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Monetary policy shocks and their effects across the wealth distribution: evidence from new European data

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TEP Working Paper No. 0524

August 2024

Revision date: March 2025

Trinity Economics Papers
Department of Economics

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31st March 2025

Abstract

We use new data on the distribution of wealth in the euro area and employ panel local projections to estimate the different impact of ECB monetary policy shocks on households across the wealth distribution. We look at how policy affects the value of their assets, the composition of their balance sheets, their investment decisions, and overall wealth inequality. We find that in response to a contractionary shock, poorer households display a substantial decline in their assets and in their overall net wealth. Conversely, the balance sheet of the very wealthiest is not significantly affected. This different response leads to a moderate increase in overall wealth inequality. We further perform a decomposition of asset movements caused by the shock, isolating the effect of revaluations and of household investment. We observe that the response of household wealth due to a monetary policy shock occurs primarily through revaluation effects.

JEL classification codes: D31, E44, E52

Keywords: Wealth Inequality, Monetary Policy, Distributional Wealth Accounts, Local Projections

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Disclaimer: all views expressed in this paper are exclusively our own and do not necessarily represent the views of the Central Bank of Ireland or the Eurosystem. Useful comments from Joe Kopecky, Boryana Madzharova, Gabriel Arce-Alfaro and two anonymous referees are gratefully acknowledged.

1. Introduction

Few developments have as broad an impact on all aspects of the economy as monetary policy does. Whether directly through interest rate movements, or indirectly through employment or inflation, every household is affected one way or another by monetary policy and its transmission across a number of different channels. However, depending on factors such as employment and income, as well as the amount and relative allocation of asset holdings, households can be impacted by (and respond to) monetary policy in very different ways, and systematically so.

What happens to households' wealth in response to monetary policy? There is a large and growing literature[1] investigating the heterogeneous effects of monetary policy on households, based on characteristics such as income level, wealth, asset holdings and indebtedness. Such heterogeneous responses to monetary policy naturally lead to developments in wealth inequality among households with different economic characteristics.

In spite of the abundance of studies and theoretical understanding of the heterogeneous effects of monetary policy on households' wealth, data limitations have made it quite difficult to gain insights into the distributional effects of monetary policy at the aggregate level.[2] In other words, not much is known about how large groups of households with similar characteristics (such as their level of wealth, which is the primary focus of this paper) respond to, or are affected by, monetary policy. Until recently, studies have been largely based on survey data, simulations and models.[3] This paper contributes to the literature on monetary policy and inequality by providing empirical findings that represent a bridge between the current micro-based (such as Casiraghi et al., 2018; Holm et al., 2021; Andersen et al., 2023; and Slacalek et al., 2020) or aggregate empirical findings, and the results of models such as Auclert (2019) and Luetticke (2021).

To do this, we employ the Distributional Wealth Accounts developed and published by the European System of Central Banks. This dataset combines detailed (but infrequent) evidence on households' finances provided by the Household Finance and Consumption Survey with timely (but aggregate) data from the Quarterly Sector Accounts of the euro area. As a result, this dataset provides us with quarterly time series of household wealth and asset holdings, broken down by a number of groupings (namely: wealth level, employment, and home-ownership status). The (relative) high frequency of this new data allows us to study the impact of monetary policy on the wealth and balance sheet composition of households across the whole wealth distribution, and to identify the effect of monetary policy on wealth inequality at an aggregate level using time-series techniques. This is a novel approach when it comes to distributional considerations in the European

[1] As well documented in Colciago et al. (2019).

[2] The World Inequality Database (Alvaredo et al., 2024; Saez and Zucman, 2016) is a notable undertaking in this direction and a great source of global data on the distribution of income and wealth. However, it is not suited to study the effects of monetary policy on inequality due to its low frequency.

[3] Exceptions are a number of papers, such as Holm et al. (2021) and Andersen et al. (2023), that make use of rich (but annual) administrative data in Northern European countries like Norway and Denmark to estimate the effects of monetary policy on different households. The latter actually finds expansionary policy to increase inequality.

context.

Our approach is similar to the one used in Franconi and Rella (2023) for the United States.[4] However, our results are novel for the euro area, and we also significantly expand the treatment of this topic by explicitly investigating the impact of monetary policy shocks on households' investment decisions, portfolio allocations, and overall wealth inequality. Furthermore, our scope extends to consider households by their tenancy and employment; two dimensions that are less commonly observed in previous research.

Our results are broadly in line with the rest of the literature and with the effects of monetary policy changes on the value of assets typically implied by economic theory.

An increase in policy rates is expected to cause a fall in the price of risky financial assets (e.g., equity) and house prices, thus lowering the wealth of households holding such assets.[5] Equity prices are expected to fall as a result of contractionary monetary policy because of the increased return on alternative risk-free assets. If risk premiums stay the same, the future expected return on equities also needs to rise, and for this to be possible the asset price needs to decline accordingly. In addition, equity prices fall because restrictive monetary policy is expected to reduce most firms' expected future revenues due to a general slowdown in the economy (Maio, 2014). In the case of house prices, higher rates on mortgages discourage some potential mortgage buyers from the housing market, therefore reducing demand. At the same time, the differential between rental yields and risk-free returns narrows, thus making housing as an investment also less attractive.[6] Finally, bond prices are inversely correlated to bond yields, which closely follow movements in policy rates.

With equity, housing and bond prices falling in response to restrictive monetary policy, we expect to see these negative asset price movements reflected (at least in part) on households' wealth, with different households being differently affected based on the size and weight of these assets on their balance sheets. Once we know what happens to asset prices, the distributional effects of such movements are well studied. For instance, Adam and Tzamourani (2016) show that an increase in house prices would tend to benefit households of all levels of wealth, but more so those in the middle of the wealth distribution. On the other hand, increases in equity and bond prices would overwhelmingly benefit those at the top, as these assets account for a larger share of richer households' wealth.

In line with the findings described above, our results indicate a moderate fall in the value of most households' risky financial assets in response to a restrictive monetary policy shock. Despite

[4]The Distributional Financial Accounts, the US equivalent of the euro area Distributional Wealth Accounts, have been available for longer and thus comprise longer time series.

[5]See, among others, Ehrmann and Fratzscher (2004) and Ioannidis and Kontonikas (2008) for what happens to equity prices; and Mishkin (2007), Jordá et al. (2015) and Koeniger et al. (2022) for how monetary monetary policy affects house prices and the housing market.

[6]The response of asset prices to monetary policy is largely predictable qualitatively, but highly uncertain quantitatively. As Paul (2020) highlights, the responses of house and equity prices to monetary policy can vary greatly across time and based on circumstances in the housing and stock markets themselves. Furthermore, there are wide ranges of estimated coefficients in the literature, both across and within economies - see Williams (2015), for instance.

being the most exposed to equity, however, this does not seem to be the case for the levels of risky assets for households in the top 10% of the wealth distribution. Consistently with theory, we also note a decline in non-risky financial assets across all households in response to a contractionary shock. For most groups, we find that housing wealth declines towards the middle of the horizon, however the effect (as expected, since housing is less liquid) is generally non-significant.

Apart from movements in asset prices, monetary policy shocks also affect the growth of credit and money circulating in the economy: consider the classic credit channel of monetary policy as per Bernanke and Gertler (1995) and Drechsler et al. (2017) for the behaviour of deposits. Indeed, this is one of the main channels of transmission of monetary policy. Consequently, we expect a contractionary monetary policy shock to negatively affect the levels of both debt and risk-free assets, this time via a lower volume of new loans and reduced flows into deposits, rather than via price effects. The decline in credit eventually leads to general equilibrium effects, with output and inflation both falling (Romer and Romer, 2004; Cloyne and Hürtgen, 2016). Slacalek et al. (2020) find that low-income households are more strongly affected by these general equilibrium effects because they are more likely to become unemployed as a result of a recession, and are also relatively more reliant on labour income.

Monetary policy can also affect household wealth through a number of other channels, starting from how it impacts the financial income and debt repayments of savers and borrowers (see Auclert, 2019; and Tzamourani, 2021). Based on whether a household has higher holdings of interest-bearing assets (i.e., deposits and bonds) or liabilities (mortgages and other debt), their income[7] would benefit or suffer from an increase in interest rates. In the former case, increased interest income from a household's deposits would more than offset any increase in debt repayments, while the opposite would be true if (variable-rate) debt levels are larger than deposits. As savers are typically wealthier, increases in policy rates, which benefit them and hurt borrowers, increase inequality. The effect of monetary policy on inflation has distributional implications, too: since the values of deposits and debt are both nominal, an increase in prices leads to a fall in the real value of both. Inflation is therefore good news for borrowers and bad for (deposit) savers. This channel contributes to a reduction in inequality, as borrowers tend to be less wealthy.[8] Therefore, a restrictive monetary policy shock - which also delivers a negative unexpected inflation shock - would conversely hurt borrowers and increase inequality through this channel.

Monetary policy further leads to changes in households' saving and investment behaviour. Households in different wealth groups might indeed react differently to changes in asset prices and interest rates depending on factors such as their income, employment status, the relative importance of these assets in their portfolios, and the availability of liquid assets. For instance, a typical "non

[7]And therefore wealth: higher income translates into higher savings wherever the marginal propensity to consume is less than one, which is almost always the case (Carroll et al., 2017).

[8]See Doepke and Schneider (2006) and Ferreira et al. (2024). As per the latter study, inflation also affects wealth inequality through income and consumption channels. El Herradi et al. (2023) find that inflation lowers the share of income held by the top earners, as it reduces the real returns on their assets (and a larger share of their income comes from assets).

hand-to-mouth" household (i.e., a wealthy household with significant liquid assets) would be able to respond more optimally to shocks than a household with more liquidity constraints, whether wealthy or not.[9] In general, a rise in real rates would encourage savings via a direct inter-temporal substitution effect. General-equilibrium income effects, however, are found to be stronger than the direct inter-temporal substitution and interest exposure effects for hand-to-mouth households (Ampudia et al., 2018) because, while the real return on saving has increased, these households are unable to take advantage of this. In addition, their incomes actually decline in response to contractionary policy due to equilibrium effects, leading to actually less saving and consumption.

Unconventional monetary policy can have substantially different repercussions on households compared to conventional interest rate monetary policy, as it works through very different channels. Casiraghi et al. (2018) find a U-shaped effect of quantitative easing on wealth across the distribution, with households at the bottom benefiting because of increased income and reduced cost of debt, while those at the top benefit from capital gains on financial assets. Overall, the effects on wealth inequality are found to be negligible. Through a micro-simulation on euro area survey data, Lenza and Slacalek (2024) find that quantitative easing policies reduce income inequality through increases in employment at the bottom of the income distribution, but they do not find statistically significant changes in the Gini coefficient of wealth despite the different portfolio holdings of households at different levels of the wealth distribution.

The rest of the paper is structured as follows: section 2 describes our dataset and provides an overview of the composition and distribution of wealth in the euro area, section 3 discusses the empirical strategy applied in analysis, and section 4 details the corresponding results. Finally, section 5 concludes.

2. Data

Our primary source of data is the Distributional Wealth Accounts ("DWA") experimental dataset, published for the first time by the European Central Bank in January 2024. The DWA provides quarterly data on the amount of assets and liabilities held by households in euro area countries, as well as on their distribution across different sections of the population. Households are broken down according to three dimensions:

- **Net wealth deciles**: bottom 50% altogether, deciles six, seven, eight, nine, and the top 10% of the net wealth (i.e., total assets minus total liabilities) distribution;
- **Tenancy status**: Home owners (including part-owners) and tenants;
- **Working status**: employees, retirees, self-employed, unemployed and other.

[9] As well modelled in the HANK literature. See, for instance, Kaplan et al. (2018), Luetticke (2021), and Slacalek et al. (2020).

Importantly, DWA series are constructed to be consistent with the existing macroeconomic aggregates for the household sector as a whole. In fact, the the dataset's methodology establishes a conceptual bridge to match the wealth instruments (assets, both financial and non-financial, and liabilities) reported in official macroeconomic statistics with items covered by specific surveys of household finances in each country. Information on the distribution of those comparable wealth instruments across households is obtained from the Household Finance and Consumption Survey[10] ("HFCS") and then reflected onto Quarterly Sector Accounts ("QSA") series for the aggregate household sector which, otherwise, would not give any insights on distributional aspects.[11]

As a result, the DWA provides, for the first time, a timely and granular view of the distribution of wealth in the euro area, consistent with the existing QSA statistics. In addition to time series for the stock of assets and liabilities, the dataset also includes some derived indicators such as the Gini index of wealth inequality, per capita amounts, and debt-to asset ratios by household group.

The DWA has been introduced in Blatnik et al. (2024) for the euro area, and its results have been described in greater detail in specific publications for the individual countries in the panel (e.g., Mesnard, 2024; Moreno, 2024; Neri et al., 2024).

Table 1 displays a typical household's balance sheet composition following the DWA concept of wealth. Some items that are otherwise covered in national accounts (such as pension entitlements or cash holdings) are not captured in the dataset due to lack of survey data. As such, they are also excluded from our analysis.

We classify the ten DWA items into five broader wealth "types":

- **Non-financial**: consisting of residential housing assets;
- **Risk-free financial**: consisting of financial assets with very low risk (or none at all) with predictable returns agreed in advance[12];
- **Risky financial**: these assets generate returns for their owners primarily through revaluations and nominal changes in their value. They generally yield higher return rates, but also exhibit a greater degree of volatility;
- **Business wealth**: this category includes equity ownership in unlisted businesses as well as non-financial assets owned by households and used for production purposes;
- **Debt**: consisting of mortgage and non-mortgage loans.

[10]For more information on the methodology adopted in the latest wave of the survey, see (Household Finance and Consumption Network, 2022).

[11]The construction process of the DWA and the assumptions adopted are described in greater detail in the "DWA Methodological Note" published on the European Central Bank's Data Portal (together with an "Overview Note" and a "Frequently Asked Questions" document).

[12]For classification purpose only, we consider debt instruments (e.g., bonds) to be held until maturity, and not to generate returns due to valuation changes. This assumption appears consistent with the view of households using debt instruments as "safe" vehicles for saving purposes.

