Investors and Inflation

Johannes Breckenfelder[†]
European Central Bank

Marie Hoerova[‡]
European Central Bank
CEPR

Giuditta Perinelli[§]
MIT Sloan

This draft: May 2025
PRELIMINARY

Abstract

Using security-level holdings of bond and equity fund shares, we show how different investors respond to inflation shocks, distinguishing between cost-push ("bad") inflation and demand-driven ("good") inflation. We compare flows across different fund shares - held by different investors - within the same fund. In the aggregate, bad inflation shocks lead to stagflation, hurting bond and equity funds' performance and leading to outflows. By contrast, good inflation shocks raise expected inflation when economic activity is high, hurting bonds but lifting equity. We show that aggregate responses are driven primarily by the re-balancing of Investment Funds who respond quickly and strongly to shocks. Households' response is less pronounced quantitatively but persistent. By contrast, Insurance Companies are "steady-hand" investors, showing an overall more muted reaction to inflation shocks.

Key words: Inflation; Investors; Demand shocks; Supply shocks; Bonds; Equity

JEL codes: E31, E44, G11, G12

[*]We would like to thank Russell Cooper, Luca Dedola, Emanuel Moench and Alp Simsek for useful comments and discussions. We are grateful to Catalina Cozariuc, William Nguyen, Giulio Radaelli, and Vittorio Vergano for excellent research assistance. The views expressed here are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem.

[†]Financial Research Division, European Central Bank, Sonnemannstrasse 20, 60314 Frankfurt am Main, Germany. Email: johannes.breckenfelder@ecb.europa.eu.

[‡]Directorate General Research, European Central Bank, Sonnemannstrasse 20, 60314 Frankfurt am Main, Germany. Email: marie.hoerova@ecb.europa.eu.

[§]MIT Sloan, 100 Main St, 02142 Cambridge, USA. Email: gperinel@mit.edu.

1 Introduction

The 2022-24 inflation surge was the most significant in developed economies since the 1970s. Inflation peaked at 9.1% in the United State and at 10.6% in the euro area, the highest on record since the inception of the euro. Inflation was driven by a mix of supply-side and demand-side factors (Eickmeier and Hofmann (2022), Firat and Hao (2023), Giannone and Primiceri (2024)). This episode rekindled interest in the link between asset prices and inflation. Cieslak and Pflueger (2023) provide a conceptual framework of how inflation affects asset returns, emphasizing the distinction between good and bad inflation. Good inflation arises from demand-driven economic expansion, which moves inflation and the output gap up, leading to a decline in long-term nominal bonds just as the output gap and stock prices rise. Bad inflation, on the other hand, stems from supply shocks, which drive down the real value of long-term nominal bonds, just as the output gap and stocks also fall.

In this paper, we analyze how different investors in stocks and bonds respond to good and bad inflation shocks. Using security-level holdings of bond and equity fund shares, we compare flows across different fund shares - held by different investors - within the same fund. In the aggregate, bad inflation shocks lead to stagflation, hurting bond and equity funds' performance and leading to outflows from funds. Good inflation shocks raise expected inflation when economic activity is high, hurting bonds but raising equity prices. We show that aggregate responses are driven primarily by the re-balancing of Investment Funds who respond quickly and strongly to shocks. Households' response is less pronounced quantitatively but persistent. By contrast, Insurance Companies are "steady-hand" investors, showing muted reaction to inflation shocks. Our findings have implications for understanding the dynamics of transmission of shocks to stock and bond prices.

Analyzing the link between investor portfolio re-balancing and inflation is subject to a number of empirical challenges. Inflation shocks may be correlated with other macroeconomic shocks, making it difficult to isolate the direct effect of inflation on investor behavior. For example, inflation is often accompanied by changes in interest rates, complicating efforts to separate pure inflation effects from central bank policy responses. In addition, cost-push and demand-driven inflation shocks have differing predictions for stock and bond returns, and their co-movements. Importantly, different investors hold different securities so that investor re-balancing may simply reflect changes in the perceived riskiness of different assets. We deal with these challenges in three ways: 1) by focusing on exogenous inflation shocks (linked to global oil prices) and by distinguishing between good and bad inflation; 2) by leveraging granular investor-security-level data (based on the database of securities holdings in the euro area) to zoom in on the responses of heterogeneous investors holding the *same* mutual fund, and 3) by employing local projections to estimate the dynamic effects of inflation while controlling for confounding factors. Importantly, this methodology allows us to take advantage of the large cross-sectional dimension of our panel data.

First, to measure inflation shocks, we rely on a measure of cost-push shocks from Känzig (2021) and a measure of demand-driven shocks from Baumeister and Hamilton (2019). Känzig (2021) constructs exogenous inflation shocks by using high-frequency oil futures price changes around OPEC announcements as an instrument for oil supply news. These shocks are plausibly exogenous because OPEC decisions are largely independent of contemporaneous macroeconomic conditions in oil-importing economies, reducing concerns about reverse causality. The identified shocks primarily capture cost-push inflation, as they reflect changes in expected oil supply that directly impact production costs and consumer prices without being driven by domestic demand fluctuations. Instead, Baumeister and Hamilton (2019) use a structural vector autoregression with sign restrictions to disentangle oil price movements driven by global demand rather than supply. Their methodology exploits variations in oil prices that correlate with broad economic activity but not with cost-push factors. Both methodologies rely on global oil prices. Our euro area data provide an ideal laboratory to study the impact of these shocks as euro area economy is highly dependent on oil imports.

Using aggregate macroeconomic and financial variables for the euro area, we verify that cost-push shocks are associated with an increase in inflation and a decrease in industrial production as well as an increase in unemployment, leading to stagflationary conditions. As a result, bond markets reprice inflation expectations and risk compensation, which causes a decline in bond prices. Stock prices also decline as cost-push inflation raises production costs and hurts growth prospects. By contrast, demand-driven shocks are associated with rising industrial production and a declining unemployment as well as higher inflation and short-term interest rates. In such environment, investors expect an increase in real interest rates and, therefore, bond valuations decline. For stocks, the economic expansion improves corporate earnings expectations, which supports higher stock prices and more than outweighs the negative effect of higher interest rates in the future.

Second, to understand the behavior of different investors, we leverage a security-level holdings data which give us information about the investor base of every security held in the euro area (EA henceforth). In particular, as part of the Euro Area Securities Holdings Statistics (SHSS), we observe, for each mutual fund share, holdings across 24 different owner types, including households, insurance corporations, pension funds, banks, and investment funds. We further merge fund performance and flows, and other fund characteristics, using the Refinitiv's Thomson Reuters Lipper database (Lipper for short). We require that EA ownership of a fund share in our dataset is at least 50% of total to ensure a sufficiently granular coverage of the ownership base.

We focus on the investor base of mutual fund shares - rather than the investor base of individual stocks and bonds - because funds' investor base is diverse and includes both households and institutional investors. By contrast, direct holdings of stocks/bonds by households are very small and confined to the richest households. On the fund side, we study both returns and flows. The link we are after is how in- or out-flows of cash from fund investors affect the amount of cash the fund manager has at his/her disposal which then translates into higher/lower demand for different asset types (depending on which type of funds have relatively large inflows or outflows). Importantly, bond (equity) mutual funds are large holders of bonds (stocks). This implies that their changing asset demand affects the evolution of asset prices in the aggregate.

Third, our empirical methodology zooms in on how different investor types respond to inflation shocks. We take advantage of the fact that the same bond or equity fund issues multiple claims (shares) which cater to different investors (households, insurance companies, investment funds etc.). Yet, these different shares are all claims on the same set of underlying assets the fund holds. This allows us to analyze the behavior of *different* investors that hold exposure to the *same* portfolio of assets.[1]

To summarize ownership base heterogeneity across fund-shares, we assign each fund share to a majority shareholder, defined as an investor type holding at least a 50% ownership share. We zoom in on the behavior of the three largest euro area shareholders of mutual funds in our sample: households, investment funds, and insurance corporations.[2] Our results are robust to choosing different ownership cutoffs.

We find that re-balancing on a fund level aligns well with theoretical predictions. In particular,

[1] We therefore require that we have at least two fund-shares per fund, to be able to conduct a within-fund analysis.

[2] It is worth noting that, unlike in the US financial accounts data, hedge funds are not consolidated with the household sector in the euro area data and, instead, are a part of the investment fund sector.

bond fund investors as well as equity fund investors redeem shares in response to cost-push shocks. For demand-driven shocks, there are net inflows into equity fund shares but net outflows from the bond fund shares. These responses of flows are consistent with the well-documented performance-flow relationship in mutual funds: cost-push inflation shocks lead to a decline in performance for both bond and equity funds and investors redeem their fund shares. In the case of demand-driven inflation shocks, performance improves for equity funds - leading to inflows - but deteriorates for bond funds after 1 month, leading to outflows.

We then analyze which investors drive these responses. In the case of cost-push shocks, we find that the key drivers of fund-level flows are Investment Funds, whose response is fast and the most pronounced. These results are consistent with, e.g., Koijen et al. (2021) who document - in a context of large-scale asset purchases by the central bank - that funds are elastic investors who re-balance frequently. Interestingly, Households do respond in the same direction as Investment Funds, but significantly less strongly, particularly in the case of equities. At the same time, Households' responses display significant persistence. For Insurance Companies, we uncover some sensitivity to cost-push shocks, both for bonds and equity, although their responses are significantly less pronounced compared to those of Investment Funds, the other institutional investor type we analyze. In the case of demand-driven shocks, we show that Insurance Companies' response to demand-driven inflation shocks is muted or delayed. This finding is in line with the notion that Insurances have long-term horizon. It is also consistent with Coppola (2024) who documents that insurances are steady-hand investors who react much less to downturns (Timmer (2018) even finds that insurances may behave countercyclically). The negative stock-bond correlations in the face of demand shocks we would expect to see are most apparent for Investment Funds in the short-run but also - interestingly - for Households over the longer horizon. The latter could be consistent with the logic in Cieslak and Pflueger (2023) , whereby demand-driven shocks correspond to the case when real payoffs of nominal bonds become more valuable during recessions, making nominal government bonds desirable hedges.

We conduct an additional analysis in which we compare the *differential* responses of shares majority-held by Investment funds with those majority-held by Households, within the same fund *and* month. This is a stringent specification as we hold the portfolio and any time-varying factors fixed. Results here confirm that, in the case of cost-push shocks, Investment funds react more strongly than Households, with the differential in outflows equal to about 1 percentage points in the case of equities and about half of that for bonds. In the case of demand-driven inflation, this analysis confirms a persistent nature of Households' response to demand-driven shocks, more persistent compared to the responses of Investment Funds.

Related literature. Our paper relates primarily to three strands of literature: 1) on inflation and asset prices, 2) on stock-bond co-movements, and 3) on portfolio re-balancing by heterogeneous investors.

First, we build on the literature which studies the macroeconomic consequences of inflation. In particular, we rely on recent advances in identification of inflation shocks. Baumeister and Hamilton (2019) develop a structural vector autoregression (SVAR) framework with incomplete identification to reassess oil supply and demand shocks, demonstrating that supply-driven inflation has broader macroeconomic consequences beyond energy markets. Känzig (2021) employs high-frequency data from OPEC announcements to identify oil supply news shocks, showing that these shocks significantly reduce economic activity and raise inflation expectations, particularly when monetary policy is constrained. Shapiro (2024) further refines the distinction between supply- and demand-driven inflation, emphasizing the differential macroeconomic implications and policy trade-offs associated with each. Baumeister et al. (2022) examine the interplay between energy markets and global economic conditions. These papers build on earlier contributions by Kilian (2009), who distinguished between demand and supply shocks in the crude oil market, and Kilian and Murphy (2014), who studied the role of inventories and speculative trading in oil price dynamics.

