniques—such as topic modeling, machine learning algorithms for sentiment analysis, and vector space models—to extract subtler nuances from central bank texts (Aruoba and Drechsel, 2022, Coibion et al., 2018, Haldane et al., 2020, Gürkaynak et al., 2005). These methodological advancements have provided deeper insights into how central bank communications shape expectations and behavior across diverse audiences, including market participants, households, and firms.

Concerning the link between investment funds and monetary policy, (Holm-Hadulla et al., 2023, Tillmann and Tiza Mimun, 2023) explore how banks and non-banks, particularly investment funds, respond to monetary policy shocks. They employ high-frequency monetary policy shocks within a local projection framework and find that monetary policy tightening negatively impacts investment fund flows. Further, Kaufmann (2023) investigates the effects of U.S. monetary policy on European investment funds through a structural Bayesian VAR model. His results indicate that a loose monetary policy in the U.S. leads to increased inflows into European investment funds, especially equity and debt funds. This result highlights the cross-border transmission of monetary policy effects and its influence on fund allocation. Giuzio et al. (2021) provide insights into how euro area investment funds react to monetary policy using a Bayesian VAR model with a monetary policy shock identification approach. Their study focuses on bond, money market, and equity funds and present evidence that expansionary monetary policy increases fund inflows, particularly towards riskier asset classes. Jin and Nadal De Simone (2020) analyze the impact of monetary policy on the systemic risk-taking behavior of euro area investment funds. Their research presents evidence that bond, mixed, and real estate funds are most prone to increased risk-taking following a monetary policy shock. Banegas et al. (2022) also examine the effects of monetary policy shocks on investment funds using a VAR model with high-frequency shock identification. They conclude that such shocks influence fund performance and inflows, with diverse impacts across different investment models. And finally, Abdi et al. (2025) explore how hedge funds adjust their equity market exposure in response to monetary policy changes. The study finds that hedge funds decrease their market exposure following expansionary monetary policy and increase

it after contractionary policy. Those funds showing stronger responses to policy changes tend to achieve higher gross and risk-adjusted returns. This observation, the authors conclude, suggests that skilled hedge funds effectively use information from Federal Open Market Committee (FOMC) announcements to update their market forecasts.

3 Text Analysis Methodology

In this section, we describe the steps undertaken to construct our index. We explain the choice of LLMs as a method for quantifying text. We present the data labeling process as well as the fine-tuning and validation process. We finally explain the calculation of the perception time series.

To build our ECB NBFI perception index, we collect 2,299 English language speeches given by the ECB between July 1998 and June 2024. The sentences within these speeches are then first classified according to their relevance to the NBFI sector, and subsequently, each sentence is assigned a corresponding sentiment/tone score.

3.1 Quantifying Text

By far the most popular approach to labeling text is unsupervised machine learning methods such as the Latent Dirichlet Analysis (LDA) method (Blei et al., 2003). Topic models capture the various topics that can occur within a set of documents (corpus). This is achieved by observing the co-occurrence between words in a sentence (or paragraph) and clustering them. However, such models neither allow too search for pre-specified topics, nor do they output an interpretable sentiment for the uncovered topics.

Measurement of the tone of text to estimate the effects of communication on various economic agents has become increasingly prevalent. A highly used method of sentiment analysis has been dictionary methods (Apel and Blix Grimaldi, 2012, Bennani, 2020, Bennani and Neuenkirch, 2017, Correa et al., 2021, Loughran, 2011, Picault and Renault, 2017, Stekler and Symington, 2016, Schmeling and Wagner,

2024). When using a dictionary method, a set of n-gams (words) is predefined, and a document's sentiment score is calculated based on the relative occurrence of positive (e.g. 'good') and negative (e.g. 'bad') n-grams. However, as Pfeifer and Marohl (2023) point out, the bag-of-word approach struggles to address the linguistic idiosyncrasies of central bank communications. Indeed, central bank communications tends to depend on context, which n-grams cannot properly capture. For instance, the bigram "lower interest" will be counted as occurring in both the sentences "we will not lower interest" and "we will lower interest" even though they mean the opposite of each other.

In the case of sentiment analysis, deep-learning models (also referred to as Large Language Models (LLM)) have been found to outperform both dictionary methods (Fischer et al., 2023, Frankel et al., 2022, Purda and Skillicorn, 2015) and non-deep-learning machine learning models (Huang et al., 2022).

LLMs are understood to be typically pre-trained on large text datasets (Peters et al., 2018, Radford, 2018). They offer the advantage of considering the context of a word within a specific sentences, allowing them to circumvent the challenged faced by dictionary methods. Further, LLMs can be fine-tuned to accommodate a specific dataset, making it possible to predict sentiment for out-of sample data. Fischer et al, use a human annotated dataset to fine-tune a FinBert model on FOMC meeting transcripts to label sentence with a set pre-defined topics and to assign them a corresponding sentiment.

3.2 Training data and labeling methodology

Our corpus is made up of 2,299 ECB speeches over a time span of 26 years. We follow Pfeifer and Marohl (2023) and keep prepossessing to a minimum as we are using LLMs that do not require the removal of stop words, punctuation, stemming or lemmatizing. We thus split our corpus into sentences to be used as input for the model.

After sentence tokenization, our full text dataframe contains around 300,000 sentences. To construct the perception index, we first identify sentences as either referring to the NBFI sector or addressing other non-NBFI-related topics. Subsequently, each sentence is assigned a label indicating whether it communicates

a positive, negative, or neutral perception. Given the large number of sentences, manual labeling is time prohibitive. We thus randomly select 3,000 sentences from the full dataset to be manually labeled, used as a benchmark and for training in order to choose the best performing model for topic and tone identification.
Figure 1 displays the words found in the sentences that capture the ECB's perception of the NBFI sector. Meanwhile, Figure 2 illustrates the specific words most frequently occurring in sentences assigned negative, neutral, or positive perception labels. When examining all text related to the NBFI sector, we observe expected terms such as non-bank, market, assets, credit, financial, risk, funds, and policy. However, when analyzing the words that correlate with negative versus positive perception labels, Figure 2 reveals that negative perception sentences are often associated with terms like risky, amplify, pressure, and illiquid, while positive perception sentences tend to feature associations with words such as encourage, foster, and positive.