Table 1: *Breakdown of household net wealth in the DWA*

Assets (A)	**Liabilities (B)**
Non-financial	*Debt*
Housing wealth	Outstanding mortgages
	Outstanding non-mortgage debt
Risk-free financial	
Deposits	
Debt securities	
Risky financial	
Listed shares	
Investment fund shares	
Life insurance and annuity entitlements	
Business wealth	
Financial business wealth	
Non-financial business wealth	**Net Wealth (A-B)**

2.1. Composition, distribution and dynamics of wealth in the euro area

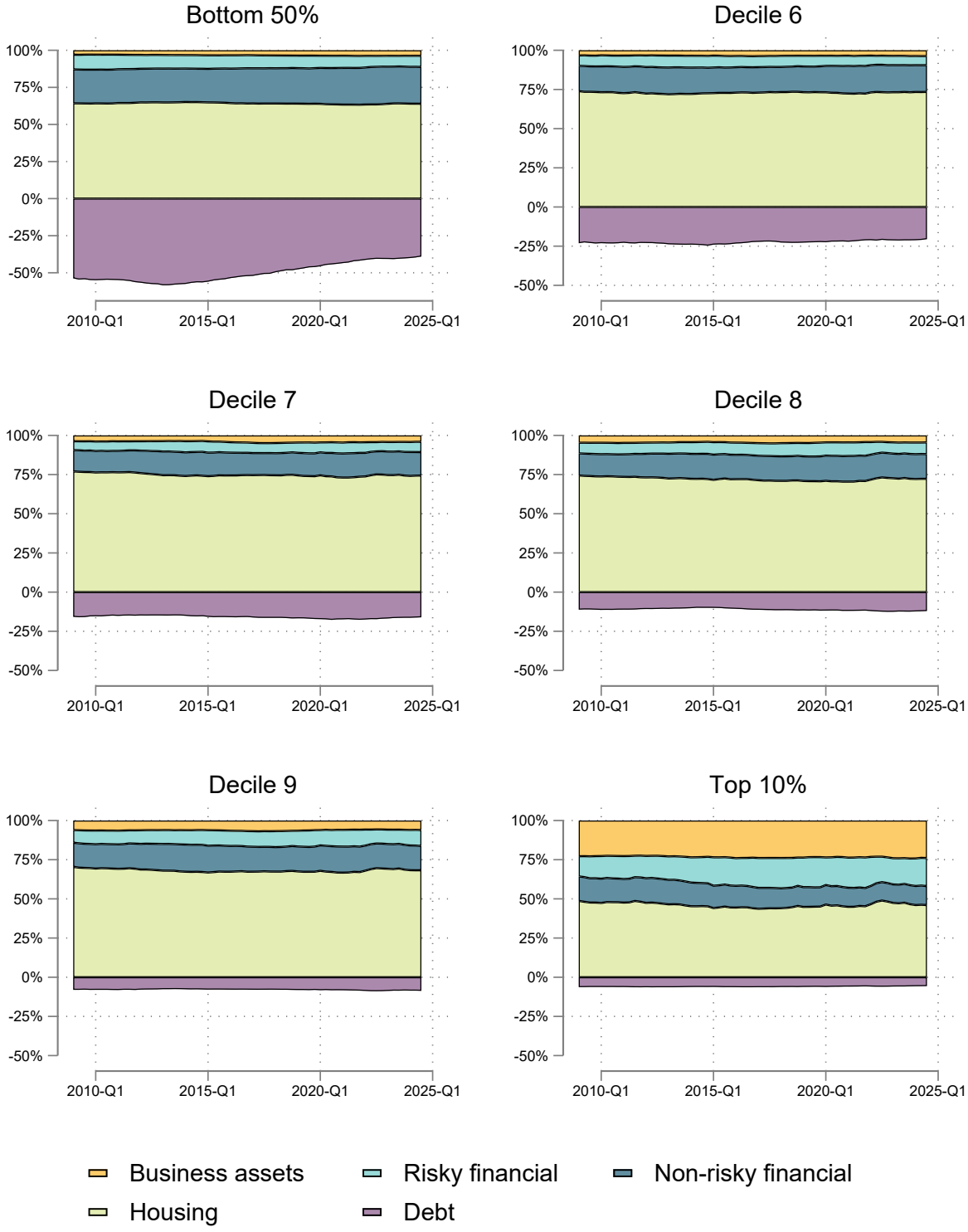
The DWA dataset gives important insights into how wealth is distributed in the euro area. These facts (neither new nor surprising to those familiar with results from the HFCS, in spite of the additional time series component given for the first time by the DWA) go a long way towards explaining and rationalising some of the results we will be showing below.

Figure 1 clearly highlights the absolute dominance of housing assets in households' portfolios at all levels of wealth, but especially so in the "middle 40%" wealth group (i.e., deciles 6 to 9), broadly representing the middle and upper-middle class. For these, housing represents about three quarters of total assets. Housing is also by far the most important asset for households in the bottom half and the top 10% of the wealth distribution. This dominant role of housing is a feature in every single country in the euro area.

We also note how the relative importance of debt decreases as households get wealthier, with the bottom half of the wealth distribution having by far the highest level of debt as a share of assets (i.e., financial leverage). Because this consists almost entirely of mortgage debt (compare Figure C.1 in the Appendix), it follows that wealthier households typically own housing outright, while those in the bottom 50% own housing with a mortgage - and indeed have only very limited housing equity.

The balance sheet composition is strikingly similar across all households apart from those in the top 10% of the wealth distribution. Indeed, on average, households' assets for the bottom 90% can be characterized as being three quarters housing and one quarter deposits, with risky assets and business wealth accounting only for a very marginal share (albeit increasing with the household's

Figure 1: *Composition of household portfolios in the euro area as a percentage of total assets, by net wealth group.*



Source: Distributional Wealth Accounts.

level of wealth).[13] Risky and business assets only become prominent for households in the top decile, who have a much more diversified and liquid portfolio (as well as, of course, larger in size). Following the categorisation adopted (among others) in Slacalek et al. (2020), these households (and perhaps the ninth decile) are the only ones that can be characterised as "non hand-to-mouth" (i.e., wealthy and with significant liquid wealth). Conversely, on average, all other groups have for the most part non-liquid wealth (housing) and limited liquid assets that are often insufficient to cover all outstanding debt. Due to the constrained nature of their balance sheets, households in the bottom 80-90% of the wealth distribution may not be able to respond to shocks the same way households in the top 10% do. Results from our analysis supports this hypothesis.

Finally, it is remarkable to note how little the relative shares of different assets in households' portfolios have changed over the period covered by the DWA.[14] Indeed, with the exception of a stark decrease in debt for households in the bottom 50% of the wealth distribution (partially as a result of the deleveraging process that followed the Global Financial Crisis and the euro area sovereign debt crisis), balance sheet compositions remained relatively stable over the years, in spite of the sometimes large volatility of certain underlying assets (namely: equity and house prices). This suggests that the saving and investment preferences of euro area households did not change noticeably since 2009/2010. In line with this observation, our results show that monetary policy shocks may only lead to moderate and short-lived changes in households' portfolio composition in the short-to-medium term, but not over longer horizons.

Figure 2 (or Figure C.2, for an equivalent with all asset types) displays the actual monetary values of portfolio holdings by wealth group. In addition to the considerations about portfolio compositions already pointed out above, we may also note that the overall increase in real[15] wealth across groups is largely driven by the evolution of housing. However, while the net wealth of households in the upper half of the wealth distribution increased as a result of rising asset values, the net wealth of those in the the lower half mainly rose due to a reduction in their outstanding debt. The charts also highlight the significant existing level of inequality. Although the bottom half of the wealth distribution has five times the number of households, their combined net wealth is comparable to that of the sixth decile, which has lower assets but also less debt. The wealth gap widens significantly at the top: the tenth decile owns more than three times the wealth of the ninth decile, which in turn has only about 50% more wealth than the eighth decile. Overall, wealth is heavily concentrated at the top, with the bottom half owning very little in comparison.

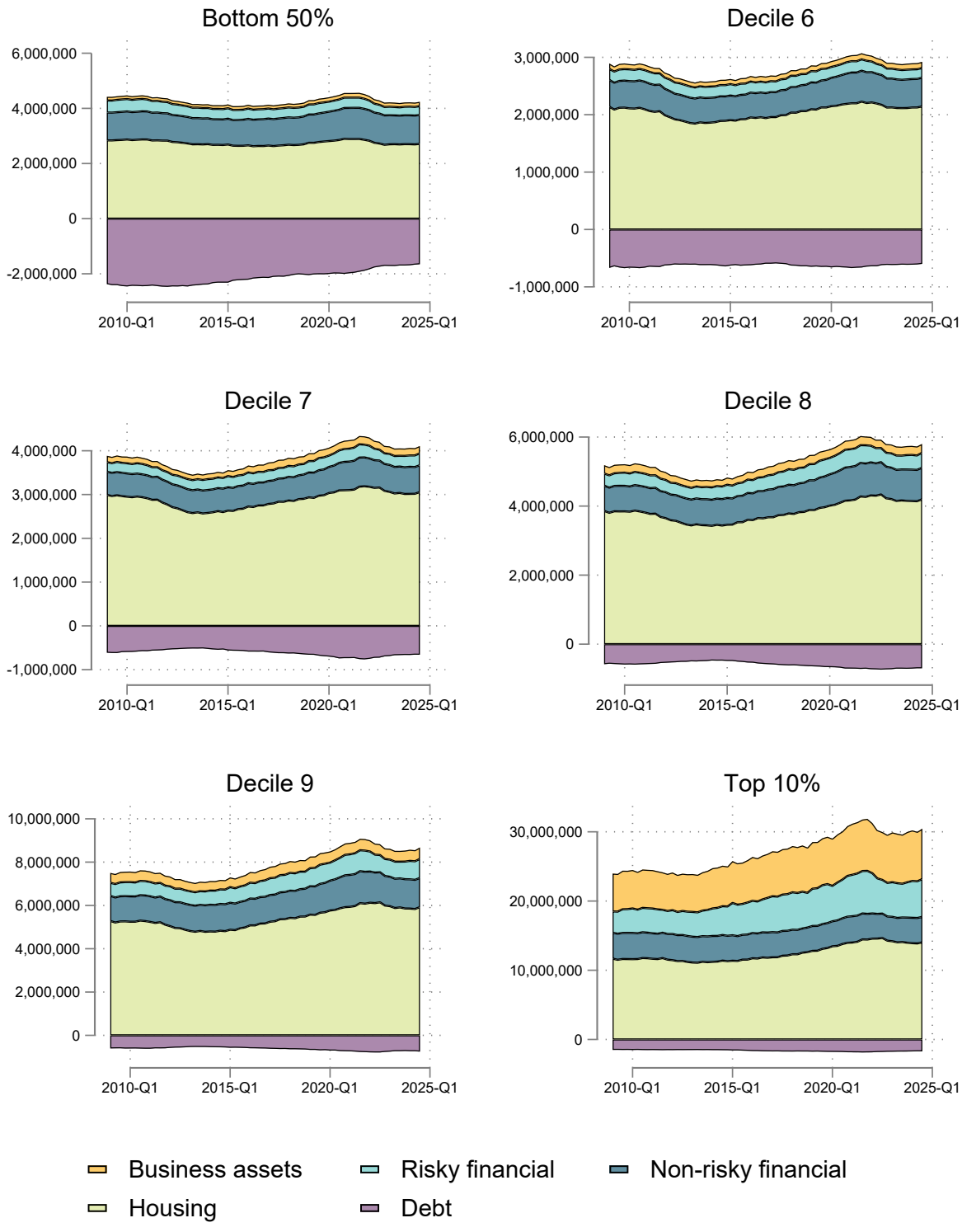
Figure 3 clearly shows that over half of total net wealth in the euro area is held by the wealthiest 10% of households. The Figure also shows the extent to which assets are unequally owned across

[13] And even then, these households' exposure to risky assets is mostly due to insurance instruments rather than equity (see Figure C.1). Both insurance and mutual funds, while classified as "risky" here, have large exposures to risk-free financial assets.

[14] Figure 1 displays results for the whole euro area. While on a country-by-country basis the portfolio shares are generally more volatile, this fact still holds in most cases.

[15] Figure 2 shows asset values adjusted for inflation. This is also the case throughout the remainder of the analysis.

Figure 2: *Composition of household portfolios in the euro area, by net wealth group (millions of 2015 €).*



Source: Distributional Wealth Accounts.

wealth groups. For instance, housing assets and non-risky financial assets are distributed much more equally across the whole wealth distribution than business assets and risky financial assets. Households in the top wealth decile own the overwhelming majority of the latter two, due to the very low participation of poorer households in these assets. While significant movements in the relative shares of holdings of certain assets can be seen from Figure 3 (for instance, the decrease of the overall share of debt in the bottom 50% of the wealth distribution, and the increase of the share of risky financial assets held by the wealthiest 10% of households), the relative shares of overall net wealth among household groups have remained quite steady over time.

3. The empirical approach

In order to assess the impact of monetary policy on the asset levels and portfolio allocation of households along the wealth distribution, and given the nature of our data (relatively short time series, but for several different countries), we estimate impulse responses to an identified monetary policy shock by way of panel local projections. This approach better suits our purposes compared to any VAR estimation, given the shortness of the DWA time series and our interest in quantifying the response of households' wealth to monetary policy, rather than the inference of any particular coefficient.[16]

We make use of the euro area monetary policy shock series as constructed in Jarocinski and Karadi (2020) ("J&K"). These shocks are estimated based on asset movements during a short time window around the announcement of ECB monetary policy decisions (such that they can only be explained by the announcements themselves, and not other factors).[17] These are further corrected for movements that can be related to central bank *information* shocks also conveyed together with the monetary policy decision. Thus, they can be taken as *pure* monetary policy surprises.[18] To fit the monthly frequency of the J&K shock series to the quarterly frequency of the DWA data, we sum the monthly J&K shocks in each quarter. Furthermore, we standardise the shock to remove traces of autocorrelation and have a standard deviation equal to one.

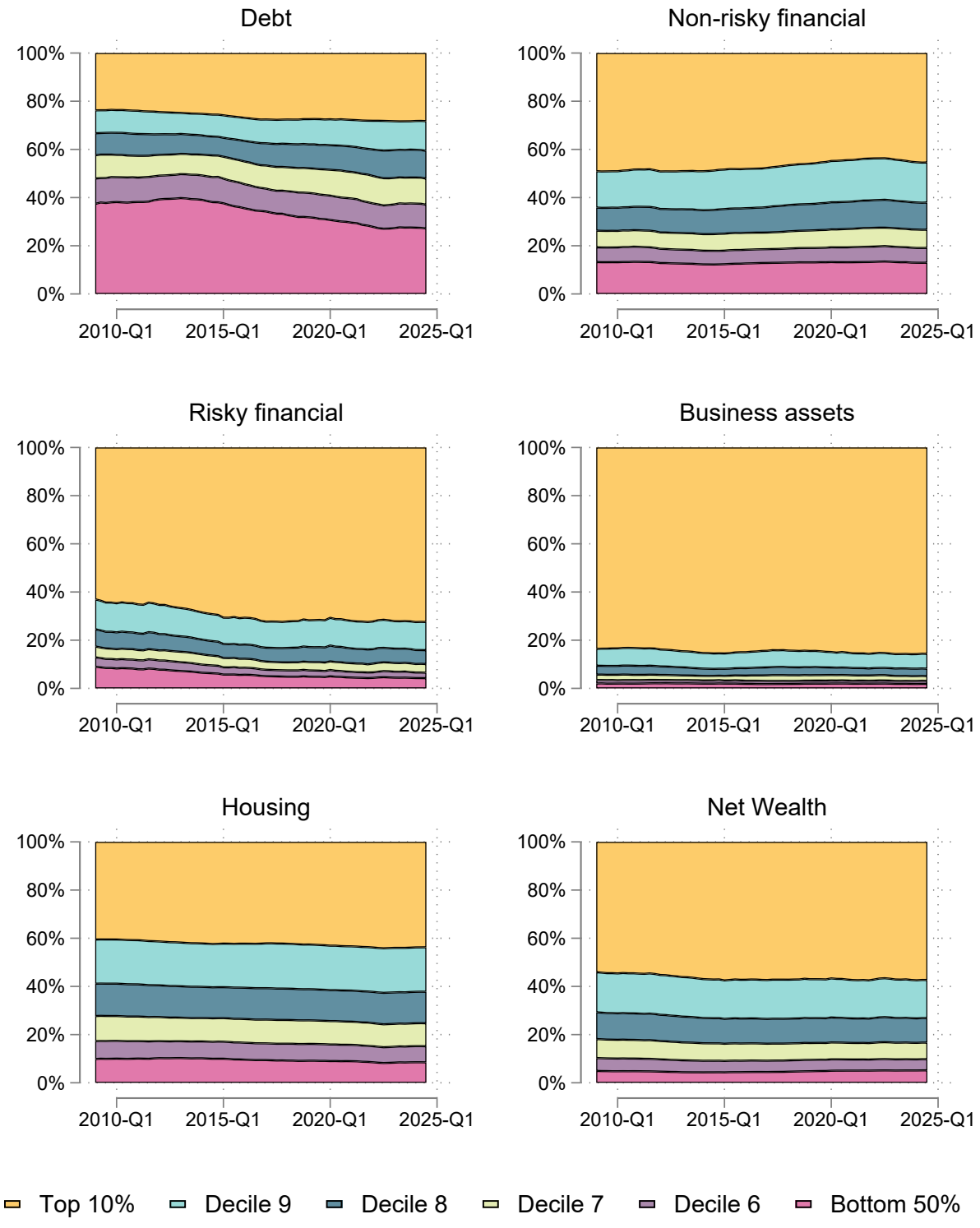
As our goal is to understand how the different assets and liabilities (and consequently, net wealth) of each wealth group respond to monetary policy shocks, we estimate a set of local projections for each combination of asset type and wealth group. While the DWA includes data for several instruments, some of these show limited movement and/or are only very marginal components of households' portfolios. Since, according to economic theory, they are expected to behave similarly to other types of assets sharing similar characteristics, we assess the response of the aggregates introduced in section 2 (non-financials, risk-free financials, risky financials, business wealth, and debt).