Second, inflation and macroeconomic risks drive the co-movement of stock and bond returns through their effects on real interest rates, risk premia, and monetary policy expectations. The inflation sensitivity of bonds has evolved over time. For example, Pflueger (2024) and Campbell et al. (2017) document that nominal bonds, once deflation hedges, now exhibit positive betas in inflationary environments, amplifying portfolio risk. Inflation risk also raises corporate bond spreads, as firms with high exposure to inflation face higher refinancing costs (Kang and Pflueger (2015)). Beyond inflation, other macroeconomic risks shape stock-bond return correlations. Campbell et al. (2020) and Ermolov (2022) show that time-varying macroeconomic shocks drive shifts in bond risk premia, altering their role as equity hedges. Bekaert et al. (2021) link stock-bond correlations to the term structure of interest rates, while Baele et al. (2010) find that monetary policy shifts and inflation uncertainty jointly determine stock-bond co-movement. Treasury convenience yields also influence bond pricing. Cieslak et al. (2023) and Acharya and Laarits (2023) show that bonds serve as safe-haven assets when monetary credibility is strong but lose this role when inflation expectations rise. Finally, common shocks to stocks and bonds, such as shifts in risk-free rates, further explain their changing co-movement (Cieslak and Pang (2021). Cieslak et al. (2023) highlight that the impact of inflation on asset prices depends on its source: good inflation from demand-driven growth supports equities, while bad inflation from supply shocks raises risk premia and erodes equity valuations. We contribute to the literature by analyzing which investors drive bond and stock returns following inflation shocks, thus adding an investor cross-sectional perspective to the analysis of stock-bond co-movements.

Third, investor heterogeneity and its effect on asset prices through their portfolio re-balancing is a subject of a growing literature. Koijen et al. (2017), Koijen et al. (2021) rely on the same database of security-level portfolio holdings in the euro area as our paper to show that quantitative easing induced portfolio shifts, with institutional investors increasing risk exposure as central banks absorbed sovereign debt. Vayanos and Vila (2021) provide a conceptual framework to analyze the impact of heterogeneous investors and market segmentation on bond markets. Koijen et al. (2024) find that differences in investor demand drive equity valuations and expected returns. Timmer (2018) studies how different financial institutions adjust their investment strategies in response to economic cycles, finding that insurance companies often exhibit countercyclical investment behaviors, increasing their risk exposure during economic downturns and reducing it during expansions. Coppola (2024) documents that insurances are steady-hand investors who react much less to downturns. We find that while insurance companies do not react much to demand-driven shocks, they are somewhat more sensitive to supply-driven inflation although their responses are much smaller compared to those of Investment Funds.

By affecting the value of financial instruments, inflation redistributes wealth in the economy. Doepke and Schneider (2006) quantitatively assess the effects of inflation through changes in the value of nominal assets. They document nominal asset positions in the United States across sectors and groups of households and estimate the wealth redistribution caused by a moderate inflation episode. They emphasize that redistributional effects of inflation depend on how quickly agents adjust to inflation. Our results shed light on how fast different investors - in both stocks and bonds - react to inflation shocks. Pallotti et al. (2024) analyze the heterogeneous welfare effects of the recent inflation surge across households in the euro area, highlighting nominal net positions as a key driver of heterogeneity across households.

Methodologically, we employ granular mutual funds data and local projections (Jordà, 2005) to study the impact of shocks on fund performance and flows. Similar approaches - albeit in different economic contexts - have been used, e.g., by Daniel et al. (2021) or Hau and Lai (2016). Daniel et al. (2021) examine how monetary policy affects mutual fund investment behavior, emphasizing the phenomenon of reaching for income. They show that low interest rates induce bond funds to shift toward riskier, higher-yielding assets, with implications for financial stability and risk transmission. Hau and Lai (2016) employ euro area mutual funds data to assess portfolio adjustments in response to monetary policy, finding that monetary policy shifts drive portfolio reallocation among institutional investors, with easing policies leading to increased exposure to riskier assets. Our paper focuses instead on inflation shocks. In addition, we zoom in on investors re-balancing away/towards the *same* basket of assets, by studying investor flows within the same fund. Local projections allow us to control for fund fixed effects, and have an added advantage of being more robust to misspecification compared to other methods (Jordà and Taylor, 2025).[3]

The remainder of the paper is organized as follows. Section 2 describes the data and provides summary statistics. Section 3 lays out our conceptual framework and empirical strategy. Section 4 presents responses to good and bad inflation shocks using local projections with monthly data, first for the aggregate macroeconomic and financial variables, and then using granular investor-security-level data. Section 5 concludes.

2 Data

Our analysis relies on four main data sources: (1) cost-push and demand-driven inflation shocks from Känzig (2021) and Baumeister and Hamilton (2019), respectively; (2) aggregate macroeconomic and financial series such as inflation, industrial production, bond and equity indices; (3) security-level information on investor holdings of mutual fund shares in the euro area; (4) the Refinitiv's Thomson

[3]Local projections have recently been applied to analyzing granular data beyond mutual fund flows. For example, Ottonello and Winberry (2020) employ them to study the heterogeneous investment responses of firms to monetary policy, showing that financially constrained firms react more strongly to rate changes. Similarly, Cloyne et al. (2020) use household-level data and local projections to demonstrate that the transmission of monetary policy depends on household leverage, with indebted households exhibiting larger consumption responses to rate cuts.

Reuters Lipper for Investment Fund Management database (Lipper for short), which contains detailed fund share-level data including flows and performance. In what follows, we describe our data sources in turn. We then present summary statistics for the sample resulting from the merge between the holdings data and the Lipper databases.

2.1 Inflation shocks

The major challenge in assessing the impact of inflation on the economy is to disentangle between demand- and supply- driven shocks. Such distinction is important for both financial and real variables. Aggregate demand-driven inflation shocks arise from increased consumer spending, investment, or expansionary monetary policy, leading to higher output, rising employment, and stronger corporate earnings. Stock prices typically rise due to improved growth prospects, while bond prices fall as stronger demand pressures push up real interest rates. In contrast, supply-driven inflation shocks originate from cost-push factors such as energy price spikes, supply chain disruptions, or adverse productivity shocks. These shocks reduce real output, increase production costs, and squeeze corporate profit margins, leading to lower stock prices and higher credit spreads. Cost-push shocks also lower bond prices, implying that nominal bond yields rise following such shocks. This is because supply-driven inflation raises inflation risk premia and increases uncertainty about future monetary policy, as central banks may need to tighten policy even in the face of weaker economic activity.

To measure cost-push inflation shocks, we rely on the measure developed by Känzig (2021). He constructs his measure of cost-push shocks using high-frequency oil futures price changes around OPEC announcements as an instrument for exogenous oil supply news shocks. He identifies these shocks by focusing on unexpected shifts in oil supply expectations that occur within a short time window around OPEC meetings, ensuring that the price movements are not driven by contemporaneous macroeconomic developments or demand-side factors. This high-frequency identification strategy isolates oil supply-driven fluctuations from broader economic conditions, making the resulting shocks exogenous to domestic economic activity.

To measure demand-driven inflation shocks, we rely on the measure developed by Baumeister and Hamilton (2019). They use a structural vector autoregression (SVAR) with sign restrictions to isolate oil price movements driven by global demand fluctuations. They identify demand shocks as instances where oil prices and global economic activity move together, ensuring that the rise in oil prices reflects increased global demand rather than supply constraints. Specifically, they impose the restriction that a positive demand shock must be accompanied by rising global industrial production and oil consumption, distinguishing it from supply disruptions that raise prices while reducing output.

Both methodologies rely on global oil prices. Our euro area data provide an ideal laboratory to study the impact of these shocks as euro area economy is dependent on oil imports. The time series plots of the cost-push and demand-driven inflation shocks are displayed in Figure 14. Table 2 presents summary statistics for the shocks.

2.2 Aggregate macroeconomic and financial series

For our local projections using aggregate data, we employ nine monthly variables. Real oil price employs WTI spot crude oil deflated by the US CPI. As indicators of inflation, we use the European Union Harmonized Index of Consumer prices (HICP) as well as the inflation rate. As business cycle indicators, we use the Industrial Production Index and the unemployment rate. We also consider individual household consumption deflated by the price index (quarterly consumption data are interpolated using the retail sales index). In terms of the financial variables, we use the overnight rate, the yield on the German 10-year bond and the stock market index (STOXX Europe 600). While financial variables are available at high frequency, we convert them to monthly frequency by taking the last monthly observation. Table 1 contains details the data sources and data transformations.

The aggregate time series data span the period from January 1991 to June 2024. The time series plots of all macroeconomic and financial variables are displayed in Figure 15. Table 2 presents summary statistics for all aggregate variables.

2.3 Security-level holdings information

Our information on investor holdings comes from the Securities Holding Database Aggregated by Sector (SHSS). The data has been collected by the European Ssytem of Central Banks since the fourth quarter of 2013. The SHSS database provides holding information - at the level of each individual security - for all securities held in the euro area (EA henceforth), plus some additional non-EA European countries, or with an EA custodian bank. The information is collected quarterly. On the holder side, the database provides information about EA Investor types holding a security.

The Investor type dimension of the dataset is defined according to the 2010 European System of

Variable	Description	Source	Transformation
Inflation Shocks			
Aggregate Demand Shock	Demand-driven inflation shocks from Baumeister and Hamilton (2019)	Baumeister's Website	normalized to increase the Real Oil Price by 10% on impact
Oil Supply News Shocks	Cost-push shocks from Känzig (2021)	Kanzig's Website	normalized to increase the Real Oil Price by 10% on impact
Macroeconomic Variables			
Real Oil Price	WTI spot crude oil price (WTISPLC) deflated by U.S. CPI (CPIAUCSL)	FRED	$100 \times \log(\text{WTISPLC})$ $-100 \times \log(\text{CPIAUCSL}/100)$
Price Index	Eurostat Harmonised Index of Consumer Prices (HICP)	Eurostat (from OECD)	$100 \times \log(\text{Index})$
Inflation Rate	Annual Percentage Change, Monthly Series, Eurostat Harmonised Index of Consumer Prices	Eurostat (from OECD)	Percent
Industrial Production	Industrial Production of EU20 (EUBLPBB-PAAAGWZ)	Eurostat	$100 \times \log(\text{Index})$
Unemployment Rate	Seasonally Adjusted Unemployment Rate, Monthly Series	OECD (from FRED) until January 2023; Eurostat from February 2023	Percent
Real Consumption	Quarterly Aggregate Individual Consumption series interpolated using Retail Trade Sales and deflated by Price Index	Eurostat and FRED	$100 \times \log(\text{Consumption in Bln EUR})$ $-100 \times \log(\text{HICP}/100)$
Financial Variables			
EA Overnight	Call Money/Interbank Rate: Total for Euro Area (19 countries)	FRED	Percent
German 10-year Bond	German 10 Year Government Benchmark Bond Yield	Refinitiv	Percent
STOXX Europe 600	STOXX 600 Index, Last Price, End of Month Observation (SXXP)	Bloomberg	$100 \times \log(\text{Index})$
VSTOXX	EURO STOXX 50 Volatility Index	Bloomberg	$100 \times \log(\text{Index})$

Table 1: Data sources

Accounts and distinguishes between 24 different investor types. We first consolidate investors with very small ownership shares, ending up with nine main owner groups: 1) EA Households; 2) EA Non-Money market fund Investment funds ("Investment funds") which comprise nearly solely of mutual funds, 3) EA Insurance corporations, 4) EA Pension funds, 5) EA Non-financial corporations, 6) EA General government ("Government"), 7) EA Deposit-taking corporations (referred to as "Banks"), 8)

Inflation Shocks	Mean	SD	P10	Median	P90
Aggregate Demand Shock	-0.02	0.72	-0.71	0.01	0.62
Oil Supply News Shock	-0.01	0.59	-0.69	-0.03	0.74
Macroeconomic Variables					
Real Oil Price	305.22	47.03	248.10	301.88	371.04
Price Index	447.21	17.99	422.77	448.87	466.59
Inflation Rate	2.22	1.67	0.43	2.05	3.85
Industrial Production	447.29	11.49	429.46	449.76	460.32
Unemployment Rate	9.30	1.48	7.40	9.30	11.00
Real Consumption	727.13	5.48	719.32	727.88	734.41
Financial Variables					
Overnight Rate	2.00	2.10	-0.37	2.06	4.71
10-year German Yield	3.39	2.49	0.06	3.57	6.81
STOXX Europe 600	558.12	43.43	483.56	568.30	600.99

Table 2: Summary statistics

The table reports summary statistics for cost-push and demand-driven inflation shocks as well as macroeconomic and financial variables employed in our analysis. The sample period is January 1991 - June 2024. Details on data sources and data transformations are provided in Table 1.

