Monetary policy and the wealth distribution

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Using the Distributional Financial Accounts of the United States, we study the effects of monetary policy on the wealth distribution. The direction and persistence of these effects depend on the policy instrument. Interest rate cuts initially reduce wealth inequality but increase it in the medium run. Asset purchases, instead, increase wealth inequality but only temporarily. Housing is the main channel through which monetary policy affects wealth at the bottom while corporate equities explain wealth growth at the top. Using household-level data from the Panel Study of Income Dynamics, we document a wealth reversal at the bottom of the distribution: lower interest rates raise housing wealth in the short run but lead to higher mortgage debt and lower net wealth over time, contributing to the medium-term rise in inequality.

JEL codes: E52, D31, E44.

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1. Introduction

In the aftermath of the Great Recession, unconventional monetary policy tools, such as asset purchases, have become increasingly central to the conduct of monetary policy. These tools have helped ease financial conditions and lower long-term interest rates, but they have also drawn harsh criticism from the public for their potential role in increasing wealth inequality. A common concern is that the benefits of expansionary monetary policy accrue disproportionately to asset owners in the form of capital gains, as lower interest rates and asset purchases boost asset prices. However, short-term interest rates and asset purchases may influence the distribution of wealth through several other channels, including changes in saving behavior or portfolio rebalancing. Thus, the overall effects of different types of monetary policy on wealth inequality remain empirically unexplored.

In this article, we study the effects of monetary policy on the distribution of household wealth in the United States. We use vector autoregressive (VAR) models and local projections, distinguishing between interest rate and asset purchase shocks. Our primary data source is the Distributional Financial Accounts (DFA) of the United States, which combines household-level data from the Survey of Consumer Finances with the aggregate balance sheet of the household sector. Additionally, to corroborate the aggregate evidence and provide a more granular view of how monetary policy affects wealth dynamics, we use microdata from the Panel Study of Income Dynamics.

Our first contribution is to show, using the DFA, that the effects of monetary policy on wealth levels across the distribution depend to a large extent on the type of policy instrument. An interest rate shock initially increases net wealth across the distribution, with the bottom 50% experiencing the largest percentage gain. Over time, however, the effect remains positive only for the top 10%, while it turns significantly negative for the bottom 50%. The analysis of unconventional monetary policy presents a different picture. The initial effect of an asset purchase shock is to raise net wealth for all groups, with the bottom 50% recording the largest percentage increase, followed by the top 0.1%. This increase in net wealth, however, is short-lived, as the effects of monetary policy fade away.

The detailed nature of the balance sheet in the DFA allows us to analyze the contribution of different asset classes to the observed changes in wealth following a monetary policy shock. We focus on two asset classes: real estate, and corporate equities and mutual funds. These are particularly relevant because their ownership, relative to other assets owned, vary systematically with the position in the wealth distribution. We show that the effect of monetary policy on net wealth for the bottom 50% of the distribution is entirely driven by the response of housing net wealth, especially following an interest rate shock. This is consistent with the fact that the bottom 50% is highly exposed to housing, with real estate assets accounting for more than half of total assets between 1989 and 2019. Consequently, as we move toward the top of the wealth distribution, the importance of housing wealth diminishes. Instead, the response of corporate equities and mutual funds becomes the main factor driving changes in net wealth after a monetary policy shock, particularly in the short run. Using data on aggregate revaluations, and in line with previous research, we also find that monetary policy shocks have heterogeneous effects on capital gains across the wealth distribution, especially in the short run. This is consistent with extensive evidence showing that asset price revaluations drive unequal wealth growth following monetary policy shocks, beyond effects through income, inflation, and mortgage payments (McKay and Wolf 2023).[1]

We then use the estimated responses of net wealth across wealth groups to monetary policy shocks to derive the implied effects on wealth inequality. Our results reveal a previously undocumented feature of the distributional effects of monetary policy. An expansionary interest rate shock initially reduces wealth inequality (as measured by the top 1% wealth share) but subsequently leads to a persistent increase. By contrast, an asset purchase shock initially increases wealth inequality, but this effect is temporary. We show that the responses of real estate and corporate equities and mutual funds across the wealth distribution play a key role in shaping these dynamics.

The analysis of the effects of monetary policy on net wealth using the DFA reveals an interesting phenomenon in the bottom 50% after an interest rate shock that affects this group's wealth share: a wealth reversal. The initial rise in total net wealth is driven by higher housing net wealth, reflecting an increase in real estate holdings. Over time, however, the stronger rise in home mortgage balances dominates, compressing housing net wealth and, consequently, total net wealth. To rule out the influence of household mobility across the wealth distribution, we use the Panel Study of Income Dynamics (PSID) to estimate how monetary policy affects wealth dynamics at the household level. We find that lower interest rates lead to an expansion of real estate assets along both the intensive and extensive margins. Households in the lower part of the wealth distribution become more likely to own homes and, conditional on homeownership, real estate

[1]For recent surveys on monetary policy and inequality, see Colciago, Samarina, and de Haan (2019) and Kappes (2021).

assets rise, potentially driven by both net investment in housing and revaluation effects. The monetary expansion eventually triggers an increase in borrowing, potentially due to home equity extraction but also to the entry of new homeowners, as indicated by the expansion of homeownership. The resulting rise in mortgage balances ultimately reduces housing net wealth and, given the large exposure of these households to housing, total net wealth. This mechanism contributes to the medium-term increase in wealth inequality, consistent with the evidence obtained from the DFA.

Our article is the first to provide a comprehensive comparison of the distributional effects of conventional and unconventional monetary policy in the United States, an issue that has received particular attention from monetary policymakers (Yellen 2016; Schnabel 2021). Two other studies have examined the distributional effects of monetary policy using the DFA, but both focused solely on interest rate shocks. One is Feilich (2023), who finds that a contractionary interest rate shock has larger negative effects at the bottom of the wealth distribution. The other is Bricker et al. (2025), who shows that the wealth Gini index increases after an expansionary interest rate shock. Other studies use a mix of surveys, simulations, and estimates of the elasticity of asset prices to monetary policy to show that expansionary interest rate shocks have unequal effects on wealth accumulation (Albert and Gómez-Fernández 2021) and widen the racial wealth gap (Bartscher et al. 2022). However, none of these studies consider the distributional effects of asset purchase shocks.[2]

Road map. The article is organized as follows. Section 2 introduces and describes the DFA. Section 3 outlines the econometric strategy and the identification of monetary policy shocks. Section 4 presents and discusses the main results. The robustness of these results is assessed in Section 5. Section 6 provides household-level evidence of a wealth reversal. Section 7 concludes.

[2]Research on the impact of monetary policy on wealth inequality in the U.S. is less developed compared to income and consumption inequality due to the limited availability of wealth data. For labour and consumption inequality, a contractionary interest rate shock increases labor and consumption inequality in the U.S. (Coibion et al. 2017; Dolado, Motyovszki, and Pappa 2021). For other countries and dimensions of inequality, previous research has used surveys and administrative data. For example, the income response to expansionary monetary policy is U-shaped across the income distribution in Sweden (Amberg et al. 2022). In Denmark, expansionary monetary policy has larger effects on income, consumption, and wealth across the income distribution (Andersen et al. 2023). For the euro area, expansionary conventional monetary policy reduces income inequality (Samarina and Nguyen 2024). For Italy and the euro area, Casiraghi et al. (2018) and Lenza and Slacalek (2024) find that asset purchases reduce income inequality and have negligible effects on wealth inequality, respectively. De Luigi et al. (2023), instead, find conflicting results using euro area data depending on how wealth inequality is measured: an asset purchase shock increases top wealth shares while it decreases the wealth Gini index.

2. The Distributional Financial Accounts of the United States

Our primary data source is the Distributional Financial Accounts (DFA), a new dataset that provides quarterly measures of household balance sheets across the wealth distribution (Batty et al. 2021). In this section, we present an overview of the dataset and highlight key findings on the distribution of household wealth, focusing on five wealth groups: the bottom 50%, the next 40% (50th-90th percentile), the next 9% (90th-99th percentile), the top 0.9% (99th-99.9th percentile), and the top 0.1% (99.9th-100th percentile). Throughout the article, we use the terms "wealth" and "net wealth" interchangeably to refer to total household assets, including consumer durables and unfunded defined benefit pensions, less all debts and other liabilities.

The DFA integrates the Financial Accounts and the Survey of Consumer Finances (SCF). The former measures the aggregate assets and liabilities of the household sector, while the latter compiles detailed balance sheets from a representative sample of households, including the very wealthy, who are intentionally oversampled. The construction of the DFA involves three main steps. First, an SCF counterpart is constructed for each component of aggregate household wealth in the Financial Accounts. Second, these SCF counterparts are interpolated and forecasted for different segments of the wealth distribution between the triennial SCF surveys. Third, the distribution of the interpolated SCF counterparts is applied to the Financial Accounts aggregates on a quarterly basis.

2.1. Wealth concentration and growth

According to the DFA, U.S. wealth inequality has increased since 1989, with trends in top wealth shares comparable to those reported in other studies (Morelli et al. 2023; Saez and Zucman 2016; Blanchet, Saez, and Zucman 2022).[3] However, differences in the level of inequality persist due to disagreements in the definition of wealth. For example, according to the DFA, the top 0.1% wealth share stands lower than that estimated by Blanchet, Saez, and Zucman (2022) because wealth in the latter excludes consumer durables and unfunded pensions.[4]

[3] Figure A.1 in Appendix A provides a comparison of the top 0.1% wealth share in the DFA with the high-frequency estimates of net wealth in Blanchet, Saez, and Zucman (2022). See Batty et al. (2021) for additional comparisons with other studies.

[4] Differently from the DFA, Blanchet, Saez, and Zucman (2022) estimate the wealth distribution using the income capitalization method applied to income tax data. In the DFA, pension entitlements include the balances of defined contribution pension plans, accrued benefits to be paid in the future from defined benefit plans, and annuities sold by life insurers directly to individuals (Batty et al. 2021). In contrast,

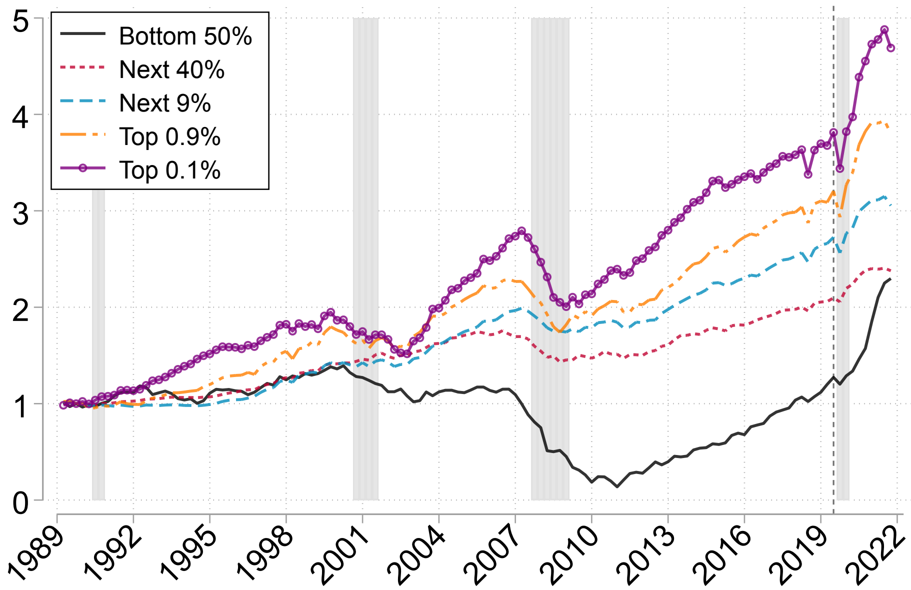


FIGURE 1. Real net wealth growth across the wealth distribution (1989Q3 - 2022Q1)

Notes: The figure shows real net wealth growth across wealth groups according to the Distributional Financial Accounts. All time series are indexed to 1 in 1990Q1 and deflated using the consumer price index. The dashed vertical line indicates the end of the estimation sample of the empirical analysis (2019Q4).

Figure 1 compares real net wealth growth across wealth groups. Until the early 2000s, wealth growth followed a relatively uniform pattern across all groups, with the exception of the top 1%, which has always experienced higher growth. For the bottom 50%, wealth growth was already stagnant by the early 2000s. During the Great Recession, all groups experienced a slowdown, although the severity varied considerably. While the bottom experienced an almost complete erosion of net wealth, the impact of the crisis on the top 50% was much less severe. It is worth noting that the pandemic and its aftermath boosted wealth growth especially for the bottom 50% and the top 1% of the distribution.

2.2. Heterogeneous portfolios across the wealth distribution

Differences in wealth growth arise from changes in saving rates, capital gains, and other returns. Changes in asset prices can significantly affect the dynamics of wealth

Blanchet, Saez, and Zucman (2022) excludes unfunded pensions because these are promises of future transfers that are not backed by actual wealth. Similarly, durables are treated as non-financial assets in the DFA but not in Blanchet, Saez, and Zucman (2022).

inequality through two channels (Kuhn, Schularick, and Steins 2020). First, if portfolios differ across the wealth distribution, changes in asset prices will affect wealth differently. Second, when the wealth-to-income ratio is high, changes in asset prices have a larger impact on the wealth distribution than savings alone. For asset prices to affect the distribution of wealth, it is crucial that households' portfolios across the distribution are heterogeneous. Table 1 shows a significant heterogeneity in the composition of portfolios across the wealth distribution. Moving toward the top, households hold a larger share of financial assets and a smaller share of non-financial assets. Throughout the article, we will show how such heterogeneity in portfolios shapes the distributional effects of monetary policy. Real estate and consumer durables together account for more than 70% of total assets for households in the bottom 50%, while the importance of corporate equities, mutual funds and private businesses increases for wealthier groups. Pensions account for nearly one-third of total assets for households in the next 40% and the next 9% of the distribution. Home mortgages make up the bulk of liabilities, and their relative importance grows with wealth levels except for the top 1%. Conversely, the share of consumer credit declines as we move up in the distribution.

3. Econometric methodology

In this section, we first present the econometric approach used to estimate the distributional effects of monetary policy. Then, we describe the identification of monetary policy shocks.

3.1. VAR Model

Model. The core framework for our analysis is the following VAR model:

$$\underset{n\times 1}{\mathbf{y}_t} = \underset{n\times 1}{\mathbf{c}} + \sum_{j=1}^{p} \underset{n\times n}{\mathbf{B}_j}\, \mathbf{y}_{t-j} + \underset{n\times 1}{\mathbf{u}_t} \quad \text{with} \quad \mathbf{u}_t \sim \mathcal{N}\left(\underset{n\times 1}{\mathbf{0}}, \underset{n\times n}{\mathbf{\Sigma}}\right) \tag{1}$$

where $\mathbf{y}_t$ is a $(n \times 1)$ vector of endogenous variables, $\mathbf{c}$ is a $(n \times 1)$ constant vector, $\mathbf{B}_j$ are $(n \times n)$ matrices of parameters with $j = 1, \ldots, p$, $\mathbf{u}_t$ is a $(n \times 1)$ vector of reduced-form innovations with zero mean and variance-covariance matrix $\mathbf{\Sigma}$. Time is indexed by $t = 1, \ldots, T$, each time period is a quarter, and the lag length is $p = 4$. To address the challenge of dimensionality resulting from a relatively large number of parameters compared to the sample size, we estimate the model using Bayesian techniques with

TABLE 1. Average composition of portfolios across the wealth distribution (1989Q3-2019Q4)

	Bottom 50%	Next 40%	Next 9%	Top 0.9%	Top 0.1%
Assets (% of total)					
Nonfinancial assets	71.65	42.41	26.46	20.04	13.57
Real estate	51.14	34.71	22.48	16.69	9.08
Consumer durables	20.51	7.70	3.98	3.35	4.49
Financial assets	28.35	57.59	73.54	79.96	86.43
Deposits	6.39	10.60	11.47	10.77	9.20
Corporate equities and mutual funds	2.57	6.98	16.65	28.90	32.77
Private businesses	2.52	5.02	9.63	18.45	23.70
Pension entitlements	10.78	29.30	28.52	9.91	3.60
Other assets	6.09	5.70	7.27	11.92	17.15
Liabilities (% of total)					
Home mortgages	60.24	77.74	81.03	69.79	49.08
Consumer credit	36.03	19.36	10.25	7.66	10.89
Other liabilities	3.72	2.90	8.72	22.55	40.02
Wealth-to-asset ratio	27.49	81.04	92.02	95.85	98.86

Notes: For each wealth group, the table shows average shares of wealth and type of assets in total assets and type of liabilities in total liabilities. The table reports simple averages between 1989Q3 and 2019Q4. Other assets include US government and municipal securities, corporate and foreign bonds, loans, life insurance reserves, and miscellaneous assets. Similarly, other liabilities are include depository institutions loans n.e.c., other loans and advances, deferred and unpaid life insurance premiums.

standard macroeconomic priors, as in Miranda-Agrippino and Ricco (2021). The tightness of the prior is set as in Giannone, Lenza, and Primiceri (2015). Further details on estimation can be found in see Appendix B.1.

Specification. We use different specifications of the VAR model in equation (1). We start with a standard model in which the vector of endogenous variables $\mathbf{y}_t$ includes, in the following order, the monetary policy surprise series, real GDP, the consumer price index, the excess bond premium (Gilchrist and Zakrajšek 2012), and the policy variable. In the model for conventional (unconventional) monetary policy, the surprise series is $\hat{s}_t^R$ ($\hat{s}_t^{LSAP}$), and the policy variable is the 1-year Treasury yield (term spread). The term spread is the difference between the 10-year and the 3-month Treasury yields. We refer to these specifications as the models with macroeconomic data, and all the details are summarized in Table 2, Panel A. We then augment these models with the balance sheet components from the DFA to study the distributional effects of monetary policy

(Table 2, panel B). More specifically, we estimate a separate VAR model for each wealth group and each type of monetary policy shock. Interest rates, spreads and ratios are expressed in percent. All remaining variables are expressed in levels of their natural logarithms. Nominal variables, including macroeconomic and distributional variables, are deflated using the consumer price index. Models for conventional monetary policy are estimated using quarterly time series from 1989Q3 to 2019Q4, and from 1992Q3 to 2016Q4 for unconventional monetary policy.

Identification. To obtain impulse responses, we estimate the VAR in equation (1) using two monetary policy surprise series as internal instruments (Plagborg-Møller and Wolf 2021). This approach is implemented by ordering the instrument first in a recursive VAR. In our application, the instrument are the monetary policy surprise series $\hat{s}_t^i$ (with $i = R, LSAP$) and their construction is described in Sections 3.2 and 3.3.

Let z_t be a generic instrument (in our case, $\hat{s}_t^R$ or $\hat{s}_t^{LSAP}$), ε_t^p be the monetary policy shock and $\boldsymbol{\varepsilon}_t^q$ be a $(n-1) \times 1$ vector of other structural shocks. The internal instrument approach requires the instrument z_t to be correlated with the shock of interest ε_t^p, to be orthogonal to all other shocks $\boldsymbol{\varepsilon}_t^q$ as well as to all leads and lags of the structural shocks. Formally, we assume:

$$\mathbb{E}[z_t \varepsilon_t^{p'}] \neq 0 \tag{2}$$

$$\mathbb{E}[z_t \boldsymbol{\varepsilon}_t^{q'}] = \mathbf{0} \tag{3}$$

$$\mathbb{E}[z_t \boldsymbol{\varepsilon}_{t+k}] = \mathbf{0}, \quad \text{for } k \neq 0 \tag{4}$$

where (2) is the relevance condition with the structural shock of interest, (3) is the exogeneity condition with the remaining structural shocks, and (4) is the orthogonality condition to leads and lags of the structural shock. Under these assumptions, we can estimate the causal effect of monetary policy by augmenting the VAR with the monetary policy surprise series. The internal instrument strategy has the favorable property that it leads to consistent estimates of the impulse responses even if the instrument is contaminated with measurement error and the shock is not invertible (Plagborg-Møller and Wolf 2021; Li, Plagborg-Møller, and Wolf 2024; Forni, Gambetti, and Ricco 2022).