[16] See Jordá (2005), Jordá and Taylor (2024) and Plagborg-Møller and Wolf (2021).

[17] A similar high-frequency approach is used by Altavilla et al. (2019) and Cesa-Bianchi et al. (2020) among plenty others, and was first introduced by Kuttner (2001) and Gürkaynak et al. (2005).

[18] See also Kerssenfischer (2022) for a treatment of ECB information surprises versus pure policy surprises.

Figure 3: *Household group's share of total holdings in each asset type, euro area.*



Source: Distributional Wealth Accounts.

The econometric specification of our local projection estimates is as follows:

$$\hat{y}_{c,g,t+h} = (y_{c,g,t+h} - y_{c,g,t-1}) = \alpha_h + \delta_c + \beta_h s_t + \gamma_h \mathbf{X}_{c,t} + v_{c,g,t+h} \quad (1)$$

Where: (i) $\hat{y}_{c,g,t+h}$ is the dependent variable representing the change in the specific response under investigation (e.g., changes in the amount of a certain type of asset, or in the household group's share of the country's holdings of a specific wealth instrument, etc.) at horizon h for household group g in country c; (ii) δ_c are country fixed-effects; (iii) s_t is the (quarterly) J&K euro area identified pure monetary policy shock; and (iv) the $\mathbf{X}$ matrix includes country-specific controls such as: the unemployment rate, real GDP (both in logs), and the difference in yields between 10-year and 3-month government bonds. All control variables enter the equation contemporaneously (with the exception of the yields difference) and with four lags. We further include a quarterly dummy for each quarter of 2020 to explicitly account for COVID-19, and four differenced lags of $y_{c,g,t-1}$. Local projections are estimated over a horizon of 12 quarters.[19] Our original panel consists of all euro area countries (except Croatia), and has unbalanced quarterly frequency (while country series start from as early as 2009-Q3 and as late as 2017-Q3, the majority starts at or before 2010-Q4). Due to lack of data for some controls in a few small countries (namely: Cyprus, Estonia, Lithuania, Latvia and Malta), the sample is restricted to 14 countries, where we have a minimum of 32 and a maximum of 53 observations in each.[20]

In the next section, we present and discuss the identified effect of monetary policy shocks on the following measures for euro area households:

- Levels of each wealth type (as defined in section 2), scaled by net wealth before the shock;
- Decomposition of the above movements into revaluations and investment by households;
- Levels of each wealth type as a share of total assets (i.e., the portfolio composition);
- Overall distribution of each wealth type across household groups (i.e., the level of inequality).

Here, we consider households grouped by their position in the wealth distribution.[21] However, since our data also allows us to perform the same analysis by considering the employment or

[19] Given the limited length of our time series, a shorter horizon might be warranted for fear of losing important degrees of freedom or significant dates (notably, the strong monetary policy shocks at the end of the sample in 2022-2023). However, interesting movements are still captured in the third year of the IRF horizon.

[20] DWA data is subject to ongoing updates and revisions. Our analysis is based on the most recent version released by the ECB at the time of writing. The J&K shocks have been updated up to October 2023.

[21] We are aware of the fact that households can, and generally do, transition from one group to another over time, and that these composition changes may affect the interpretability of our results. However, due to typically limited movements in wealth, these transitions should be relatively infrequent, especially over shorter time horizons, which are the scope of our analysis. Also, due to the wealth quantiles being of constant size relative to the population, as many households need to enter a group as those that exit it, and there needs to be balance in the direction of movements; this means that households transitioning from a group to another should be similar to each other.

tenancy status of households, we also briefly discuss results for these additional breakdowns in the Appendix.

The impulse response functions ("IRFs") reported in the following section display changes following a one-standard-deviation contractionary shock. We report one-standard-deviation and 90% confidence intervals computed using "Driscoll-Kraay" standard errors (Driscoll and Kraay, 1998; Hoechle, 2007).

4. Monetary policy and wealth dynamics across the wealth distribution

4.1. Changes in asset holdings

In this first set of local projections, the dependent variable is the cumulated change in the stock of holdings (by each group) in each asset type. We rescale the dependent variable by net wealth at $t-1$ ($W_{c,g,t-1}$), such that our results here show the impact of the shock on movements in a certain asset relative to initial wealth. This shows clearly how important such movements are for the household's total wealth. It implies a slight tweak on Equation 1, namely:

$$\hat{y}_{c,g,t+h} = \frac{y_{c,g,t+h} - y_{c,g,t-1}}{W_{c,g,t-1}} = \alpha_h + \delta_c + \beta_h s_t + \gamma_h \mathbf{X}_{c,t} + v_{c,g,t+h} \tag{2}$$

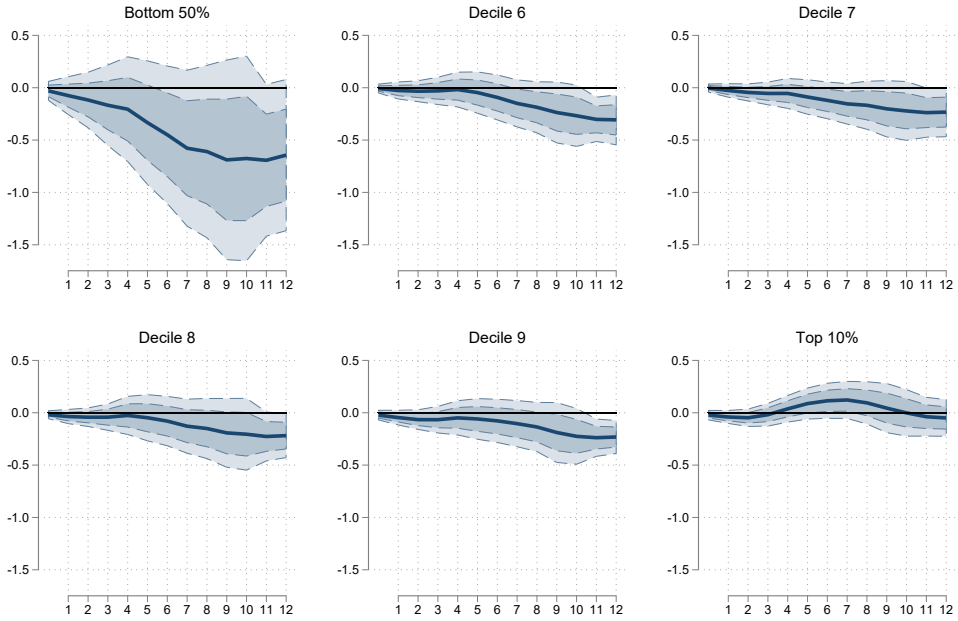
The impulse responses in Figure 4, Figure 5, Figure 6, Figure C.3, Figure C.4, and Figure C.5 display our results for this specification.

Broadly in line with the different channels of monetary policy outlined above, a number of assets display a decline for most wealth deciles (we will discuss in the following subsection whether this is due to price effects or changes in investment behaviour, or a combination of the two). However, our results show that these movements significantly differ in intensity across wealth types and household groups.

Non-risky financial assets (Figure 4) tend to decline across all household groups. This is consistent with a contraction in the monetary aggregates suggested by theory. The decline increases throughout the horizon, but it is only marginally statistically significant at the 90% confidence level at the end of the projection periods. The direction of the response is also strikingly similar: all groups except the top wealth decile see non-risky financial assets decline between 0.2 and 0.6% of household's net wealth, with the bottom group by far the most impacted. However, for those in the top 10% of the wealth distribution, there seem to be no decline at all.

The responses of risky assets (Figure C.4) are actually not too different from those of non-risky assets, despite their different nature. The bottom 50% is again by far the most impacted, especially by the end of the horizon, and deciles 6-9 display generally non-significant small declines. Two years after the shock (but only temporarily), the top decile alone witnesses a significant increase in these assets. As they are the group who owns the largest share of risky assets by far, this might

Figure 4: *IRFs: cumulative changes in households' non-risky financial assets (as a percentage of net wealth in $t-1$) following a contractionary monetary policy shock, by net wealth group*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

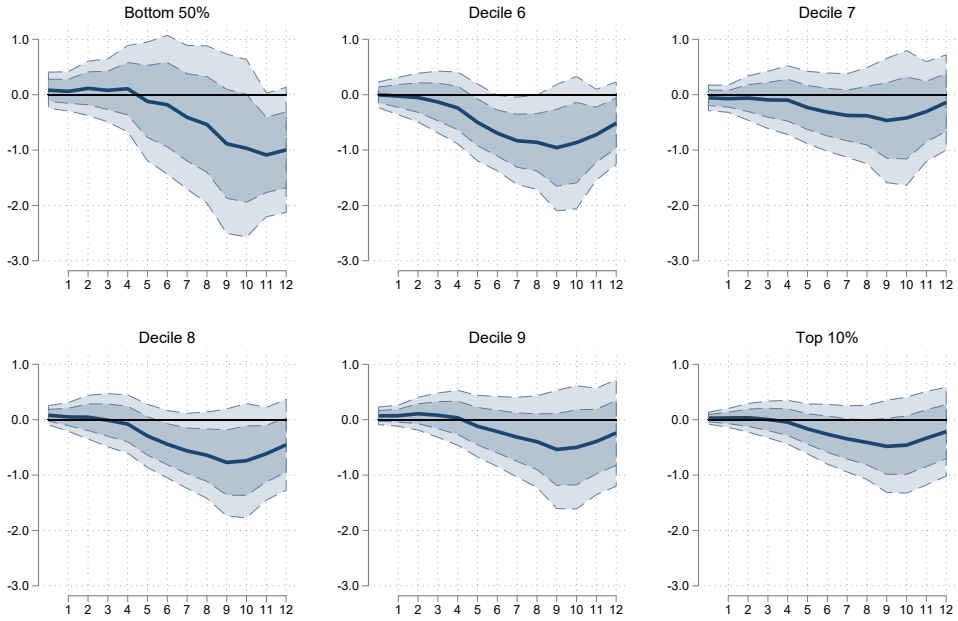
appear slightly at odds with the expectation of monetary policy negatively affecting equity prices. Below, we explore to what extent this increase is due to investment behaviour rather than changes in the value of the underlying assets.

Compared to financial assets, the response of housing (see Figure 5) to monetary policy is even less heterogeneous across groups. This is not surprising, given that housing is a very illiquid asset, and there is little scope for households to quickly rebalance their portfolios in and out of housing (i.e., a lot of movement must be due to house prices rather than sales and purchases). Indeed, we see in subsection 4.2 below that revaluation effects overwhelmingly drive movements in these assets. Due to the predominance of this asset class within household portfolios across the whole wealth distribution, its movements are a major driver of net wealth developments. We observe an only occasionally statistically significant decline in housing assets, peaking at between 0.5% and 1% of net wealth in most groups after about two years. Once again, households in the bottom half of the distribution are the most affected group, while those in the top decile are the least affected.

Debt (Figure C.3), which is essentially made more expensive by the contractionary shock, declines significantly and rather persistently for deciles 6, 8 and 10, but by a small amount. There is instead large uncertainty in the estimates for the bottom 50%, which may be due to the large differences in the level of indebtedness of this group across countries, as well as of households within this group.

Finally, we find that the response of business assets (Figure C.5) is quite heterogeneous. However

Figure 5: *IRFs: cumulative changes in households' housing assets (as a percentage of net wealth in $t-1$) following a contractionary monetary policy shock, by net wealth group*



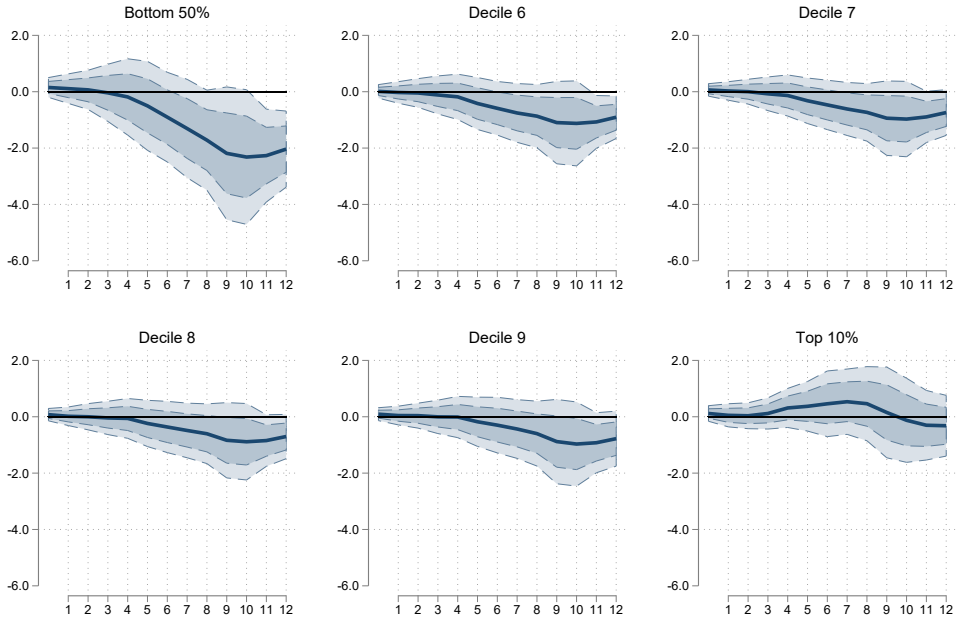
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

we note a very strong and negative response of the bottom 50% households in particular. These movements might be due to asset-rich (but indebted) business owners. However, due to the bottom group holding very limited amounts of business assets overall (over four fifths of these assets are held by the top decile), and to the known difficulties in estimating statistics on business assets, we exhort care in the interpretation of these results.

The response of net wealth (Figure 6) is a combination of the individual asset movements discussed above, and the importance of these assets in each group's balance sheet. Out of the noise of the group-asset responses, we can observe that there is heterogeneity in how groups are affected by monetary policy, especially comparing households at the top and the bottom of the distribution. Because of common movements in housing and financial assets, net wealth responses for deciles 6 to 9 are remarkably similar to each other, and show (borderline statistical significance aside) wealth falling by around 1% for all of them, seemingly persistently, by the end of the horizon. The decline in wealth for households in the bottom 50% of the distribution, meanwhile, is considerably steeper, approaching 2% towards the end of the horizon.[22] Although not significant, the response of wealth held by the top 10% seems to differ from the rest by being relatively unaffected by the shock, suggesting a different behavioural response of this group. There is plenty of evidence in the

[22]This is to a large extent due to the fact that these households are generally more leveraged: a certain percentage change in the value of holdings of an asset is going to have a larger effect on their net wealth (assets minus debt) compared to less leveraged households.

Figure 6: *IRFs: cumulative percent changes in households' net wealth following a contractionary monetary policy shock, by net wealth group*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

literature of the different behaviour of top wealth holders: for instance, Martínez-Toledano (2020) finds that the wealthiest households are better able to optimally reshuffle their portfolio during housing boom and bust cycles. We investigate whether this is the case in the next subsection.