Other EA investors (grouping EA owners with small ownership shares, incl. Financial auxiliaries, Captive financial institutions and money lenders, and Money market funds). The last, ninth, category is Foreign investors (without further information on what type of investor the Foreigner is). We compute the Foreign investors holdings as the difference between the total net assets of the fund-share class and the total market value of EA investor holdings as reported in the database, which is similar to the approach employed by Koijen et al. (2021) who worked with the SHSS data in a different context.

To have a sufficiently granular information on investor base for each security in our sample, we focus on securities for which EA ownership share is at least 50% of the total amount outstanding.

The holding information is complemented with the Centralized Securities Database (CSDB) that contains information such as issuer name and outstanding amount, price, and precise instrument type.

2.4 The Lipper database

From Refinitiv's Thomson Reuters Lipper database, we retrieve fund-share level data on flows and performance as well as fund-level information on fund type (Bond, Equity, Alternatives, Mixed Assets, Real Estate, Money Market). We restrict our sample to open-end bond and equity mutual funds using information on the fund-type from (1) the closed-end flag available in Lipper, and (2) data on a fund's legal structure. Together, bond and equity funds represent the vast majority of mutual funds in the euro area.

Our local projections using granular data employ monthly data. To this end, we construct monthly net fund flows variable as is standard in the literature (see, e.g., Chevalier and Ellison (1997)):

$$Flows_{i,t} = 100 \ \frac{TNA_{i,t} - (1 + r_{i,t})\, TNA_{i,t-1}}{TNA_{i,t-1}} \tag{1}$$

where $TNA_{i,t}$ is total net assets of fund share i in month t and $r_{i,t}$ is the return over month t on a fund share level.

The merged holdings-fund shares database. We merge the SHSS and Lipper through an International Securities Identification Number (ISIN) which is unique for each fund share. We follow the same procedure as Allaire et al. (2023). Their paper studies investor base of bond and equity mutual fund shares, analyzing run incentives of different fund investors. They document that the three largest euro area shareholders of mutual funds are households, investment funds, and insurance corporations. We confirm this in our sample.

From SHSS, we use information on the investor base on a fund-share level. Since the holdings data is quarterly while our fund flow and performance data is monthly, we impute, for each fund share in the sample and each month t, investor holding shares from the previous quarter. That is, as an example, we take investor holding shares from the fourth quarter of 2015 and assign those to January 2016, February 2016 and March 2016. Our goal is to identify the dominant investor for each fund share and month, assign the share to that investor type and then trace the evolution of performance and flows in that fund share following inflation shocks. We define a dominant shareholder type as an investor type who holds at least 50% of a fund share.[4] In addition, we require that we have at least two such fund-shares per fund, to be able to conduct our within-fund analysis which holds fund portfolio fixed and exploits variation across fund-shares of the same fund.

In principle, a particular fund share can be held by a diverse set of investors. However, we find that

[4]Given that we focus on securities for which at least 50% of shares is held in the EA, this means that securities with the majority Foreign owners drop out from our sample.

there are three main EA shareholder types across fund shares in our sample: Households, Investment Funds, and Insurance companies. Other investor types hold very low ownership shares which do not cross our dominant shareholder threshold.

	Fund-Level		HH		IC		IF	
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev
Panel A: Bond Funds								
Flow	0.46	10.00	0.23	7.51	0.54	10.33	0.80	12.30
Return	-0.00	2.01	-0.06	1.96	-0.02	2.25	0.04	2.11
Volatility	1.76	0.98	1.73	0.92	1.97	1.07	1.87	1.01
Size	4.26	1.21	3.99	1.14	4.27	1.15	4.34	1.15
Panel B: Equity Funds								
Flow	0.51	9.60	0.63	6.94	0.56	10.38	0.63	12.08
Return	0.66	4.81	0.62	4.83	0.73	4.83	0.70	4.78
Volatility	4.64	1.37	4.63	1.37	4.62	1.30	4.63	1.36
Size	4.22	1.20	4.06	1.19	4.23	1.19	4.27	1.15

Table 3: Summary Statistics: Bond and equity funds

This table reports mean and standard deviation for the fund sample. The data are from SHSS merged with Lipper and covers 2,374 bond funds (of which 1,463 mainly held by households, 1,043 by Insurance Companies, and 1,553 by Investment Funds), 2,939 equity funds (of which 1,891 mainly held by households, 1,338 by insurance companies, and 1,992 by investment funds). In terms of fund shares, we have 10,298 fund shares of bond funds (of which 3,650 held by households, 1,899 by insurance companies, 3,849 by investment funds) and 12,714 equity fund shares (of which 4,695 held by households, 2,499 by insurance companies, and 4,437 by investment funds). The sample period is October 2013 - June 2024. As in Daniel et al. (2021), *Flow* is net flows (inflows minus outflows) into a fund share class in percent, *Returns* is fund return month-on-month in percent, *Volatility* is standard deviation of fund returns over the previous year in percent, *Size* is log of assets under management in log of millions.

Our final sample of monthly fund flows, performance and dominant shareholder data consists of 10,298 bond shares, out of which 3,650 are held at least 50% by households, 1,899 by insurance companies, 3,849 by investment funds. For equity shares, our sample comprises 12,714 equity fund shares total, out of which 4,695 are held at least 50% by households, 2,499 by insurance companies, and 3,849 by investment funds.

Table 3 presents summary statistics for bond and equity funds, respectively, in our sample. In addition, we compare the performance we obtain for funds in our sample from the Lipper database with the aggregate indices (see Figures 11 and 12). Specifically, bond funds' returns have a 0.64 correlation with the returns on the EU Government Bond index. Equity funds' returns have a correlation of 0.93 and 0.91 with returns on Eurostox600 and on S&P500, respectively.

Figure 13 compares fund flows obtained by our SHSS plus Lipper merge (in blue) with aggregate fund flows statistics based on the Investment Fund Statistics database (IVF for short) compiled by the ECB (in red). This latter statistic provides an extensive (up to 95%) coverage of the investment fund sector in the euro area but is available on the aggregate level only, and does not provide details on fund investor base. It is apparent that series from our sample align well with the aggregate data. For equity funds, the correlation between our time series and the IVF equals to 0.76, while for bond funds, it is equal to 0.72. This suggests that variation in our sample is representative of the variation in the aggregate data.

3 Research design

This section describes our conceptual framework and empirical strategy. We also outline the hypotheses we will be testing in the data.

3.1 Conceptual framework

To study the effects of inflation shocks on asset prices, it is crucial to distinguish between "good" and "bad" inflation shocks, as the nature of the inflation shocks determines the direction in which bond and stock returns correlate.

To outline the basic intuition, we follow the exposition in Cieslak and Pflueger (2023). Let i_t and $i_t^{(2)}$ denote the interest rates on one- and two-period default-free nominal bonds, i.e., bonds that promise to pay one euro one or two periods in the future. The corresponding bond prices are then given by $exp(-i_t)$ and $exp(-2i_t^{(2)})$. Similarly, let r denote the real risk-free rate, or the interest rate on a default-free bond that promises to pay one unit of real consumption next period. The real risk-free rate is assumed to be constant for simplicity. We use π_t to denote log inflation from time $t-1$ to time t, and use lower-case letters to denote logs throughout. Using the notation π_t^e to denote the time t expected inflation next period and assuming that inflation and the Stochastic Discount Factor (SDF) are jointly log-normal, the one- and two-period nominal interest rates can be written as:

$$i_t = r_t + \pi_t^e + Cov_t(m_{t+1}, \pi_{t+1}) - \frac{1}{2}\sigma_\pi^2 \quad (2)$$

and

$$i_t^{(2)} - \frac{i_t + E_t i_{t+1}}{2} = \frac{1}{2}Cov_t(m_{t+1}, \pi_{t+1}^e) - \left(\frac{1}{2}Cov_t(\pi_{t+1}, \pi_{t+1}^e) + \frac{1}{4}Var(\pi_{t+1}^e)\right) \tag{3}$$

The expression for the one-period bond is merely illustrative as inflation is rarely a problem at very short horizons. By contrast, for long-term bonds, inflation can be a very significant risk if persistent. This what the second equation above illustrates. For long-term bonds, inflation risk premia depend on the covariance between expected inflation with the stochastic discount factor simply because long-term bond prices decline as expected inflation rises. Inflation is therefore "bad" if inflation expectations rise just as the marginal utility of an additional dollar is high, and inflation is "good" if inflation expectations rise when marginal utility and the SDF m_{t+1} are low.

The reaction of stock returns ought to depend on whether the inflationary shock is driven by an increase in demand or an increase in costs. Cost-push shocks mean bad news for the economy and so stock returns should decline. At the same time, nominal bonds are worth less exactly in the states of the world that investors value more. This implies a decrease in the price of bonds which would translate in a deterioration of bond fund performance. In contrast, when inflation is demand-driven, investors in stocks expect an increase in future dividends, boosting stock prices and equity fund performance. However, bonds do not experience such a boost since since their coupon are fixed in nominal terms. In other words, higher inflation expectations imply a decrease in the real value of future cash flows from outstanding bonds.

This framework hence predicts that, in response to an aggregate demand shock, bond prices decrease and equity prices increase. On the other hand, a cost-push inflationary shock should drive both stock and bond prices down. Since fund returns are defined as the change in the value of fund asset holdings, we obtain the following predictions for fund returns.

Prediction 1: Cost-push inflation shocks lead to a decrease in both bond and equity fund returns.

Prediction 2: Aggregate demand-driven inflation shocks lead to a decrease in bond fund returns and to an increase in equity fund returns.

Prior literature on mutual funds has documented a strong link between fund performance and fund flows. For example, Sirri and Tufano (1998) showed that mutual fund flows are sensitive to past performance, with investors tending to redeem shares from funds that have underperformed. Berk and Green (2004) provide a theoretical model which shows why past performance predicts fund flows. The performance-flow relationship leads us to the following two predictions for how bond and equity fund flows, respectively, respond to inflation shocks.

Prediction 3: Cost-push inflation shocks lead to outflows from both bond and equity funds.

Prediction 4: Aggregate demand-driven shocks lead to outflows from bond funds and inflows to equity funds.

We note that this conceptual framework is based on the assumption that a representative investor prices all assets. Therefore, it is helpful to derive implications for the reaction of bond and equity flows on the more aggregate level. However, it is silent on how heterogeneous investors may respond to inflation shocks. Indeed, in our granular analysis, we will let the data speak. Conceptually, different responses may be linked to different business models or (regulatory) constrains faced by different investors.

3.2 Empirical framework

We empirically test our predictions by estimating dynamic responses of stock and bond returns, as well as fund returns and flows, to "good" and "bad" inflation shocks using local projections.

First, we analyze how cost-push shocks from Känzig (2021) and aggregate demand-driven shocks from Baumeister and Hamilton (2019) affect aggregate macroeconomic and financial variables on the aggregate level. This analysis also serves as a check that these shocks affect the real economy in the expected direction. To this end, we estimate the following set of regressions (separately for cost-push and for demand-driven inflation shocks):

$$y_{i,t+h} = \beta_0^i + \phi_h^i Shock_t + \boldsymbol{\beta}_h^i \boldsymbol{X}_{t-j} + \epsilon_{i,t,h} \tag{4}$$

where $y_{i,t+h}$ is the dependent variable of interest, $Shock_t$ is a "bad" or a "good" inflation shock, respectively, $\boldsymbol{X}_{t-j}$ is a vector of controls, $j = 1, 2, 3$, and $\epsilon_{i,t,h}$ is the error term. As controls, we include 3 lags of inflation shocks, 3 lags of the business cycle control variable (industrial production), 3 lags of the inflation control (log price level), and 3 lags of the overnight rate to control for possible monetary policy response. The term of interest is ϕ_h^i which captures the impulse response of variable

i at horizon h to the inflation shock.

The variables of interest include real oil prices, European Union (EU) Industrial Production,Unemployment Rate, EU Harmonized Index of Consumption Prices (HICP), Inflation Rate, as well as, the overnight rate, yield on the 10-year German bond, and stock market index STOXX Europe 600. The variables are monthly and cover the sample period from January 1991 to June 2024.