Figure 1: Worcloud of Non-Bank Related Sentences in ECB Speeches

Note: This figure presents a word cloud generated from sentences labeled as belonging to the topic of the NBFI sector in speeches by the ECB between 1998 and 2024. The word clouds were derived using TF-IDF vectorization, which identifies key terms within each sentiment group based on their frequency and relevance.

When constructing our training dataset, we assign two labels to each sentence. A topic label, classifying the sentences as either referring to the NBFI sector or as "other" for all other topics, as well as a sentiment/tone label. Sentences can be labeled as either positive (1), neutral (0) or negative (-1) only if they belong to

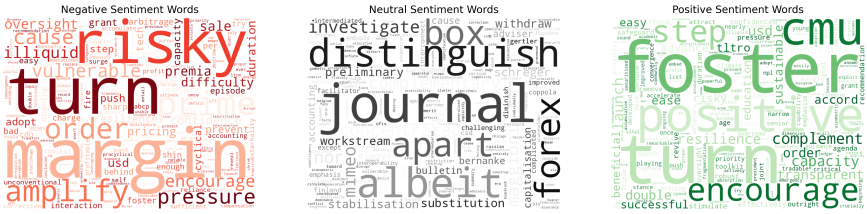


Figure 2: Worclouds by Sentiment of the Perception of the ECB of the NBFI Sector

Note: This figure presents word clouds generated from text data related to the perception of non-bank financial intermediaries (NBFIs) across different tone of perception categories: Positive, Neutral, and Negative. The word clouds were derived using TF-IDF vectorization, which identifies key terms within each sentiment group based on their frequency and relevance.

the subset of sentences that received the label NBFI topic.

We define positive and negative tone as any sentence that discusses the ECB's perceptions of NBFIs from a positive perspective or a negative perspective. A neutral tone is a statement about the NBFI sector that states facts without any obvious negative or positive descriptive adjectives. We further follow a set of rules for the tone classification that is specific to what we observed in the data during the labeling process.

1. Sentences that contain references to the transmission of monetary policy through non-banks and explicitly raise concerns about its functioning are labeled as negative.[1]

2. Sentences that contain references to a specific need for regulation of the NBFI sector are labeled as negative. As they could be a sign of increasing in financial instability for example.

[1]As Cucic and Gorea (2024) show, non-banks are increasingly engaging in credit lending activities. We argue that from the ECB's perspective, increased lending activity by non-banks can be viewed as negative as it might impose challenges for the overall transmission of monetary policy to the whole economy. For instance in the case where non-bank lending increases in a context of reduced bank lending due to a tightening of monetary policy.

3. Sentences that contains mentions of already implemented regulation of the NBFIs are labeled as positive as they might reflect a guarantying of financial stability.

4. Sentences that describe any growth in the size of the NBFI sector without any explicit descriptive adjectives are labeled as neutral.[2]

Table 1 shows example sentences and their corresponding labels.

Sentence	**Sentiment**	**Topic**
At the same time, the increase in non-bank finance has created new hazards for monetary policy.	-1	Non Bank
The investment fund industry doubled in size in the last five years in Europe.	0	Non Bank
Fund investors shifted their exposure from higher to lower risk assets, especially from high-yield corporate to government bond funds.	1	Non Bank
Persistent ultra-low policy interest rates may not be the right medicine for lifting inflation close to the target.	N.A.	Other

Table 1: Sample of manually labeled sentences from the training dataset

Of the 3,000 labeled sentences, we found that 300 referred to the NBFI sector. With negative sentiment being more prevalent than the other two sentiments. We then split our labeled dataset into training, testing and validating subsets.
For the topic labeling task, we found that the Gpt-4o-mini outperformed both Bert and Llama2. It's accuracy rate- which measures the proportion of total predictions that are correct- was at 0.97. Requiring no fine-tuning, we ran the entire corpus through Gpt-4o-mini, and labeled all sentences that related to the NBFI sector. Of the 300,000 sentences in our corpus, 8,172 were labeled as "non_bank" .
For the tone of perception labeling task, we looked at various LLMs without any fine-tuning to establish a baseline for their performance "off-the-shelf". We ran FinBert, Llama2 in version 7-hf and 13b-hf. They all performed poorly in the

[2]NBFI sector growth can reflect two things: a more diversified supply of financing options, but also an increased concern for either financial stability or transmission of monetary policy.

off-the-shelf versions. The details of the fine-tuning and validation are detailed below.

3.3 Fine-tuning for sentiment

To test which LLM is most suited to classify the ECB speeches, we fine-tuned FinBert and two different versions of Llama2. The Llama2 7-hf is a version of the model containing 7 billion parameters, whereas Llama2 13b-hf includes 13 billion parameters, offering a larger capacity for processing and generating more nuanced text. Consequently, while both models share a similar architecture and training foundation, the 13b variant typically achieves enhanced performance at the cost of increased computational resource requirements compared to the more efficient 7b version. Table 2 shows the details of the hyperparameters used for the fine-tuning of the different LLMs.

In their baseline form, the different LLM models we tested for classifying the tone of the perception of NBFI-related sentences in ECB speeches perform rather poorly. As can be seen in Table 3, the highest weighted average of Precision- a measure that quantifies the quality of, for example, positive predictions by calculating the ratio of true positives to the sum of true and false positives- is 0.33 for the Llama2-13b-hf model. Fine-tuning yields positive results and doubles on average the performance of all three tested models.

Model	**GAS**	**Batches**	**Epochs**
FinBert	2	8	3
Llama2-7-hf	2	2	3
Llama2-13b-hf	8	1	3

Table 2: Hyperparameters for classifier model

When only looking at the performance metrics in Table3, the best performing model post fine-tuning seems to be the FinBert with an overall accuracy of 0.69. However, when we look at the confusion matrices in figure and closely inspect the directions of the false positives, false negatives and false neutrals, it becomes clear

that the FinBert is positive biased compared to the Llama2-7-hf model. Further, the individual accuracy scored per label show that for Llama2-7-hf, the positive label is as low as 0.28, while the negative and neutral labels are above 0.71. Both FinBert and Llama2-7-hf are under-performing when it comes to the positive labels. This could result in the case of the FinBert model in an overly positive perception and for the Llama2-7 in an overly neutral perception.