4.2. Asset revaluations and households' investment behaviour

Because of the larger levels of liquidity at their disposal, we would expect the wealthier households to be better able to adjust their portfolios in response to shocks. On the other hand, credit-constrained or hand-to-mouth households would instead be faced with a much reduced set of options, potentially preventing them from rebalancing their wealth composition or take advantage of investment opportunities.

We want therefore to investigate how much of the total changes in holdings in response to a shock as discussed in subsection 4.1 is due to changes in asset prices versus behavioural responses (i.e., net investment or divestment in certain assets) triggered by the shock. To do this, we consider that changes in the stock of holdings S of a certain asset between quarters are due to the following: (i) net sales or purchases of such asset (investment I, where it is positive in the case of net purchases); and (ii) a change in its value (revaluation, R).[23] In other words:

[23] In addition to net investment and revaluations, quarter-on-quarter changes of S also reflect "other volume changes". These represent reclassifications and changes due to exceptional and unanticipated events. For

$$S_t = S_{t-1} + I_t + R_t \tag{3}$$

While the DWA does not provide time series for either investments or revaluations by household group, we estimate this based on data from the euro area QSA, which align to DWA totals by construction.[24]

Published by the European Central Bank, the QSA provide household net investment for each financial instrument in our wealth definition. However, only the total household sector aggregate is provided, without any breakdown by household group. In order to calculate this, we rely on the assumption that the *quality* of each asset is homogeneous across all groups. In other words, each household group will have identical revaluations (in relative terms) of the same asset in each period.[25] Our process follows these steps:

- We obtain aggregate revaluations using Equation 3, subtracting QSA investment amounts from the DWA stock changes;
- Given our homogeneity assumption, we apply the following formula to ensure that revaluations of wealth item i in period t for each group g are proportional to the overall share of i held by g at the end of the previous period:

$$R_{i,g,t} = R_{i,t} \times \frac{S_{i,g,t-1}}{\sum_{g=1}^{G} S_{i,g,t-1}} \tag{4}$$

- Now having stocks and revaluations by asset, time, and household group, investment flows at the same disaggregation level can be backed out by again using Equation 3.[26]

To decompose the effects of the shock into a revaluation and an investment component, we take the dependent variable in our local projection specification to be (i) the overall change in asset values due to the shock as a percentage of net wealth at $t-1$ (i.e., the coefficients found in subsection 4.1); (ii) the cumulated level of revaluations in that same asset; or (iii) the cumulated level of investment in that same asset. Both (ii) and (iii) are similarly scaled by net wealth at $t-1$, and their estimated

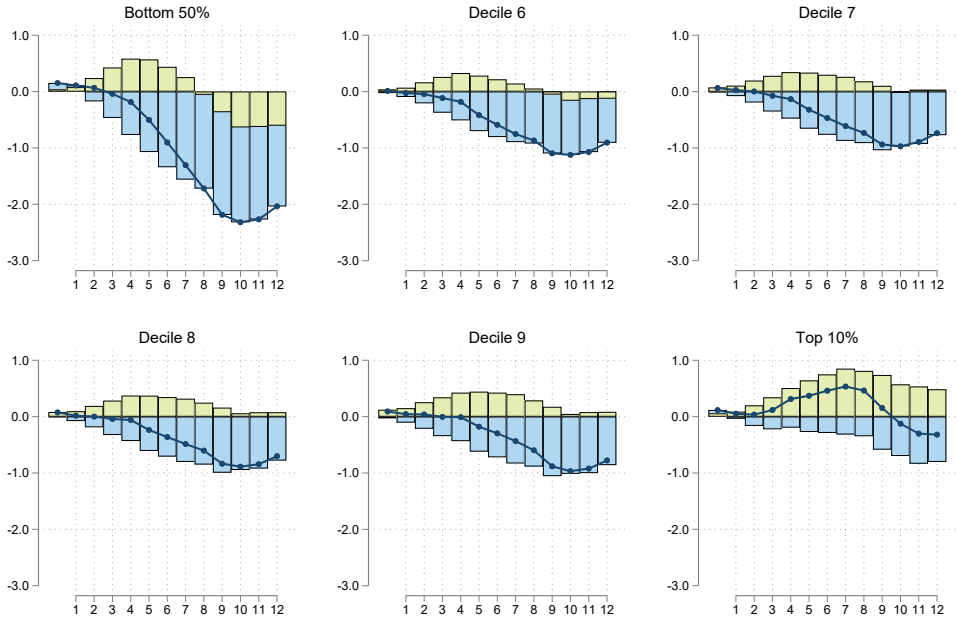
practical purposes, we include them into our "revaluations".

[24] In a limited amount of instances, detailed in the DWA methodological note, this is not the case. In these situations, we rescale QSA data accordingly.

[25] While this appears to be a strong assumption, it is in line with Bach et al. (2020), who find that, although wealthier households tend to have higher returns to net wealth, this is due to the higher share of high-return assets in their portfolios, rather than a higher rate of return on the same assets.

[26] We follow this approach for all financial items, but not for non-financial assets, for which aggregate investment series are not provided in QSA. For housing, we directly estimate revaluations of the existing stock based on changes in the real residential property price index, and for non-financial business wealth we do the same using the commercial property price index (this index is only available at the euro area level, so we use it for all countries for lack of better alternatives). Investment by group is then calculated by difference according to Equation 3.

Figure 7: *Decomposition of Figure 6 (net wealth) into revaluations and investments, by net wealth group.*



Notes: Solid line: local projection moving-average-smoothed IRF of the cumulative change. Green bars: contribution of investment. Blue bars: contribution of revaluations.

coefficients sum up to the those of (i).[27]

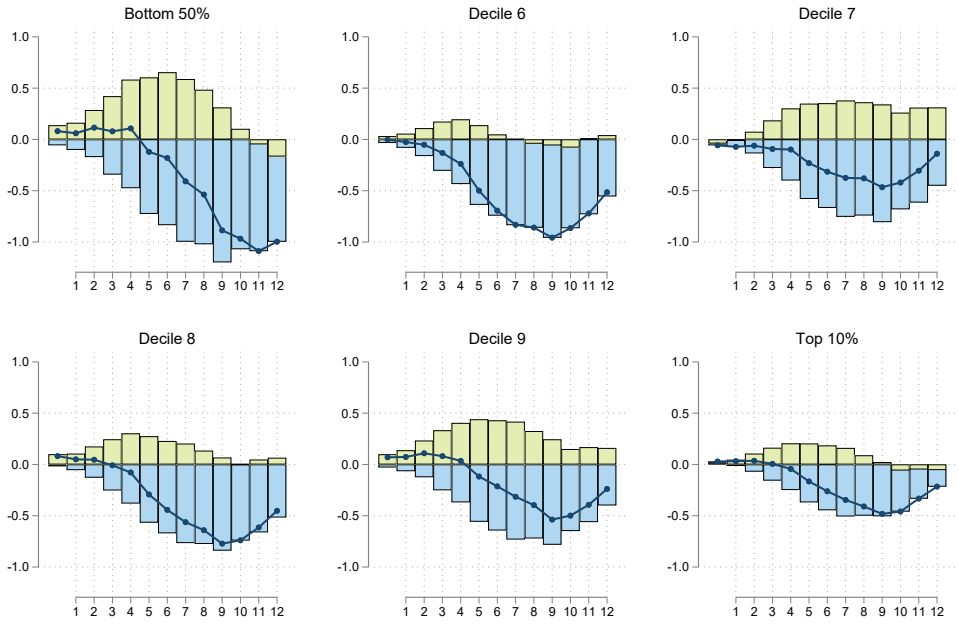
Here, we display results in bar format, showing the contributions of revaluations versus investments on the overall net effect of the shock on a certain asset. We do not display confidence intervals for visualisation purposes, but statistical significance for the total effect is equal to the corresponding bands for the respective assets and groups in subsection 4.1, with the IRFs for investment and revaluations showing similar variation.

Note that while revaluations are estimated to be the same in relative terms across groups for the same asset type, each household group has a different weight for each asset type in their balance sheet, leading to heterogeneous effects of revaluations on their net wealth. Additionally, since we have grouped assets by broad type (e.g. non-risky financial) and calculated revaluations at the level of the single asset (e.g. debt securities) to sum them up, the different composition of these aggregates by household group (for instance, the top 10% might have a higher weight of shares in their risky financial assets than the bottom 50% do) can lead different groups to have revaluations of different magnitude and even different sign at times (as in Figure 9, for instance).

As Figure 7 shows, overall movements in net wealth are primarily due to revaluations, which

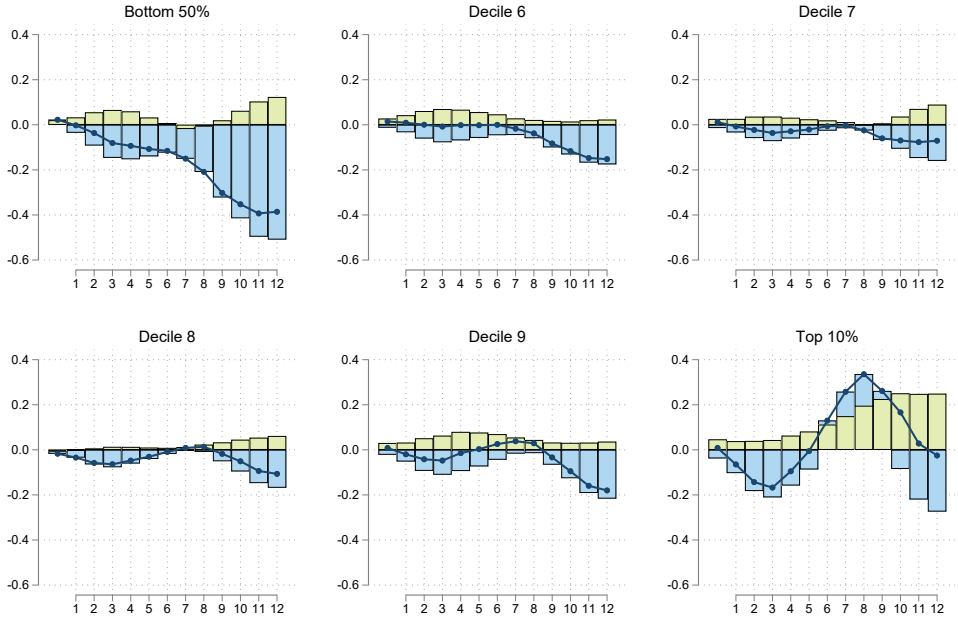
[27]To note, in order for this to be possible we need to have exactly the same regressors in all three sets of equations (overall effect from subsection 4.1, cumulated revaluations, and cumulated investments). As a result, in the equations for revaluations and investments, we used the differenced lags of the dependent from subsection 4.1, and not their own lags.

Figure 8: *Decomposition of Figure 5 (housing) into revaluations and investments, by net wealth group.*



Notes: Solid line: local projection moving-average-smoothed IRF of the cumulative change. Green bars: contribution of investment. Blue bars: contribution of revaluations.

Figure 9: *Decomposition of Figure C.4 (risky financial assets) into revaluations and investments, by net wealth group.*



Notes: Solid line: local projection moving-average-smoothed IRF of the cumulative change. Green bars: contribution of investment. Blue bars: contribution of revaluations.

by the end of the horizon account for virtually all of the decline in wealth for deciles 6 to 9.[28] Investments actually move in the opposite direction for all groups (and most strongly for the wealthiest), at least at the start. Their contribution becomes negative and substantial by the end of the horizon for the bottom 50%, and remains positive and substantial for the top 10%. These findings are coherent with a narrative of poorer households being the most affected by negative employment effects of contractionary policy (leading to reduced savings), while the wealthiest, who rely relatively less on labour income, are less affected and their income might even benefit from an increase in interest rates.

The overall developments for wealth reflect to a considerable extent those of housing assets (Figure 8), as they account for the largest component of wealth for all groups. Indeed, the monetary policy shock leads to a fall in house prices (see also Figure A.1), and therefore negative revaluations in households' housing assets peaking after about two years. These affect the net wealth of households relatively less and less as we move up the wealth distribution. Investments are initially positive but revert towards zero by the end of the projections horizon, with the exception of decile 7.

The behaviour of risky assets (Figure 9) is rather heterogeneous across groups, even when considering revaluations, due to differences in the holdings of individual "risky" assets across groups. Risky financial assets for the less wealthy groups are mostly made up of insurance assets, while households in the top 10% tend to own more shares and funds, which appear to have significantly different revaluation behaviours in response to the shock.[29] After some movement, cumulative revaluations turn negative for all groups by the end of the horizon, with the bottom 50% suffering the largest decrease. However, the top 10% built up a substantial amount of investment through the horizon to ultimately offset the negative impact of revaluations.

4.3. Portfolio composition

Our above results show that individual asset classes evolve differently in response to a monetary policy shock. What happens then to their weight in households' portfolios? To investigate this, we use the portfolio share (i.e., the proportion of *total assets*) of each wealth type[30] in our local projections specification (Equation 1). The resulting impulse responses are displayed in Figure 10, Figure 11, Figure C.6, Figure C.7, and Figure C.8.

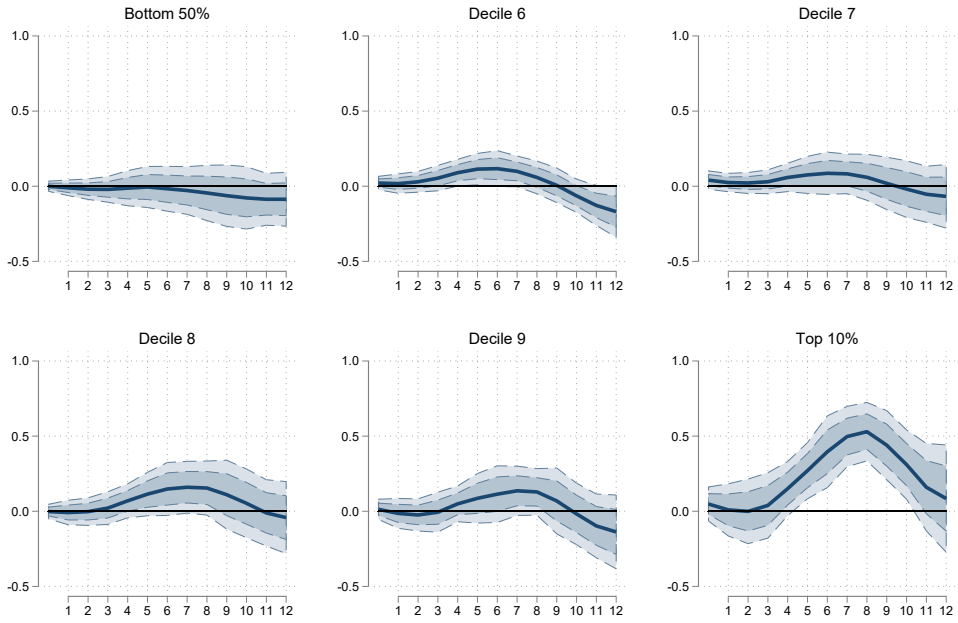
The heterogeneous extent to which the levels of wealth held in the different asset classes respond to (contractionary) monetary policy shocks, shown in subsection 4.1, already gives an indication as to what might happen to households' portfolio composition. However, movements in portfolio shares reflect movements in other assets as well (as they affect the overall amount of assets - the

[28] An exception is non-risky financial assets. As these are predominantly made up of deposits, which do not change in price, their movements are mostly due to saving behaviour.

[29] Furthermore, we do not know what underlying assets in mutual funds and insurance holdings are causing the revaluations, but part of their movements here could paradoxically be due to bond (i.e. risk-free) holdings.