3.2. Conventional monetary policy: interest rate shock

A common approach to the identification of monetary policy shocks is to measure high-frequency changes in interest rates around policy announcements. This strategy

TABLE 2. Models and variables description

	Series	Unit	Source
Panel A: *Models with macroeconomic data*			
1	Policy shock:		
	Interest rate surprise ($\hat{s}_t^R$)		Sections 3.2
	Asset purchase surprise ($\hat{s}_t^{LSAP}$)		Sections 3.3
2	Real GDP	BoC 2012$	Bureau of Economic Analysis
3	Consumer price index	2015 = 100	Bureau of Economic Analysis
4	Excess bond premium	Percent	Gilchrist and Zakrajšek (2012)
5	Interest rate or spread:		
	1-year Treasury Rate	Percent	McCracken, Ng et al. (2021)
	Term spread	Percent	McCracken, Ng et al. (2021)
Panel B: *Models augmented with Distributional Financial Accounts data for each wealth group i*			
	Model with macroeconomic data +		
6	Consumer durables$_i$	Bil. of 2015$	DFA
7	Real estate$_i$	Bil. of 2015$	DFA
8	Deposits$_i$	Bil. of 2015$	DFA
9	Pension entitlements$_i$	Bil. of 2015$	DFA
10	Corporate equities and mutual funds$_i$	Bil. of 2015$	DFA
11	Private businesses$_i$	Bil. of 2015$	DFA
12	Home mortgages$_i$	Bil. of 2015$	DFA
13	Consumer credit$_i$	Bil. of 2015$	DFA
14	Net wealth$_i$	Bil. of 2015$	DFA

Notes: DFA is Distributional Financial Accounts. Bil. is billions. Real estate assets are owner-occupied real estate including vacant land and mobile homes at market value. Deposits include checkable deposits and currency, time deposits and short-term investments, and money market fund shares. Pension entitlements includes defined contribution (DC) pension plans, accrued benefits to be paid in the future from defined benefit (DB) plans, and annuities sold by life insurers directly to individuals. Corporate equities and mutual funds exclude equities and mutual fund shares owned through DC pensions. Private businesses (or equity in noncorporate business) is proprietors' equity in noncorporate business (including non-publicly traded businesses and real estate owned by households for renting out to others). Home mortgages are residential home mortgage loans as reported by lenders. Consumer credit includes credit card, student loan, and vehicle loan balances, and other loans extended to consumers.

is based on the assumption that asset prices respond *solely* to monetary policy shocks during a short time window around policy announcements. However, surprise series identified in this way may be subject to endogeneity problems if the central bank possesses private information about the state of the economy (Miranda-Agrippino and Ricco 2021; Jarociński and Karadi 2020) or if both the central bank and economic agents react to publicly available economic news (Bauer and Swanson 2023). To address these problems, we use the series of Jarociński and Karadi (2020), which isolates *pure monetary policy* surprises based on the negative comovement between changes in the

3-month federal funds futures rate and the S&P500 stock price index around policy announcements. Changes in these futures reflect the overall stance of monetary policy by capturing both the actual rate setting and the near-term path of future rates.

The internal instrument approach involves ordering the surprises first in the VAR and then estimate the dynamic effects of the first orthogonalized shock (Plagborg-Møller and Wolf 2021). However, this approach is problematic in our estimation sample, which is constrained by the availability of the DFA (starting in 1989). Specifically, the raw monetary policy surprise series may contain substantial measurement noise relative to the true monetary policy signal. This issue is compounded by the fact that monetary policy has been conducted more systematically in recent times (Ramey 2016), which reduces the amount of unexpected variation in policy actions and makes identification in more recent samples more challenging. In a longer sample, the noise component of the proxy plays a smaller role because the relationship between the proxy and the underlying structural shock can be estimated more precisely. The presence of earlier episodes with larger and less systematic policy movements provides additional information that helps isolate the component of the proxy truly related to monetary policy innovations, allowing the idiosyncratic noise in the instrument to average out. In contrast, when estimation is restricted to a more recent period, the noisy variation in the proxy may dominate, leading to weaker and potentially misleading identification in the internal-instrument VAR.

To address this problem, we use a longer sample to improve the precision of the identified monetary policy shock. Following Forni, Gambetti, and Ricco (2022), we estimate a monthly Proxy VAR over the period July 1979–December 2019 and obtain a unit-variance monetary policy shock. By exploiting a richer information set and a longer sample that includes periods with greater exogenous variation in policy, this approach enhances the model's ability to filter out measurement noise in the instrument and isolate the component of the proxy that is most closely related to true monetary policy innovations.[5] We then aggregate the cleaned monthly shock to quarterly frequency and use it as the internal instrument in the VAR with distributional data. This ensures that, in the shorter post-1989 sample, the variation in the instrument is more tightly linked to genuine exogenous monetary policy shocks rather than to measurement noise in the

[5] The monthly model includes six lags and the following variables: the log of industrial production, the log of the consumer price index, the unemployment rate, the excess bond premium of Gilchrist and Zakrajšek (2012), the log of a commodity price index, and the 1-year Treasury rate as the policy variable. The F-statistic in the first stage is 10.9, exceeding the threshold of Stock, Wright, and Yogo (2002). We verify the invertibility condition of the identified shock following Forni, Gambetti, and Ricco (2022) (see Table B.1 in Appendix B.2).

proxy. We refer to the orthogonalized residual in the internal-instrument VAR as the interest rate shock ($\hat{s}_t^R$).[6]

3.3. Unconventional monetary policy: asset purchase shock

To identify surprise changes in unconventional monetary policy, we use the large-scale asset purchase factor of Swanson (2021). This factor represents one of the principal components that explain asset price changes around monetary policy announcements between July 1991 and June 2019. By construction, the large-scale asset purchase factor is uncorrelated with other factors capturing changes in the federal funds rate and forward guidance, making it an appropriate measure of "the component of FOMC announcements that conveys information about asset purchases above and beyond changes in the federal funds rate itself" (ibid., p. 37).[7]

In contrast to the conventional monetary policy shock, the large-scale asset purchase factor covers all major events associated with unconventional policies (QE1, QE2 and QE3). This makes the identification strategy a more straightforward task. To enhance comparability between the two procedures, we purge the large-scale asset purchase factor from the information contained in Greenbook forecasts, as in Miranda-Agrippino and Ricco (2021), and obtain an informationally-robust asset purchase surprise series ($\hat{s}_t^{LSAP}$). In the text, we refer to its orthogonalized residual from the internal-instrument VAR as the asset purchase shock. Further details of this procedure can be found in Appendix B, along with a plot of both shocks (Figure B.1).

4. Results

We now examine the effect of interest rate and asset purchase shocks on the wealth distribution.

4.1. Macroeconomic effects of monetary policy

We begin our analysis by examining the impact of monetary policy on macroeconomic aggregates using the models in Table 2, Panel A. Figure 2 plots the impulse responses

[6] An alternative would be to use the surprises of Jarociński and Karadi (2020) as an external instrument in a quarterly Proxy VAR with distributional data. However, given both the short sample and the quarterly frequency, the instrument is too weak and noisy to deliver reliable identification.

[7] Swanson (2021) shows that changes in the large-scale asset purchase factor have small effects on yields at short maturities but a larger impact on long-term rates, particularly on Treasury bonds.

normalized to produce a 1% response in real GDP three quarters after the shock. We adopt this normalization convention to facilitate comparison across models, and we maintain it throughout the article. In addition, following our sign convention, the impulse responses trace the effects of expansionary monetary policy shocks.

An interest rate shock leads to an immediate decline of about 60 basis points in the 1-year Treasury rate. Similarly, an asset purchase shock narrows the term spread by about 30 basis points. Both the decline in interest rates and the narrowing of the spread are statistically significant, with a faster reversion observed after an interest rate shock. Consistent with previous research on the macroeconomic effects of monetary policy, both shocks increase real GDP, raise the price level, and ease financial conditions as measured by the excess bond premium (Gertler and Karadi 2015; Ramey 2016).[8]

4.2. Monetary policy and wealth inequality

To evaluate the distributional effects of monetary policy shocks, we estimate the augmented models in Table 2, Panel B. We do so using a different model for each type of shock and wealth group. Each model includes consumer durables, real estate, deposits, pension entitlements, corporate equities and mutual funds, private businesses, home mortgages, consumer credit, and net wealth. Together, these categories account for most of assets (Figure A.2) and liabilities (Figure A.3) across wealth groups.[9]

To illustrate the impact of monetary policy shocks on net wealth across the wealth distribution, we focus on the percentage change in real net wealth resulting from monetary policy shocks at specific points in time (impact and one, three, and six years after the shock). We interpret the impact and one-year responses as short-term distributional effects of monetary policy. Similarly, the three- and six-year responses represent the medium-run effects. We report the short- and medium-run effects of monetary policy shocks on net wealth across the wealth distribution in Figure 3 and Figure 7, and discuss them separately for each type of shock in the following.

We then examine the impact of monetary policy shocks on wealth inequality by using the estimated impulse responses to derive the implied changes in wealth shares

[8]The persistent real effects of monetary policy are consistent with theoretical models that take into account consumption habits, variable capital utilization, and staggered wage contracts (see, for example, Christiano, Eichenbaum, and Evans 2005). However, in a robustness check using local projections we find less persistence effects of monetary policy (see Figure D.5).

[9]We focus our main analysis on net wealth and its distribution. The assets and liabilities included in the VAR models allow us to isolate the channels through which monetary policy shocks affect the distribution of household wealth. For completeness, we report the responses of all other balance sheet variables included in the model in Appendix E, Figure E.1 and Figure E.2.

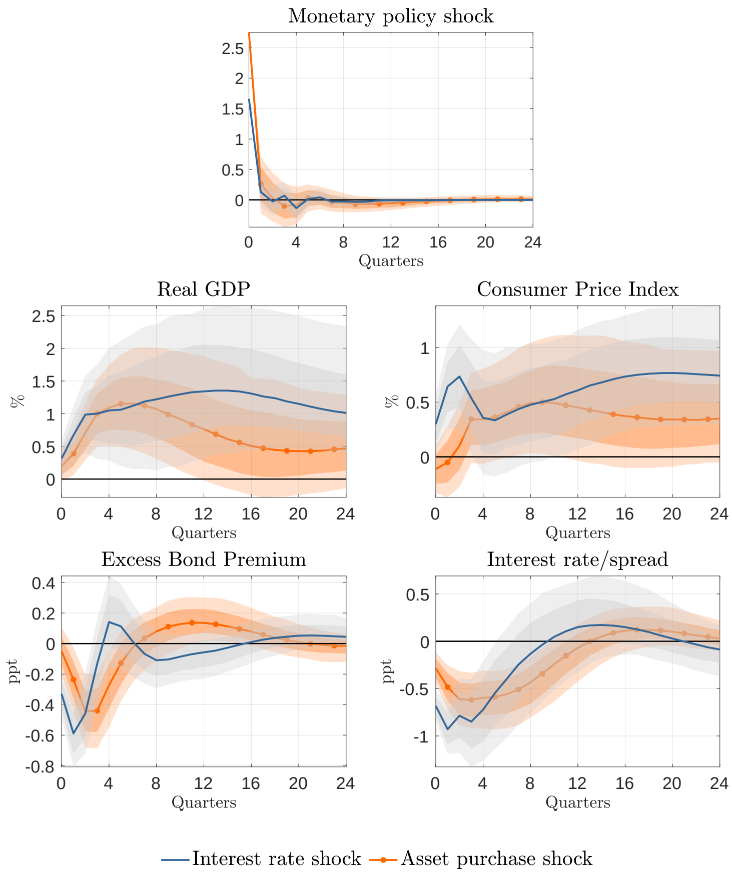


FIGURE 2. Macroeconomic effects of monetary policy

Notes: The figure shows the impulse response functions to an interest rate (solid line) and an asset purchase (solid line with markers) shock estimated using the Bayesian VAR described in Table 2, Panel A. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands.

induced by each shock. Specifically, for each group i, we denote w_{it} as real net wealth, $w_i = {}^1/_T \sum_{\forall t} w_{it}$ as the average real net wealth in our sample, and $p_i = {}^{w_i}/_{\sum_{\forall i} w_i}$ as the average wealth share. We then simulate the evolution of real net wealth for each group i using the following equation:

$$w_{ih} = w_i(1 + IRF_{ih}) \quad \text{with} \quad h = 0, \ldots, 24. \tag{5}$$

The term IRF_{ih} represents the response of net wealth of group i in period h to a monetary policy shock. Finally, we compute the implied deviation in net wealth share from its average (Δp_{ih}) for each group i using the following formula:

$$\Delta p_{ih} = p_{ih} - p_i \quad \text{with} \quad p_{ih} = \frac{w_{ih}}{w_h} \quad \text{and} \quad w_h = \sum_{\forall i} w_{ih}. \tag{6}$$

We report the effect of monetary policy on wealth shares in Figure 4 and Figure 8 and consider the top 1% wealth share as measure of wealth inequality.[10]

Finally, we examine two channels that underlie the distributional effects of monetary policy. The first channel we explore - which we call the *housing wealth channel* - primarily affects the bottom of the wealth distribution, given the importance of housing for this group. The second channel we examine involves the response of corporate equities and mutual funds to monetary policy shocks. This channel operates with much greater intensity at the top of the wealth distribution, where holdings of corporate equities and mutual funds are larger relative to total assets.[11]

Below, for each type of monetary policy, we present the estimated effects on the level of wealth, examine the implied effects on wealth inequality, and explore the channels through which these effects occur.

4.2.1. Interest rate shock

Figure 3 shows that an interest rate shock increases aggregate net wealth in the short run. Across the distribution, it has broadly positive effects, although heterogeneous

[10]We focus on the top 1% because this is the share of wealth that, according to various sources, has increased significantly in the US since the 1980s (see Figure 2 in Blanchet and Martínez-Toledano 2022). However, when showing the impact of monetary policy on wealth inequality, we report changes in wealth shares for all groups, including the top 0.1% and the top 10%, for the sake of completeness.

[11]We emphasize that in our analysis of the channels driving the effects of monetary policy we focus on the influence of individual asset classes (e.g., real estate) and liabilities (e.g., mortgages) without separating the role of asset prices from non-price effects (e.g., saving). Thus, the effects of monetary policy shocks on individual assets and liabilities that we report arise from the effect of shocks on both prices and quantities as it can be seen in Figure C.3. This asset price or capital gains channel has received considerable attention in the literature on the distributional effects of monetary policy (De Luigi et al. 2023) also because the most direct effects of monetary policy are often observed in financial markets (Paul 2020). We examine the role of this channel in detail in Appendix F where we show that the response of capital gains to monetary policy is larger at the top of the wealth distribution. Moreover, for individual assets, we show that the size of the response of capital gains to a monetary policy shock depends on the relative importance of each asset in total wealth for each group. However, we find that the effects of monetary policy shocks are only temporary and cannot explain our findings of persistent effects on net wealth. Recently, Fagereng et al. (2025) shift the focus away from unrealized capital gains to a monetary measure of the welfare gains from changing asset prices. From this perspective, higher asset prices benefit sellers rather than holders, and changes in asset price redistribute welfare between sellers and buyers. Nevertheless, in models with wealth in the utility function, higher wealth from capital gains provides welfare (Michaillat and Saez 2021).

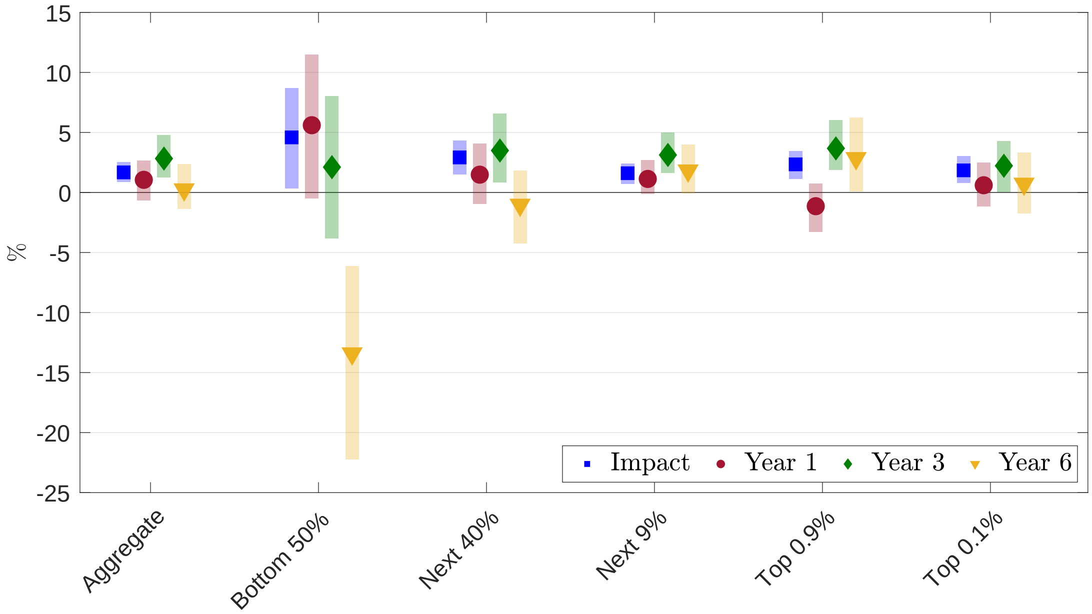


FIGURE 3. Change in net wealth after an interest rate shock

Notes: The figure shows the response of real net wealth to an interest rate shock estimated from the group-specific Bayesian VAR described in Table 2, Panel B. Net wealth is deflated using the consumer price index. Markers are median impulse responses from the posterior distribution. Intervals are 68% posterior coverage bands. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. See Figure C.1 in Appendix C for the full impulse response functions.

in size.[12] Most of the percentage increase in net wealth is concentrated in the bottom 50%, the next 40%, and the top 0.9% of the distribution, amounting to 4.6%, 2.9%, and 2.3%, respectively. In the medium run, however, the impact of an interest rate shock varies substantially across the distribution. Three years after the shock, the percentage increase in net wealth remains statistically significant for all groups except the bottom 50%. Six years after the shock, only the top 10% records positive net wealth growth, and this is statistically significant only for the top 0.9%. A striking result is the roughly 13% decline in net wealth for the bottom 50% six years after the shock. The next 40% also experience a small decline of about 1% over the same period. This finding is important because it suggests that an expansionary interest rate shock can have long-lasting and heterogeneous effects across the wealth distribution.

Next, we examine the effect of an interest rate shock on wealth inequality. Figure 4 shows the full dynamics of wealth shares, plotted as deviations from their sample aver-

[12] The effects are statistically significant at the 90% credible interval for all groups except for the bottom 50%. Figure C.1 in Appendix C shows the full impulse response functions.