We then analyze the responses of different investors to inflation shocks using granular investor-security-level data. Each security, i.e., fund share, is assigned to a majority investor in that share, either the Household sector, the Insurance sector, or the Investment Fund sector (see Section 2). We employ panel local projections and include fund fixed effects to zoom in on the response of different investors within the same fund.

For fund returns, we run the following set of regressions:

$$Return_{f,s,t+h} = \beta_f + \phi_h Shock_t + \boldsymbol{\beta}_{f,s,h}\boldsymbol{X}_{t-j} + \epsilon_{f,s,t,h} \tag{5}$$

where β_f are fund fixed effects (FEs), $Return_{f,s,t+h}$ is the return of fund share s from month $t+h-1$ to $t+h$, $Shock_t$ is an inflationary shock (either demand or cost-push), and X_{t-j}, $j = 1,2,3$ is a vector of controls. We control for 3 lags of the shock and 3 lags of returns. The control variables also include lagged fund characteristics: 3 lags of fund return volatility and 3 lags of the log of fund assets under management. To control for market volatility, we also include 3 lags of stock market volatility as measured by the the VSTOXX (the European equivalent of the VIX index), we control for the business cycle with 3 lags of EU industrial production, for inflation with 3 lags of the price level, and for 3 lags of the overnight rate. Standard errors are clustered at the fund f and month t level.

For fund flows, the specification is:

$$Flow_{f,s,t+h} = \beta_f + \phi_h Shock_t + \boldsymbol{\beta}_{f,s,h}\boldsymbol{X}_{t-j} + \epsilon_{f,s,t,h} \tag{6}$$

where $Flow_{f,s,t+h}$ is the flow of fund share s from month $t+h-1$ to $t+h$ and flows are constructed as in equation 1. In addition to the controls used in regression 5, X_{t-j} also includes 3 lags of fund-share returns. Standard errors are clustered at the fund f and month t level.

Finally, we investigate the differential reaction of investors within a given fund and month by running the following regression:

$$Flow_{f,s,t+h} = \beta_f \cdot \theta_t + \phi_h Shock_t \cdot InvType_{f,s,t} + \psi_s InvType_{f,s,t} + \boldsymbol{\beta}_{f,s,h} \boldsymbol{X}_{t-j} + \epsilon_{f,s,t,h} \quad (7)$$

where $\beta_f \cdot \theta_t$ are fund-month fixed effects, $InvType_{f,s,t}$ is a categorical variable with value 0 if the majority owner of a given fund share is the Household sector, 1 if the majority owner is the Insurance sector, 2 if the majority owner is the Investment Fund sector, and the other variables are ad defined in the previous equation. Such a specification allows us to understand, within the same fund in a given month, the differential behavior of Insurance Companies and Investment Funds with respect to Households, which we use as the base category.

Jordà and Taylor (2025) discuss the robustness of local projections to model misspecification. They highlight that local projections offer a flexible approach to estimating impulse responses by directly projecting future values of an outcome variable onto current and past information. This direct estimation reduces the risk of compounding specification errors over time, a common issue in alternative methods like vector autoregressions. Consequently, local projections may be more robust to misspecification, providing reliable estimates even when the underlying model is not well-specified.

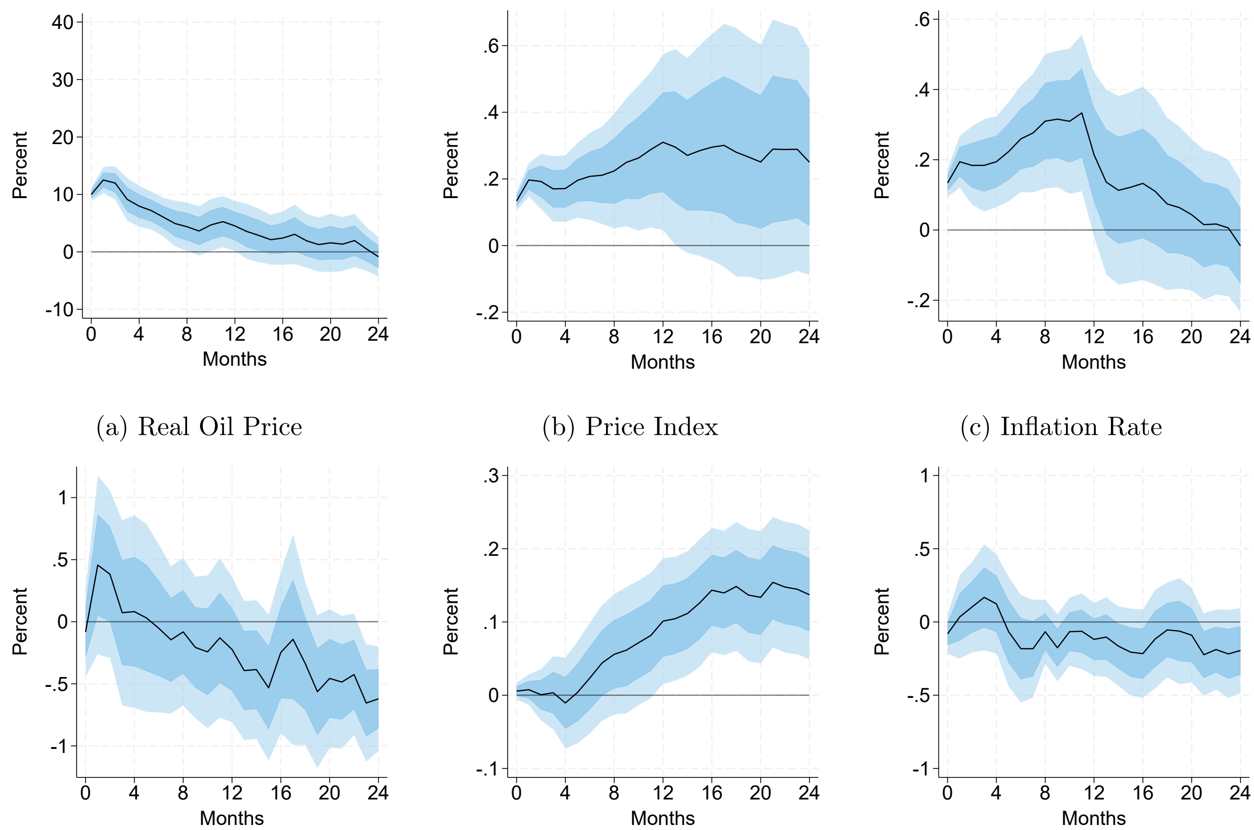
4 Results

In this section, we present our results. We start with the responses of aggregate macroeconomic and financial variables to inflation shocks. We then proceed to granular, investor-security-level evidence.

4.1 Aggregate evidence

Cost-push shocks. Figure 1 shows the impulse responses to a cost-push shock, normalized to increase the real oil price by 10 percent. The solid blue lines are the point estimates, while the dashed and dotted lines are the 68 and 90 percent confidence bands, respectively.

Real oil price, the price level as well as the inflation rate increase immediately and significantly in response to a cost-push shock (Panels (a)-(c)). Industrial production (Panel (d)) declines by 0.5 percent at the end of the projection horizon (24 months). Unemployment rate (Panel (e)) increases by



(a) Real Oil Price (b) Price Index (c) Inflation Rate

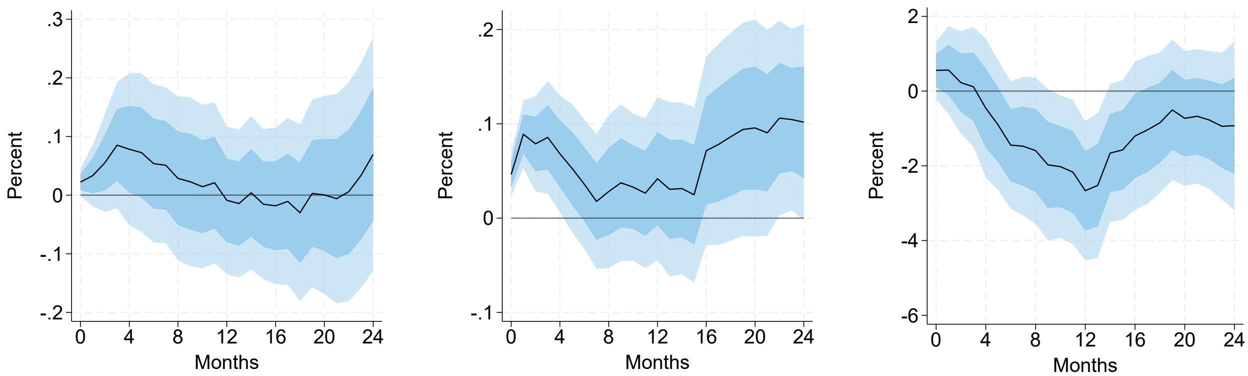
(d) Industrial Production (e) Unemployment Rate (f) Real Consumption

Figure 1: Response of macroeconomic variables to cost-push shocks

This figure shows impulse responses estimated using local projections to a cost-push shock. The shock is the oil-supply news shock from Känzig (2021) and is normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is January 1991 - June 2024.

close to 0.2 percentage points while real consumption (Panel (f)) also declines, by about 0.2 percent. These responses are clearly in line with what we would expect after a supply shock. Indeed, although our results are based on the euro data, they are comparable, also quantitatively, to the results based on the US data in Känzig (2021).

Responses of financial variables are in Figure 2. The overnight rate - a proxy for the monetary policy response - barely moves in response to cost-push shocks. This may be consistent with a "look-through" approach for transitory supply shocks which avoids the output costs of raising interest rates in the face of cost-push shocks. The yields on 10-year bonds increase on impact, implying a decrease in bond prices. The mechanism behind this effect is that supply-driven inflation raises inflation risk



(a) Overnight Rate (b) 10-year German Yield (c) STOXX Europe 600

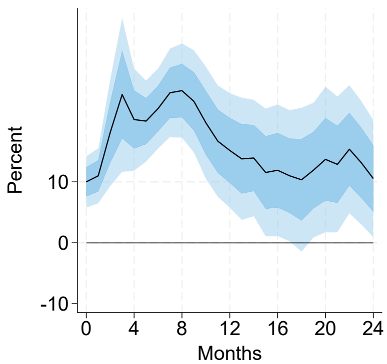
Figure 2: Response of financial variables to cost-push shocks

This figure shows impulse responses estimated using local projections to a cost-push shock. The shock is the oil-supply news shock from Känzig (2021) and is normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is January 1991 - June 2024.

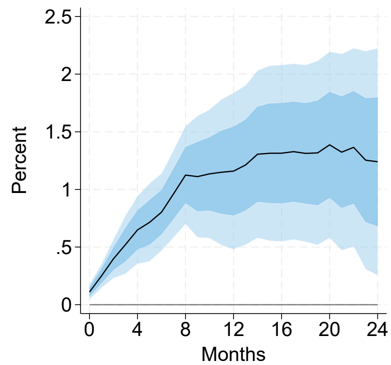
premia and increases uncertainty about future monetary policy, as central banks may need to tighten policy in the future even in the face of weaker economic activity. Unlike demand-driven inflation, which is associated with stronger growth and rising real interest rates, cost-push inflation leads to stagflationary pressures - lower output and higher prices - causing bond markets to reprice inflation expectations and risk compensation. That is, cost-push inflation can erode the hedging properties of nominal bonds, making them a less reliable safe-haven asset during supply-driven inflationary episodes.

Stock prices (STOXX Europe 600 index) start declining after the initial period (i.e., cumulative response shows a declining trend), with the impact becoming statistically significant after 6 months and reaching a minimum of more than -2%, 12 months after the shock. A decline in stock prices is consistent with cost-push inflation raising production costs and squeezing profit margins, particular in the euro area economies which are high energy-dependent. Additionally, cost-push inflation increases uncertainty about future monetary policy, further depressing equity valuations. These results highlight that cost-push inflation leads to stagflationary conditions, in which equities fall alongside bonds, reducing diversification benefits for investors.