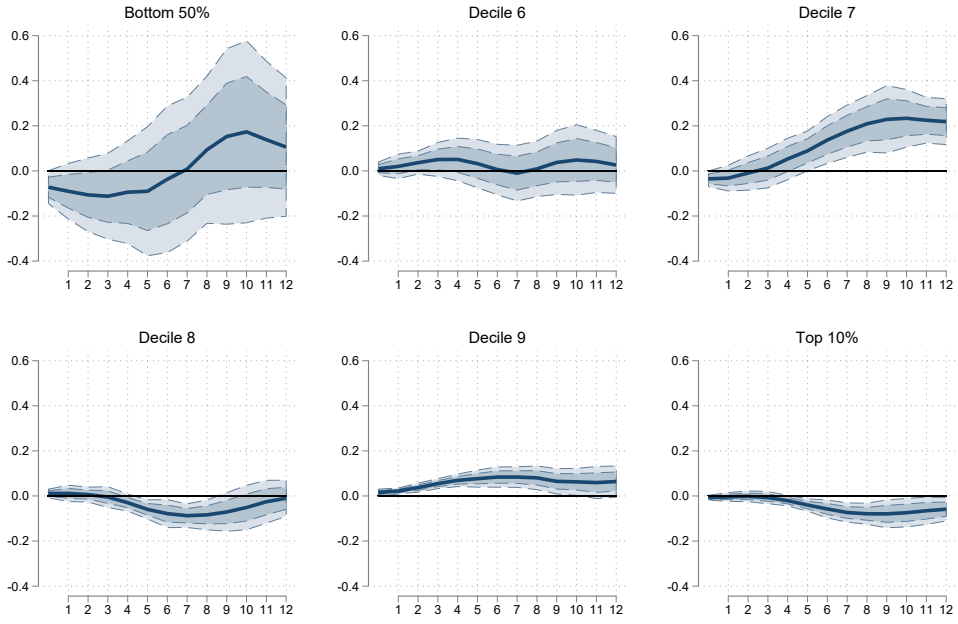
[30] Essentially what is displayed in Figure 1 for the euro area.

Figure 10: *IRFs: cumulative percentage-point change in financial assets as a share of total assets following a contractionary monetary policy shock, by net wealth group.*



Notes: Solid line: local projection moving-average-smoothed IRF of the cumulative change. Green bars: contribution of investment. Blue bars: contribution of revaluations.

Figure 11: *IRFs: cumulative percentage-point change in debt as a share of total assets (i.e., financial leverage) following a contractionary monetary policy shock, by net wealth group.*



Notes: Solid line: local projection moving-average-smoothed IRF of the cumulative change. Green bars: contribution of investment. Blue bars: contribution of revaluations.

the denominator). This can sometimes have a larger effect than changes in holdings of a particular asset itself. In other words, what we might see here is often not a portfolio reallocation by active choice of the household, but caused by "external" circumstances (we discussed in subsection 4.2 how movements can be mainly explained by revaluations, rather than investments).

For instance, we saw that both risky and non-risky financial assets tend to decline in response to a shock. However, their share in portfolios does not decrease, and even increases in some cases (most notably for households in decile 10). Apart from the top group, this is because housing assets decline more strongly than the rest (see Figure 10, where we display the the joint response of all financial assets). Indeed, impulse responses for housing assets are the exact opposite of these.

The response of debt is rather heterogeneous (Figure 11), but leverage appears to increase for households in deciles 7 and 9 and decrease for 8 and 10 - significantly but not substantially. Again, this seems to be driven at least in part by movements in other asset types rather than actual changes in debt, which are rather limited (compare with Figure C.3).

In general, we note that movements in portfolio compositions remain very limited, which is in line with the fact that these have been remarkably stable historically, as evidenced in Figure 1.

4.4. Wealth inequality

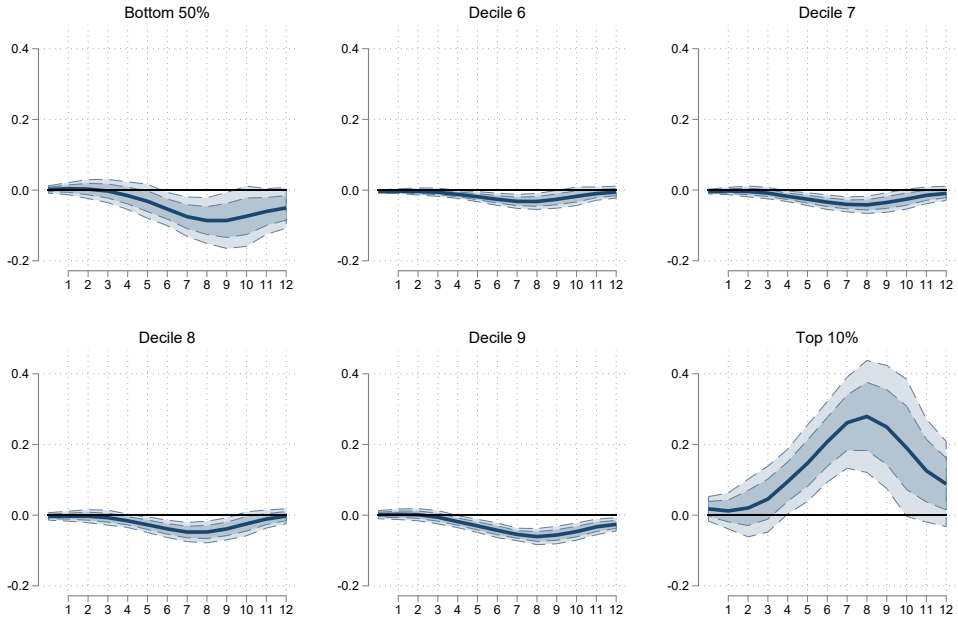
In the previous sections we discussed how both the levels and the portfolio shares of certain assets evolve in response to monetary policy shocks, and how these movements differ across wealth groups. What are the implications of these findings for overall inequality? To investigate this, we use the change in each household group's share of the country's total holdings of a certain asset (i.e., the values displayed in Figure 3) as dependent variables in our local projection equation. The results of this exercise are reported in Figure 12, Figure C.9, Figure C.10, Figure C.11 and Figure C.12.

Throughout our analysis we noted how responses for households in the wealthiest decile can differ substantially from those of the rest of the population in a number of cases. It is therefore no surprise to find that the share of total net wealth held by households in the top 10% of the wealth distribution significantly changes in response to a restrictive monetary policy shock. More specifically, as displayed in Figure 12, it increases. The peak of the positive response is reached two years after the shock, when their share of net wealth increases by around 0.3 percentage points. This is primarily driven by an increase in the total share of both risky and non-risky financial assets owned by this group, while there is no significant change in their share of housing.

Conversely, all other household groups see their share of net wealth similarly fall by less than 0.1 percentage points (or remain statistically unchanged). While the magnitudes of these movements may appear small, this is in line with the generally limited movements in household distributional shares over the course of the time series.[31]

[31] Moreover, consider for instance that households in the bottom half of the distribution own around 5% of total net wealth in the euro area; to see this share decline by 0.1 percentage points is sizeable - it is 2% of the initial share of 5%.

Figure 12: *IRFs: cumulative percentage-point change in the share of overall net wealth following a contractionary monetary policy shock, by net wealth group*



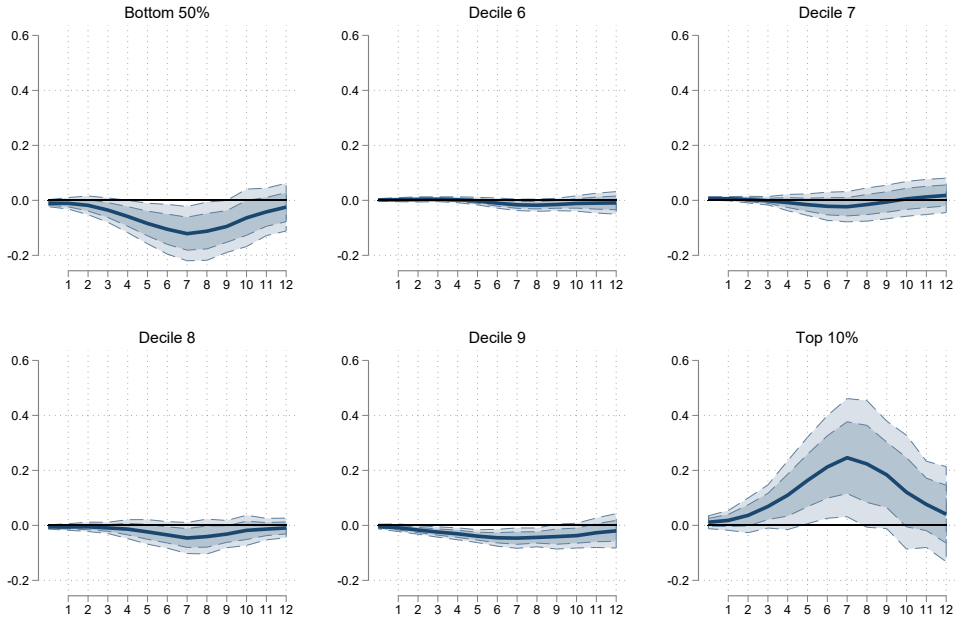
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Overall, our identified impulse response functions tend to display the largest change around 8 quarters after the shock, while the point estimates converge towards zero (or their confidence intervals increase enough to surround it) at the end of the projection horizon for almost all household groups and assets in our analysis.

The largest change in concentration occurs for risky financial assets (which are already predominantly held by the top 10% in the first place). The share of these assets held by households in the top decile increases by about 0.4 percentage points by the end of the projection, while it falls by around 0.2 for households in the bottom 50% of the wealth distribution altogether. The share of risky financial assets held by those in the "middle" four deciles remains largely unchanged. Responses for the share of non-risky financial assets also follow a very similar pattern.

The concentration of housing and debt appears to be more stable, with the changes estimated for almost all deciles being non-significant at all projection horizons. We interpret this as a result of the general decrease in housing value affecting households in all deciles of the distribution, as described in previous sections. Since housing assets are less unequally distributed than other wealth instruments, and the size and direction of their change in value is similar across deciles - we do not observe any "redistribution" movement (or the opposite). Similarly, the share of overall debt decreases marginally for households in the bottom 50% of the distribution during the first four quarters, while remaining unchanged for most other groups over the estimation horizon.

Figure 13: *IRFs: cumulative percentage-point change in the share of overall non-risky financial assets following a contractionary monetary policy shock, by net wealth group*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

5. Conclusions

In this paper, we have investigated the impact of monetary policy shocks on household wealth across the wealth distribution employing newly released, quarterly, distributional wealth data for the euro area. By using panel local projections, we have estimated the effects of monetary policy shocks on asset levels, balance sheet composition, and asset concentration across the wealth distribution. We also broke down movements due to revaluations of assets versus investment behaviour by households.

We find that contractionary monetary policy shocks lead to a decline in the value of most asset classes for a large part of the wealth distribution, driven by negative revaluations of the same. We observe this decline for financial and non-financial assets alike.

Households in the bottom half of the wealth distribution exhibit more pronounced declines of almost all assets, as well as net wealth. Conversely, the wealthiest 10% of households is virtually unaffected by the shock, as investment in financial assets contributes to offset negative revaluations. Intermediate deciles display similar patterns to the bottom 50% (but to a lesser extent, often non-significantly), and movements in their net wealth are similar to each other and in large part linked to the response of their housing assets.

Due to the heterogeneous responses of asset holdings of poorer and wealthier households, our

results ultimately indicate that contractionary monetary policy shocks may lead to a (temporary) increase in wealth inequality. However, this is not necessarily observed for the distribution of each individual asset: for instance, while financial assets tend to become more concentrated within wealthier households, the distribution of housing wealth tends to remain relatively unchanged.

Our results are broadly aligned with previous evidence from the literature, as well as with economic theory, and complement these earlier findings by providing evidence from quarterly time-series distributional data for the euro area for the first time.

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APPENDIX

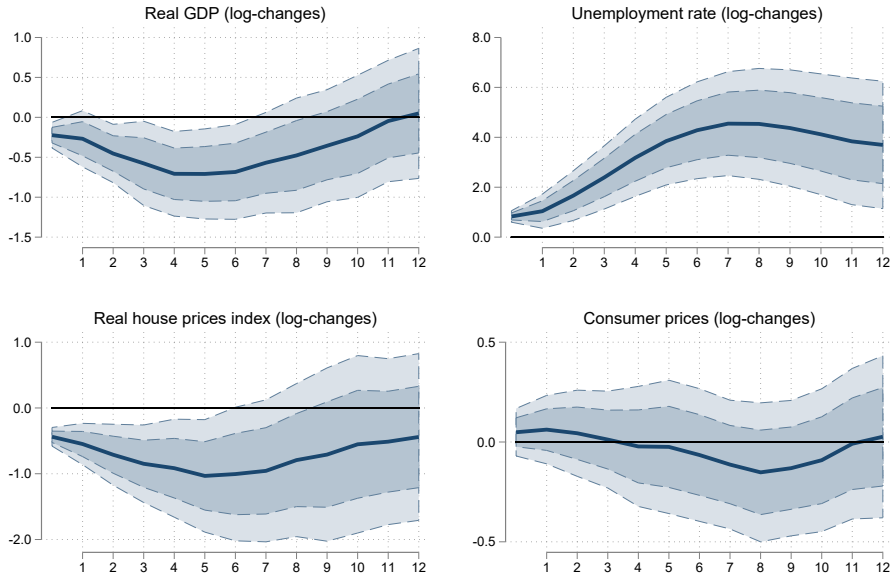
A. Robustness

Here, we detail a number of robustness checks we performed to assess the validity of our estimation technique and results.

A.1. Response of macroeconomic variables in our model

Firstly, because our results shown above are in some cases completely new, and some of them may not seem intuitive, we want to make sure that our specification captures effects of monetary policy on macroeconomic variables as previously found in the literature: this would increase confidence in the estimation. We estimate the same model as per Equation 1, including in terms of periods covered and frequency, and shock, with four macro variables as dependents.[32] Figure A.1 shows that using this model we find familiar signs and magnitudes for all these variables in response, with the exception of a lack of significance for the effects on prices.

Figure A.1: *IRFs: effect of a contractionary moentary policy shock on selected macroeconomic variables.*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

For the effects of the same shocks at a monthly frequency and over a longer time frame and for more variables, which we cannot replicate with the short time series and quarterly frequency of our data, we refer back to results reported in Jarocinski and Karadi (2020) and Miranda-Agrippino

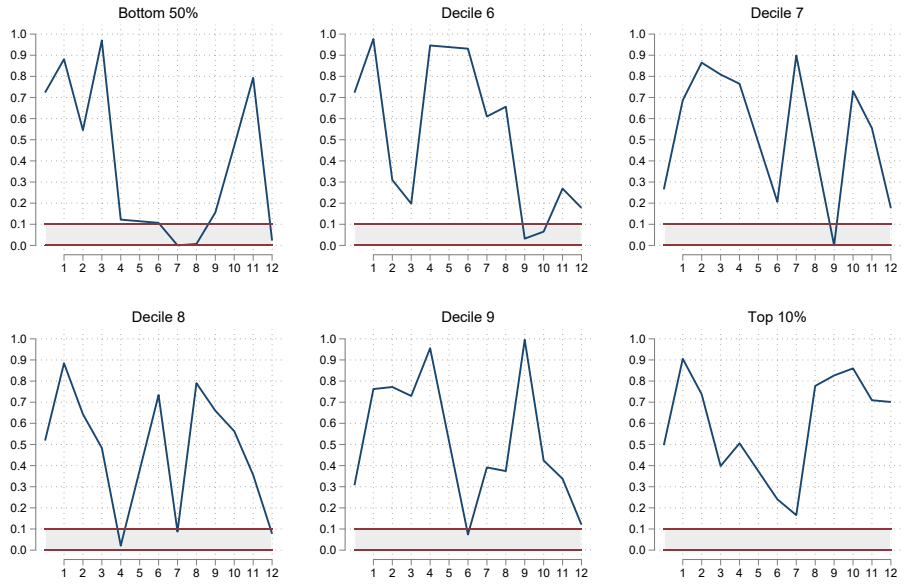
[32] We remove a variable from the controls when it is the dependent.

and Ricco (2021), showing that estimations of macro responses to the shock we use in our local projections are in line with established findings.