Model	**Precision**	**Recall**	**F1**
FinBert Baseline	0.31	0.30	0.25
FinBert fine-tuned	0.69	0.67	0.69
Llama2-7-hf Baseline	0.28	0.33	0.20
Llama2-7-hf fine-tuned	0.65	0.62	0.60
Llama2-13b-hf Baseline	0.33	0.36	0.24
Llama2-13b-hf fine-tuned	0.63	0.60	0.58

Table 3: Results of classifiers before and after fin-tuning

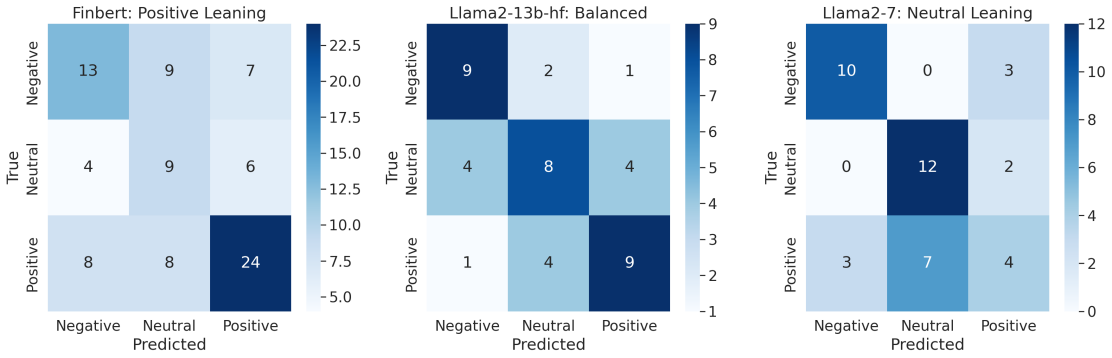


Figure 3: Confusion Matrices by Fine-Tuned Model

Note: In this figure we plot the true and predicted sentiment labels of each LLM after fine-tuning.

The Llama2-13b-hf seems to strike a balance between the two others. While the fine-tuning process does not yield the highest performance metrics, the distribution of the false positives, negatives and neutral is more homogeneous.

3.4 Sentiment Time Series

We use the fine-tuned Llama2-13b-hf model to make predictions on every sentence labeled non_bank. We follow Fischer et al. (2023) by aggregating the sentence-level perception score in order to obtain a speech-level perception score.

$$\text{Perception}_{d,t} = \frac{1}{n}[\sum_{s=1}^{n} \text{Perception}_{s,d,t}] \tag{1}$$

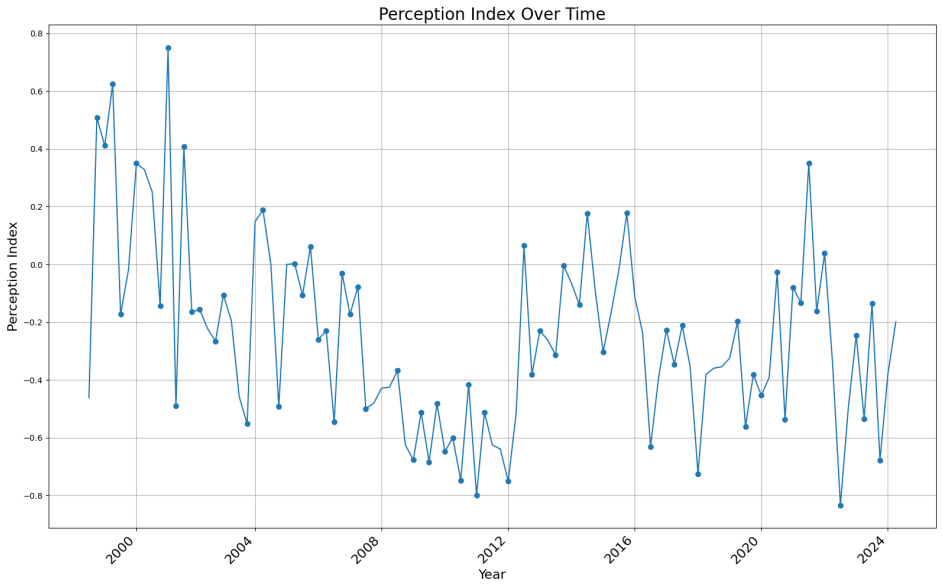


Figure 4: ECB-NBFI Perception Index

Note: In this figure we plot the time series for the perception index. Aggregated over quarters

Equation 1 shows the way we calculate the speech-level perception. For each speech contained in document d at time t (day on which speech was given), one perception score is obtained by averaging over the sentences s within the document.
Figure 4 shows the sentiment time series plotted over quarters. The perception index shows an early phase of positive perception of the NBFI in the early years of the monetary union, corresponding with enthusiasm about increased market access, growth and integration. Quickly followed by increasing negatives perception with lows as much as -0,80 during the height of the great financial crises (GFC). With the implementation of post-GFC regulatory frameworks, the perception in-