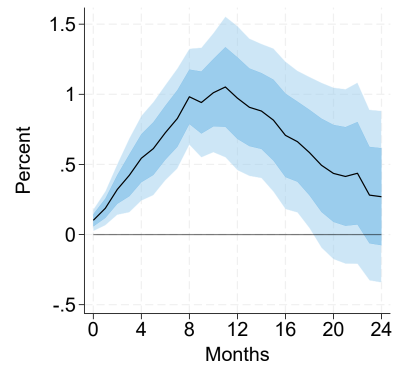
Demand-driven shocks. Turning to aggregate demand shocks (Figure 3), the positive reaction of real oil price is greater and more persistent compared to the case of a cost-push shock, reaching



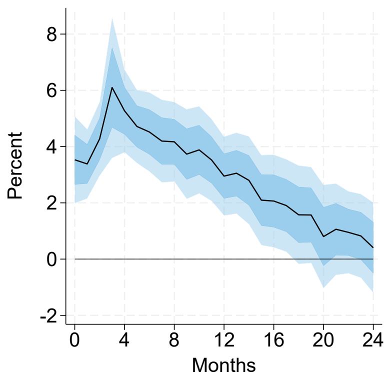
(a) Real Oil Price



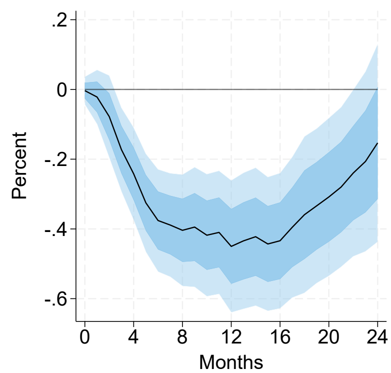
(b) Price Index



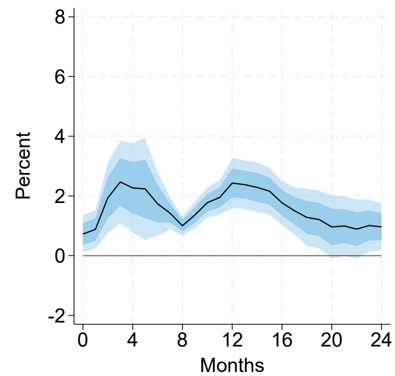
(c) Inflation Rate



(d) Industrial Production



(e) Unemployment Rate



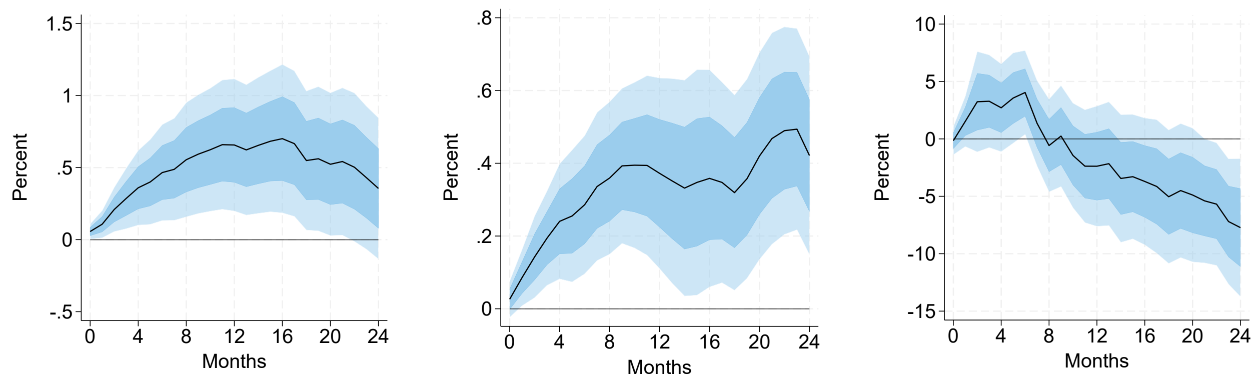
(f) Real Consumption

Figure 3: Response of macroeconomic variables to demand shocks

This figure shows impulse responses estimated using local projections to an aggregate demand shock. The shock is from Baumeister and Hamilton (2019) and is normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is January 1991 - June 2024.

the peak of 25% increase after 8 months. Correspondingly, the price level rises, with inflation rate reaching a peak of just above 1% after 12 months. The industrial production increases significantly and persistently for more nearly 2 years, reaching a peak of 6% within 4 months after the shock. Unemployment also declines, by 0.5 percentage points after 12 months. Real consumption increases significantly and persistently, by more than 2% at the peak. These responses generate macroeconomic impact in line with what we would expect after a demand shock.

Responses of financial variables are in Figure 4. Central bank responds to demand-driven inflation, with short-term rates increasing gradually, peaking at 0.75 percentage points, and remaining persistently elevated even 2 years after the shock. Yields on 10-year bonds increase significantly and



(a) Overnight Rate (b) 10-year German Yield (c) STOXX Europe 600

Figure 4: Response of financial variables to demand shocks

This figure shows impulse responses estimated using local projections to an aggregate demand shock. The shock is from Baumeister and Hamilton (2019) and is normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is January 1991 - June 2024.

persistently, implying a decline in prices of long-term bonds. When inflation is driven by stronger aggregate demand — accompanied by rising economic activity and significantly higher oil consumption — investors anticipate that the central bank will tighten policy, leading to an increase in real interest rates and a corresponding decline in bond valuations. Unlike cost-push inflation shocks, which may create uncertainty about central bank policy reactions, demand-driven inflation tends to generate a more predictable tightening response (as we see clearly in the response of the short-term rate), reinforcing the negative relationship between demand-driven shocks and bond prices.

Stock prices increase on impact, peaking at 5% after six months. Following demand-driven shocks, corporate earnings expectations improve, supporting higher stock prices. The economic expansion associated with these shocks increases revenues and profitability for firms, particularly in cyclical industries that benefit from stronger consumer spending and investment. Although higher inflation may lead to expectations of monetary policy tightening, the positive effects of increased demand on corporate earnings outweigh the negative effects of higher interest rates, resulting in a net increase in equity valuations.

4.2 Evidence using granular data

In this section, we present the results for responses of mutual fund returns and flows to inflation shocks, using granular data. In subsection 4.2.1, we present responses at the fund level and across different investor types, while including a number of controls like the overnight rates and fund fixed effects. In subsection 4.2.2, we additionally analyze differential investor responses to inflation shocks, by looking at how different investors - *within* the same fund and month - react to inflation shocks.

4.2.1 Baseline results

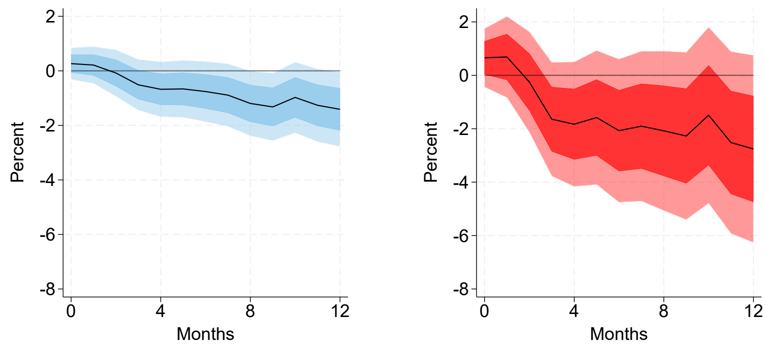
In this section, we show how returns and flows of bond and equity mutual funds respond to inflation shocks, both at the fund level and across different investor types.

Impact on fund performance. We begin by testing Predictions 1 and 2 (see Section 3.2). We use the empirical specification in Equation (5) which, among other controls, includes fund fixed effects.

Figure 5 presents cumulative fund returns response, in percent, to a 10 percent increase in the real oil price driven by the cost-push shocks, for bond fund returns (Panel (a)) and for equity fund returns (Panel (b)). In each panel, the solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. Both bond and equity fund returns decline as of period 1. The decline is statistically significant (at least at the 68% level) between months 3 and 12, reaching the lowest point at the end of the projection horizon. The decline is more pronounced for equity fund returns compared to bond fund returns: 12 months after the shock, the drop in equity fund performance reaches almost 4 percent, twice the magnitude of the performance decline for bond funds.[5]

Results in Figure 5 confirm our Prediction 1. Cost-push shocks imply an increase in (expected) inflation which leads to a decline in the value of outstanding bonds. At the same time, such shocks tend to be stagflationary, hurting growth prospects and thus the performance of equities. The results based on the granular data align well with the results based on the aggregate bond and equities data (see Section 4.1): we also observed a more pronounced decline in equities compared to a more modest

[5] We present results for fund returns across different fund shares within a fund, without distinguishing which investors hold a fund share. This is because returns of fund shares within a fund are quite similar, implying very similar dynamics. This is not too surprising as, apart from the differences in fees, different fund shares within the same fund are claims on the same set of underlying assets, implying similar performance. As we will see shortly, however, the responses of fund *flows* differ substantially across fund shares within a fund as different shares are held by different investor types.

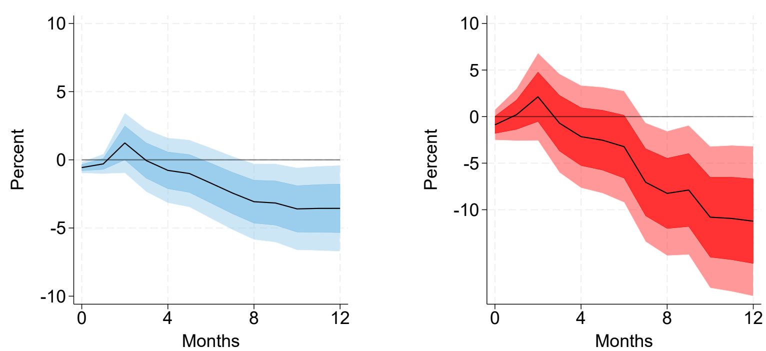


(a) Bond (b) Equity

Figure 5: Response of fund returns to cost-push inflation shocks

This figure shows cumulative impulse responses of monthly returns on bond funds (Panel (a)) and equity funds (Panel (b)) estimated using local projections. The cost-push shocks are normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is October 2013 (the start of the SHSS data collection) to June 2024. Standard errors are clustered at the fund and month level.

impact of cost-push shocks on bond yields (which are inversely related to bond prices), see Figure 2, Panels (b) and (c). In the words of Cieslak and Pang (2021): "in recessions, prices of nominal Treasury fall together with risky consumption claims". In sum, bond and equity fund returns co-move positively in response to a cost-push shock.



(a) Bond (b) Equity

Figure 6: Response of fund returns to demand-driven inflation shocks

This figure shows cumulative impulse responses of monthly returns on bond funds (blue) and equity funds (red) estimated using local projections. The demand-driven shocks are normalized to increase the real price of oil by 10 percent on impact. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is October 2013 (the start of the SHSS data collection) to June 2024. Standard errors are clustered at the fund and month level.

In response to demand-driven inflation shocks (Figure 6), the returns on equity funds respond positively while the returns on bond funds are on a declining trend as of month 2 (i.e., cumulative response begins to decline). Specifically, equity fund returns increase and peak at nearly 5% in month 2. By contrast, bond fund returns decline to about -2% by month 7 (statistically significant at 68% level), then remain broadly unchanged until month 12.

These results confirm our Prediction 2. They are also consistent with the responses of macroeconomic and financial variables in Section 4.1, see Figure 4, Panels (b) and (c). In particular, when inflation is driven by stronger aggregate demand - accompanied by rising economic activity - investors expect an increase in real interest rates and, therefore, we observe that bond yields increase (bond prices decline). For stocks, the economic expansion increases revenues and profitability of firms, supporting higher stock returns.