A.2. Panel heterogeneity

We proceed to test whether the local projections responses identified for each country in our panel display significant heterogeneity. In order to do so, we estimate our model for each individual country at each horizon, and perform an test that all estimated coefficients of interest are equal. Campello et al. (2019) discusses how estimates from the fixed-effect OLS model imply the assumption of homogeneous slope coefficients across panel groups and may thus be biased. In order to assess slope heterogeneity we apply a test (Pesaran and Yamagata, 2008; Bersvendsen and Ditzen, 2021) based on a standardized version of Swamy (1970). We note, however, that the intrinsic features of our data imply a limited time dimension of our panel.

Figure A.2: *Test of panel heterogeneity*



Notes: Dark blue line: *p-value* of the Pesaran and Yamagata (2008) slopes heterogeneity test.

The *p-value* of each of these repeated tests (by household group and projection horizon) is reported in Figure A.2. As displayed, the null hypothesis of homogeneous coefficients across countries can only rarely be rejected at the standard 10% confidence level.

A.3. State-dependence

We further wish to assess whether our responses may significantly depend on existing macroeconomic conditions ("states") at the time of the shock. Recent literature on state-dependent local

projections (Gonçalves et al., 2024) outlined how the local projections estimator is able to recover the population response when the state is exogenous. However, if the state depends on macroeconomic shocks it may only recover the conditional response to an infinitesimal shock. In order to assess whether our data falls under the latter case, we run a conditional fixed-effect logit model using the shocks series as explanatory variable. We perform this exercise for the following two possible states of the economy:

- High-inflation: if the yearly rate of inflation is greater than the indicative 2% ECB target;
- Economic downturn: if the country is in a recession period (here indicatively identified using the rule-of-thumb of two consecutive quarters of negative real GDP growth).

In both cases, the estimated coefficients are not significant at the standard 10% confidence level.

In order to address potential concerns of endogeneity, we also consider the *opposite* relationship between states and shocks (i.e., whether the monetary policy surprises may depend on the economic condition). The estimated coefficients are once again not statistically significant.

In practical terms, we follow Gonçalves et al. (2024), Tenreyro and Thwaites (2016), Alpanda et al. (2021), Alpanda and Zubairy (2019) among others, and model state-dependence by including interaction terms in our specification. As a result, our local projections Equation 1 becomes:

$$\hat{y}_{c,g,t+h} = (y_{c,g,t+h} - y_{c,g,t-1}) = \alpha_h + \delta_c + \mathcal{S}_t(\beta_h s_t + \gamma_h \mathbf{X}_{c,t}) + (1 - \mathcal{S}_t)(\beta_h s_t + \gamma_h \mathbf{X}_{c,t}) + v_{c,g,t+h} \quad (5)$$

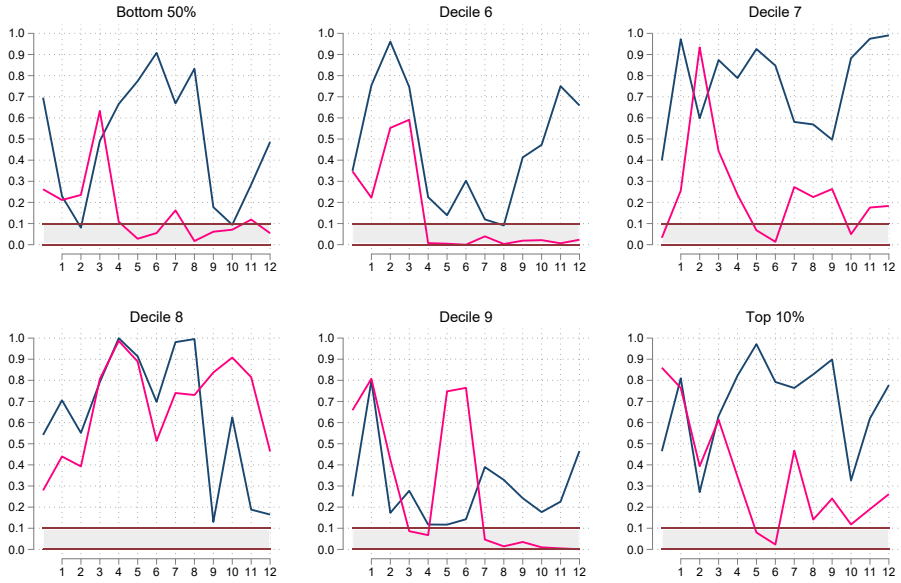
where $\mathcal{S}_t$ indicates if the economy is in a given state or not (we use the same states as above: high vs. low inflation, and recession vs. expansion phase). We then test whether the coefficients of interest associated with each state are statistically different from one another (i.e., $\mathcal{S}_t\beta_h s_t \neq (1 - \mathcal{S}_t)\beta_h s_t$). Figure A.3 displays the *p-values* of this test, for each household group, at each horizon. With the exception of the bottom 50% and decile 6, these tend to be largely above the indicative 10% confidence threshold. Thus, in most cases, it is not possible to reject the null hypothesis of the coefficient of interest being equal in both states of the economy.

B. Results over tenancy and working status breakdowns

We have shown how the impact of monetary policy on the wealth of different households depends on the size and composition of their balance sheet at the time of the shock. DWA data shows that households differ in these aspects depending on where they are positioned within the wealth distribution. Similarly, households with different employment and home-ownership status also have heterogeneous balance sheet compositions. Thus, it is possible to apply the same empirical strategy introduced in section 3 and discuss analogous results for work and tenancy breakdowns.

It should be noted that employment and tenancy breakdowns are fundamentally different than net wealth deciles. The number of households within a specific group is, in fact, not fixed, whereas net wealth deciles in each country all contain approximately one tenth of the total. Furthermore,

Figure A.3: *Test of state-dependence*



Notes: Dark blue line: *p-value* of the coefficients equality test for the recession vs. expansion state. Fucsia line: *p-value* of the coefficients equality test for the high vs. low inflation state.

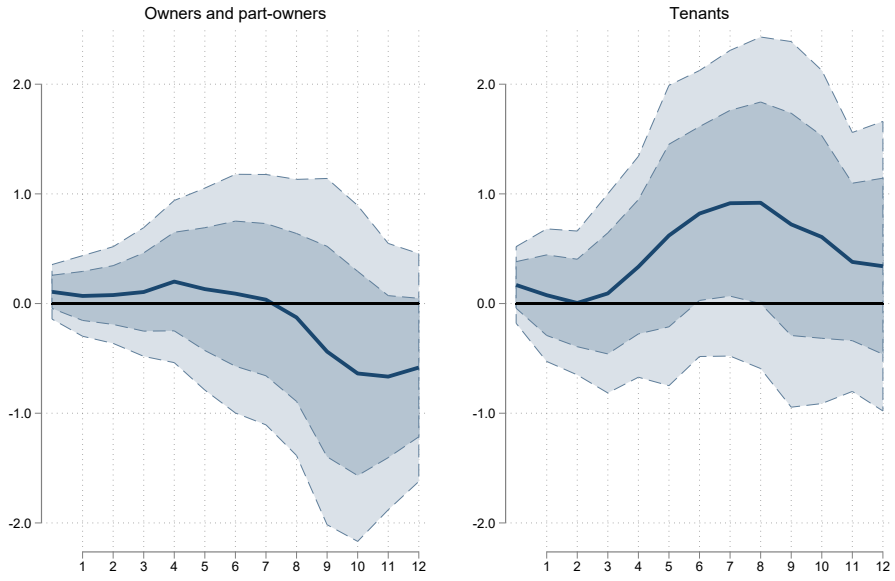
individual households may "switch" from one group to the other and cause issues in correctly isolating the evolution of each breakdown. For instance, if a tenant household takes up debt to acquire their main residence it would be recorded as an *increase* in debt on the side of home-owners in the following period, as it would then become part of the other group (meaning that this behaviour would not be visible from the tenants group's perspective, despite being the origin of this movement). In other words, it is partly unclear whether changes in one group are entirely due to households originally included in that very group or not.[33]

B.1. Home-ownership breakdown

Households are classified as either "owners or part-owners" of their main residence dwelling, or as "tenants". In the euro area, homeowners account for the large majority of all wealth types (with percentages often surpassing 90%), and are significantly richer, both overall and on a per-capita basis. Furthermore, the wealth composition of the two groups differs notably. Tenants have a more diversified portfolio, as lack of housing assets prevents the concentration of wealth in this item (as it is otherwise found on the balance sheet of home-owners). Housing still accounts for about 25%

[33]The same issue of households "moving" from one group to the other is also present when considering net wealth deciles breakdowns. However, the constraint of having the same, fixed, amount of households in each group largely prevents this from being a relevant problem, as this only interests households that are at the very "edge" of two groups, whereas it could potentially affect all households when considering employment or tenancy characteristics.

Figure B.1: *IRFs: cumulative percent changes in households' net wealth following a contractionary monetary policy shock, by tenancy status*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

of tenant's total assets,[34] while risky and non-risky financial assets altogether account for around 60%. The weight of business assets and debt liabilities (as a share of total assets) is similar between tenants and homeowners.

Figure B.1 shows the percent change of overall net wealth after a contractionary monetary policy shock for the two groups. The responses are statistically non-significant for both groups, but the point estimates indicate opposing directions for the two groups at the end of the projections horizon. Indeed, this is also reflected in the changes for the share of overall wealth held by each group (Figure B.2), which displays a non-significant increase in concentration for tenants and a contextual decrease for home-owners.

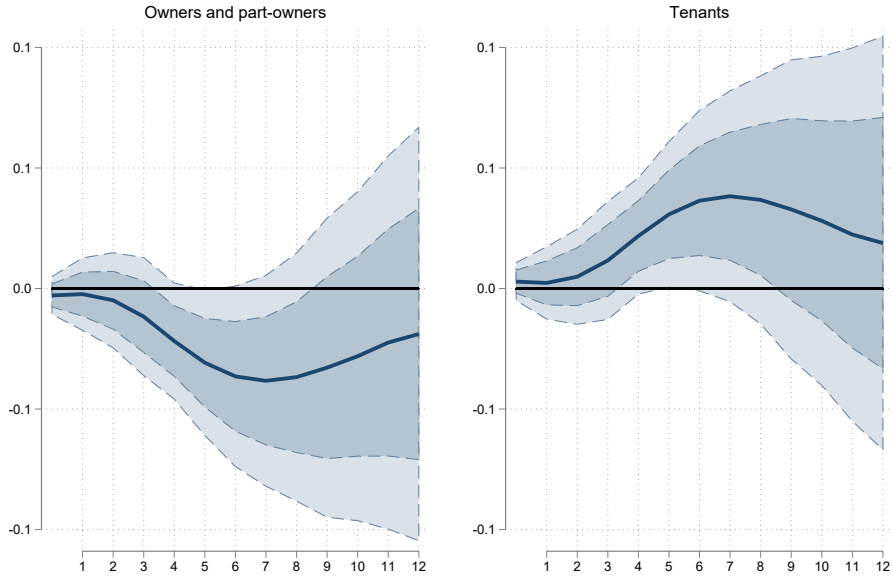
The change in portfolio shares for non-risky financial assets differ between the two groups (Figure B.3). For tenants, it tends to fall much more strongly due to the higher weight this instrument has in their portfolios. Overall, however, the movement for both groups is largely statistically non-significant.

B.2. Employment breakdown

We now provide some insight into the behaviour exhibited by euro area households broken down by their employment status. Our data distinguishes five categories, according to the working status

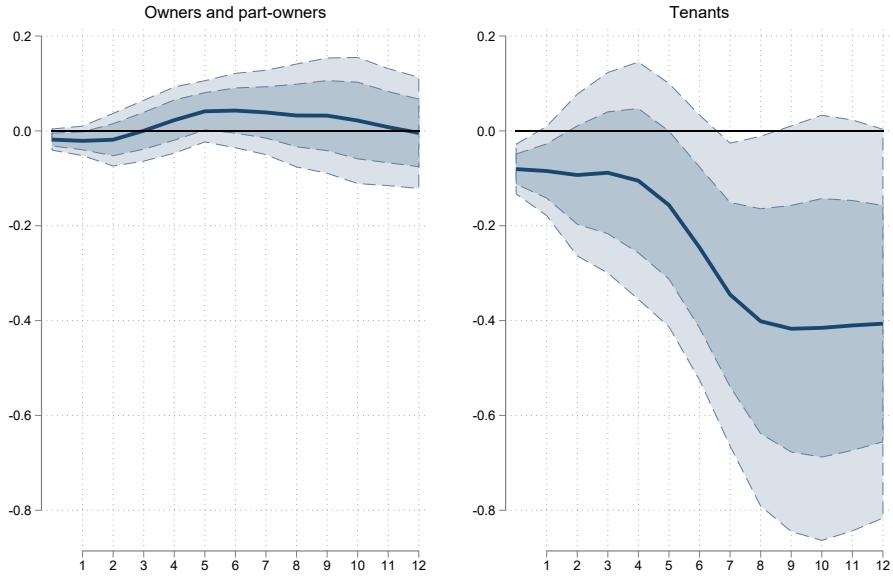
[34] Meaning that some tenant households own housing assets they do not live in. It is due to the limited wealth of tenants as a category overall that these assets end up having a rather significant weight.

Figure B.2: *IRFs: cumulative percentage-point change in the share of overall net wealth following a contractionary monetary policy shock, by tenancy status*



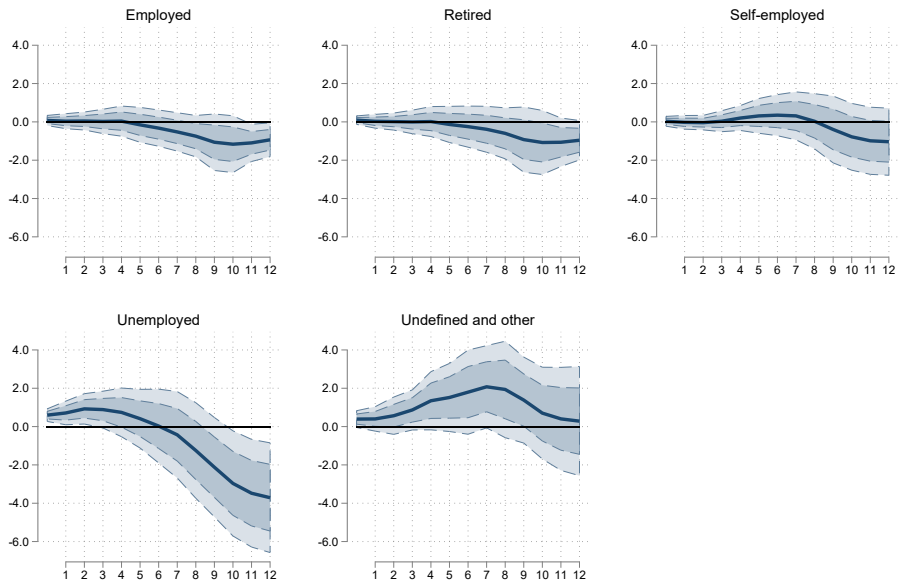
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure B.3: *IRFs: cumulative percentage-point change in non-risky financial assets as a share of total assets following a contractionary monetary policy shock, by tenancy status*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure B.4: *IRFs: cumulative percent changes in households' net wealth following a contractionary monetary policy shock, by employment status*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

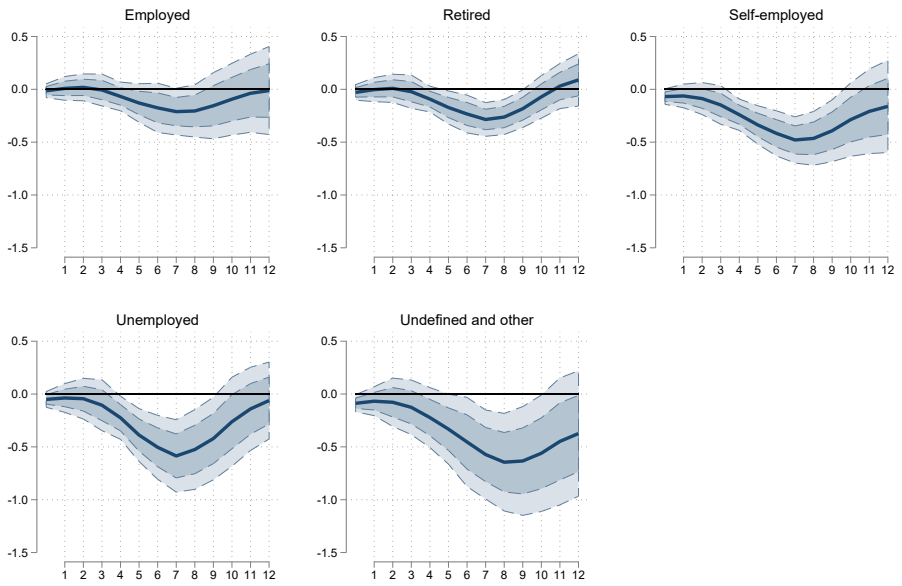
of the main income earner of the household: employed, retired, self-employed, unemployed or "undefined and other". Overall, employees and retirees account for the two largest (and very similar) shares of total net wealth in the euro area, followed by self-employed households. However, the concentration of specific wealth instruments within certain groups differs notably. For instance, employees alone account for about 60% of total debt in the euro area (as retired households have largely repaid their mortgages by the time they stopped working), and the largest part of total business wealth is held by self-employed households.