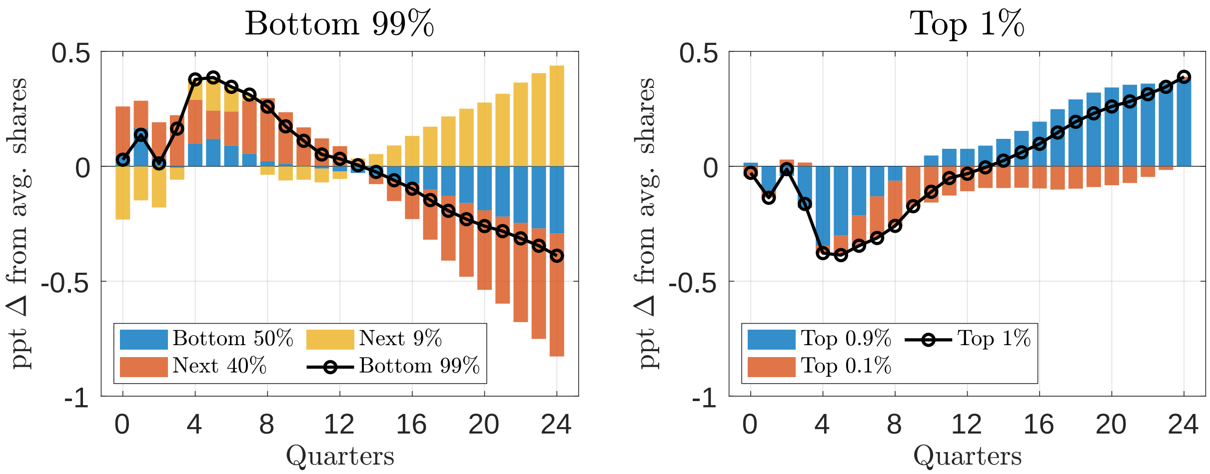


FIGURE 4. Change in wealth shares after an interest rate shock

Notes: The figure shows the implied response of wealth shares to an interest rate shock. Implied changes in wealth shares are expressed in deviation from their sample averages and using the median impulse response. See Section 4.2 for more details in the derivation of changes in wealth shares.

ages (solid lines with markers).[13] An expansionary interest rate shock reduces inequality in the short run but increases it in the medium run, as suggested by the dynamics of the top 1% wealth share. The initial decline in inequality is mainly driven by an increase in the wealth share of the next 40% and a decrease in that of the top 0.9%. The bottom 50%, in contrast, experiences only a small increase in its wealth share despite recording the highest net wealth growth. This is not surprising, given that its average share of total wealth is only 2.34% over the sample period. In the medium run, the wealth share of the top 1% rises, driven by the top 0.9%. Within the bottom 99%, we observe a marked reduction in the wealth share of the bottom 90%, which outweighs the modest increase in that of the next 9%.

After presenting the findings on the distributional effects of an interest rate shock, we know delve deeper into the two underlying channels driving these results, namely housing and corporate equities and mutual funds.

[13]Table C.1 in Appendix C reports the percentage change in net wealth, the corresponding (real) dollar change, and the implied wealth share, both in level and in deviation from its sample average, induced by an interest rate shock. By including the dollar changes in real net wealth, we aim to emphasise that seemingly uniform percentage changes in net wealth lead to highly heterogeneous outcomes in terms of wealth accumulation, depending on the initial level of wealth.

Housing wealth channel. An interest rate shock generates a pronounced boom–bust pattern in net wealth for the bottom 50%. For this group, the cyclical response of net wealth closely mirrors that of net housing wealth (real estate minus home mortgages), as shown in Figure 5, Panel A, first row. The temporary increase in real estate relative to home mortgages following an interest rate shock produces a short-run expansion in net housing wealth. In the medium run, however, net housing wealth declines as home mortgage balances rise persistently relative to real estate holdings.

To test the hypothesis that net housing wealth drives the effects of an interest rate shock at the bottom of the wealth distribution, we perform the following exercise. We re-estimate the models in Table 2, Panel B, replacing net wealth with non-housing wealth (net wealth minus net housing wealth). If housing were not driving the results, the dynamics of non-housing wealth should resemble those in our baseline estimates. Figure 5, Panel A, second row, shows the results of this exercise. As expected, we find no evidence of a boom–bust pattern in non-housing wealth for the bottom 50% (compare solid and dashed lines). For higher-wealth groups, especially for the top 1%, net housing wealth represents a smaller share of total wealth and is less important in explaining the effects of an interest rate shock. Indeed, the differences between the two wealth measures disappear as we move toward the top of the distribution.

We now turn to the role of housing in shaping the impact of an interest rate shock on the wealth distribution. Figure 6, Panel A, plots the implied changes in wealth shares derived from the response of non-housing wealth to an interest rate shock (bars). We compare the dynamics of the bottom 99% and top 1% wealth shares for non-housing wealth (solid line with circles) with the baseline results based on total net wealth (solid line with crosses). The comparison shows that the initial reduction in inequality - captured by the decline in the top 1% wealth share - following an interest rate shock is more short-lived when housing is excluded from net wealth. By the second year (quarter 8) after the shock, the non-housing wealth share of the top 1% begins to rise, while the share of the bottom 99% declines, and both trends persist thereafter. In the baseline specification, the top 1% share starts to grow roughly one year earlier. The importance of housing for the bottom 50% is also evident from the fact that this group plays virtually no role in movements of the bottom 99% share of non-housing wealth.

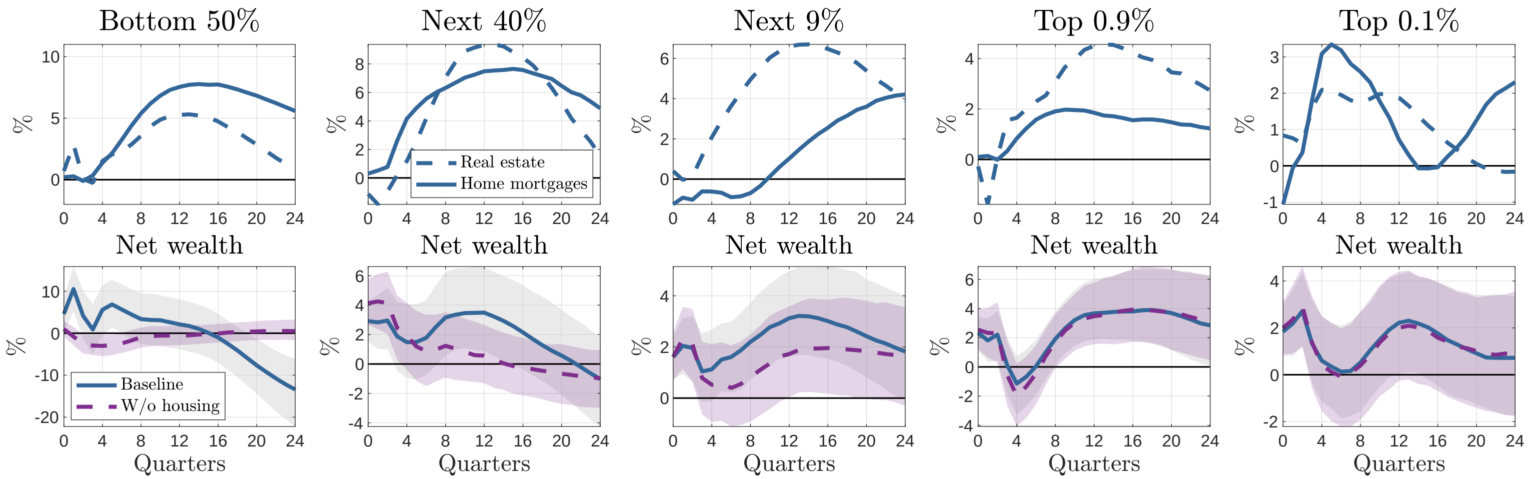
Corporate equities and mutual funds channel. We now turn to the corporate equities and mutual funds channel, applying the same strategy used for housing wealth. Figure 5, Panel B, first row, shows that corporate equities and mutual funds increase in the short run following an interest rate shock. The second row reports the response of net wealth excluding these assets, alongside the baseline results. For the bottom 50%, corporate equities and mutual funds play virtually no role in driving the response of net wealth to an interest rate shock. In contrast, their importance rises steadily toward the top of the distribution. For the top 1%, in particular, the short-run increase in net wealth observed in the baseline disappears once corporate equities and mutual funds are excluded, indicating that these assets are the main channel through which monetary policy affects wealth at the top.

Figure 6, Panel B, shows the implied responses of the bottom 99% and top 1% wealth shares when corporate equities and mutual funds are excluded (solid line with circles) and when they are included (solid line with crosses). In the baseline model, an interest rate shock initially reduces inequality but increases it in the medium run. When corporate equities and mutual funds are excluded from net wealth, an interest rate shock still reduces inequality in the short run, but the subsequent medium-term increase is much smaller than in the baseline. The effect of an interest rate shock on the wealth share of the bottom 90% depends little on whether corporate equities and mutual funds are included in net wealth. In particular, the bottom 50% and the next 40% are barely affected in the medium run, consistent with their limited exposure to this asset class. In contrast, the smaller medium-term increase in the wealth share of the top 1%, relative to the baseline, is explained by the reaction of corporate equities and mutual funds and their important role in their portfolios.

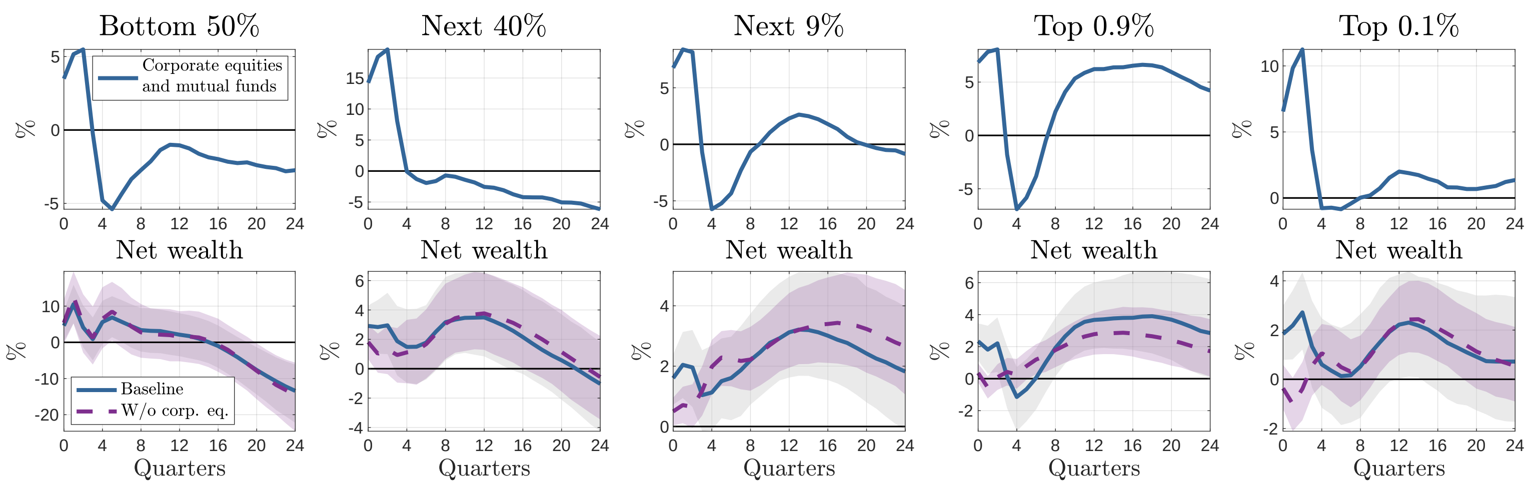
Compared to the existing literature, we provide new evidence on the effects of conventional monetary policy on the wealth distribution. It is useful to compare our results with those of Feilich (2023) and Bricker et al. (2025), who also use the DFA but rely on alternative econometric approaches.[14] Similar to Feilich (2023) , we find a strong response of wealth at the bottom of the distribution to an interest rate shock, but we additionally uncover the key role of real estate and mortgages in explaining the boom–bust pattern. This is a novel finding in the literature. The medium-run inequality-increasing effect of an interest rate shock is consistent with Bricker et al. (2025), who measures inequality using the wealth Gini index. However, we find that inequality initially declines before rising. Additionally, we extend previous analyses of the distributional effects of

[14]Another useful comparison is with Wolff (2024), who shows that expansionary monetary policy (measured as a reduction in the 10-year real bond rate) has an equalizing effect on the distribution of wealth. This approach, however, does not isolate unexpected monetary policy shocks from systematic movements in interest rates.

conventional monetary policy by decomposing the top 1% of the wealth distribution.



A. Housing wealth channel



B. Corporate equities and mutual funds channel

FIGURE 5. Interest rate shock: channels

Notes: The figure shows the impulse response functions to an interest rate. Baseline refers to the response of net wealth. W/o housing refers to the response of non-housing wealth (net wealth net of real estate and home mortgages) in Panel A. W/o corp. eq. refers to the response of net wealth net of corporate equities and mutual funds in Panel B. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid and dashed lines are median impulse responses from the posterior distribution. Shaded areas are 68% posterior coverage bands.

4.2.2. Asset purchase shock

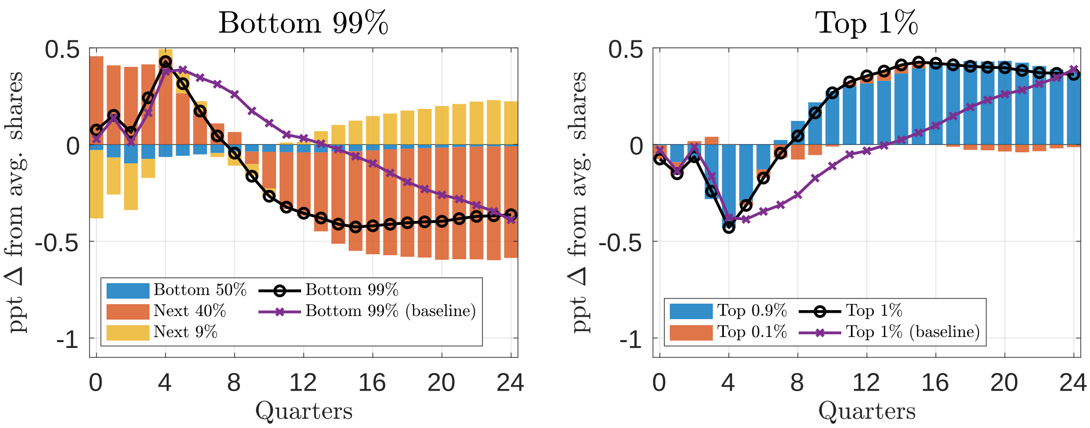
We now turn to the distributional effects of unconventional monetary policy. While the aggregate effect of an asset purchase shock is positive in the short run, there are marked differences between the bottom 50% and the rest of the distribution (Figure 7). At impact and one year after the shock, the effects on net wealth are significantly larger for the bottom 50% than for any other group (7.4% at impact and 7.9% after one year). In contrast, for the next 40%, the shock has almost no effect on net wealth. Among the top 10%, the effects are positive but smaller in magnitude relative to those at the bottom. In the medium run, an asset purchase shock reduces net wealth for most groups except the top 0.9%, although these effects dissipate over longer horizons.

Figure 8 plots the full dynamics of wealth inequality following an asset purchase shock (solid lines with markers).[15] An expansionary asset purchase shock increases inequality (as measured by the top 1% wealth share) in the short run, with no lasting effect in the medium run. The initial rise in inequality is mainly driven by a decline in the wealth share of the next 40% and an increase in that of the top 0.9%. The bottom 50% experiences a comparatively small increase in its wealth share despite recording the largest growth in net wealth, reflecting its very low initial level of wealth. Over time, the top 1% share gradually returns to its pre-shock level, with the top 0.9% contributing positively and the top 0.1% negatively. Overall, Figure 8 indicates that the effects of an asset purchase shock on wealth inequality are transitory.

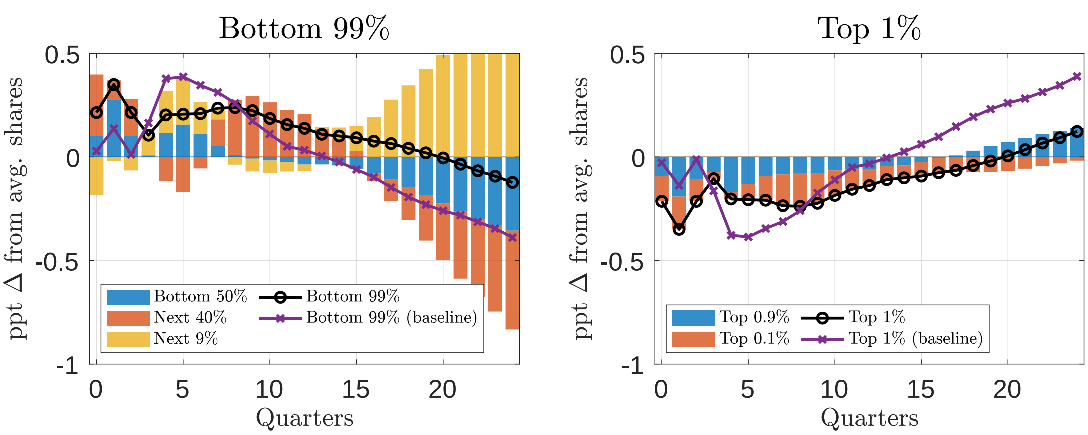
Following the same approach we used for conventional monetary policy, we now proceed to examine the role of housing and corporate equities and mutual funds.

Housing wealth channel. An asset purchase shock has mixed effects on real estate and home mortgages across the wealth distribution (Figure 9, Panel A, first row). Real estate responds positively only for the bottom 50% and the top 0.9%. Home mortgages, by contrast, decrease immediately for the bottom 90% and with a delay for the next 9%. For the bottom 50%, the combination of a temporary increase in real estate and an immediate, persistent decline in mortgages boosts net housing wealth. In the second row of Figure 9, Panel A, turning off the influence of real estate and mortgages eliminates the short-run increase in wealth. As before, the dashed line represents the response of non-housing wealth, while the solid line with markers depicts the baseline response of

[15] As with the interest rate shock, Table C.2 in Appendix C reports the dynamics of wealth inequality induced by an asset purchase shock at specific points in time, along with the corresponding dollar changes in real net wealth.



A. Housing wealth channel



B. Corporate equities and mutual funds

FIGURE 6. Interest rate shock and wealth inequality: channels

Notes: The figure shows the implied response of wealth shares to an interest rate shock. In Panel A, vertical bars and solid lines with circles are changes in wealth shares with wealth defined as non-housing wealth (net wealth net of real estate and home mortgages). In Panel B, vertical bars and solid lines with circles are changes in wealth shares with net wealth defined as total assets minus all debts and liabilities, net of corporate equities and mutual funds (Panel B). In both panels, Solid lines with crosses are changes in wealth shares with net wealth defined as total assets minus all debts and liabilities (baseline). Implied changes in wealth shares are expressed in deviation from their sample averages and using the median impulse response. See Section 4.2 for more details in the derivation of changes in wealth shares.