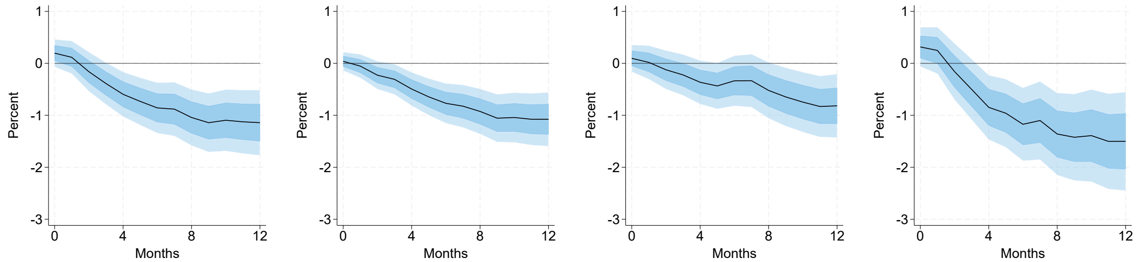
Impact on fund flows. We now test our Predictions 3 and 4 (see Section 3.2), using the empirical specification in Equation (6) which, among other controls, includes fund fixed effects.

Figure 7 shows cumulative fund flows response, in percent, to a 10 percent increase in real oil price driven by a cost-push shock. In the first row, Panel (a) reports the results at the bond fund-level, Panel (b) focuses on bond fund shares held by households (HH) as majority owners, Panel (c) by insurance companies (IC) as majority owners, and Panel (d) by investment funds (IF) as majority owners. In the second row, the panels report the corresponding results for equity funds.

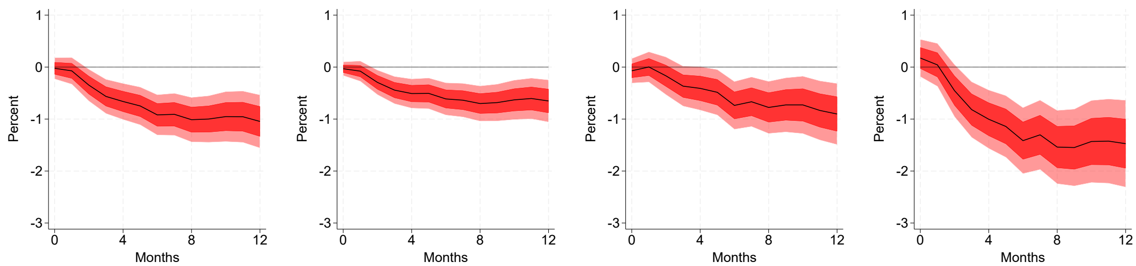
In response to a cost-push shock, there are outflows in both bond and equity funds (Figure 7, Panels (a) and (e)), in line with our Prediction 3. Bond flows steadily decrease up to -1.14 percent in month 9, while equity outflows reach the peak of -1.05 percent, likewise 12 months after the shock. These results are consistent with the results on performance and the well-documented performance-flow relationship in mutual funds: given that cost-push shocks lead to a decline in performance for both bond and equity funds, investors react by redeeming their fund shares.

The key question is: do all investors react similarly in the face of cost-push shocks? This is what we investigate in Figure 7, Panels (b)-(d) for bonds and Panels (f)-(h) for equity. We analyze how flows across different fund shares, held by different investors in mutual funds (Households, Insurance corporations, and other Investment Funds), react to cost-push inflation shocks.

Figure 7, Panel (b) reveals that bond fund shares held mainly by Households experience a somewhat milder decline compared to the fund-level results, with the cumulative decline of -1.08 percent by month 12. By contrast, outflows from Household-held equity shares (bottom row, Panel (f)) are



(a) Fund-level (Bond) (b) HH (Bond) (c) IC (Bond) (d) IF (Bond)



(a) Fund-level (Equity) (b) HH (Equity) (c) IC (Equity) (d) IF (Equity)

Figure 7: Response of fund flows to cost-push shocks

This figure plots cumulative impulse responses of monthly fund flows to a cost-push shock for bond funds (top row) and equity funds (bottom row), estimated using panel local projections which include fund fixed effects (equation 6). The shocks are normalized to increase the real price of oil by 10% on impact. Monthly flows are computed as in equation (1). The plots report responses at the fund-level, as well as for fund shares owned primarily by Households (HH), Insurance companies (IC), and Investment funds (IF). A fund-share is assigned to an investor if at least 50% of TNA is held by that investor. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is October 2013 (the start of the SHSS data collection) to June 2024. Standard errors are clustered at the fund and month level.

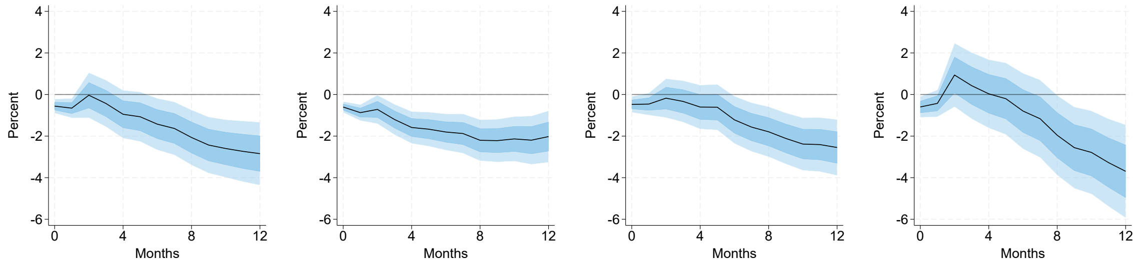
about half as large compared to the fund-level results, with the cumulative decline of -.69999999 percent by month 12. This finding suggests that Households perceive bonds to be more sensitive to cost-push shocks compared to equities. Panel (c) presents results for bond fund shares in which the majority owners are Insurance corporations. Outflows are milder compared to the fund-level results in Panel (a) (a decline of -.82999998 percent by the end of the projection horizon). Panel (g) show the responses of equity fund shares majority-held by Insurance corporations. We do see outflows, peaking at about -.89999998 percent in month 12. Panels (d) and (h) present results for fund shares in which the majority owners are Investment Funds. We observe significant outflows for both bond and equity shares. Importantly, Investment Fund owners' response is faster and quantitatively stronger compared to Households and Insurances. For bonds, outflows reach -1.2 percent already by month 4 and a minimum of -1.5 percent in month 11. For equity, outflows reach -1.5 percent already by month 4 and a minimum of -1.55 percent 9 months after the shock. In both cases, the peak responses are stronger compared to fund-level results.

Taken together, these results suggest that the key drivers of fund-level flows are Investment funds while Households and Insurances respond less strongly and with a delay. Importantly, the differences among investors we observe are not along the lines of institutional versus retail investors: Insurances - who are likewise institutional investors - do not react to shocks nearly as strongly as Investment Funds. These results are consistent with, e.g., Koijen et al. (2021) who document (in a context of large-scale asset purchases by the central bank) that Investment Funds are elastic investors who re-balance frequently. Our finding that Insurances react less strongly to shocks relate to Coppola (2024) who documents that Insurances are steady-hand (bond) investors who react much less to downturns.

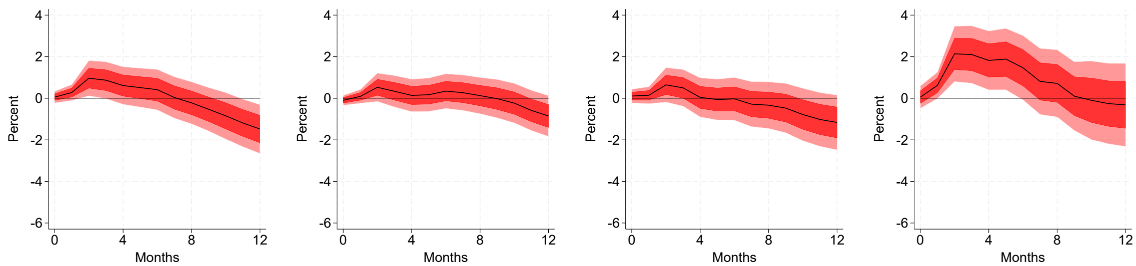
Figure 8 plots the cumulative flows response to demand-driven inflation shocks. Bond funds see outflows on impact. Outflows continue, with cumulative response steadily declining and reaching a minimum of -2.8399999 percent in month 12 (see Figure 8, Panel (a)). By contrast, equity funds experience inflows in the short-term, reaching a peak of of .97000003 percent in month 2 (see Figure 8, Panel (e)). Equity flows stabilize at the (cumulatively) higher level until month 6. Responses are not statistically significant thereafter. These results are consistent with our results on fund performance: demand-driven inflation shocks lead to a decline in performance for bonds as of month 2 - and bond funds experience outflows - while the performance of equity improves with the booming economy and investors pour more money into equity fund shares.

Next, we study whether there is heterogeneity in investor responses to demand-driven inflation shocks (Figure 8, Panels (b)-(d) for bond funds and (f)-(h) for equity funds). The short answer is yes, with interesting differences across the major owners of fund shares: Households, Insurance Corporations and Investment Funds.

Figure 8, Panel (b) reveals that, in the case of bonds, Households react strongly and persistently to demand-driven shocks. Specifically, the flows in bond fund shares held by Households start decreasing gradually on impact, reaching a low of -2.22 percent in month 9. By contrast, the flows in equity fund shares held by Households pick up only gradually to reach a peak of .52999997 percent, 2 months after the shock. Figure 8, Panels (c) and (g) show the responses of cumulative flows in shares held pre-dominantly by Insurance Corporations. The response of bond flows in Panel (c) shows a small decline in the short-term, followed by a stronger deadline between months 7 and 12, reaching a low of -2.55 percent at the end of the projection horizon. The responses of equity flows in Panel (g)



(a) Fund-level (Bond) (b) HH (Bond) (c) IC (Bond) (d) IF (Bond)



(a) Fund-level (Equity) (b) HH (Equity) (c) IC (Equity) (d) IF (Equity)

Figure 8: Responses of fund flows to demand-driven shocks

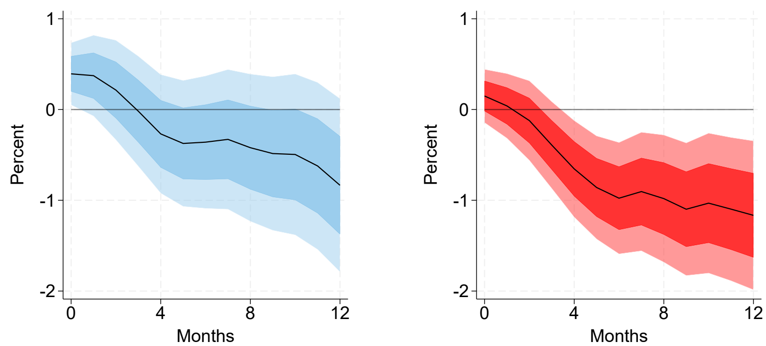
This figure plots cumulative impulse responses of monthly flows to demand-driven inflation shocks for bond funds (top row) and equity funds (bottom row), estimated using panel local projections with fund fixed effects (equation 6). Shocks are normalized to increase the real price of oil by 10% on impact. Monthly flows are computed as in equation (1). The plots report responses at the fund-level, as well as for fund shares owned primarily by Households (HH), Insurance companies (IC), and Investment funds (IF). A fund-share is assigned to an investor if at least 50% of TNA is held by that investor. The solid black lines are the point estimates and the shaded areas are 68 and 90% confidence bands. The sample period is October 2013 (the start of the SHSS data collection) to June 2024. Standard errors are clustered at the fund and month level.

are mostly insignificant. Figure 8, Panels (d) and (h) show the responses of flows in shares held pre-dominantly by Investment Funds. In the case of bonds, there are outflows in the first two periods (cumulative decline of about 1%) as well as outflows towards the end of the projection horizon, reaching a low of -3.6900001 percent in month 12. In the case of equities, there are steep inflows until month 2, peaking at 2.1400001 percent. Flows remain elevated until month 6; the response becomes insignificant thereafter.

In sum, the negative stock-bond correlations in the face of demand shocks is most apparent for Investment Funds in the short-run but also - interestingly - for Households over the longer horizon. The latter could be consistent with the logic in Cieslak and Pflueger (2023), whereby demand-driven shocks correspond to the case when real payoffs of nominal bonds become more valuable during recessions, making nominal government bonds desirable hedges for Households. As for Insurance Corporations, they appear to be overall less sensitive to demand-driven shocks, in line with their long-term investment orientation.