The distribution of wealth by employment breakdown is less unequal than by net wealth decile or tenancy status, and the portfolio composition across clusters is more similar. It is therefore expected that the impulse response functions estimated by our model will exhibit somewhat similar movements across groups. This is the case for employees and retirees, who have almost identical IRFs for percent changes of net wealth, displaying negative changes by the end of the projections horizon (Figure B.4). The self-employed, typically wealthier and with more business assets, also show a similar (yet clearly non-significant) response. Conversely, unemployed households show a large (around -4%) and significant decrease in net wealth as a result of a monetary policy shock. This appears to be driven by a contextual decrease in housing assets for this group.[35]

Our results indicate that the portfolio share of housing tends to fall substantially for unemployed,

[35]Similar to tenants, unemployed households own a very modest amount of housing overall, but since their total wealth is lower than that of the other groups, it may still account for a sizeable proportion of their wealth.

Figure B.5: *IRFs: cumulative percentage-point change in housing assets as a share of total assets following a contractionary monetary policy shock, by employment status*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

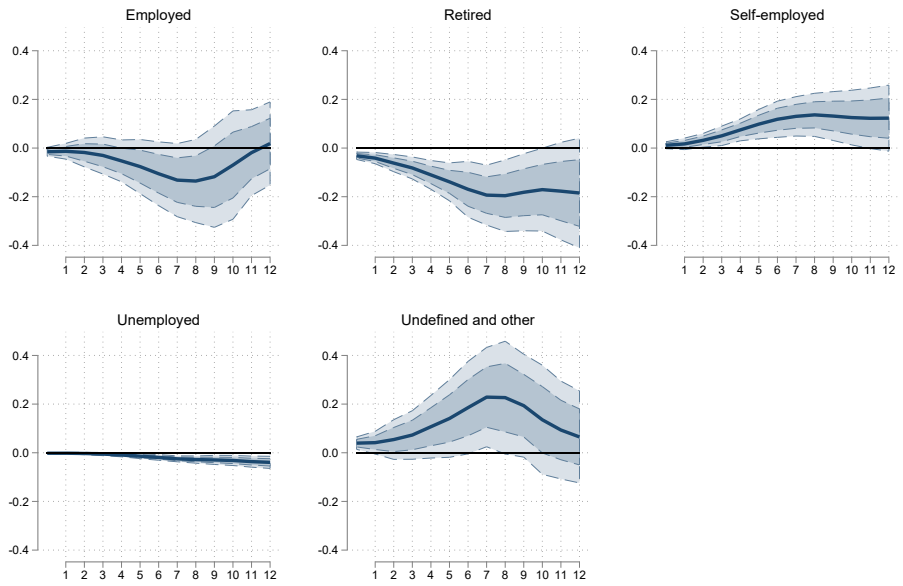
self-employed and retirees households, as shown in Figure B.5. The response for employees is similar in direction, but non-significant. This implies that for all households, there is a tendency to "re-balance" their wealth composition towards financial assets, at the expense of housing assets.

This is broadly in line with the results observed when grouping households by their level of net wealth, but with greater similarity in the response of different employment groups. By considering the work status dimension we are gain further insight into the different responses of heterogeneous households in response to monetary policy shocks (with the caveat mentioned above regarding group compositions).[36]

While the decline in wealth for employees and retirees in response to a contractionary shock is minimal and similar between the two groups, we can see from Figure B.6 that the change in their overall share of net wealth in the country differs. Employed households display a non-significant change over the projections horizon, while retired households decrease their share by around 0.2 percentage points (although this becomes non-significant in the last couple of projected quarters). Self-employed (and, with less statistical significance, "undefined") households conversely tend to increase their share of wealth. Since these categories include households generally placed in the upper section of the wealth distribution, this is consistent with the results presented in subsection 4.4.

[36]Consider also the issue of movements across groups, again. Technically, an increase in unemployment generated by monetary policy might lead to an increase in the assets of the "unemployed" group simply due to the fact that the group is growing in size, while what researchers would be more interested in investigating is whether the households who were already unemployed before the shock are now worse or better off.

Figure B.6: *cumulative percentage-point change in the share of overall net wealth following a contractionary monetary policy shock, by employment status*

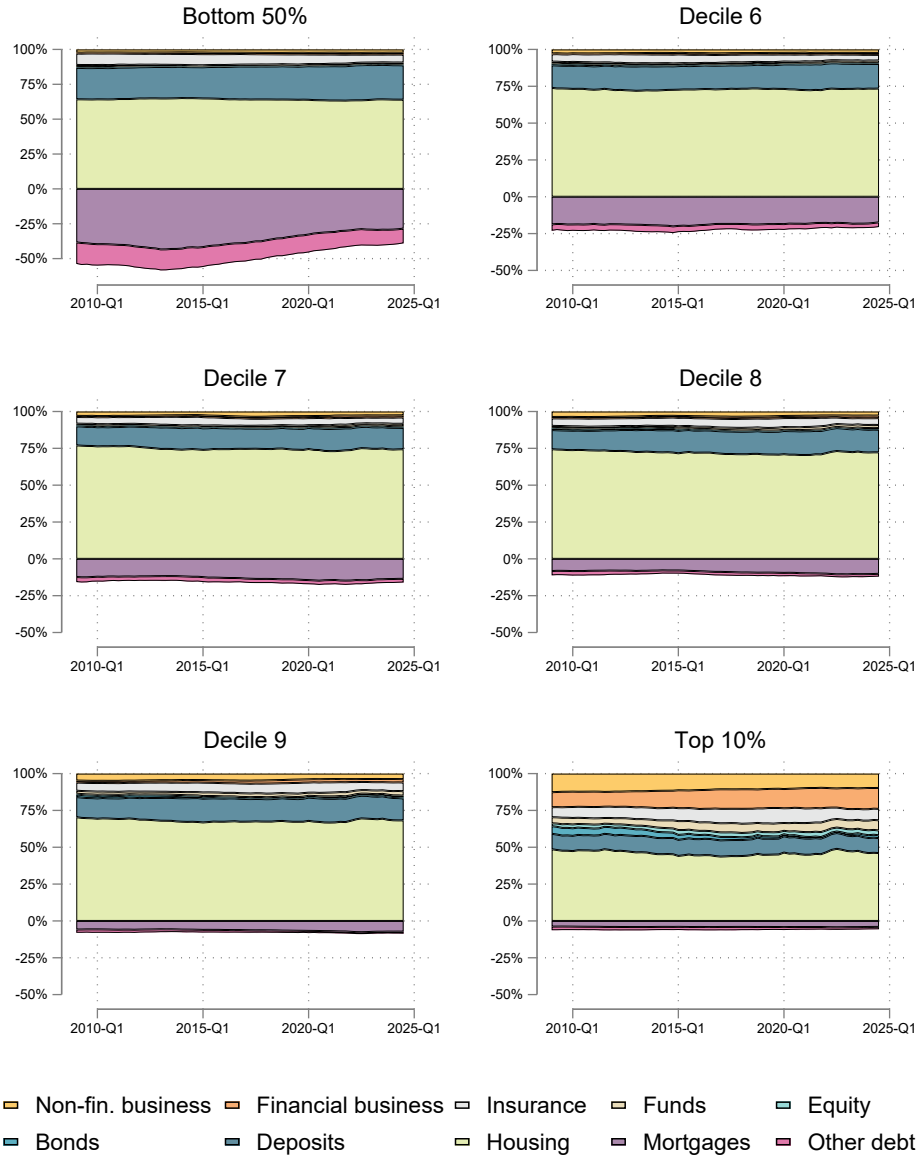


Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Unemployed households display a marginal negative change in their overall share of net wealth after the shock, due to the extremely limited amount they own relative to the country's total wealth.

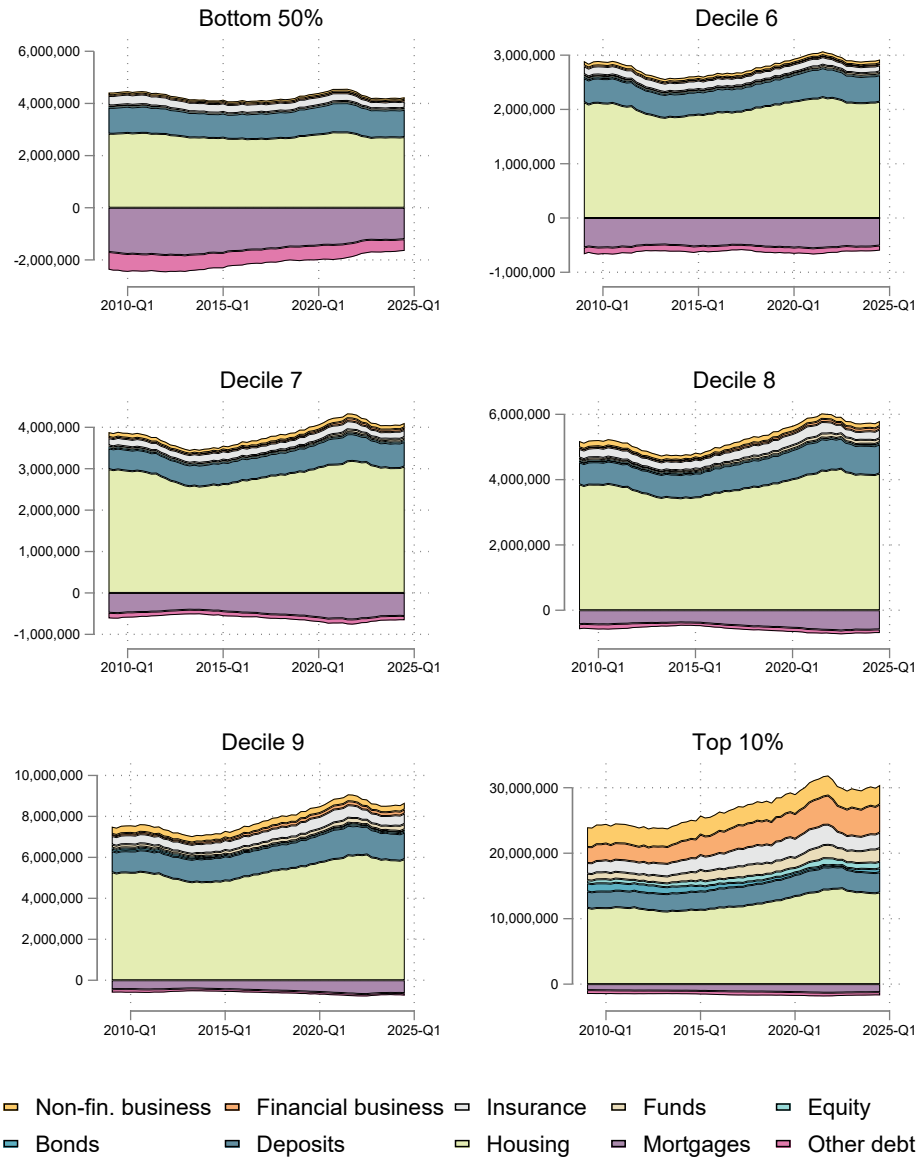
C. Additional charts

Figure C.1: *Composition of household portfolios (detailed breakdown) in the euro area, by net wealth decile.*



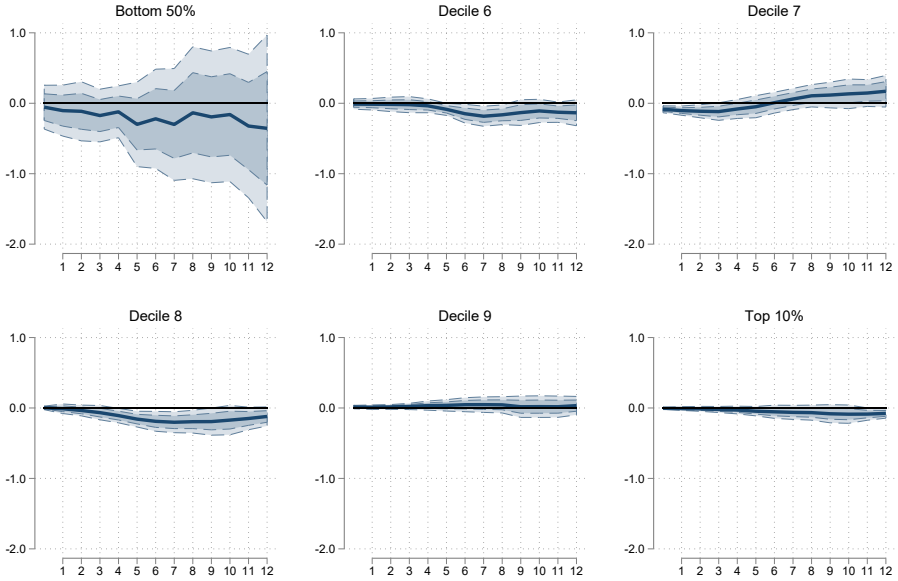
Source: Distributional Wealth Accounts.

Figure C.2: *Composition of household portfolios (detailed breakdown) in the euro area, by net wealth decile.*



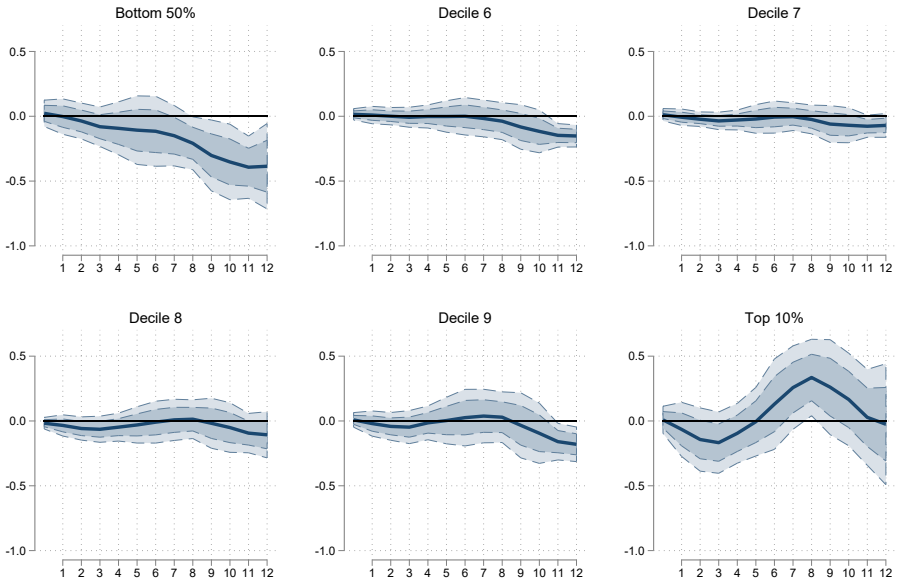
Source: Distributional Wealth Accounts.