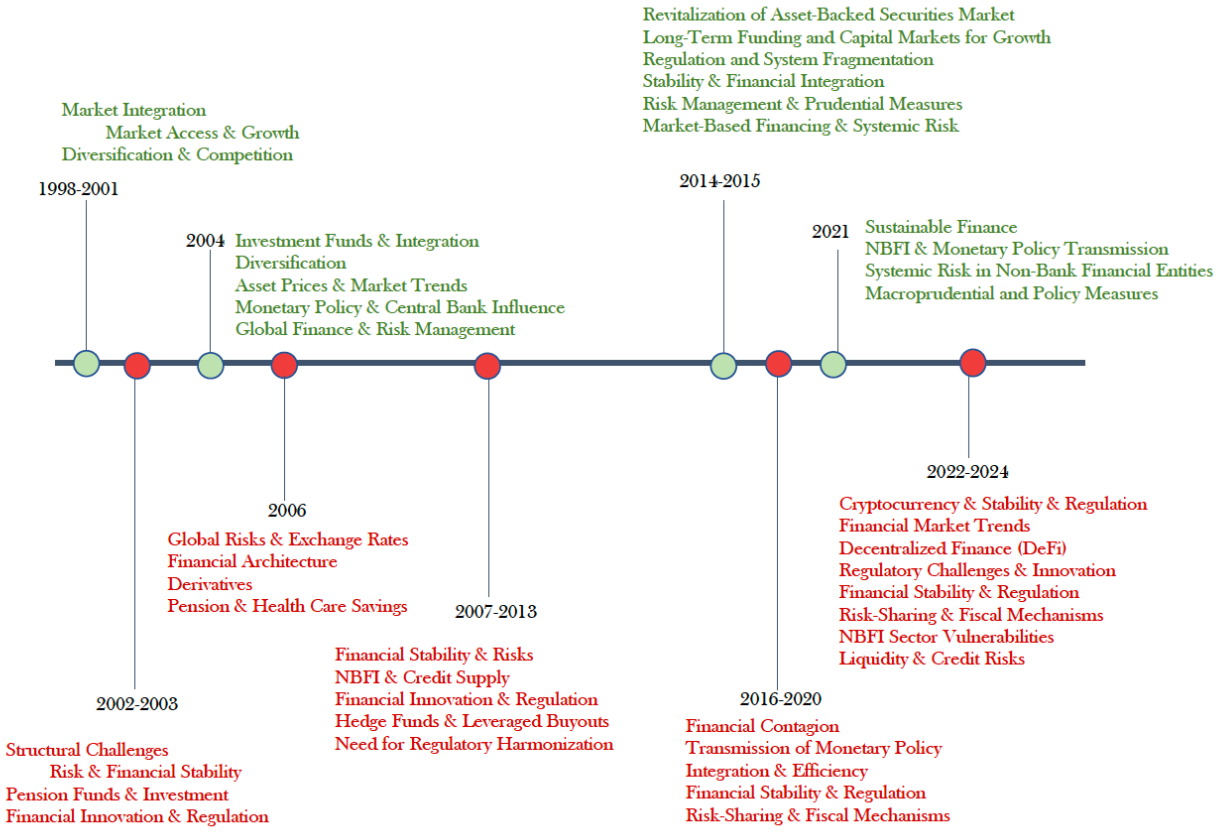


Figure 5: Clusters of Positive and Negative Topics Discussed in ECB-NBFI Perception Index over Time

Note: In this figure we show topics that can be found in the ECB speeches clustered by perception and time period. Topics relating to a negative perception are found below the line while positive ones are above it.

dex rises again, reaching more positive values in the years immediately after the crisis. Despite this recovery, the index fluctuates significantly over the following years, with another period of negative perception emerging around 2016-2020, which corresponds to concerns over systemic risks and vulnerabilities within the NBFI sector.

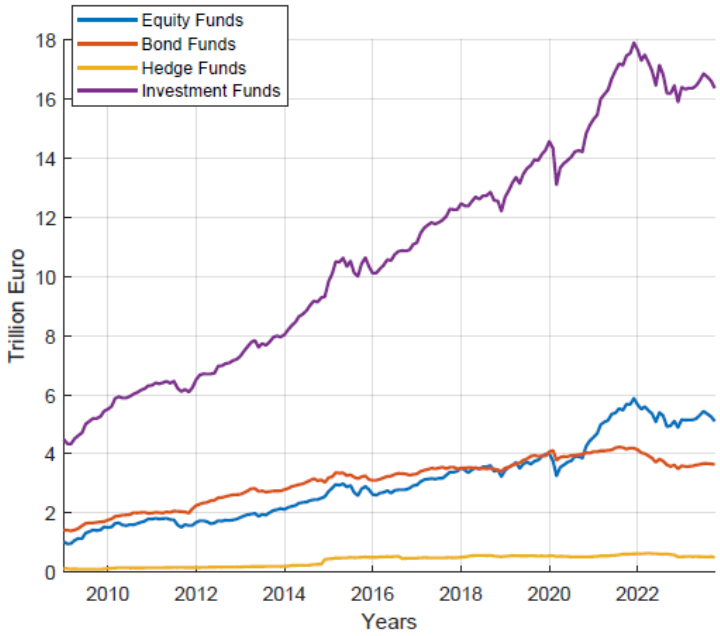
Figure 5 offers further insight into the perception index by presenting a timeline that clusters various topics found in the ECB speeches according to their associated perception and the corresponding time period. From the timeline, we can observe that earlier periods (such as 1998-2001 and 2002-2003) feature topics primarily related to market integration, asset prices, and financial stability, which are generally associated with a more positive perception of the NBFI sector. Shortly before the GFC, topics that highlight concerns about financial innovation and an increasingly complicated financial architecture start to be detected in the speeches. The negative perception shifts further between 2007 and 2013 largely due to concerns over systemic risk, financial contagion, and the stability of market-based financing. This negative shift is particularly evident in topics related to the vulnerabilities of the NBFI sector, including liquidity and credit risks, which were exacerbated by the crisis and prompted regulatory reforms. Interestingly the positive perception spike in the period 2014-2015, which coincides with the implementation of new regulatory frameworks designed to ensure financial stability and reduce systemic risk. Furthermore, more recent years (2021-2024) focus on regulatory challenges, systemic risks, and the influence of new financial technologies like cryptocurrencies and decentralized finance (DeFi), which are again linked to a more critical stance. Despite the small positive perception around 2021 with topics such as sustainable finance.

4 Econometric methodology

This section introduces the econometric methodology we apply to further implement our index into an economic analysis. We aim to employ an economic analysis to understand how the public stand of the ECB on non-bank financial intermediaries may influence this particular sector. For this purpose, we employ local projections (Jordà (2005)) and include our sentiment index into an interaction

term with monetary policy. As a proxy for monetary policy shocks, we include a pure monetary policy shock and a central bank information shock introduced by Jarocinski and Karadi (2020). We chose to study the interaction of our index with a monetary policy shock for various reasons. First, we aim to understand how non-banks react to a change in the monetary policy stance *depending* on their particular role explained publicly by the ECB. In other words, non-banks do react to monetary policy shocks (see e.g. Holm-Hadulla et al. (2023), Tiza Mimun et al. (2025)), but we believe it is also relevant to understand how they react if, in parallel to their reaction to the change in the monetary conditions, they are targeted by speeches as well. For example, assume a time period where our perception index is particularly negative, e.g. in the context of the global financial crisis. It would then follow that non-banks might and will likely react to a change in the monetary policy stance if there is any, but they will also likely pay attention to how the ECB perceives them. For example, assume non-bank entities may expect potential regulatory requirements or investor groups may not engage in searching-for-yield behaviour or regulatory arbitrage. As a proxy for non-banks, we include investment funds into our analysis. Further, we would like to study the responses of investment funds and its subcategories, since equity funds and bond funds have witnessed a huge increase in the last decade (see Figure 6).