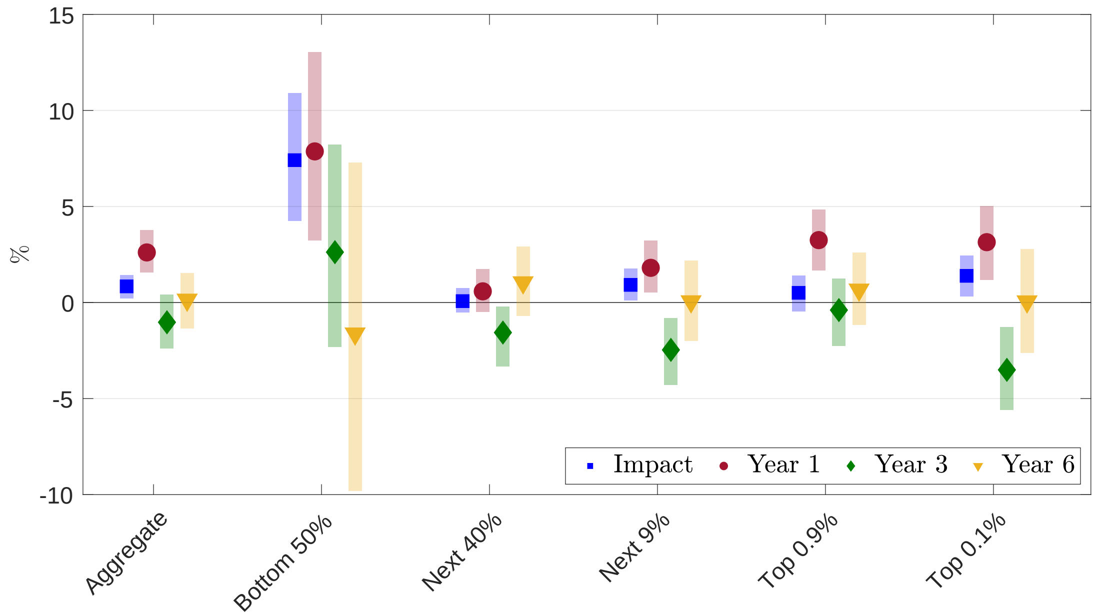


FIGURE 7. Change in net wealth after an asset purchase shock

Notes: The figure shows the response of real net wealth to an asset purchase shock estimated from the group-specific Bayesian VAR described in Table 2, Panel B. Net wealth is deflated using the consumer price index. Markers are median impulse responses from the posterior distribution. Intervals are 68% posterior coverage bands. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. See Figure C.1 in Appendix C for the full impulse response functions.

net wealth. For all other groups, we do not observe a significant contribution from net housing wealth, consistent with the greater diversification of their portfolios. Figure 10, Panel A, shows the implied responses of non-housing wealth (solid line with circles) and net wealth (solid line with crosses) shares. In the baseline scenario, an asset purchase shock initially increases the wealth share of the top 1%, but this effect is temporary. Excluding housing slightly alters the impact of an asset purchase shock on wealth inequality, particularly in the medium term. More specifically, the short-run rise in the top 1% non-housing wealth share is followed by a temporary decline.

Corporate equities and mutual funds. An asset purchase shock raises corporate equities and mutual funds across the distribution for about three years (Figure 9, Panel B, first row). For the top 10%, the response of these assets explains the short-run increase and subsequent medium-run decline in net wealth, particularly for the next 9% (Figure 9, Panel B, second row). As with the interest rate shock, excluding corporate equities and mutual funds alters the effects of an asset purchase shock on inequality (Figure 10,

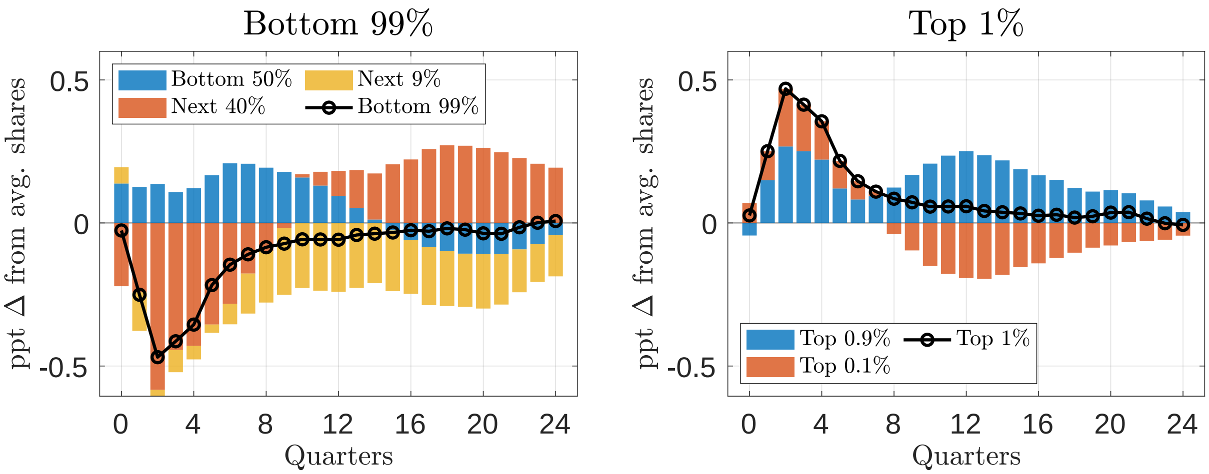


FIGURE 8. Change in wealth shares after an asset purchase shock

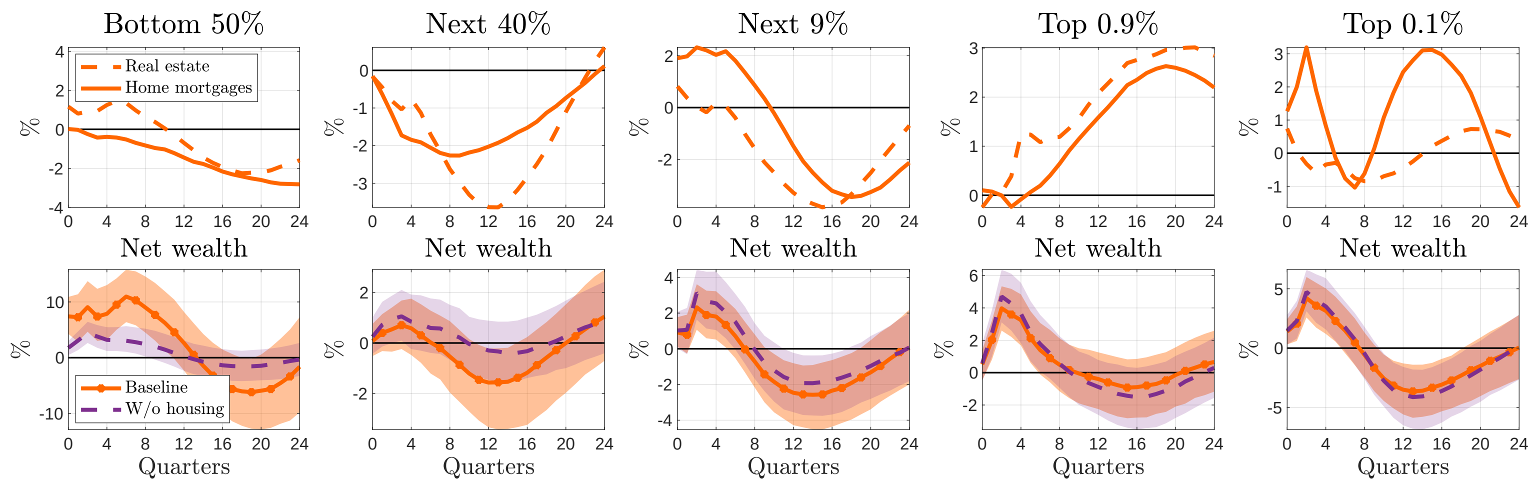
Notes: The figure shows the implied response of wealth shares to an interest rate shock. Implied changes in wealth shares are expressed in deviation from their sample averages and using the median impulse response. See Section 4.2 for more details in the derivation of changes in wealth shares.

Panel B). When these assets are excluded from net wealth, the short-run increase in the wealth share of the top 1% is less pronounced than in the baseline (compare solid line with circles with that with crosses). In the medium run, however, the exclusion causes an asset purchase shock to raise inequality even at longer horizons. This pattern reflects the fact that corporate equities and mutual funds respond positively in the short run but temporarily decline in the medium run.

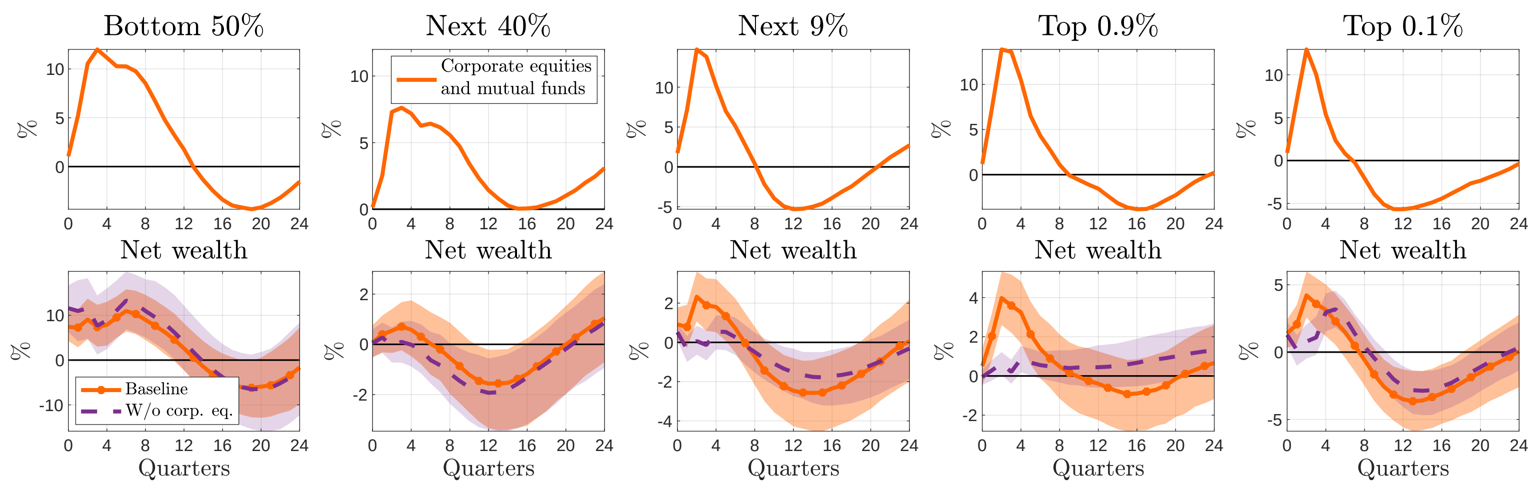
The results presented in this section provide new evidence on the impact of unconventional monetary policy on wealth inequality. Our findings on the effects of asset purchase shocks are consistent with Greenwald et al. (2021), who show that the secular decline in long-term real interest rates has increased financial wealth inequality because wealthier households hold long-duration assets. One notable finding concerns the heterogeneous response of mortgages to an asset purchase shock. Such a shock leads to a permanent decline in home mortgages for the bottom 90% and an increasefor the top 10%. A likely explanation for these divergent responses lies in the segmentation of the U.S. mortgage market. Numerous studies have shown that this segmentation makes the transmission of monetary policy heterogeneous across mortgages with different characteristics, such as whether they are guaranteed and their loan-to-value ratios. For example, Di Maggio, Kermani, and Palmer (2020) show that, after the start of unconventional monetary policies, refinancing activity rose and interest payments fell more for QE-eligible mortgages than for others. As documented by Fuster and Willen (2010), changes in mortgage rates following the announcement of QE1 ranged from negative to positive, reflecting factors such as borrowers' credit scores, loan-to-value ratios, and other loan or property characteristics. They also document a shift in refinancing toward borrowers with high credit scores. Access to refinancing also varies along other dimensions of inequality, including income (Agarwal et al. 2024) and race (Gerardi, Willen, and Zhang 2023), with low-income, Black, and Hispanic households benefiting far less from refinancing than high-income, white, and Asian households. Although we cannot observe credit scores, loan-to-value ratios, or other borrower characteristics across the wealth distribution, it is plausible that low-credit-score, low-income, and minority borrowers fall predominantly outside the top 10% of the wealth distribution. Thus, our finding of heterogeneous effects of an asset purchase shock on mortgages across the wealth distribution likely reflects the degree of segmentation in the mortgage market.

Overall, our results provide new insights into the effects of different types of monetary policy on wealth inequality. A clear stylised fact emerges: while an interest rate shock leads to persistent increase in the top 1% wealth share, an asset purchase shock induces cyclical fluctuations that dissipate over time. Monetary policy also influences the dynamics of wealth shares beyond the top 1% versus bottom 99% divide, suggesting that such shocks can have lasting effects on the broader wealth distribution. We reach the same conclusion when using alternative measures of monetary policy shocks and when increasing the lag length of the model, as shown in Section 5.[16]

[16] At first glance, the persistent effects of monetary policy on inequality may seem surprising, as wealth inequality is generally thought to be driven by structural factors (e.g., demographics). Bayer, Born, and Luetticke (2024), however, show that in a heterogeneous agents New Keynesian model, monetary policy shocks can have long-lasting effects on income and wealth inequality. Their model features capacity utilisation, sticky wages, frictional labour markets, and progressive taxation. The impulse responses from the estimated model suggest that the effects of monetary policy shocks on the wealth share of the top 10% persist for more than 40 quarters.



A. Housing wealth channel



B. Corporate equities and mutual funds channel

FIGURE 9. Asset purchase shock: channels

Notes: The figure shows the impulse response functions to an asset purchase. Baseline refers to the response of net wealth. W/o housing refers to the response of non-housing wealth (net wealth net of real estate and home mortgages) in Panel A. W/o corp. eq. refers to the response of net wealth net of corporate equities and mutual funds in Panel B. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid and dashed lines are median impulse responses from the posterior distribution. Shaded areas are 68% posterior coverage bands.

5. Sensitivity analysis

In this section, we discuss some potential pitfalls of the econometric methodology we use and show that the results are robust to deviations from our baseline specification.

Interest rate shock. The method adopted by Jarociński and Karadi (2020) to isolate pure monetary policy surprises assumes a non-negative response of stock prices. Because stocks are an important component of household wealth, the assumption implies a specific response of wealth to the shock. We test the robustness of our findings to this assumption by using alternative measures of interest rate surprises. Specifically, we use the surprise series of Gertler and Karadi (2015), Miranda-Agrippino and Ricco (2021), and Aruoba and Drechsel (2022). Based on these alternative measures of interest rate shocks, the results remain largely unchanged as shown in Figure D.3 in Appendix D.

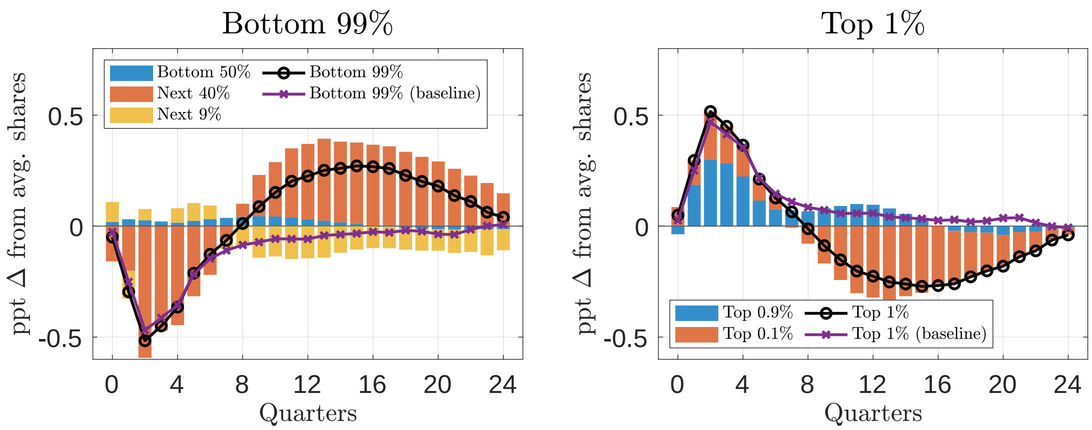
Asset purchase shock. The large-scale asset purchase factor of Swanson (2021) takes nonzero values in the years before the Great Recession, when the Federal Reserve did not rely on unconventional policy. To rule out the possibility that our results are driven by fluctuations in the large asset purchase factor before 2008, we set the factor to zero for the quarters before 2008. Figure D.1 and Figure D.2 in the Appendix D.1 show that neither the macroeconomic nor the distributional effects of an asset purchase shock are driven by pre-2008 fluctuations in the factor.

Model specification. To rule out that our medium-run estimates of the distributional effects of monetary policy are sensitive to using a VAR model, we increase the lags of the model and use local projections as robustness check. Figure D.4 shows that our baseline results are robust to increasing the VAR lag length to 6 and 8. As a further check, we estimate the dynamic effects of monetary policy shocks using local projections.[17] Figure D.6 shows that our findings are robust to using local projections.

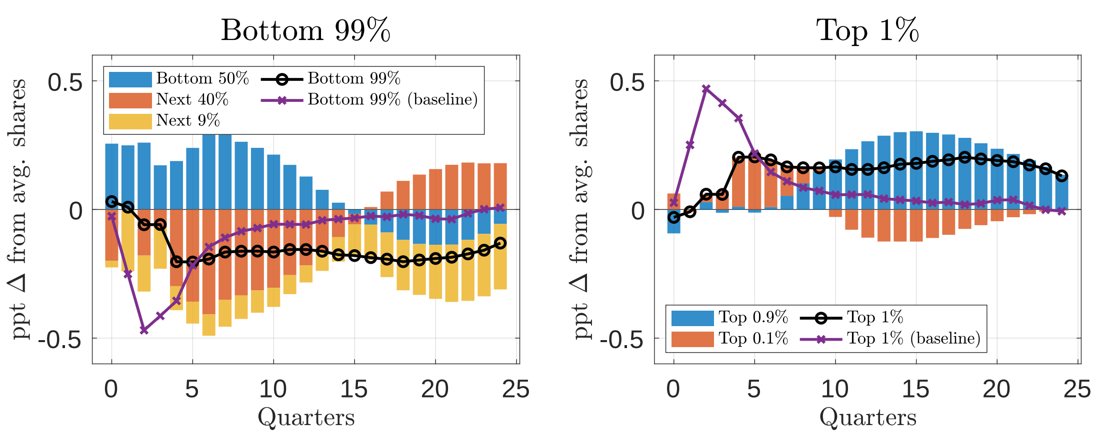
6. The wealth reversal

An important result from the previous section is the wealth reversal observed at the bottom of the wealth distribution following an interest rate shock. Figure 11 zooms

[17] Local projections are an alternative and popular method of estimating the dynamic impulse response to a shock of interest. We use traditional (Jordà 2005) and smooth (Barnichon and Brownlees 2019) local projections (see Appendix D.4 for more details).



A. Housing wealth channel



B. Corporate equities and mutual funds

FIGURE 10. Asset purchase shock and wealth inequality: channels

Notes: The figure shows the implied response of wealth shares to an asset purchase shock. In Panel A, vertical bars and solid lines with circles are changes in wealth shares with wealth defined as non-housing wealth (net wealth net of real estate and home mortgages). In Panel B, vertical bars and solid lines with circles are changes in wealth shares with net wealth defined as total assets minus all debts and liabilities, net of corporate equities and mutual funds (Panel B). In both panels, Solid lines with crosses are changes in wealth shares with net wealth defined as total assets minus all debts and liabilities (baseline). Implied changes in wealth shares are expressed in deviation from their sample averages and using the median impulse response. See Section 4.2 for more details in the derivation of changes in wealth shares.