4.2.2 Differential responses within fund-month

In this section, we conduct an additional analysis in which we compare the responses of shares majority-held by Investment funds with those majority-held by Households, *within the same fund and month.* This is a stringent specification as we hold the portfolio and any time-varying factors fixed. We focus on the differential responses of Investment funds and Households as we have fewer observations to capture the variation within a fund and month for Insurance Corporations.



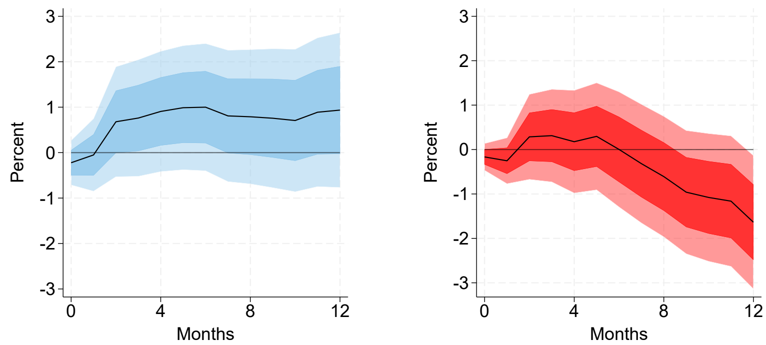
Fund-shares held by Investment funds (Households base category)

Figure 9: Differential responses of fund flows to cost-push shock

This figure plots *differential* impulse responses of monthly flows to cost-push driven inflation shocks for bond funds (blue) and equity funds (red), estimated using panel local projections with fund-month fixed effects (equation 7). Shocks are normalized to increase the real price of oil by 10 percent on impact. The plotted responses compare fund shares primarily held by Investment funds (at least 50% TNA) against those held by Households. Solid black lines show point estimates; shaded bands denote 68% and 90% confidence intervals. Sample: October 2013 to June 2024. Standard errors are clustered at both fund and month level.

Figure 9 shows *differential* impulse responses of cumulative fund flows in shares majority-held by Investment funds, in percent, to a 10 percent increase in real oil price driven by a cost-push shock. Fund shares in which Households are majority owners are the base category. Each panel presents the responses of bond fund flows on the left-hand side and for equity fund flows on the right-hand side of the chart. Results confirm that, in the case of cost-push inflation shocks, Investment funds redeem their shares more than Households, with the differential in outflows equal to about 1 percentage points in the case of equities and about half of that in the case of bonds.

Figure 10 presents the corresponding *differential* responses to a demand-driven shock. In the case of bonds, Investments funds redeem their shares somewhat stronger on impact compared to House-



Fund-shares held by Investment funds (Households base category)

Figure 10: Differential responses of fund flows to demand shock

This figure plots *differential* impulse responses of monthly flows to demand-driven inflation shocks for bond funds (blue) and equity funds (red), estimated using panel local projections with fund-month fixed effects (equation 7). Shocks are normalized to increase the real price of oil by 10 percent on impact. The plotted responses compare fund shares primarily held by Investment funds (at least 50% TNA) against those held by Households. Solid black lines show point estimates; shaded bands denote 68% and 90% confidence intervals. Sample: October 2013 to June 2024. Standard errors are clustered at both fund and month level.

holds, although this differential is not statistically significant. After this initial reaction, Households' response in more pronounced - and persistently so - compared to Investment Funds. In the case of equities, Households' response is once again more persistent - and more positive in the longer-term - than that of Investment Funds, leading to a negative differential between months 9 and 12, significant at the 68% level. That is, 9 months after a demand-driven shock, Household-held equity fund shares exhibit more pronounced inflows compared to Investment Fund-held equity fund shares, within the same fund.

These results largely confirm our baseline findings where we observed that Investment Funds react more strongly than Households in the face of supply-driven shocks. In the face of demand-driven shocks, Investment funds reacted quickly while Households showed a more persistent reaction.

5 Conclusion

In this paper, we take advantage of a confidential security-level holdings data to examine whether different investors in stocks and bonds respond differently to inflation shocks and whether their response depends on the nature of inflation shocks.

Two main advantages of our approach set this paper apart from existing literature. First, we exploit the recent advances in the literature on inflation shocks identification, employing exogenous inflation shocks and distinguishing between cost-push and demand-driven inflation, as they have different implications for stock and bond returns, and their co-movement. Second, the granularity of our data allows us to zoom in on heterogeneity in investor responses to inflation shocks by looking at their re-balancing within the same mutual fund.

Our main findings can be summarized as follows. In the aggregate, both cost-push and demand-driven inflation shocks hurt bond funds' performance and lead to outflows from bond funds. For equity, performance and flows increase if inflation shocks are of the demand-driven variety but decrease if inflation shocks are of the cost-push variety. We show that the aggregate responses are driven primarily by re-balancing of Investment funds who respond quickly and strongly to shocks. Households' response is often less pronounced quantitatively but persistent. By contrast, Insurance corporations exhibit a more subdued reaction, in particular to demand-driven shocks. This is in line with Insurances being "buy-and-hold" investors who re-balance more infrequently. Our findings have implications for understanding the dynamics of transmission of shocks to stock and bond prices.

References

Acharya, V. V. and T. Laarits (2023). When do treasuries earn the convenience yield?: A hedging perspective. Technical report, National Bureau of Economic Research.

Allaire, N., J. Breckenfelder, and M. Hoerova (2023). Fund fragility: The role of investor base. ECB Working Paper 2874, European Central Bank.

Baele, L., G. Bekaert, and K. Inghelbrecht (2010). The determinants of stock and bond return comovements. *The Review of Financial Studies 23*(6), 2374–2428.

Baumeister, C. and J. D. Hamilton (2019). Structural interpretation of vector autoregressions with incomplete identification: Revisiting the role of oil supply and demand shocks. *American Economic Review 109*(5), 1873–1910.

Baumeister, C., D. Korobilis, and T. K. Lee (2022). Energy markets and global economic conditions. *Review of Economics and Statistics 104*(4), 828–844.

Bekaert, G., E. Engstrom, and A. Ermolov (2021). Macro risks and the term structure of interest rates. *Journal of Financial Economics 141*(2), 479–504.

Berk, J. B. and R. C. Green (2004). Mutual fund flows and performance in rational markets. *The Journal of Finance 59*(4), 1537–1564.

Campbell, J. Y., C. Pflueger, and L. M. Viceira (2020). Macroeconomic drivers of bond and equity risks. *Journal of Political Economy 128*(8), 3148–3185.

Campbell, J. Y., A. Sunderam, L. M. Viceira, et al. (2017). Inflation bets or deflation hedges? the changing risks of nominal bonds. *Critical Finance Review 6*(2), 263–301.

Chevalier, J. and G. Ellison (1997). Risk-taking by mutual funds as a response to incentives. *Journal of Political Economy 105*(6), 1167–1200.

Cieslak, A., W. Li, and C. E. Pflueger (2023). Inflation and treasury convenience. *USC Marshall School of Business Research Paper Sponsored by iORB*.

Cieslak, A. and H. Pang (2021). Common shocks in stocks and bonds. *Journal of Financial Economics 142*(2), 880–904.

Cieslak, A. and C. Pflueger (2023). Inflation and asset returns. *Annual Review of Financial Economics 15*(1), 433–448.

Cloyne, J., C. Ferreira, and P. Surico (2020). Monetary policy when households have debt: new evidence on the transmission mechanism. *The Review of Economic Studies 87*(1), 102–129.

Coppola, A. (2024). In safe hands: The financial and real impact of investor composition over the credit cycle. *Review of Financial Studies*. Forthcoming.

Daniel, K., L. Garlappi, and K. Xiao (2021). Monetary policy and reaching for income. *The Journal of Finance 76*(3), 1145–1193.

Doepke, M. and M. Schneider (2006). Inflation and the redistribution of nominal wealth. *Journal of Political Economy 114*(6), 1069–1097.

Eickmeier, S. and B. Hofmann (2022). What drives inflation? Disentangling demand and supply factors. *BIS Working Papers No 1047*.

Ermolov, A. (2022). Time-varying risk of nominal bonds: How important are macroeconomic shocks? *Journal of Financial Economics 145*(1), 1–28.

Firat, M. and O. Hao (2023). Demand vs. supply decomposition of inflation: Cross-country evidence with applications. *IMF Working Papers No 23/205*.

Giannone, D. and G. Primiceri (2024). The drivers of post-pandemic inflation. Technical report, National Bureau of Economic Research.

Hau, H. and S. Lai (2016). Asset allocation and monetary policy: Evidence from the eurozone. *Journal of Financial Economics 120*(2), 309–329.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review 95*(1), 161–182.

Jordà, and A. M. Taylor (2025, March). Local projections. *Journal of Economic Literature 63*(1), 59–110.

Kang, J. and C. E. Pflueger (2015). Inflation risk in corporate bonds. *The journal of finance 70*(1), 115–162.

Känzig, D. R. (2021). The macroeconomic effects of oil supply news: Evidence from opec announcements. *American Economic Review 111*(4), 1092–1125.

Kilian, L. (2009). Not all oil price shocks are alike: Disentangling demand and supply shocks in the crude oil market. *American Economic Review 99*(3), 1053–69.

Kilian, L. and D. P. Murphy (2014). The role of inventories and speculative trading in the global market for crude oil. *Journal of Applied Econometrics 29*(3), 454–478.

Koijen, R., F. Koulischer, B. Nguyen, and M. Yogo (2017). Euro-area quantitative easing and portfolio rebalancing. *American Economic Review PP 107*(5), 621–627.

Koijen, R., F. Koulischer, B. Nguyen, and M. Yogo (2021). Inspecting the mechanism of quantitative easing in the euro area. *Journal of Financial Economics 140*(1), 1–20.

Koijen, R., R. J. Richmond, and M. Yogo (2024). Which investors matter for equity valuations and expected returns? *Review of Economic Studies 91*(4), 2387–2424.

Ottonello, P. and T. Winberry (2020). Financial heterogeneity and the investment channel of monetary policy. *Econometrica 88*(6), 2473–2502.

Pallotti, F., G. Paz-Pardo, J. Slacalek, O. Tristani, and G. L. Violante (2024). Who bears the costs of inflation? euro area households and the 2021–2023 shock. *Journal of Monetary Economics 148*, 103671.

Pflueger, C. (2024). Back to the 1980s or not? The drivers of inflation and real risks in treasury bonds. *Journal of Financial Economics*. Forthcoming.

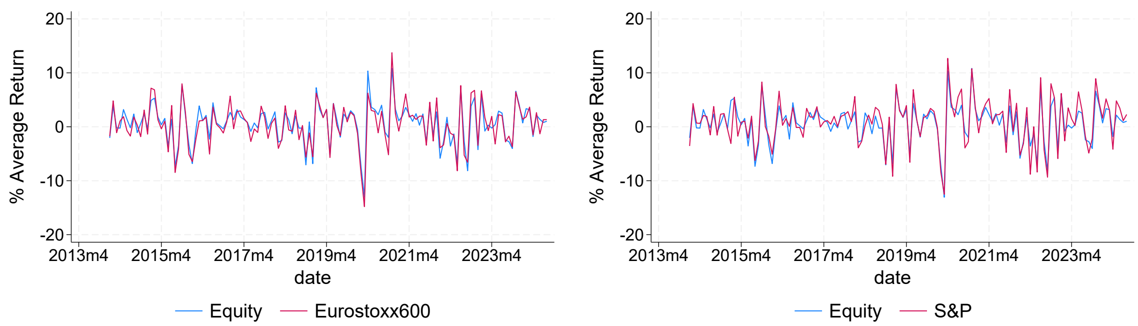
Shapiro, A. H. (2024). Decomposing supply-and demand-driven inflation. *Journal of Money, Credit and Banking*. Forthcoming.

Sirri, E. R. and P. Tufano (1998). Costly search and mutual fund flows. *The Journal of Finance 53*(5), 1589–1622.

Timmer, Y. (2018). Cyclical investment behavior across financial institutions. *Journal of Financial Economics 129*(2), 268–286.

Vayanos, D. and J.-L. Vila (2021). A preferred-habitat model of the term structure of interest rates. *Econometrica 89*(1), 77–112.