Figure 6: Total assets of investment funds in the euro area



Source: ECB Data Portal, own calculation.

Therefore, we include total assets of investment funds, equity funds, bond funds, and hedge funds into our analysis.
In technical terms, our analysis takes the following form:

$$y_{t+h} = \alpha_h + \beta_h shock_t + \phi_h(shock_t \times F_t) + \gamma_h X_t + \epsilon_{t+h}, \tag{2}$$

where y_{t+h} includes total assets of equity funds, bond funds, hedge funds, and investment funds (in logs and multiplied by 100). $shock_t$ reflects two monetary policy shocks, i.e. a pure monetary policy shock and a central bank information shock, respectively, following Jarocinski and Karadi (2020), and X_t include the control variables euro area industrial production, harmonised index for consumer prices, and the composite indicator of systemic stress.

We decide to include a monetary policy shock and a central bank information shock into our analysis for various reasons. A pure policy shock reflects unexpected changes in the policy rate that are orthogonal to the central bank's assessment of economic conditions and might influence financial markets and the real economy through different transmission channels. In contrast, a central bank information shock arises when policy announcements convey new information about the economic outlook and likely lead market participants to revise their expectations about future macroeconomic conditions. Hence, while a contractionary pure monetary policy shock typically leads asset prices to decline and economic activity, an information shock can generate the opposite response if it signals a more optimistic economic outlook than previously anticipated. It follows that including both monetary policy shocks might show additional information that is being processed by non-bank entities. In other words, by including these two different monetary policy shocks, we can observe in a baseline estimation how non-banks might react differently depending on their revised expectations. In addition, by then letting the monetary policy shocks interact with our perception index, we might be able to observe stronger reactions, in both directions, due to an amplification mechanism driven by this specific perception.

Therefore, turning back to the equation above, F_t is our index with a higher value indicating a more positive perception. We are particularly interested in the coefficient ϕ_h. The marginal effect of policy on the dependent variable is:

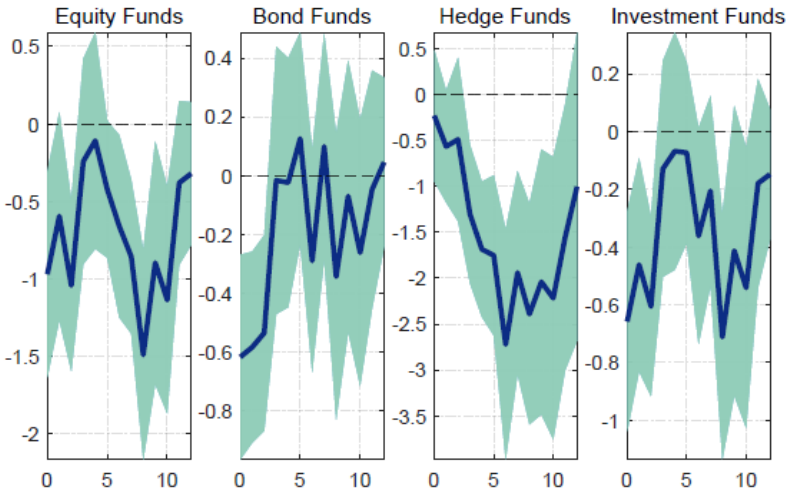
$$\frac{\partial y_{t+h}}{\partial shock_t} = \beta_h + \phi_h \times F_t. \tag{3}$$

Hence, a negative estimate of ϕ_h would imply that the negative response of investment funds to a monetary tightening is stronger under more negative perception of the ECB. The indicator F_t is also included in the vector of controls.

5 Results baseline

This section presents our baseline results. Figure (7) displays the impulse response functions of equity funds, bond funds, hedge funds, and investment funds to a pure monetary policy shock, respectively. We observe that a shock leads all four funds types to decrease in total assets, with equity funds experiencing the strongest decline. Interestingly, bond funds appear to contract the negative reaction over time. Also, the immediate reaction of hedge funds is negligible. This observation might support the narrative that this particular funds types typically does not show strong sensitivity to monetary contraction.

Figure 7: Impulse response functions of non-bank entities to a pure monetary policy shock

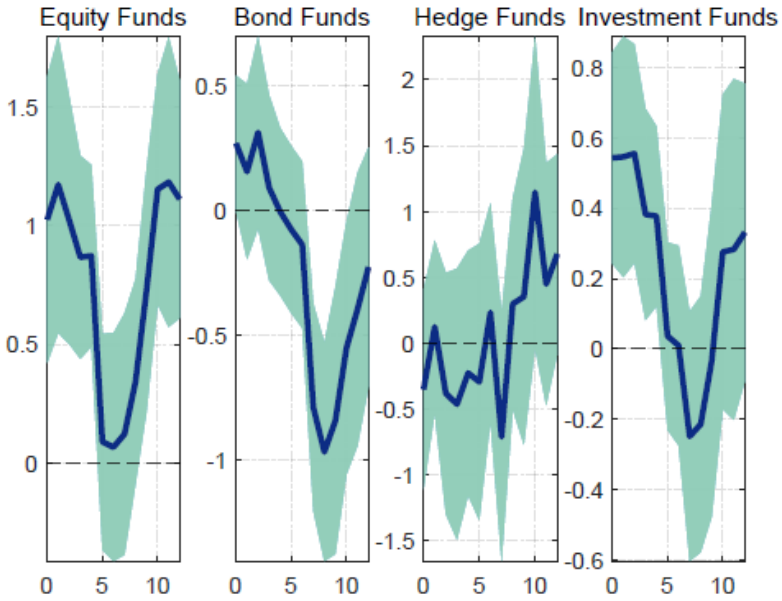


Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (8) shows the responses of our variables of interest to a central bank information shock. Here we observe, as anticipated, a reversed reaction. Concretely, equity funds as well as bond funds react positively on impact, with equity funds showing the strongest reaction in terms of magnitude and being highly statistically

significant. Interestingly, hedge funds do also react negatively like in the estimation in Figure (7). This observation might indicate that hedge funds reduce their holdings in tighter monetary policy moments reflecting their overall searching-for-yield behaviour that is emphasized in loosening conditions. Finally, investment funds also react positively and statistically significant, representing the complete funds sector.