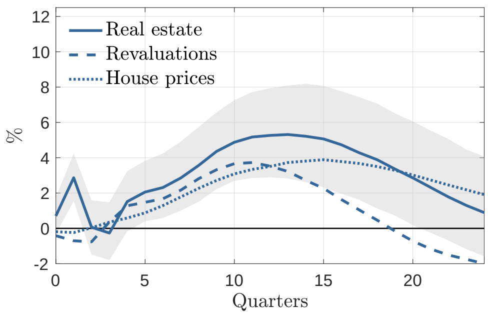
in the dynamics of this reversal. After a shock, real estate holdings rise for about 12 quarters before gradually returning toward their pre-shock level (panel A, solid line). The response of home mortgages is more sluggish (panel B, solid line), but its response surpasses that of real estate and remains significantly positive throughout the impulse response horizon. Because housing is the largest component of wealth for households at the bottom of the distribution, the interaction between the responses of real estate and home mortgages translates into short-run wealth growth and the medium-run reversal shown earlier. This can be seen more clearly in panel C, where we overlay the response of housing net wealth (real estate net of home mortgages) with that of total net wealth.[18] The initial rise in total net wealth is driven by higher housing net wealth, which in turn reflects the jump in real estate holdings. Later, the stronger rise in home mortgages dominates, compressing housing net wealth and thus total net wealth. This mechanism underlies what we term the wealth reversal at the bottom of the wealth distribution.

The wealth reversal can be interpreted through the lens of the financial accelerator hypothesis (Bernanke, Gertler, and Gilchrist 1999). An expansionary monetary shock lowers the external finance premium and the cost of borrowing by raising house prices and homeowners' housing wealth. Panel A of Figure 11 shows that the response of real estate captures both revaluations (due to house price changes) and net investment (purchases or divestment). The dashed line isolates real estate revaluations while the dotted line shows the response of real house prices.[19] Revaluations and house prices rise with a lag of about four quarters before gradually reverting, suggesting that the initial jump in real estate is partly driven by new investment activity stimulated by lower rates and stronger housing market conditions. Beyond the initial surge, the dynamics of real estate, revaluations, and house prices are qualitatively similar, although the latter reverts faster. Lower borrowing costs and higher housing net wealth may encourage households to extract equity through home equity loans. Indeed, panel B shows that

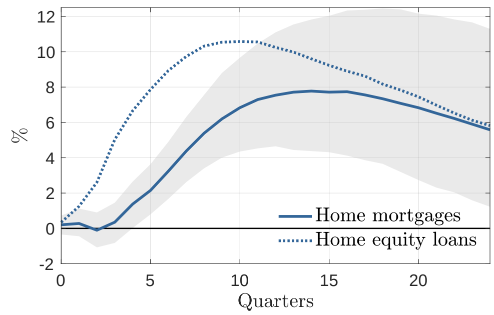
[18]To obtain the impulse response of housing net wealth, we first compute the dollar changes in real estate and home mortgages implied by their respective impulse responses. The dollar change in housing net wealth is then calculated as the difference between the two. Finally, we express the impulse response of housing net wealth as $IRF_h = {}^{w_h}/_{w} - 1$, where$w_h$ denotes real housing net wealth h periods ahead (derived from the impulse responses of real estate and home mortgages) and w is the average real housing net wealth over the estimation sample (see also equation 5).

[19]To obtain revaluations, or capital gains, we use Table R.101 of the Financial Accounts. This table reports changes in aggregate household net wealth arising from holding gains and losses across all assets on the household balance sheet, including real estate. We allocate the aggregate revaluations of real estate holdings to the bottom 50% of the wealth distribution using their share of total real estate assets as weights. These revaluations are then cumulated over time to construct a measure of the stock of real estate reflecting valuation changes only. The resulting series is subsequently used to estimate impulse responses within a group-level VAR, in which real estate assets are replaced by revaluations.

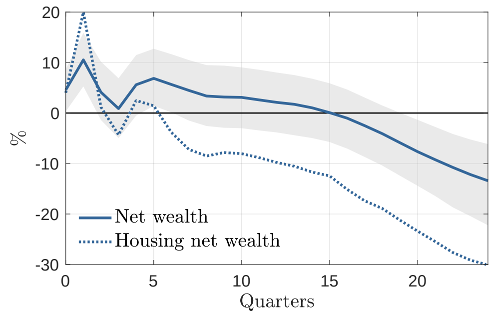
home equity loans increase in response to an interest rate shock, earlier and more sharply than total home mortgages, which include them.[20]



A. Real estate



B. Home mortgages



C. Net wealth

FIGURE 11. The wealth reversal at the bottom 50%

Notes: The figure shows impulse response functions to an interest rate shock. Panel A reports median posterior impulse responses of real estate (solid line, with 68% posterior coverage bands), revaluations (dashed line), and house prices (dotted line). Panel B reports median posterior impulse responses of home mortgages (solid line, with 68% posterior coverage bands) and home equity loans (dotted line). Panel C reports median posterior impulse responses of net wealth (solid line, with 68% posterior coverage bands) and the implied response of housing net wealth (dotted line).

While the DFA provide a valuable starting point for estimating the distributional effects of monetary policy, their group-level structure introduces an important limitation. Changes in wealth by percentile groups may conflate two mechanisms: within-group changes in wealth for the same set of households and between-group (composition)

[20]Home equity loans are defined as the sum of home equity lines of credit and loans secured by junior liens. To estimate home equity loans for the bottom 50% of the wealth distribution, we allocate the aggregate amount of home equity loans reported for the total household sector in the table B.101h Balance Sheet of Households table of the Financial Accounts. The allocation uses the bottom 50%'s share of total mortgages as weights. The resulting series is then used to estimate impulse responses within a group-level VAR, in which home mortgages are replaced by home equity loans.

effects, where households become poorer or richer and move across the wealth distribution. Therefore, relying solely on the DFA does not allow us to determine whether our estimates reflect the effect of monetary policy on the same group of households or the effects of mobility across groups.

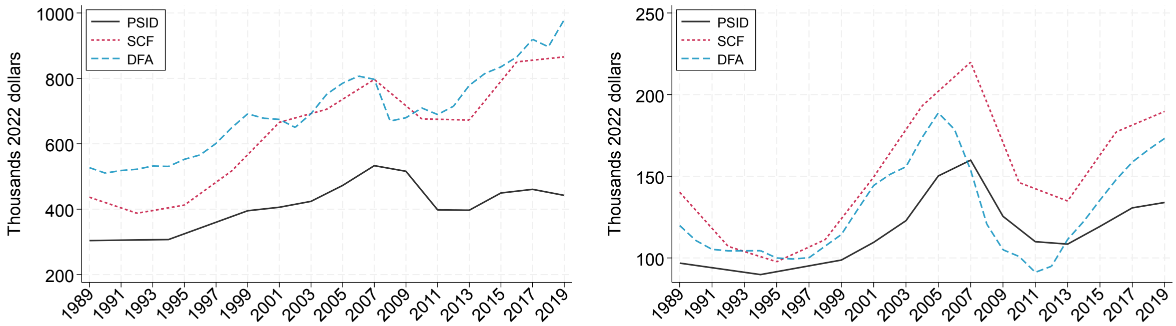
6.1. Household-level evidence on the wealth reversal

To better understand how monetary policy affects wealth dynamics at the household level, we require panel data. Unfortunately, the Survey of Consumer Finances (SCF), the gold standard for measuring household wealth and inequality and the survey underlining the DFA, lacks this structure. A natural alternative is the Panel Study of Income Dynamics (PSID), which has collected wealth information since 1984. The PSID's wealth module decomposes net wealth into nine components, including equity in the main home, business and farm ownership, investments, and debts outside mortgages or auto loans.

Two key sets of differences emerge when comparing the PSID and the SCF (Insolera, Simmert, and Johnson 2021; Cooper, Dynan, and Rhodenhiser 2019; Pfeffer et al. 2016). First, the SCF oversamples wealthy households, which is essential for understanding the dynamics of wealth concentration. The SCF also devotes more interview time to assets and liabilities relative to the PSID. Second, the SCF provides a more detailed breakdown of assets and liabilities, capturing highly concentrated assets, such as business ownership. Differences in business asset estimates largely explain the gap in average wealth between the two surveys. Other differences stem from the PSID's less detailed categories (e.g., "other assets") and lower reported balances for checking, savings, and investment accounts (Pfeffer et al. 2016). A further difference is that pension assets are completely excluded from the PSID (except for IRAs), while the SCF includes defined-contribution (DC) retirement accounts, such as 401(k)s. Given the growing importance of DC pensions, this omission helps explain the widening gap in estimated net wealth (Cooper, Dynan, and Rhodenhiser 2019). The DFA further augments SCF estimates by adding defined-benefit (DB) pensions and annuities, which are recorded in the national accounts but not in the SCF.

Bearing these considerations in mind, we use the PSID to examine the wealth reversal observed in the DFA from a household-level perspective. We use the PSID-SHELF Longitudinal File (Pfeffer, Daumler, and Friedman 2025). Despite its limitations for analyzing assets concentrated at the top of the distribution (such as equities), the PSID is well suited to study housing wealth, which dominates the balance sheets of middle- and lower-wealth households. Accordingly, our analysis focuses on primary home assets, mortgages, and housing net wealth, excluding secondary residences and financial assets that are either poorly captured or highly concentrated at the top. Moreover, the PSID reports only net equity in secondary residences before 2013.

Figure 12 compares average net wealth (panel A) and housing net wealth (panel B) across the PSID, SCF, and DFA. We rely on each dataset's baseline definition of wealth. In the PSID, net wealth is defined as the sum of all assets, including primary and non-primary real estate, vehicles, savings, investments, business holdings, and other assets, minus all corresponding debts. In the SCF, we use the summary measure of net worth, which encompasses a broader range of financial and pension assets. For the DFA, we compute average net wealth by aggregating wealth across all groups and dividing by the total number of households. Both the SCF and the DFA yield higher average wealth levels across all years, with the gap relative to the PSID widening over time, likely reflecting rising pension wealth and growing concentration at the top, both of which are underrepresented in the PSID. By contrast, the gap in housing net wealth is much smaller. The DFA series exhibits somewhat larger cyclical fluctuations, possibly due to the interpolation method used to construct higher-frequency estimates, but overall the three measures show a broadly similar pattern.



A. Net wealth, average

B. Housing net wealth, averages

FIGURE 12. PSID-SCF-DFA comparison

Notes: The figure plots average net wealth (Panel A) and housing net wealth (Panel B) using data from the Panel Study of Income Dynamics (PSID), the Survey of Consumer Finances (SCF), and the Distributional Financial Accounts of the United States (DFA). In the PSID, net wealth is defined as the sum of home equity in the primary residence, real estate holdings other than the primary home (net of debts), farm and business holdings (net of debts), savings, investment funds, vehicle holdings (net of debts), and other assets, net of all remaining debts. For the SCF and DFA, we use the reported measure of net wealth. Housing net wealth is defined as home equity in primary home in the PSID and SCF, and real estate net of home mortgages (including property other than the primary residence) in the DFA. Average SCF values are obtained from the SCF Interactive Chartbook.

We use all available waves of the PSID between 1999 and 2019. We exclude pre-1999 waves because the wealth module was collected only every four years. We impose minor sample restrictions, that is we focus on a dataset of family-unit heads aged between 20 and 90 years old, for whom we can observe at least one component of wealth and who are followed for at least four consecutive waves. This setup allows us to trace household wealth responses over the same horizon as the impulse response functions obtained using the DFA and VAR models.

Our empirical model follows Holm, Paul, and Tischbirek (2021), who study the effects of monetary policy on various household-level outcomes across the liquid asset distribution using administrative data for Norway. We divide households into groups and estimate separate impulse responses for each wealth group. A household i is allocated to group g in period t if its net wealth in $t-1$ lies between the $g-1$-th and g-th percentiles of the distribution. Ordering households according to lagged net wealth ensures that group allocation is unaffected by the contemporaneous monetary policy shock, thus avoiding the problem of mobility across wealth groups. It is important to stress that, due to differences in wealth definitions and population, there is no direct correspondence between PSID and DFA wealth groups. Therefore, we consider a partition that helps illuminate wealth dynamics for groups that are arguably more exposed to housing wealth. We consider the following wealth groups: 0–25, 25–50, 50–75, 75–90, and 90–100. For each wealth group g, we estimate the following local projections:

$$y_{i,t+h} = \delta_i^h + \beta_g^h \hat{s}_t^R + \sum_{k=1}^{K} \gamma_{g,k}^h X_{i,t-k} + u_i^h \quad \forall i \in g, \tag{7}$$

where y is a household-level outcome variable, δ is a constant, $\hat{s}_t^R$ is the interest rate shock, and $X_{i,t-k}$ includes controls such as one lag of the shock, three lags of y, and 10-year age group dummies to capture life-cycle effects. Because they PSID is conducted every two years, the horizons of the local projections are set to $h = 0, 2, 4, 6$ years. We cluster standard errors at the household level and report 90% confidence intervals.

Before turning to the outcome variables and results, it is useful to compare the PSID and DFA wealth groups in terms of their exposure to housing wealth. This comparison helps identify which PSID groups are most affected by the wealth reversal. In Table 3, we measure each group's exposure to housing wealth fluctuations as the ratio of housing net wealth to total net wealth, both aggregated across all households within the group. In the DFA, the bottom 50% of the wealth distribution is the most exposed to housing wealth, consistent with the evidence of a wealth reversal. In the PSID, however, the highest exposure is found among households between the 25th and 90th percentiles, and to a lesser extent among those in the top 10%. By contrast, households in the bottom 25% have little exposure to housing, largely because many hold negative equity in personal businesses, placing them at the bottom of the distribution because of negative net wealth. For these reasons, our analysis focuses primarily on households between the 25th and 90th percentiles of the wealth distribution. Nonetheless, for completeness, we also report impulse responses for all groups.

We begin by estimating a version of equation (7) in which the dependent variable is a dummy indicating whether a household holds real estate assets, regardless of whether its mortgage exceeds the property's value (underwater owners). In practice, we estimate a linear probability model to assess how an interest rate shock affects the probability of homeownership over time and across wealth groups, that is the extensive margin. For this specification, we omit the lagged dependent variable among the controls. Figure 13, panel A, shows the results. An interest rate shock increases the probability of becoming a homeowner for households below the 50th percentile. For the 25–50 group, the effect is positive during the first two years but turns marginally negative thereafter. For all higher-wealth groups, the effect is either negative or not statistically significant. Overall,

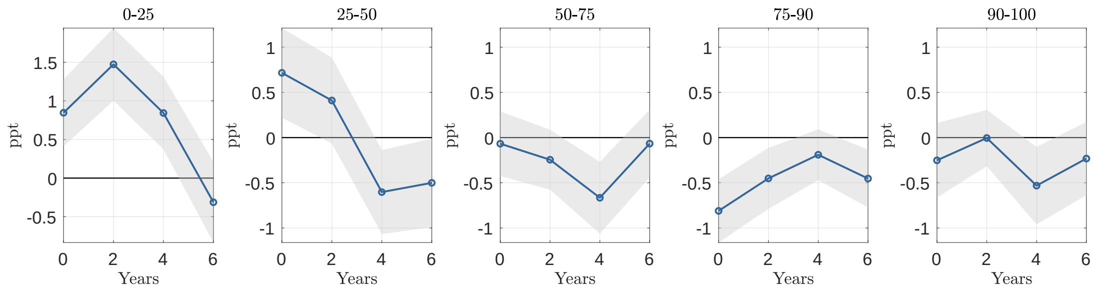
TABLE 3. Housing wealth exposure, 2019

Panel Study of Income Dynamics		**Distributional Financial Accounts**	
Wealth groups	Exposure	Wealth groups	Exposure
0–25	-0.08	0–50	0.65
25–50	0.48	50–90	0.25
50–75	0.62	90–99	0.15
75–90	0.43	99–99.9	0.14
90–100	0.20	99.9–100	0.08

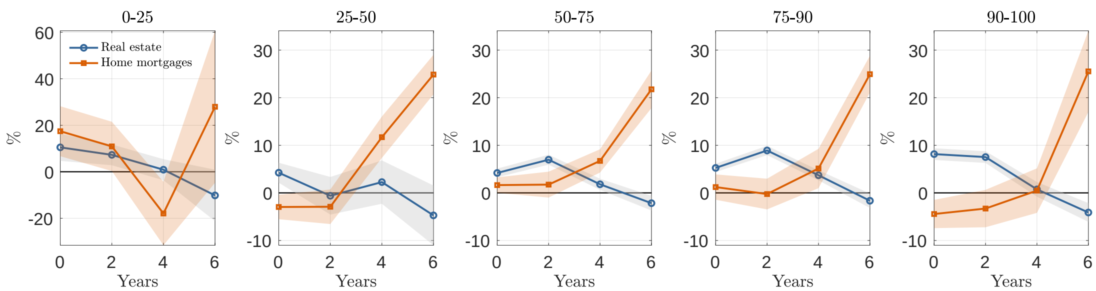
Notes: Notes: Exposure is defined as the ratio of housing net wealth to total net wealth, aggregated for each wealth group. In the Panel Study of Income Dynamics (PSID), housing net wealth is home equity in the primary residence. In the Distributional Financial Accounts (DFA), housing net wealth is real estate net of home mortgages, including property other than the primary residence. In the PSID, total net wealth is defined as the sum of home equity in the primary residence, real estate holdings other than the primary home (net of debts), farm and business holdings (net of debts), savings, investment funds, vehicle holdings (net of debts), and other assets, net of all remaining debts. For the DFA, we use the reported measure of total net wealth.

this confirms that the post-shock rise in real estate holdings observed in the DFA cannot be attributed solely to price effects. It also reflects transitions into ownership, i.e., an increase along the extensive margin.

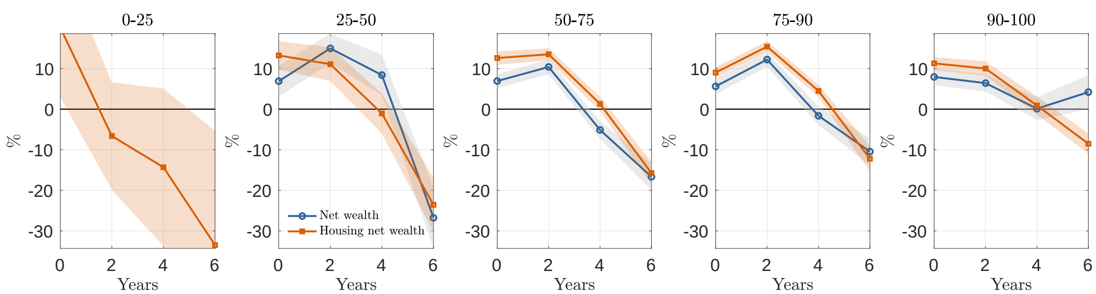
Next, we examine the intensive margin of monetary policy. We restrict the sample to households with positive housing net wealth (net homeowners) and focus on four outcome variables: real estate assets, outstanding home mortgages, housing net wealth, and total net wealth, all expressed in natural logarithms in equation (7). Conditioning on net homeowners excludes underwater households, whose responses to monetary policy have been shown to dampen expansionary effects, as additional income is typically used to deleverage rather than to increase spending or investment (Di Maggio et al. 2017). Underwater households could, in principle, mechanically amplify the initial rise in net wealth if deleveraging raises home equity. While this mechanism is interesting in its own right, our focus is on identifying the wealth reversal. In the PSID, only about 2.2% of households report negative housing net wealth, almost all concentrated in the 0–25 group. For these households, non-housing assets appear to be much more important drivers of total net wealth accumulation. For example, around 70% of homeowners in the 0–25 group have negative total net wealth, mostly due to negative equity in personal businesses. Finally, conditioning on net homeowners substantially reduces the sample size of the 0–25 group. Combined with the large mass of households near zero wealth, this may lead to imprecise estimates. For these reasons, we do not report the response of net wealth for the 0–25 group.