Figure C.3: *IRFs: cumulative changes in households' debt liabilities (as a percentage of net wealth in $t-1$) following a contractionary monetary policy shock, by net wealth group*



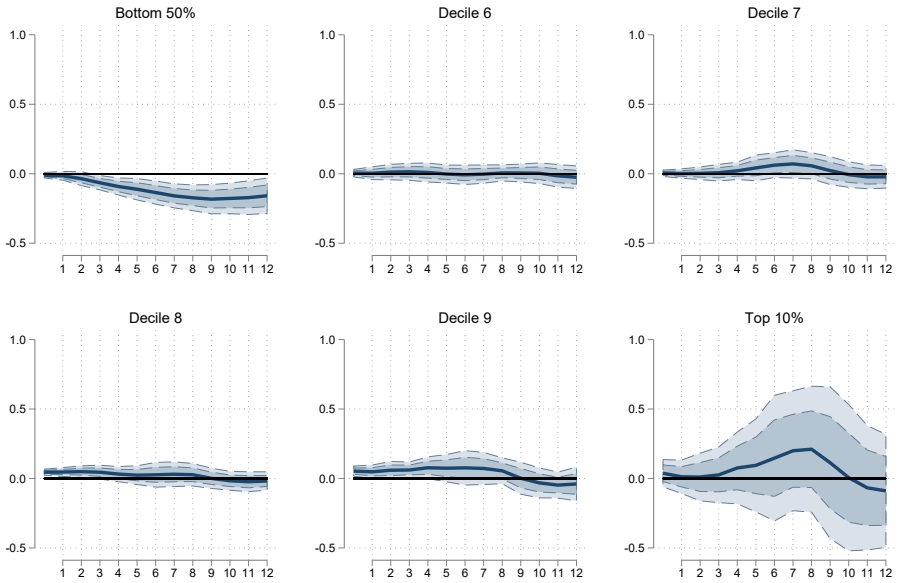
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.4: *IRFs: cumlative percent changes in households' risky financial assets (as a percentage of net wealth in $t-1$) following a contractionary monetary policy shock, by net wealth group*



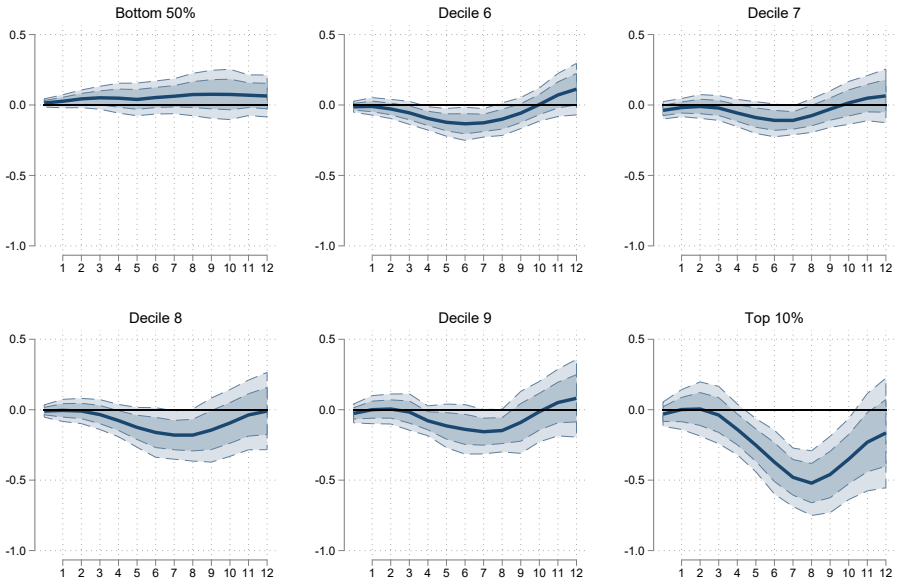
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.5: *IRFs: cumulative percent changes in households' business assets (as a percentage of net wealth in $t-1$) following a contractionary monetary policy shock, by net wealth group*



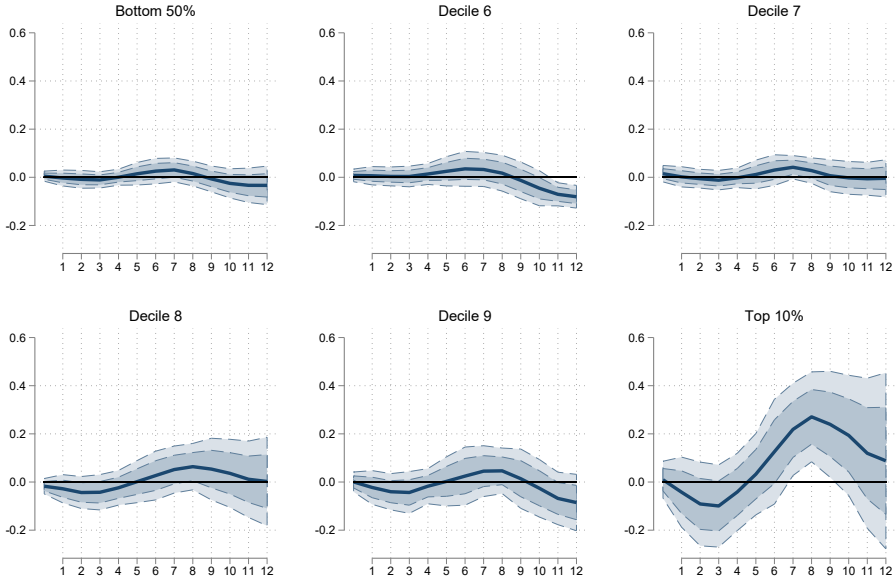
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.6: *IRFs: households' portfolio share of housing assets following a one-standard-deviation contractionary monetary policy shock, by net wealth decile*



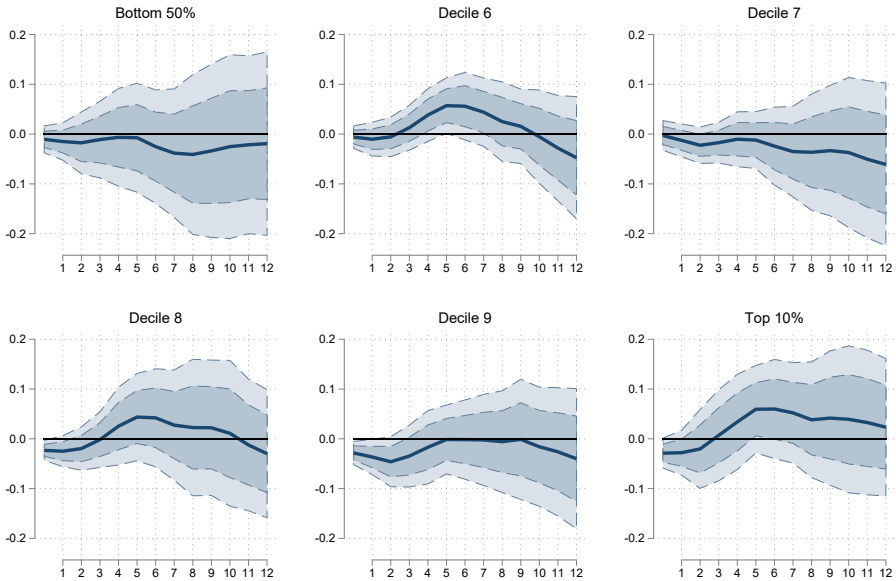
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.7: *IRFs: households' portfolio share of risky assets following a one-standard-deviation contractionary monetary policy shock, by net wealth decile*



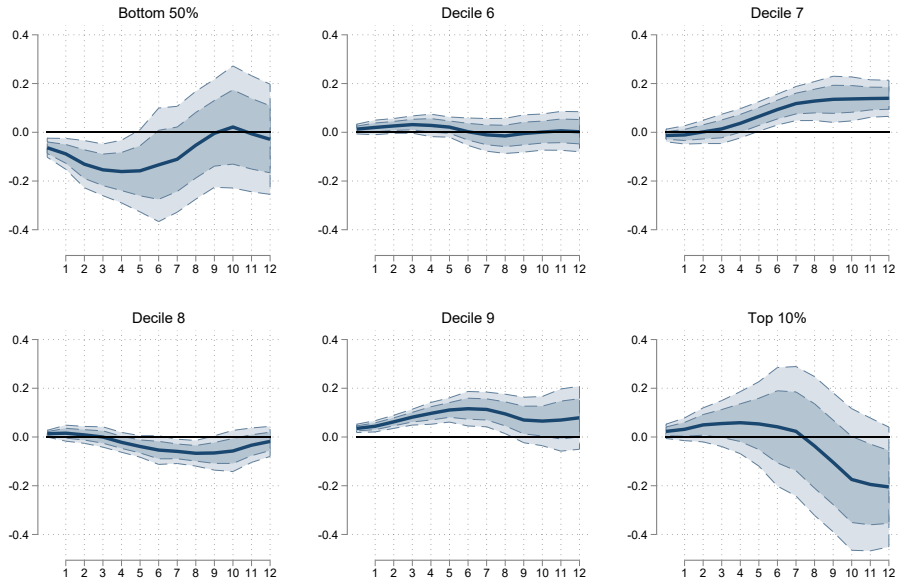
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.8: *IRFs: households' portfolio share of non-risky financial assets following a one-standard-deviation contractionary monetary policy shock, by net wealth decile*



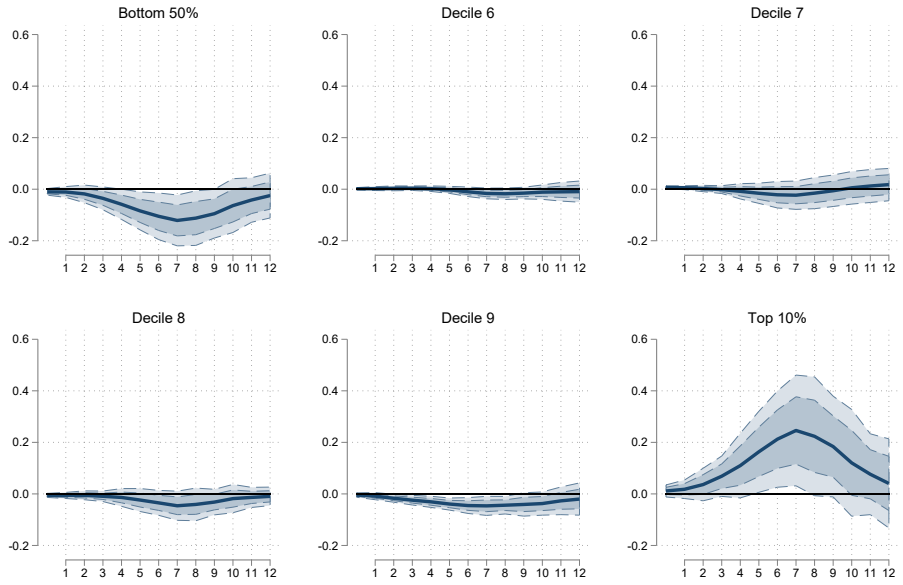
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.9: *IRFs: household group's share of country's debt liabilities following a one-standard-deviation contractionary monetary policy shock*



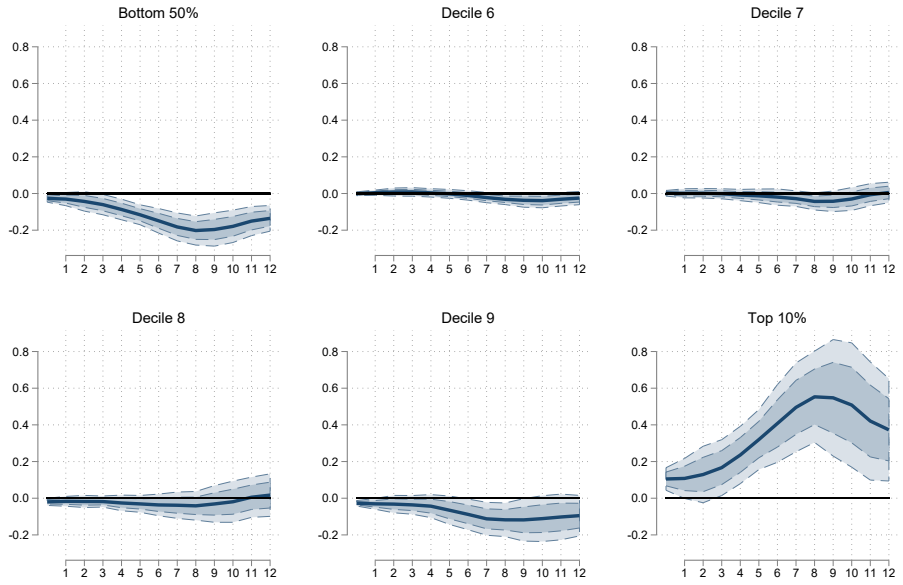
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.10: *IRFs: household group's share of country's non-risky financial assets following a one-standard-deviation contractionary monetary policy shock*



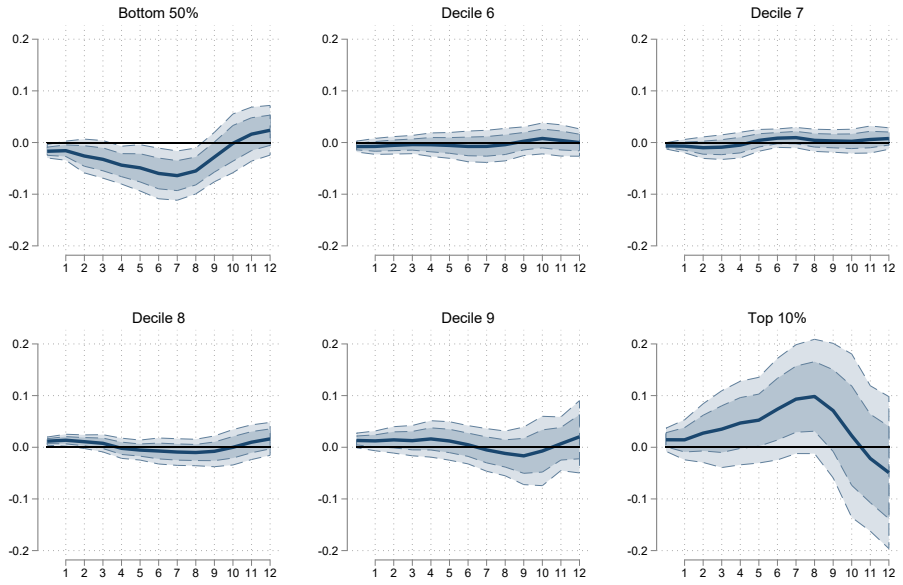
Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.11: *IRFs: household group's share of country's risky financial assets following a one-standard-deviation contractionary monetary policy shock*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.

Figure C.12: *IRFs: household group's share of country's business assets following a one-standard-deviation contractionary monetary policy shock*



Notes: Dark-shaded area: one-standard-deviation Driscoll-Kraay confidence interval. Light-shaded area: 90% Driscoll-Kraay confidence interval. Solid line: local projection moving-average-smoothed IRF.