Figure 8: Impulse response functions of non-bank entities to a central bank information shock



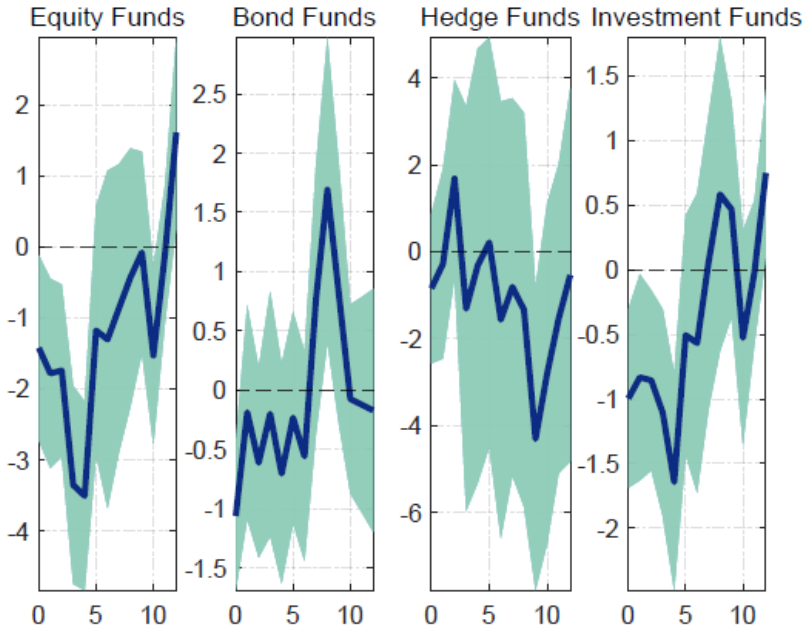
Notes: The figure shows the estimated β_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

6 Results for monetary policy interactions

This section introduces the results we gained by letting the two different monetary policy shocks interact with our perception index. As stated above, in principle we would expect the reactions to be amplified. Indeed, we can partly observe a

stronger reaction in Figure (9) compared to Figure (7). Concretely, we observe that all reactions are much stronger in terms of magnitude. For example, equity funds decrease their assets under management by approximately 1.5 percentage points (compared to roughly 1 percentage point in the baseline estimation, see Figure 7).

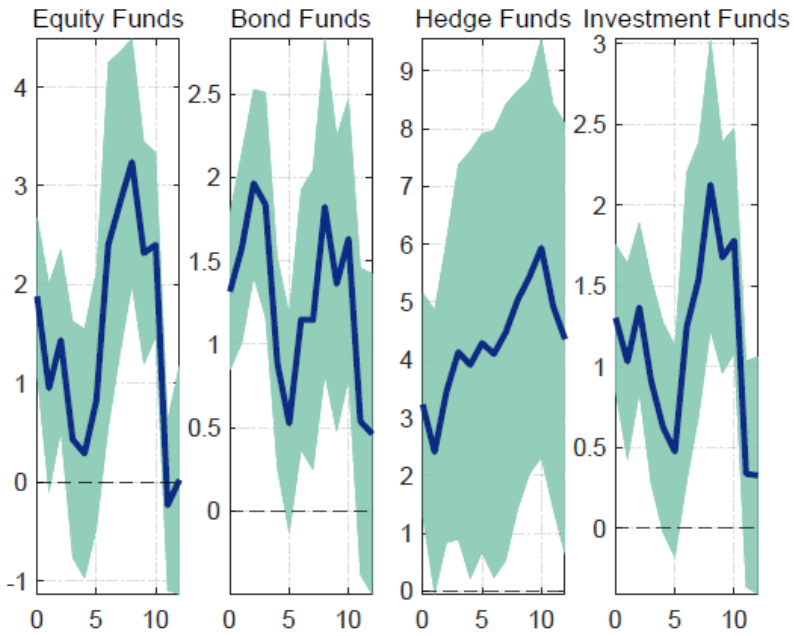
Figure 9: Impulse response functions of non-bank entities to a pure monetary policy shock interacted with our perception index



Notes: The figure shows the estimated ϕ_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Figure (10) shows the response functions of our variables of interest to a central bank shock in the context of our non-bank perception index. Contrary to Figure (9), we observe that the perception does not have a negative amplification. In contrast, we observe that the responses are stronger than in our baseline estimation (see Figure (8).

Figure 10: Impulse response functions of non-bank entities to a central bank information shock interacted with our perception index



Notes: The figure shows the estimated ϕ_h coefficients of a 1bp shock within 68% confidence bands. The x-axis displays quarters, and the y-axis represents percentage points.

Our interpretation for this observation is the following one. Potentially, a tightening monetary policy shock leads investors to decrease their shares - as seen in the responses in Figure (7). But here, although the monetary policy stance is tightening, investors increase even stronger their shares when our perception index is included. This result suggests that while the perception matters in the context of a pure monetary policy shock, the role of an information shock is dominant. In other words, although non-bank investors might be aware of the (on average) negative perception of the ECB, the effects of the information shock are stronger. We assume here that the updated expectations due to the information shock are of a bigger relevance than the perception per se.

7 Conclusions

The ECB's perception of non-banks matters. But only if market participants overly regard a change in the monetary policy stance as a measure to improve economic conditions. In this paper, we build a perception index of how the ECB speaks *publicly* about non-banks. We construct our index based on general assumptions, e.g. whenever the ECB speaks about the need of regulation of non-banks, the assume the perception to be negative. In contrast, whenever we find the ECB speaking about already implemented regulations or enhanced supervision, we assume a positive perception due to the fact that potential financial instabilities associated with non-banks are in that case under control. In our econometric analysis, we study the effects of monetary policy *interacted* with our perception index. Our motivation to apply this method is that we would like to understand how the transmission of monetary policy might be affected by the perception of the ECB. Our findings present an interesting picture. While a pure monetary policy shock leads non-bank entities to decrease, a central bank information shock leads to increases in the different funds types. When in addition including our perception index, we observe that the (negative) perception of the ECB of non-banks indeed affects the transmission of monetary policy to and through non-banks. However, this observation happens only when we estimate the responses to a pure monetary policy shock. In that case, the perception of the ECB amplifies the already observable negative response. On the other hand, the central bank information shock somehow seems to be stronger than the negative influence of the negative response. Our interpretation is that the updated expectations due to a better outlook of the economy affects non-banks stronger (in a positive way) than the negative perception only. Overall, we present a measurable way of the perception of the ECB on non-banks, and the role of this precise perception in the transmission of monetary policy. We conclude that the perception of the ECB of non-banks matters for the transmission of monetary policy in the euro area.