A. Extensive margin: homeownership rate



B. Intensive margin: real estate and home mortgages



C. Intensive margin: real estate and home mortgages

FIGURE 13. The wealth reversal: evidence from the PSID

Notes: The figures plots the effects of monetary policy estimated for each wealth group or percentile $g = [0-25, 25-50, 50-75, 75-90, 90-100]$ using the local projections in equation (7). Shaded areas are 90% confidence intervals. ppt is percentage points. Real estate is the value of primary residence. Home mortgages is the total mortgage value secured by the primary home. Net wealth is defined as the sum of home equity in the primary residence, real estate holdings other than the primary home (net of debts), farm and business holdings (net of debts), savings, investment funds, vehicle holdings (net of debts), and other assets, net of all remaining debts. Housing net wealth is home equity in the primary residence.

Figure 13, panel B, presents the results. Conditional on homeownership, real estate holdings rise following an interest rate shock for households between the 25th and 90th percentiles. As discussed earlier, this increase would reflect both net investment and revaluation effects. The response of home mortgages (which includes all mortgage balances on primary homes, including home equity loans) is initially insignificant but exceeds that of real estate between the second and fourth years after the shock, remaining positive throughout the projection horizon. Figure 13, panel C, portrays the wealth reversal: an interest rate shock boosts housing net wealth in the short run, with the peak increase occurring between the impact year and the second year after the shock, depending on the wealth group. Thereafter, the effect diminishes, and the response turns negative around four years after the shock. Although the timing of the reversal in housing net wealth is not the same as in the DFA, the results are qualitatively similar. For the wealth groups that likely overlap with the bottom 50% in the DFA, we observe a strong correlation between the responses of housing net wealth and total net wealth. For the top 10%, despite the reversal in housing net wealth, total net wealth responds positively at the end of the horizon, potentially due to the behavior of other wealth components for this group. The relative movements of net wealth across the wealth groups are particularly interesting, as they confirm, despite the use of a different dataset, that an expansionary interest rate shock ultimately leads to a rise in wealth inequality.

To sum up, household-level data also point to the importance of a wealth reversal following an expansionary interest rate shock. Lower interest rates lead to an expansion of real estate assets along both the intensive and extensive margins. This expansion eventually triggers an increase in borrowing, potentially driven by home equity loans but also by more households entering the housing market as owners, as indicated by the expansion of homeownership. The resulting rise in home mortgage balances ultimately reduces housing net wealth and, in turn, given the large exposure of these households to housing, total net wealth, contributing the increase in wealth inequality in the medium term.

7. Concluding remarks

In this paper, we provide new evidence on the effects of expansionary monetary policy on the wealth distribution in the United States. Our primary data source is the Distributional Financial Accounts, which provides quarterly estimates of the distribution of household wealth. We then use VAR models and distinguish between interest rate and asset purchase policies to estimate the distributional effects of monetary policy. Microdata from the Panel Study of Income Dynamics allow us to explore the household-level effects of monetary policy on wealth accumulation.

The distributional impact of monetary policy depends on the type of policy instrument and the composition of household wealth. Unexpected interest rate cuts initially reduce wealth inequality but increase it in the medium term, whereas asset purchase shocks raise inequality only temporarily. Monetary policy affects household balance sheets mainly through housing wealth and corporate equities, though the strength of these channels varies across the wealth distribution. For the bottom of the wealth distribution, housing wealth plays a crucial role in shaping both the level and share of total wealth, especially following an interest rate shock.

We provide novel evidence of a wealth reversal after an interest rate cut. Lower interest rates lead households in the lower part of the wealth distribution to become more likely to own homes and to expand their real estate assets, driven by both net investment in housing and revaluation effects. The monetary expansion eventually triggers an increase in borrowing, potentially due to home equity extraction but also to an increase in homeownership. The resulting rise in mortgage balances ultimately reduces housing net wealth and, given the large exposure of these households to housing, compresses total net wealth. This mechanism contributes to the medium-term increase in wealth inequality, consistent with the evidence from the Distributional Financial Accounts.

Our findings inform the debate on the distributional effects of monetary policy and macroeconomic models that place household heterogeneity at the core of the monetary policy transmission mechanism. Whether monetary policy should take distributional considerations into account in its formulation remains an open question.

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A. Distributional Financial Accounts of the United States: additional tables and charts

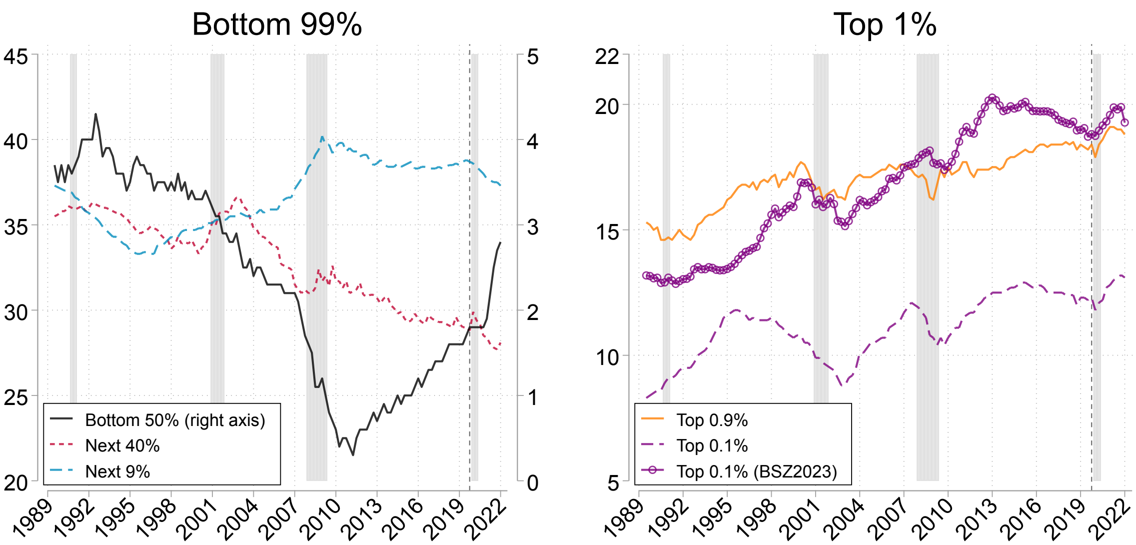


FIGURE A.1. Wealth shares (1989Q3 - 2022Q1)

Notes: The figure shows the evolution of wealth shares for the bottom 50%, next 40%, next 9%, the top 0.9%, and top 0.1% of the wealth distribution between 1989Q3 and 2022Q1. The dashed vertical lines indicate the end of the estimation sample of the empirical analysis (2019Q4). BSZ2023 refers to the series by Blanchet, Saez, and Zucman (2022). Table A.1 in Appendix C reports average wealth shares together with the distribution of balance sheet components between 1989Q3 and 2019Q4.

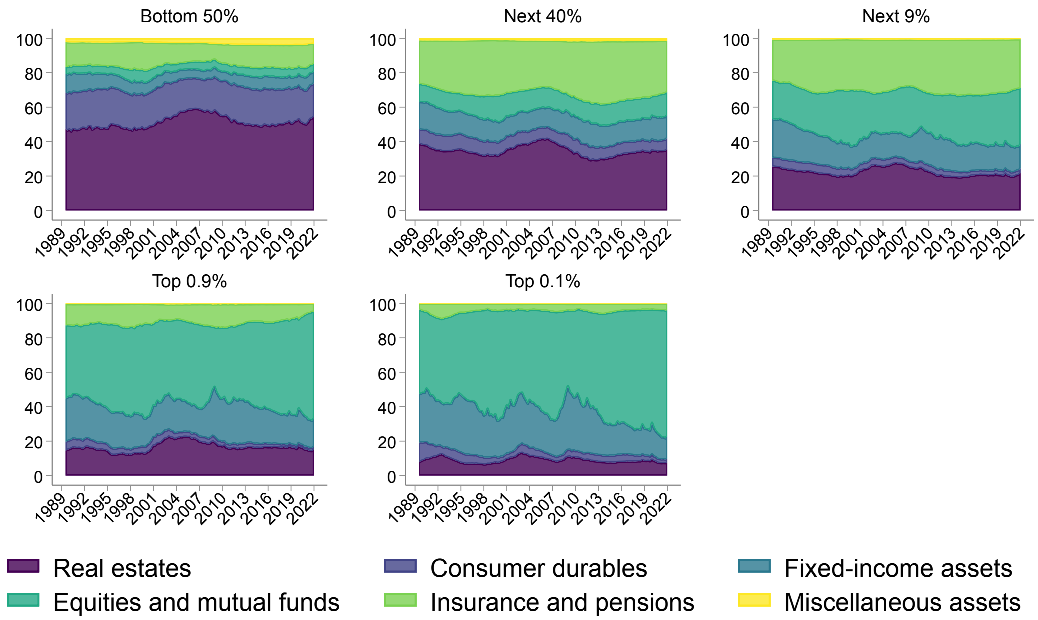


FIGURE A.2. Composition of portfolios across the wealth distribution (1989Q3 - 2022Q1)

Notes: The figure shows the composition of assets across wealth groups in the Distributional Financial Accounts. Following Bauluz, Novokmet, and Schularick (2022), we organise non-financial and financial assets in the following asset classes: real estates, consumer durable goods, fixed income assets, equities and mutual funds holdings, life insurance and pension funds, and miscellaneous assets. Fixed income assets include: checkable deposits and currency, time deposits and short-term investment, money market funds, US government and municipal securities, corporate and foreign bonds, loans. Equities and mutual funds holdings include: corporate equities, mutual fund holdings and private businesses. Insurance and pension funds include: life insurance reserves and pension entitlements.

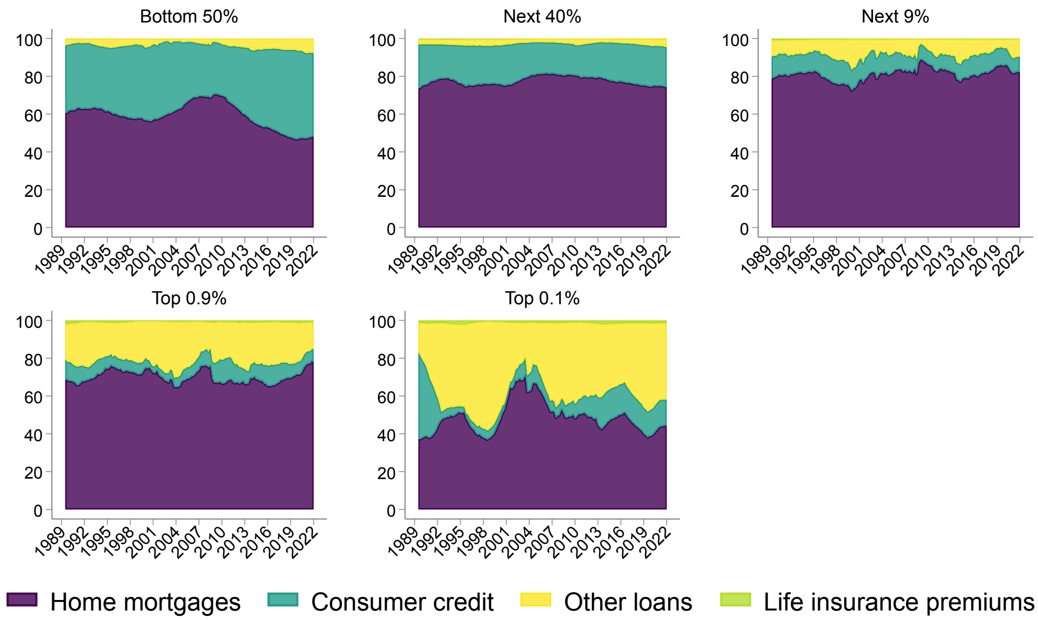


FIGURE A.3. Composition of liabilities across groups

Notes: The figure shows the composition of liabilities across the wealth distribution. Each liability type is expressed as share of total liabilities. Other loans include depository institutions loans n.e.c. and other loans and advances. Life insurance premiums include deferred and unpaid life insurance premiums.

TABLE A.1. Distribution of assets, liabilities, and wealth (1989Q3-2019Q4)

	Bottom 50%	Next 40%	Next 9%	Top 0.9%	Top 0.1%
Assets	7.07	34.59	33.83	15.01	9.49
Nonfinancial assets	15.37	44.51	27.13	9.13	3.87
Real estate	13.60	45.16	28.59	9.43	3.21
Consumer durables	22.85	41.98	20.88	7.70	6.58
Financial assets	3.00	29.72	37.14	17.90	12.24
Deposits	4.30	35.07	36.88	15.40	8.35
Corporate equities and mutual funds	1.19	15.61	35.87	27.69	19.65
Private businesses	1.76	17.14	31.99	27.05	22.06
Pension entitlements	3.43	45.18	43.22	6.65	1.53
Other assets	5.23	24.07	29.95	21.62	19.13
Liabilities	33.58	43.61	17.97	4.13	0.71
Home mortgages	28.11	47.15	20.26	4.01	0.47
Consumer credit	52.98	37.21	8.07	1.40	0.35
Other liabilities	23.00	23.96	29.29	18.26	5.48
Net wealth	2.34	33.01	36.66	16.94	11.05

Notes: The table shows average shares of wealth, assets, liabilities and their components owned or by each wealth group. The table report simple averages between 1989Q3 and 2019Q4. Other assets include US government and municipal securities, corporate and foreign bonds, loans, life insurance reserves, and miscellaneous assets. Similarly, the other liabilities are include depository institutions loans n.e.c., other loans and advances, deferred and unpaid life insurance premiums.

B. Econometric methodology: additional results and details

B.1. Bayesian VAR

We estimate the following VAR model using Bayesian techniques and standard macroeconomic priors:

$$\underset{n\times 1}{\mathbf{y}_t} = \underset{n\times 1}{\mathbf{c}} + \sum_{j=1}^{p} \underset{n\times n}{\mathbf{B}_j} \mathbf{y}_{t-j} + \underset{n\times 1}{\mathbf{u}_t} \quad \text{with} \quad \mathbf{u}_t \sim \mathcal{N}\left(\underset{n\times 1}{\mathbf{0}}, \underset{n\times n}{\boldsymbol{\Sigma}}\right) \tag{B.1}$$

where $\mathbf{y}_t$ is a $(n \times 1)$ vector of endogenous variables, $\mathbf{c}$ is a $(n \times 1)$ constant vector, $\mathbf{B}_j$ are $(n \times n)$ matrices of parameters with $j = 1, \ldots, p$, $\mathbf{u}_t$ is a $(n \times 1)$ vector of innovations with zero mean and variance-covariance matrix $\boldsymbol{\Sigma}$. Time is indexed by $t = 1, \ldots, T$, each time period is a quarter, and the lag length is $p = 4$. We estimate VAR coefficients using a Normal-Inverse Wishart prior, which takes the following form:

$$\Sigma \sim \mathcal{W}^{-1}(\Psi, \nu) \tag{B.2}$$

$$\beta|\Sigma \sim \mathcal{N}(b, \Sigma \otimes \Omega) \tag{B.3}$$

where β is a vector containing all the VAR parameters ($\beta \equiv vec([c, B_1, \ldots, B_p]^{'})$. Ψ is diagonal with elements ψ_i which are chosen to be a function of the residual variance of the regression of each variable on its own first p lags, and the degrees of freedom of the Inverse-Wishart are set so that the mean of the distribution exists and is equal to $\nu = n + 2$. In addition, the parameters in equation (B.2) are specified acoording to the moments for the distribution of the coefficients in the VAR model (B.1) defined by the Minnesota priors:

$$\mathbb{E}\big[(B_i)_{jk}\big] = \begin{cases} \delta_j & i = 1, j = k \\ 0 & otherwise \end{cases} \qquad \mathbb{V}ar\big[(B_i)_{jk}\big] = \begin{cases} \frac{\lambda^2}{i^2} & j = k \\ \frac{\lambda^2}{i^2}\frac{\sigma_k^2}{\sigma_j^2} & otherwise \end{cases} \tag{B.4}$$

where $(B_i)_{jk}$ represents the element in row (equation) j and column (variable) k of the matrix of coefficients B at each i lag, with $i = 1, \ldots, p$. In the case of $\delta_j = 1$, then the random walk prior is strictly imposed on all variables; however, for those variables for which this prior is not suitable we set $\delta_j = 0$. The variance of the elements in B_i is assumed to be proportional to the relative variance of the variables and to the inverse of the square of the lag (i^2). Finally, the hyperparameter λ, which controls the overall tightness of the priors, is set according to Giannone, Lenza, and Primiceri (2015), which treats it as an additional parameter of the model that is estimated in spirit of the hierarchical modeling.

B.2. Unit-variance shock estimation and invertibility test

A shock is invertible if it is a linear combination of contemporaneous VAR residuals. To test the validity of this assumption, we use the theoretical result of Forni, Gambetti, and Ricco (2022), which shows that if the shock is not invertible, then it is a function of current and future VAR residuals. Formally, the test is performed by projecting the instrument (z_t) on the current value and the first r leads of the Wold residuals u_t:

$$z_t = \sum_{k=0}^{r} \lambda_k^{'} u_{t+k} + \nu_t \tag{B.5}$$

The invertibility test is an F-test for the significance of the r leads, where the null hypothesis is $H_0 : \lambda_1 = \cdots = \lambda_r = 0$ against the alternative that at least one of the coefficients is nonzero. We estimate the regression in equation (B.5) using different numbers of leads $(1 \leq r \leq 6)$

If the invertibility assumption holds, which is the case in our Proxy VAR, the Wold residuals, say u_t, can be written as a linear combination of the structural shocks, say ϵ_t. The external instrument identification allows us to obtain covariance restrictions from proxies for the latent structural shock of interest, in line with the relevance and exogeneity conditions (see Stock and Watson 2018). We proceed with the first-stage regression by projecting the instrument z_t onto the Wold residuals. Formally:

$$z_t = \lambda' u_t + \nu_t \tag{B.6}$$

Forni, Gambetti, and Ricco (2022) show that if the shock is fundamental we can obtain an estimate of the standardized unit-variance structural shock i as:

$$\hat{\epsilon}_{it} = \frac{\hat{\lambda}\hat{u}_t}{std(\hat{\lambda}'\hat{u}_t)} \tag{B.7}$$

Table B.1 presents the results of the test by showing the p-values over different specifications of the test. The p-values are very large and therefore we cannot reject the null of invertibility for all values of r.

TABLE B.1. Invertibility test.

	Number of leads r					
	$r = 1$	$r = 2$	$r = 3$	$r = 4$	$r = 5$	$r = 6$
p-value	0.775	0.922	0.946	0.915	0.769	0.799

Notes: The table shows the p-values for each regression including the current value and up to r leads of the Wold residuals. The null hypothesis is invertibility, i.e., $H_0 : \lambda_1 = \lambda_2 = \cdots = \lambda_r = 0$.

B.3. Building an informationally-robust asset purchase shock

To build an informationally-robust asset purchase shock, we follow Miranda-Agrippino and Ricco (2021) and *purge* the large-scale asset purchase factor of Swanson (2021) according to a two step procedure.

(a) To control for the private information of the Federal Reserve, we project the large-scale asset purchase factor on Greenbook forecasts and on forecast revisions for real output growth, inflation (GDP deflator), and the unemployment rate at FOMC meeting frequency. We rely on the GDP deflator to measure inflation and use only nowcasts for the unemployment rate. These controls are collected in the vector x in the following regression:

$$MPF_m = \alpha_0 + \sum_{i=-1}^{3} \beta_i \underbrace{F_m^{cb} x_{q+i}}_{\text{Forecast}} + \sum_{i=-1}^{2} \phi_i \underbrace{\left[F_m^{cb} x_{q+i} - F_{m-1}^{cb} x_{q+i}\right]}_{\text{Forecast revisions}} + \widehat{MPF}_m \tag{B.8}$$

where $F_m^{cb} x_{q+i}$ denotes Greenbook forecasts for the vector of variables x at horizon $q+i$ that are produced prior to each meeting, and $F_m^{cb} x_{q+i} - F_{m-1}^{cb} x_{q+i}$ denotes revisions to forecasts between consecutive FOMC meetings.