Online Appendix [not for publication]



(a) Equity Funds and Eurostoxx600

(b) Equity Funds and S&P

Figure 11: Equity Fund Returns vs Equity Indices

The figures show monthly returns on equity funds, STOXX Europe 600, and S&P 500. The sample period is January 2014 - June 2024. Equity fund returns are based on the Lipper database marged with SHSS. Daily series for STOXX Europe 600 and S&P 500 returns are retrieved from Bloomberg, keeping end-of-month observations. Month-on-month returns are then calculated as the percentage change from the previous month.

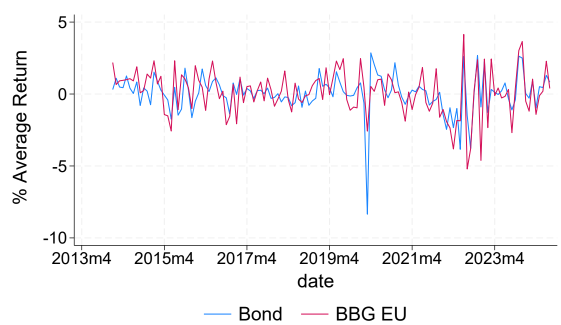
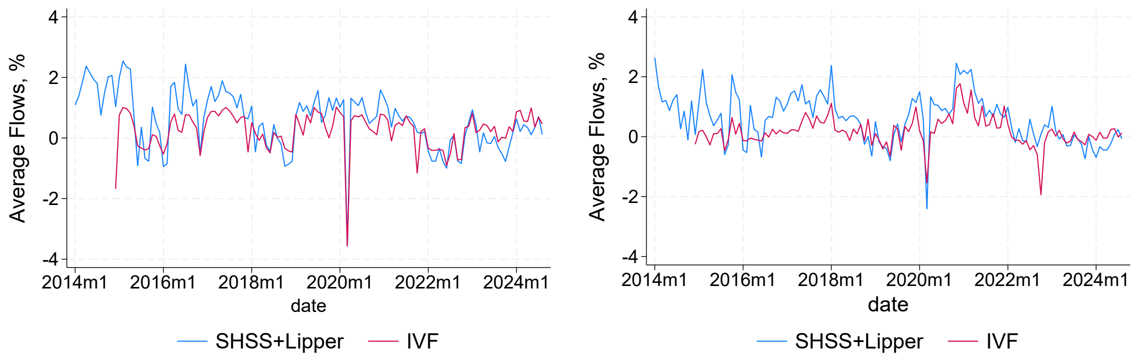


Figure 12: Bond Fund Returns vs Bond Indices

The figure shows monthly returns on bond funds and the index Bloomberg EU Government All Bonds Total Return. The sample period is January 2014 - June 2024. Bond fund returns are based on the Lipper database marged with SHSS. Daily data for the Bloomberg EU Government Bond index are retrieved from Bloomberg, keeping end-of-month observations. Month-on-month returns are then calculated as the percentage change from the previous month.

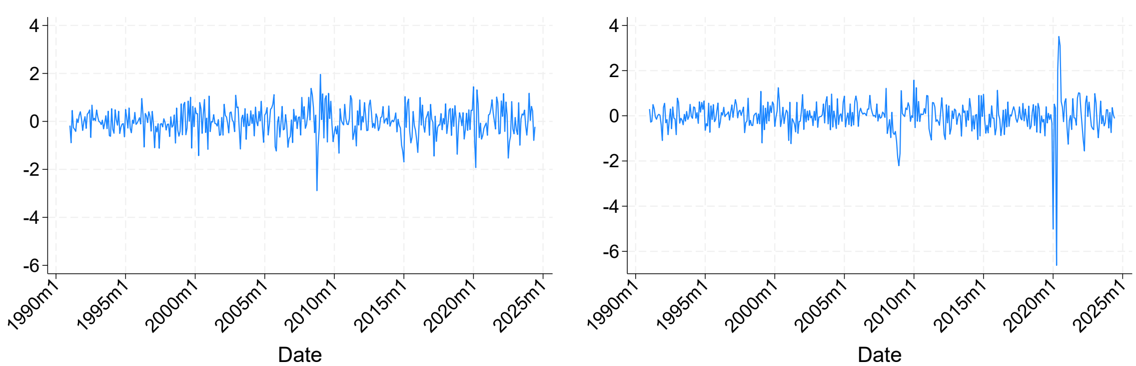


(a) Bond flows

(b) Equity flows

Figure 13: Fund Flows, Comparison to IVF

The figure plots (a) bond and (b) equity fund flows in the SHSS plus Lipper sample compared to the aggregate Investment Fund Statistics (IVF). In panel (a), the correlation between the two series is equal to 0.72, while in panel (b) it is 0.76. The sample period is January 2014 - June 2024. Bond and equity fund series are based on the Lipper database merged with SHSS.



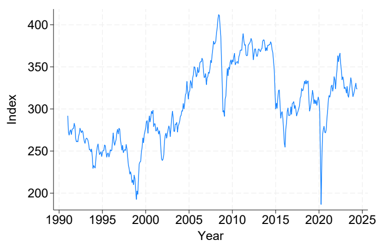
(a) Cost-push shocks

(b) Demand-driven shocks

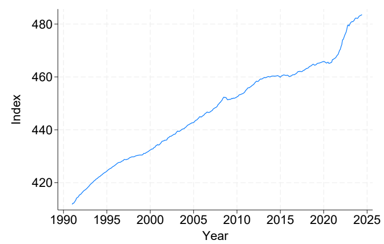
Figure 14: Time series of inflation shocks

The figure shows the time series of cost-push inflation shocks (Panel (a)) and demand-driven inflation shocks (Panel (b)). The sample period is January 1991 - June 2024. Cost-push shock series is from Känzig (2021); demand-driven shocks series is from Baumeister and Hamilton (2019)

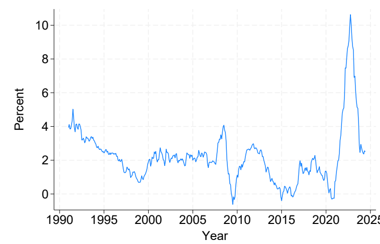
.



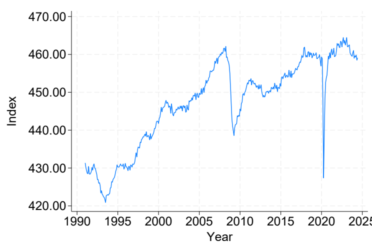
(a) Real Oil-Price



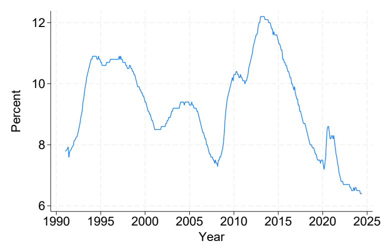
(b) Price Index



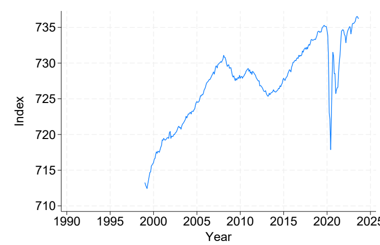
(c) Inflation Rate



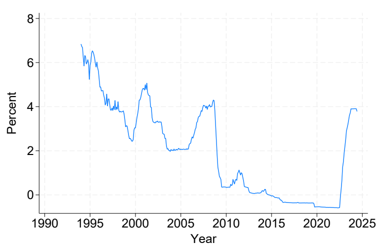
(d) Industrial Production



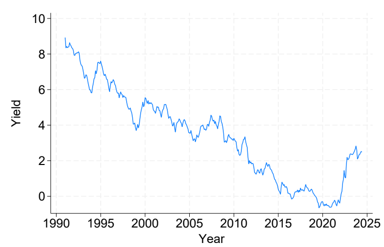
(e) Unemployment Rate



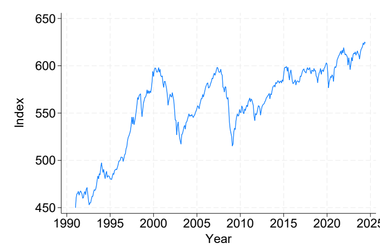
(f) Real Consumption



(g) Overnight Rate



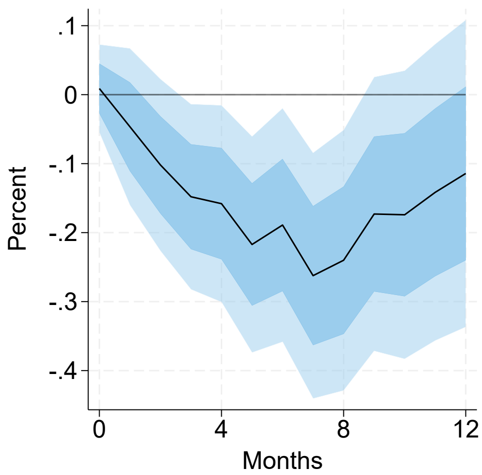
(h) 10-year German Yield



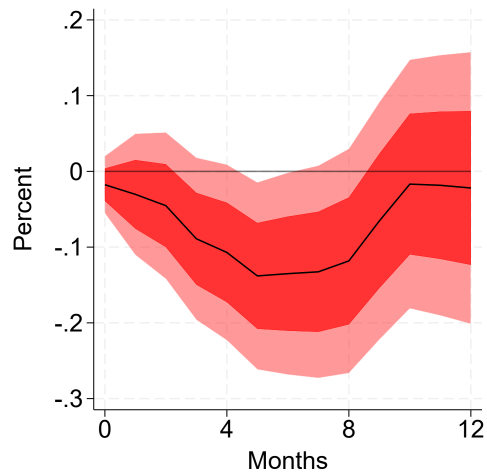
(i) STOXX Europe 600 Index

Figure 15: Time series of macroeconomic and financial variables

The figure shows the time series plots of macroeconomic and financial variables used in the estimations of local projections. The sample period is January 1991 - June 2024.



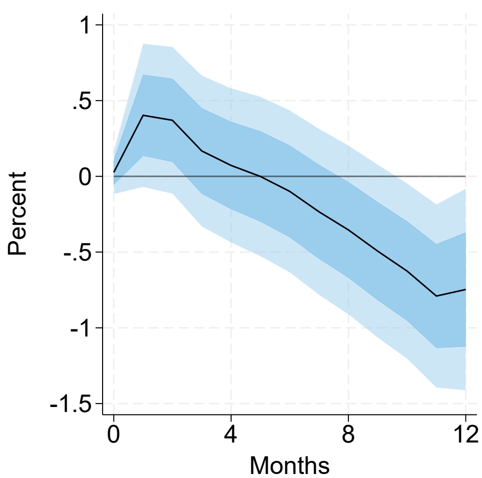
(a) Bond



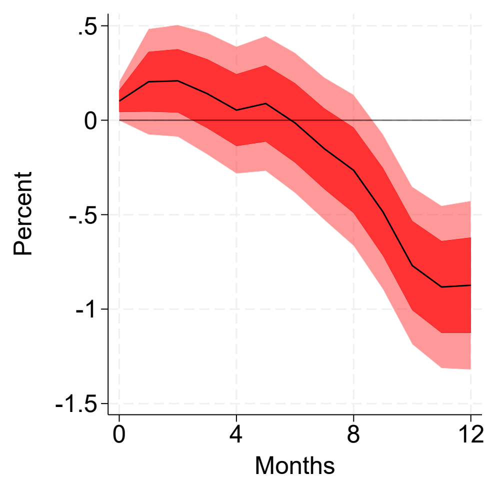
(b) Equity

Figure 16: Responses of fund flows to cost-push shocks based on an alternative data source

This figure plots impulse responses of monthly flows for bond funds (blue) and equity funds (red) based on the Investment Fund Statistics (IVF) using local projections to an cost-push shock. The shock is normalized to increase the real price of oil by 10 percent on impact. The sample period is January 2014 (the start of the IVF statistics) to June 2024.



(a) Bond



(b) Equity

Figure 17: Responses of fund flows to demand-driven shocks based on an alternative data source

This figure plots impulse responses of monthly flows for bond funds (blue) and equity funds (red) from IVF estimated using local projections to an aggregate demand shock. The shock is normalized to increase the real price of oil by 10 percent on impact. The sample period is January 2014 (the start of the IVF statistics) to June 2024.