References

Farshid Abdi, Yong Chen, and Boato Wu. Monetary policy and hedge funds' reaching for beta. 2025.

Mikael Apel and Marianna Blix Grimaldi. The information content of central bank minutes. Technical report, Sveriges Riksbank working paper series, 2012.

Boragan Aruoba and Thomas Drechsel. Identifying Monetary Policy Shocks: A Natural Language Approach. CEPR Discussion Papers 17133, C.E.P.R. Discussion Papers, March 2022. URL https://ideas.repec.org/p/cpr/ceprdp/17133.html.

Ayelen Banegas, Gabriel Montes-Rojas, and Lucas Siga. The effects of u.s. monetary policy shocks on mutual fund investing. Journal of International Money and Finance, 123(102595), 2022.

Hamza Bennani. Central bank communication in the media and investor sentiment. Journal of Economic Behavior Organization, 176:431–444, 2020. ISSN 0167-2681. doi: https://doi.org/10.1016/j.jebo.2020.05.022. URL https://www.sciencedirect.com/science/article/pii/S016726812030175X.

Hamza Bennani and Matthias Neuenkirch. The (home) bias of european central bankers: new evidence based on speeches. Applied Economics, 49(11):1114–1131, 2017. doi: 10.1080/00036846.2016.1210782. URL https://doi.org/10.1080/00036846.2016.1210782.

David M. Blei, Andrew Y. Ng, and Michael I. Jordan. Latent dirichlet allocation. Journal of Machine Learning Research, 3(4-5):993 – 1022, 2003. URL https://www.scopus.com/inward/record.uri?eid=2-s2.0-0141607824&partnerID=40&md5=505ce8839ae28d1cb56a7ff91bd0ad2d. Cited by: 31452.

Benjamin Born, Michael Ehrmann, and Marcel Fratzscher. Central Bank Communication on Financial Stability. Economic Journal, 124(577):701–734, June 2014. URL https://ideas.repec.org/a/wly/econjl/v124y2014i577p701-734.html.

Yong Cai, Santiago Camara, and Nicholas Capel. It's not always about the money, sometimes it's about sending a message: Evidence of Informational Content in Monetary Policy Announcements. Papers 2111.06365, arXiv.org, November 2021. URL https://ideas.repec.org/p/arx/papers/2111.06365.html.

Olivier Coibion, Yuriy Gorodnichenko, and Saten Kumar. How Do Firms Form Their Expectations? New Survey Evidence. American Economic Review, 108

(9):2671–2713, September 2018. URL https://ideas.repec.org/a/aea/aecrev/v108y2018i9p2671-2713.html.

Ricardo Correa, Keshav Garud, Juan M Londono, and Nathan Mislang. Sentiment in central banks' financial stability reports. Review of Finance, 25(1):85–120, 2021.

Dominic Cucic and Denis Gorea. Non-bank lending and the transmission of monetary policy. BIS Working Papers, (1211), 2024.

Ami Dalloul. The fed speaks, but does the press repeat? investigating the communication channel between the fed and the written press. Hannover Economic Papers (HEP) 724, Hannover, 2024. URL https://hdl.handle.net/10419/307738.

L. Dräger and G. Nghiem. Inflation Literacy, Inflation Expectations, and Trust in the Central Bank: A Survey Experiment. CESifo Working Paper, 10539, 2023.

Michael Ehrmann and Marcel Fratzscher. The timing of central bank communication. European Journal of Political Economy, 23(1):124–145, March 2007. URL https://ideas.repec.org/a/eee/poleco/v23y2007i1p124-145.html.

Michael Ehrmann and Jonathan Talmi. Starting from a blank page? Semantic similarity in central bank communication and market volatility. Journal of Monetary Economics, 111(C):48–62, 2020. doi: 10.1016/j.jmoneco.2019.01. URL https://ideas.repec.org/a/eee/moneco/v111y2020icp48-62.html.

Eric Fischer, Rebecca McCaughrin, Saketh Prazad, and Mark Vandergon. Fed Transparency and Policy Expectation Errors: A Text Analysis Approach. Staff Reports 1081, Federal Reserve Bank of New York, November 2023. URL https://ideas.repec.org/p/fip/fednsr/97356.html.

Richard Frankel, Jared Jennings, and Joshua Lee. Disclosure sentiment: Machine learning vs. dictionary methods. Management Science, 68(7):5514–5532, 2022. URL https://EconPapers.repec.org/RePEc:inm:ormnsc:v:68:y:2022:i:7:p:5514-5532.

Margherita Giuzio, Christoph Kaufmann, Ellen Ryan, and Lorenzo Cappiello. Investment funds, risk taking, and monetary policy in the euro area. ECB Working Paper, (2605), 2021.

Roberto Gómez-Cram and Marco Grotteria. Real-time price discovery via verbal communication: Method and application to Fedspeak. Journal of Financial Economics, 143(3):993–1025, 2022. doi: 10.1016/j.jfineco.2021.12. URL https://ideas.repec.org/a/eee/jfinec/v143y2022i3p993-1025.html.

Refet S. Gürkaynak, Brian Sack, and Eric Swanson. The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models. American Economic Review, 95(1):425–436, March 2005. URL https://ideas.repec.org/a/aea/aecrev/v95y2005i1p425-436.html.

Andrew Haldane, Alistair Macaulay, and Michael McMahon. The 3 E's of central bank communication with the public. Bank of England working papers 847, Bank of England, 2020. URL https://ideas.repec.org/p/boe/boeewp/0847.html.

Federic Holm-Hadulla, Falk Mazelis, and Sebastian Rast. Bank and non-bank balance sheet responses to monetary policy shocks. Economic Letters, 222(110918), 2023.

Feiming Huang, Lei Chen, Wei Guo, Xianchao Zhou, Kaiyan Feng, Tao Huang, and Yudong Cai. Identifying covid-19 severity-related sars-cov-2 mutation using a machine learning method. Life, 12(6), 2022. ISSN 2075-1729. doi: 10.3390/life12060806. URL https://www.mdpi.com/2075-1729/12/6/806.