(b) To account for the slow absorption of information by economic agents, we aggregate the residual series from the equation above $\widehat{MPF}_m$ to a quarterly frequency and estimate the following regression:

$$\widehat{MPF}_t = \alpha + \sum_{j=1}^{4} \psi_j \widehat{MPF}_{t-j} + \hat{s}_t^{LSAP} \tag{B.9}$$

The series of residuals $\hat{s}_t^{LSAP}$ is then used as internal instrument in the VAR.

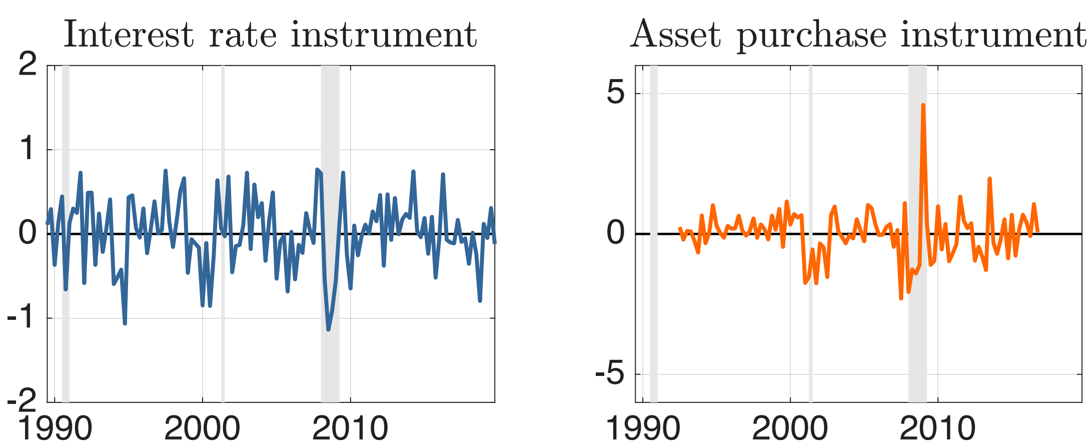
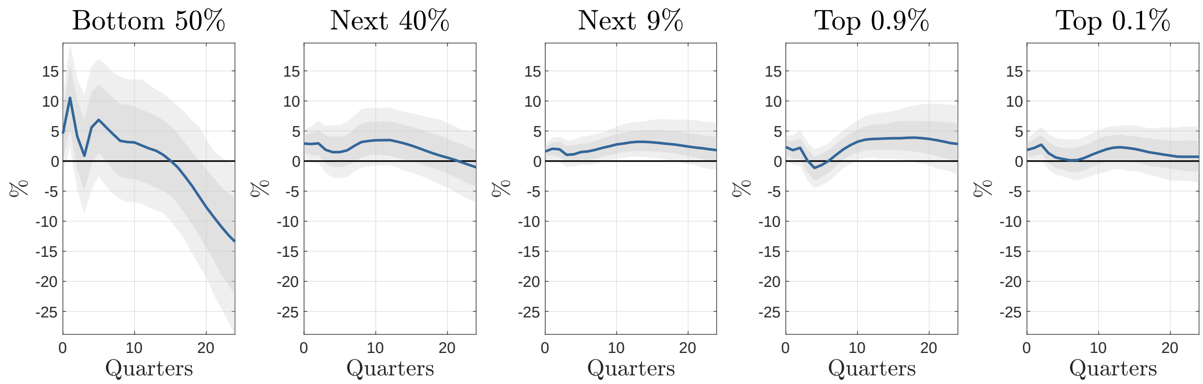


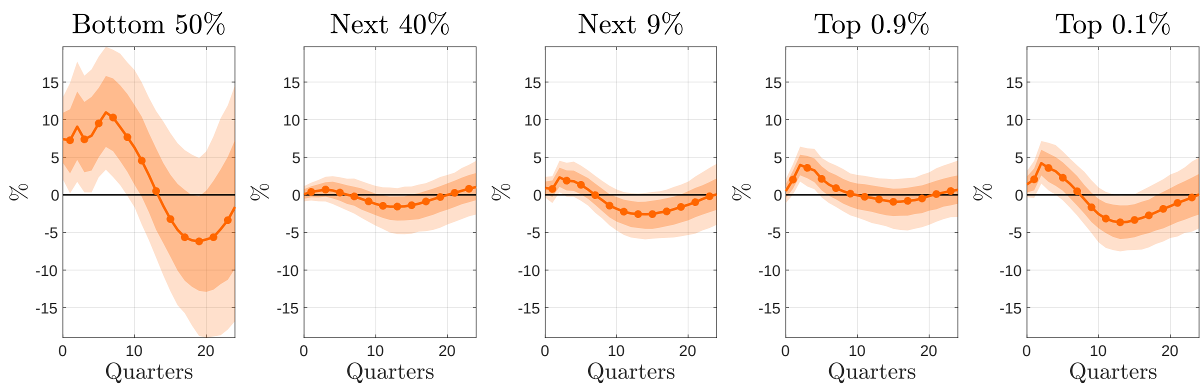
FIGURE B.1. Shocks

Notes: This figure plots the monetary policy shocks used as internal instruments in the VAR models (see Section 3 for more information).

C. Macroeconomic and distributional effects of monetary policy: additional results



A. Interest rate shock



B. Asset purchase shock

FIGURE C.1. Effects of monetary policy on net wealth

Notes: The figure shows the impulse response functions to an interest rate (solid line) and an asset purchase (solid line with markers) shock estimated using the Bayesian VAR described in Table 2, Panel B. Net wealth is deflated using the consumer price index. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands.

TABLE C.1. Implied changes in wealth levels and shares: interest rate shock

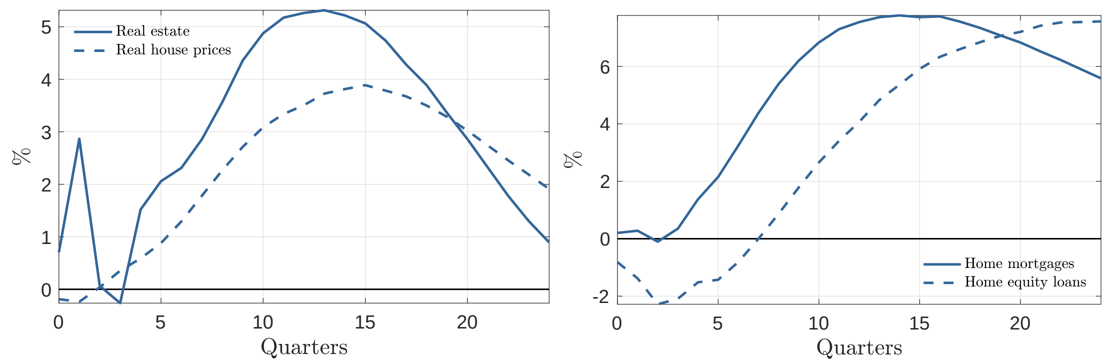
	Bottom 50%	Next 40%	Next 9%	Top 0.9%	Top 0.1%
IMPACT					
Percent change (IRF_{ih}, %)	4.58	2.91	1.60	2.34	1.84
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	59.80	589.10	370.51	250.78	129.66
Implied share (ω_{ih}, %)	2.14	32.62	36.80	17.21	11.24
Change in share ($\Delta\omega_{ih}$, p.p.)	0.05	0.21	-0.23	0.02	-0.04
1 YEAR					
Percent change (IRF_{ih}, %)	5.60	1.48	1.13	-1.14	0.60
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	73.06	299.78	260.45	-122.68	42.34
Implied share (ω_{ih}, %)	2.19	32.60	37.12	16.85	11.25
Change in share ($\Delta\omega_{ih}$, p.p.)	0.10	0.19	0.09	-0.35	-0.03
3 YEAR					
Percent change (IRF_{ih}, %)	2.11	3.49	3.12	3.67	2.22
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	27.50	706.49	721.75	393.92	156.45
Implied share (ω_{ih}, %)	2.07	32.49	36.99	17.27	11.17
Change in share ($\Delta\omega_{ih}$, p.p.)	-0.02	0.09	-0.03	0.08	-0.11
6 YEAR					
Percent change (IRF_{ih}, %)	-13.41	-1.03	1.82	2.85	0.72
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	-174.95	-208.76	420.87	305.73	50.73
Implied share (ω_{ih}, %)	1.80	31.87	37.47	17.57	11.29
Change in share ($\Delta\omega_{ih}$, p.p.)	-0.29	-0.54	0.44	0.38	0.01

Notes: For each type of monetary policy shock, wealth group and horizon, the table reports percent change in real net wealth (IRF_{ih}, %), dollar change in real net wealth ($\bar{w}_i IRF_{ih}$, billions), implied wealth share (ω_{ih}, %), and percentage point (p.p.) change in wealth share ($\Delta\omega_{ih}$, p.p.). See the main text for more information on the computation.

TABLE C.2. Implied changes in wealth levels and shares: asset purchase shock

	Bottom 50%	Next 40%	Next 9%	Top 0.9%	Top 0.1%
IMPACT					
Percent change (IRF_{ih}, %)	7.41	0.07	0.92	0.51	1.39
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	96.67	15.12	211.96	54.23	97.78
Implied share (ω_{ih}, %)	2.23	32.19	37.08	17.15	11.35
Change in share ($\Delta\omega_{ih}$, p.p.)	0.14	-0.22	0.06	-0.04	0.07
1 YEAR					
Percent change (IRF_{ih}, %)	7.87	0.58	1.81	3.25	3.14
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	102.62	117.84	417.31	348.62	221.23
Implied share (ω_{ih}, %)	2.21	31.98	36.98	17.42	11.42
Change in share ($\Delta\omega_{ih}$, p.p.)	0.12	-0.43	-0.05	0.22	0.13
3 YEAR					
Percent change (IRF_{ih}, %)	2.62	-1.56	-2.47	-0.39	-3.50
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	34.20	-316.15	-569.82	-42.26	-246.79
Implied share (ω_{ih}, %)	2.18	32.49	36.79	17.44	11.09
Change in share ($\Delta\omega_{ih}$, p.p.)	0.09	0.09	-0.24	0.25	-0.19
6 YEAR					
Percent change (IRF_{ih}, %)	-1.62	1.04	0.06	0.66	0.05
Dollar change ($\bar{w}_i IRF_{ih}$, bil.)	-21.13	211.25	12.82	71.30	3.61
Implied share (ω_{ih}, %)	2.05	32.60	36.88	17.23	11.24
Change in share ($\Delta\omega_{ih}$, p.p.)	-0.04	0.19	-0.14	0.04	-0.04

Notes: For each type of monetary policy shock, wealth group and horizon, the table reports percent change in real net wealth (IRF_{ih}, %), dollar change in real net wealth ($\bar{w}_i IRF_{ih}$, billions), implied wealth share (ω_{ih}, %), and percentage point (p.p.) change in wealth share ($\Delta\omega_{ih}$, p.p.). See the main text for more information on the computation.

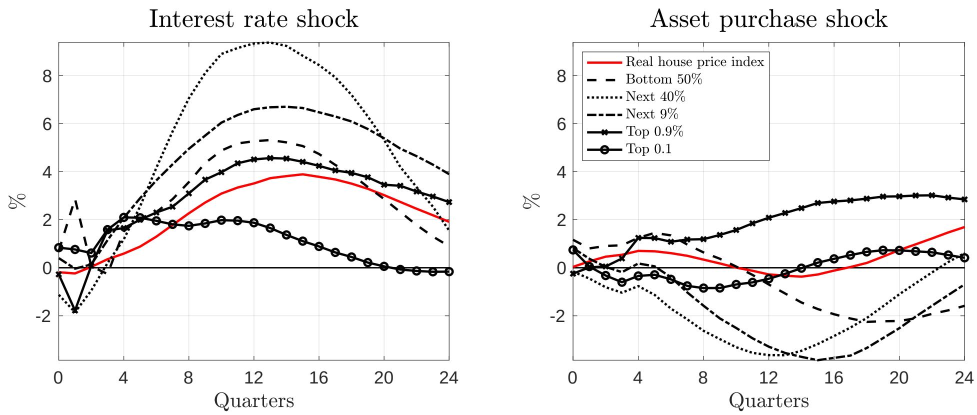


A. Assets

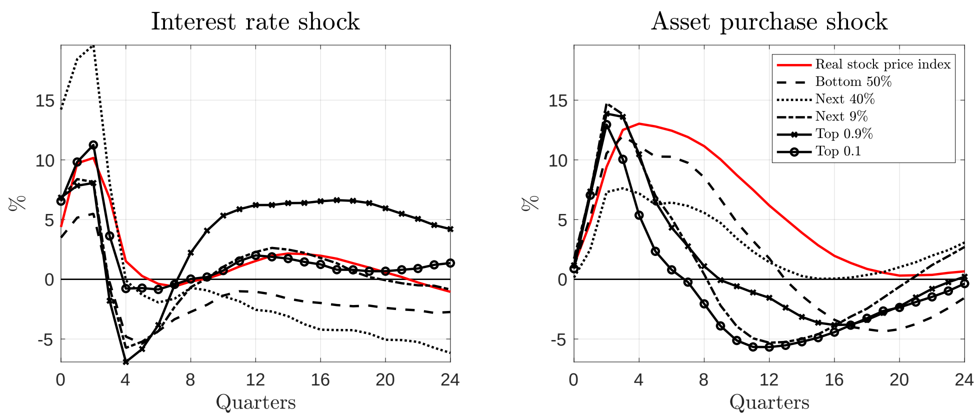
B. Liabilities

FIGURE C.2. Effects of an interest rate shock on house prices and home equity loans

Notes: The figure shows the impulse response functions to an interest rate shock estimated using the Bayesian VAR described in Table 2, Panel B (solid lines). Dashed lines are the impulse response functions to an interest rate shock of real house prices (Panel A) and home equity loans (Panel B). Real house prices are proxied by the Case-Shiller real house price index. In the DFA, home mortgages include home equity loans. We obtain an estimate of home equity loans across the wealth distribution by distributing the aggregate level of home equity loans of the household sector. We use each group's share of total mortgages as weights and estimate the impulse responses using a baseline VAR with group-level home equity loans as additional variables. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid and dashed lines are median impulse responses from the posterior distribution.



A. Real estate



B. Corporate equities and mutual funds

FIGURE C.3. Effects of monetary policy shocks on assets and price indexes

Notes: The figure shows the impulse response functions to an interest rate (Panel A) and asset purchase (Panel B) shocks estimated using the Bayesian VAR described in Table 2, Panel B (solid lines). The impulse response functions of price indexes are estimated using the Bayesian VAR described in Table 2 augmented with house and stock prices. The real house price index is the Case-Shiller house price index deflated using the CPI. The real stock price index is the S&P stock price index deflated using the CPI. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters.

D. Macroeconomic and distributional effects of monetary policy: sensitivity analysis

D.1. Restricted asset purchase shock

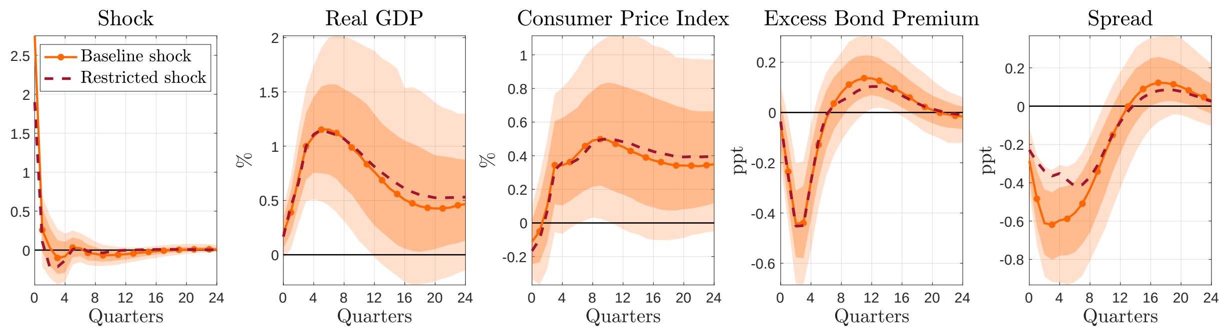


FIGURE D.1. Macroeconomic effects of an asset purchase shock: robustness

Notes: The figure shows the impulse responses to a baseline asset purchase shock (solid line with markers) and the restricted asset purchase shocks (dashed line) from a Bayesian VAR described in Table 2, Panel A. The restricted shocks restrict pre-2008 observation to zero. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid and dashed lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands. (omitted for the restricted).

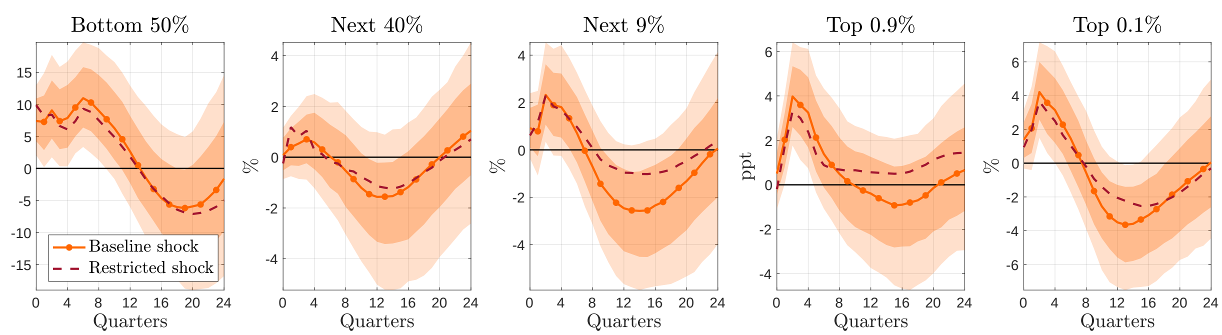


FIGURE D.2. Effects of asset purchase shock on net wealth: robustness

Notes: The figure shows the impulse responses to a baseline asset purchase shock (solid line with markers) and the restricted asset purchase shocks (dashed line) from a Bayesian VAR described in Table 2, Panel B. The restricted shocks restrict pre-2008 observation to zero. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid and dashed lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands. (omitted for the restricted).