Marek Jarocinski and Peter Karadi. Deconstructing monetary policy surprises - the role of information shocks. American Economic Journal: Macroeconomics, 12(2), 2020.

Xisong Jin and Francisco Nadal De Simone. Monetary policy and systemix risk-taking in the euro area investment fund industry: A structural factor-augmented vector autoregression analysis. Journal of Financial Stability, 49(100749), 2020.

Oscar Jordà. Estimation and inference of impulse responses by local projections. American Economic Review, 95:161–182, 2005.

Christoph Kaufmann. Investment funds, monetary policy, and the global financial cycle. Journal of the European Economic Association, 21:593–636, 2023.

Tim Loughran. When is a liability not a liability? textual analysis, dictionaries, and 10-ks. The Journal of Finance, 66:35 – 65, 02 2011. doi: 10.1111/j.1540-6261.2010.01625.x.

Haroon Mumtaz, Jumana Saleheen, and Roxane Spitznagel. Keep it Simple: Central Bank Communication and Asset Prices. Working Papers 960, Queen Mary University of London, School of Economics and Finance, July 2023. URL https://ideas.repec.org/p/qmw/qmwecw/960.html.

Tim Munday and James Brookes. Mark my words: the transmission of central bank communication to the general public via the print media. Bank of England working papers 944, Bank of England, October 2021. URL https://ideas.repec.org/p/boe/boeewp/0944.html.

Giang Nghiem, Lena Dräger, and Ami Dalloul. Anchoring Households' Inflation Expectations when Inflation is High. Hannover Economic Papers (HEP) dp-719, Leibniz Universität Hannover, Wirtschaftswissenschaftliche Fakultät, October 2024. URL https://ideas.repec.org/p/han/dpaper/dp-719.html.

Matthew E. Peters, Mark Neumann, Mohit Iyyer, Matt Gardner, Christopher Clark, Kenton Lee, and Luke Zettlemoyer. Deep contextualized word representations. In Marilyn Walker, Heng Ji, and Amanda Stent, editors, Proceedings of the 2018 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long Papers), pages 2227–2237, New Orleans, Louisiana, June 2018. Association for Computational Linguistics. doi: 10.18653/v1/N18-1202. URL https://aclanthology.org/N18-1202/.

Moritz Pfeifer and Vincent P. Marohl. Centralbankroberta: A fine-tuned large language model for central bank communications. The Journal of Finance and Data Science, 9:100114, 2023. ISSN 2405-9188. doi: https://doi.org/10.1016/j.jfds.2023.100114. URL https://www.sciencedirect.com/science/article/pii/S2405918823000302.

Matthieu Picault and Thomas Renault. Words are not all created equal: A new measure of ecb communication. Journal of International Money and Finance, 79:136–156, 2017. ISSN 0261-5606. doi: https://doi.org/10.1016/j.jimonfin.2017.09.005. URL https://www.sciencedirect.com/science/article/pii/S0261560617301808.

Lynnette Purda and David Skillicorn. Accounting Variables, Deception, and a Bag of Words: Assessing the Tools of Fraud Detection. Contemporary Accounting Research, 32(3):1193–1223, September 2015. doi: 10.1111/1911-3846.12089. URL https://ideas.repec.org/a/wly/coacre/v32y2015i3p1193-1223.html.

Alec Radford. Improving language understanding by generative pre-training. 2018.

Maik Schmeling and Christian Wagner. Does central bank tone move asset prices? Journal of Financial and Quantitative Analysis, page 1–32, 2024. doi: 10.1017/S0022109024000073.

Herman Stekler and Hilary Symington. Evaluating qualitative forecasts: The fomc minutes, 2006–2010. International Journal of Forecasting, 32(2):559–570, 2016. ISSN 0169-2070. doi: https://doi.org/10.1016/j.ijforecast.2015.02.003. URL https://www.sciencedirect.com/science/article/pii/S0169207015000588.

Peter Tillmann and Anisa Tiza Mimun. The heterogeneous effects of monetary policy on investment funds in the euro area. 2023.

Anisa Tiza Mimun, Gabor Fukker, and Matthias Sydow. The effects of monetary policy on banks and non-banks in times of stress. 2025.

Affidavit

Ich erkläre hiermit, dass ich die vorgelegten und nachfolgend aufgelisteten Aufsätze selbstständig und nur mit den Hilfen angefertigt habe, die im jeweiligen Aufsatz angegeben oder zusätzlich in der nachfolgenden Liste aufgeführt sind. In der Zusammenarbeit mit den angeführten Koautoren war ich mindestens anteilig beteiligt. Bei den von mir durchgeführten und in den Aufsätzen erwähnten Untersuchungen habe ich die Grundsätze guter wissenschaftlicher Praxis, wie sie in der Satzung der Justus-Liebig-Universität Gießen zur Sicherung guter wissenschaftlicher Praxis niedergelegt sind, eingehalten.

Anisa Tiza Mimun
28. März 2025

I hereby declare that I completed the papers submitted and listed hereafter independently and only with those forms of support mentioned in the relevant paper. When working with the authors listed, I contributed no less than a proportionate share of the work. In the analyses that I have conducted and to which I refer in the papers, I have followed the principles of good academic practice, as stated in the Statute of Justus Liebig University Giessen for ensuring good scientific practice.

Anisa Tiza Mimun
March 28, 2025

Submitted Papers

1. **Peter Tillmann and Anisa Tiza Mimun**, "The heterogeneous effects of monetary policy on investment funds in the euro area," *forthcoming*, 2023.

2. **Gabor Fukker, Matthias Sydow and Anisa Tiza Mimun**, "The effects of monetary policy on banks and non-banks in times of stress," *forthcoming, ECB Working Paper Series*, 2025.

3. **Martin Hodula and Anisa Tiza Mimun**, "Investment Funds and the Monetary-Macroprudential Policy Interplay," *forthcoming, ECB Working Paper Series*, 2025.

4. **Ami Dalloul and Anisa Tiza Mimun**, "ECB perception of non-banks and monetary policy transmission: A machine learning-based approach," *forthcoming*, 2025.

Disclaimer

The views expressed throughout the entire thesis are mine and do not reflect any view of the European Central Bank or the Eurosystem.