D.2. Interest rate shocks: robustness to alternative identification assumptions

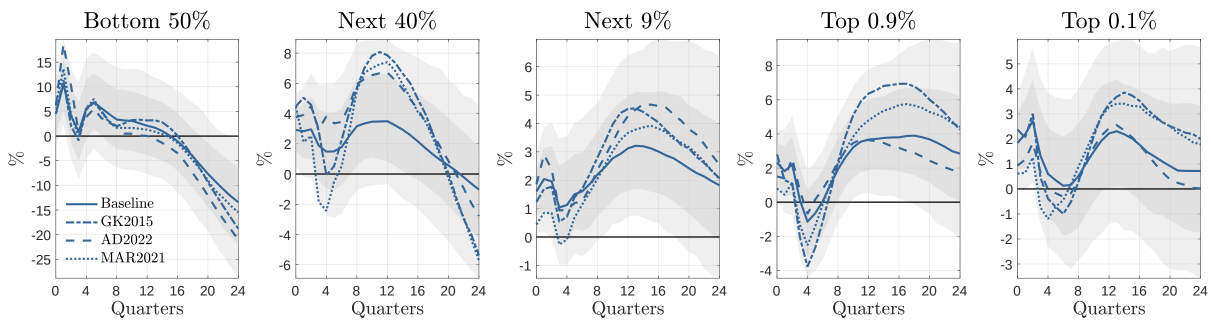
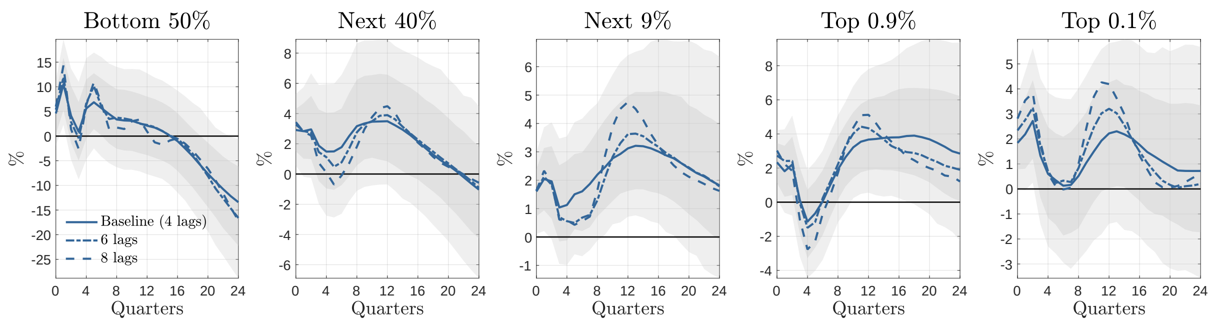


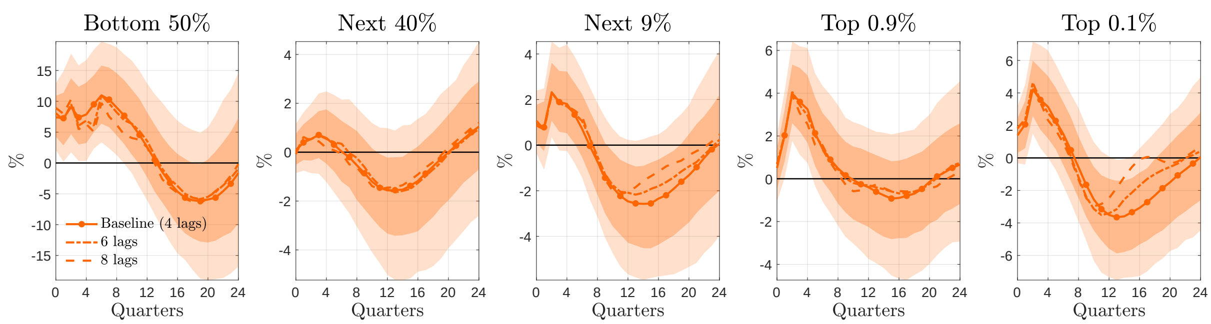
FIGURE D.3. Alternative interest rate shocks

Notes: The figure shows the impulse response functions to the baseline interest rate shock (solid line) and to alternative shocks estimated using the Bayesian VAR described in Table 2, Panel B. Baseline is Jarociński and Karadi (2020), GK2015 is Gertler and Karadi (2015), AD2022 is Aruoba and Drechsel (2022), MAR2021 is Miranda-Agrippino and Ricco (2021). For MAR2021 we use the extended series by Degasperi and Ricco (2021). Net wealth is deflated using the consumer price index. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands.

D.3. Model specification: robustness to lag length choice



A. Interest rate shock



B. Asset purchase shock

FIGURE D.4. Effects of monetary policy on net wealth: robustness

Notes: The figure shows the impulse response functions to an interest rate (solid line) and an asset purchase (solid line with markers) shock estimated using the Bayesian VAR described in Table 2, Panel B. Baseline refers to the model with 4 lags. Net wealth is deflated using the consumer price index. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands.

D.4. Model specification: robustness to model choice

In a local projection framework, the impulse response function is the series of regression coefficients β_h associated with the set of h-step ahead predictive regressions. Formally:

$$y_{t+h} = \alpha_h + \beta_h \hat{s}_t^j + \Phi_h(L)x_{t-1} + u_{t+h} \quad \text{with} \quad h = 0, 1, 2, \ldots, 24 \tag{D.1}$$

where y is a dependent variable of interest (e.g., real net wealth), x is a vector of control variables, $\Phi(L)$ is a polynomial in the lag operator, and $\hat{s}^j$ is a monetary policy surprise with $j = \{R, LSAP\}$. Because impulse responses estimated with local projections are often less precise and erratic, we estimate also a smooth local projection version of equation (D.1) following the approach of Barnichon and Brownlees (2019). In both cases, we keep the specification of the local projection as close as possible to the baseline VAR models.

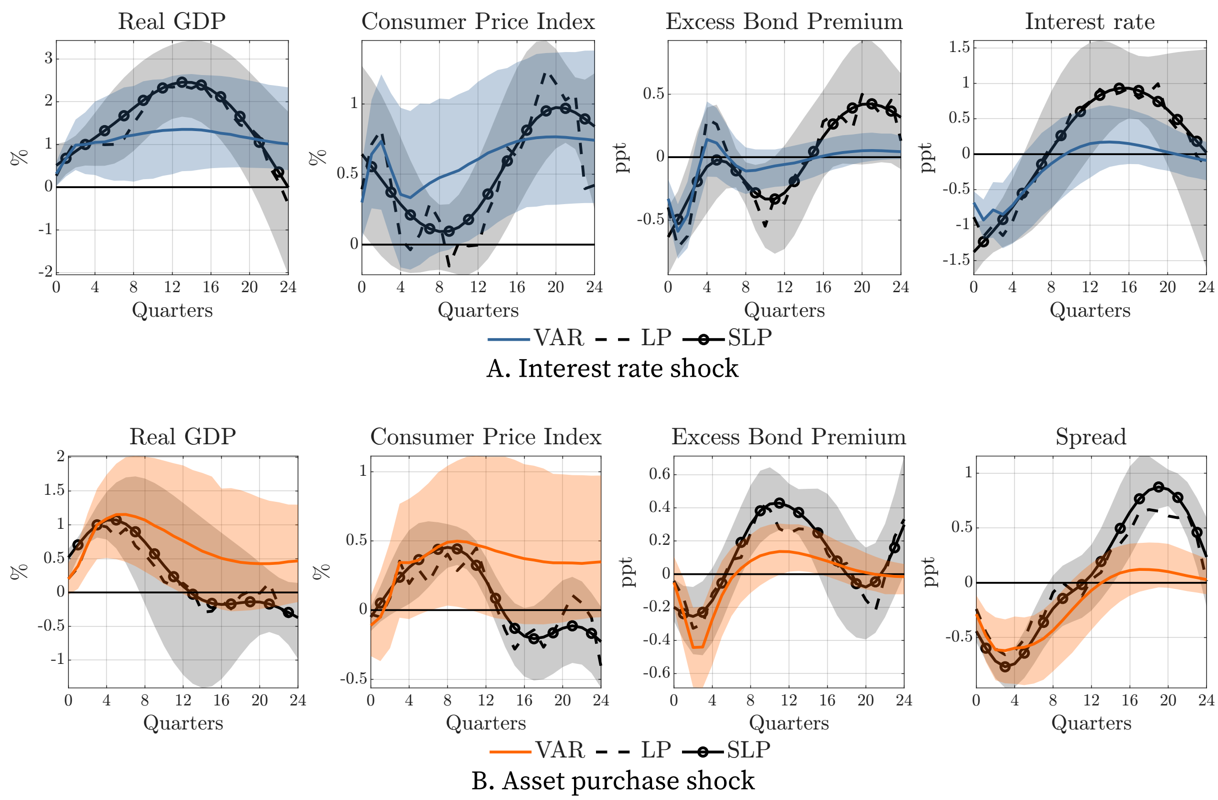
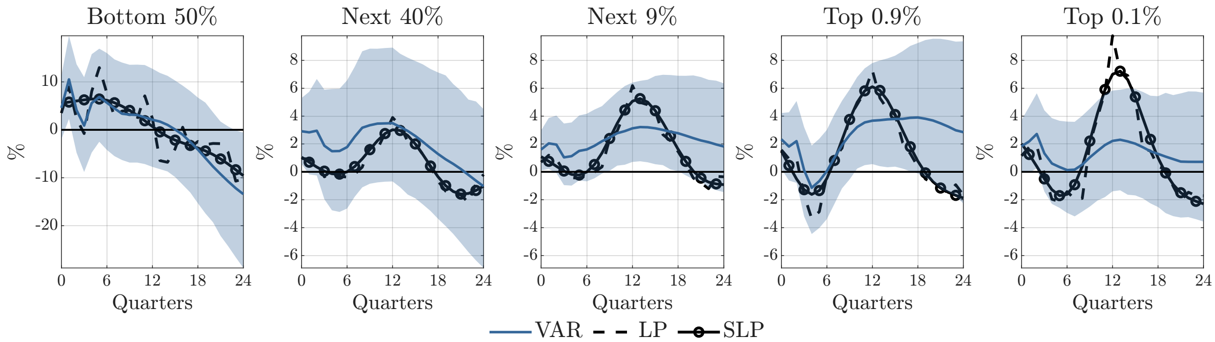
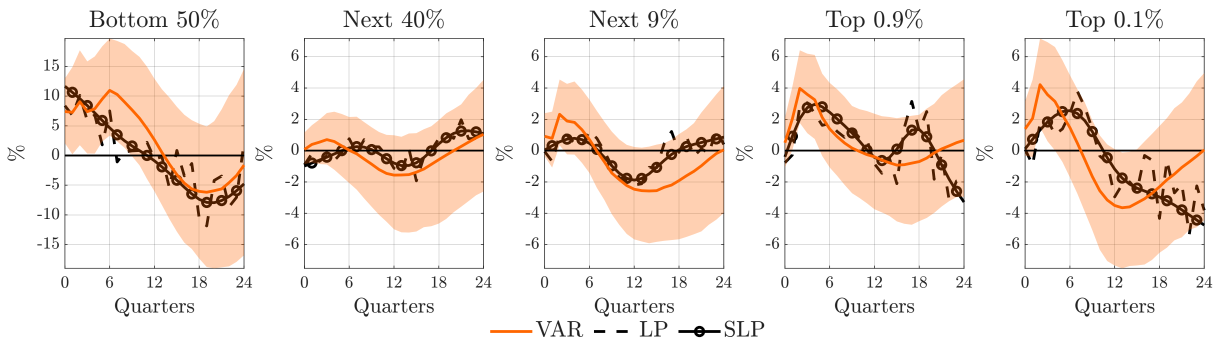


FIGURE D.5. Macroeconomic effects of monetary policy: robustness

Notes: The figure shows the impulse response functions to an interest rate (Panel A) and an asset purchase (Panel) shock estimated using the Bayesian VAR described in Table 2, Panel B, and local projections. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands. LP is Local Projections (dashed black line) and SLP is Smooth Local Projections (solid black line with markers). Impulse responses are normalized to generate a 1% response of real GDP. Shaded areas are 90% posterior coverage bands and are shown for the baseline VAR.



A. Interest rate shock



B. Asset purchase shock

FIGURE D.6. Effects of monetary policy on net wealth: robustness

Notes: The figure shows the impulse response functions to an interest rate (Panel A) and an asset purchase (Panel) shock estimated using the Bayesian VAR described in Table 2, Panel B, and local projections. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Solid lines are median impulse responses from the posterior distribution. Shaded areas are 68% and 90% posterior coverage bands. LP is Local Projections (dashed black line) and SLP is Smooth Local Projections (solid black line with markers). Impulse responses are normalized to generate a 1% response of real GDP. Shaded areas are 90% posterior coverage bands and are shown for the baseline VAR.

E. Beyond net wealth: the effect of monetary policy on balance sheets

The documented changes in net wealth across the wealth distribution due to monetary policy shocks are potentially influenced by several factors, including asset accumulation, disinvestment, borrowing, debt repayment, and asset price fluctuations. To varying degrees, these factors contribute to the channels through which monetary policy affects aggregate consumption, output, and prices, as predicted by both new and traditional theories analysing the transmission mechanism of monetary policy (e.g., Bernanke and Gertler 1995; Kaplan, Moll, and Violante 2018). In this section, we use the rich information on balance sheets available in the DFA to show that monetary policy also has heterogeneous effects on assets and liabilities across the wealth distribution.

Figures E.1 and E.2 plot the responses of assets and liabilities to an interest rate shock and an asset purchase shock, respectively. This analysis focuses on four time horizons: the initial impact, one year, three years, and six years after the shock. The height of each bar in both figures (first row) roughly corresponds to the growth in total assets induced by monetary policy.[21]

Housing. The housing sector plays a crucial role in the transmission of monetary policy to the broader economy (Mishkin et al. 2007; Cloyne, Ferreira, and Surico 2020; Amromin, Bhutta, and Keys 2020) and for wealth inequality (Kuhn, Schularick, and Steins 2020). Following an interest rate shock, all wealth groups experience a sluggish increase in real estate that peaks about three years after the shock (Figure E.1). On the liabilities side, the response of home mortgages to an interest rate shock is more heterogeneous across the distribution. While there is a lagged increase in mortgage debt for all groups, the bottom 90% of the distribution experiences a disproportionately larger growth in debt, especially the bottom 50%. Consequently, while the transmission of interest rate policy to the housing market contributes to the expansion of gross wealth through both the appreciation and accumulation of real estate, the simultaneous growth of debt acts as a countervailing force, leading to a contraction of net wealth for the bottom 90%. Instead, an asset purchase shock has mixed effects on real estate and home mortgages across the wealth distribution (Figure E.2). Real estate assets show a modest increase in the short run, followed by a decline for all wealth groups three years after

[21]Note that a direct comparison with Figure 3 and Figure 7 is not feasible due to the exclusion of certain asset components, such as government, municipal and corporate bonds, insurances, miscellaneous assets, and other liabilities that are not classified as home mortgages or consumer credit.

the shock. On the liabilities side, an asset purchase shock reduces home mortgages for the bottom 90%. Six years after the shock, however, the reduction extends to all groups, except the next 40%.

Corporate equities and mutual funds. This asset class exhibit significant inequality in their distribution, and the returns generated by these assets play a crucial role in shaping wealth inequality (Hubmer, Krusell, and Smith Jr 2021). Despite persistent differences in magnitude, we find limited heterogeneity in the patterns of responses to both interest rate and asset purchase shocks across wealth groups. Following an interest rate shock, most of the immediate increase in total assets for all wealth groups can be attributed to the response of corporate equities and mutual funds, likely driven by the impact of monetary policy on the stock market (Figure E.1). In the medium run, corporate equities and mutual funds continue to account for a significant portion of the variation in total assets over time for most groups, particularly for the top 0.9%. Similarly, corporate equities and mutual funds play a crucial role in driving asset growth after an asset purchase shock (Figure E.2). In this case, however, the impulse response exhibits a cyclical pattern, peaking about a year after the shock (panel B) and then declining over the medium term, temporarily for the next 49% (panels C and D).

Private businesses. This asset class encompass a wide range of assets, including non-publicly traded business assets and real estate owned by households for rental purposes.[22] For the top 90% of the wealth distribution, an interest rate shock has a positive impact on private businesses, especially in the medium term (see Figure E.1, panels B to D). Conversely, for the bottom 50% and the top 10% of the distribution, the response of private businesses to an asset purchase shock shows a cyclical pattern, with a short-term increase followed by a decline in the medium term (see Figure E.2). For the next 40% of the distribution, private businesses experience a temporary decline for most of the horizon considered.

[22] It is important to note that the valuation of private businesses can be complex. For instance, while real estate assets such as rental properties are valued at market value, the valuation of business assets reported in the DFA is the average of market value and cost basis (Batty et al. 2021).

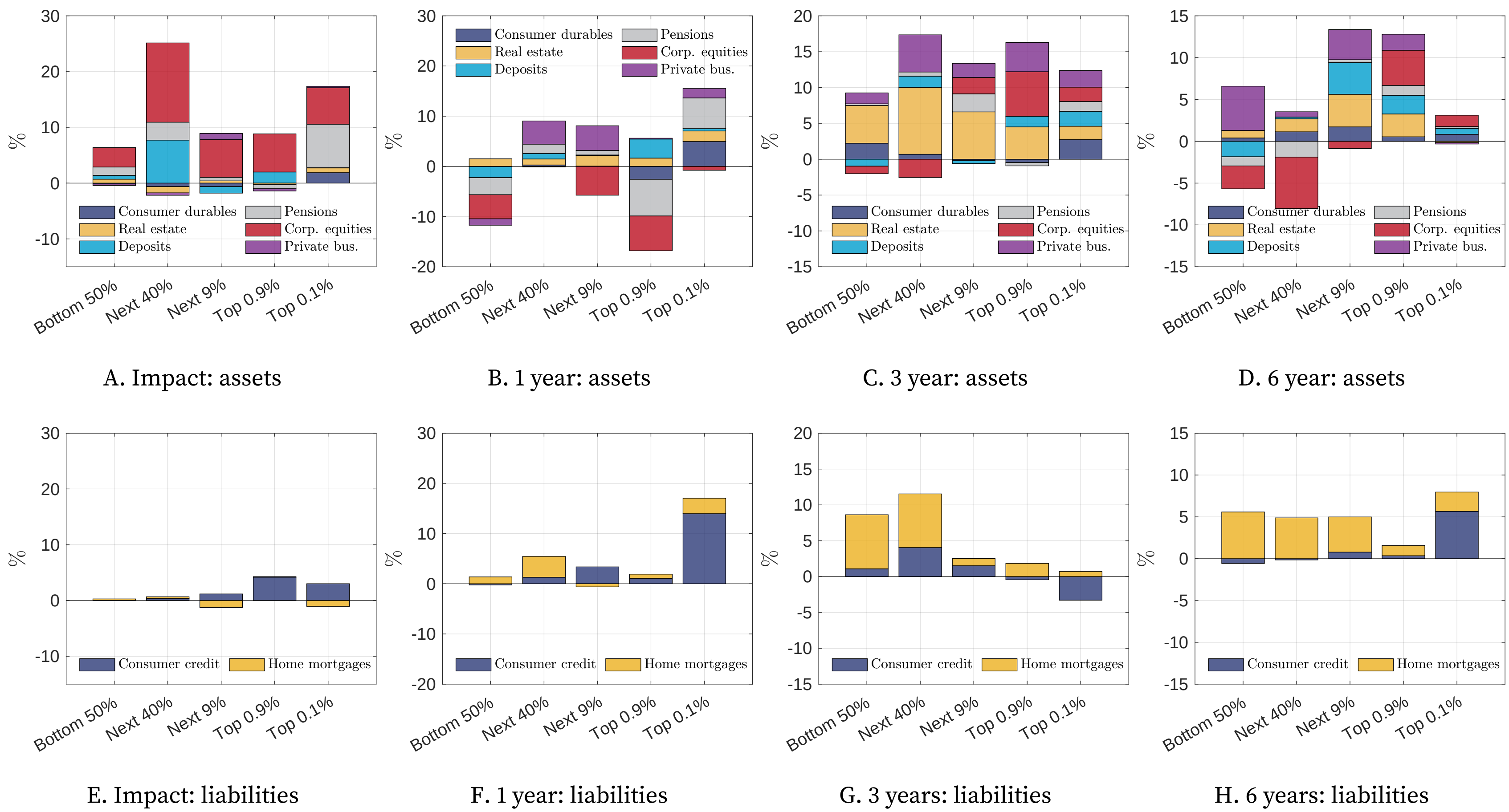


FIGURE E.1. The effects of an interest rate shock across the balance sheet: selected horizons

Notes: Impulse response functions to an interest rate shock estimated using Bayesian VAR described in Table 2, panel B. Stacked bars correspond to the median impulse responses from the posterior distribution. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Balance sheet components are deflated using the consumer price index.

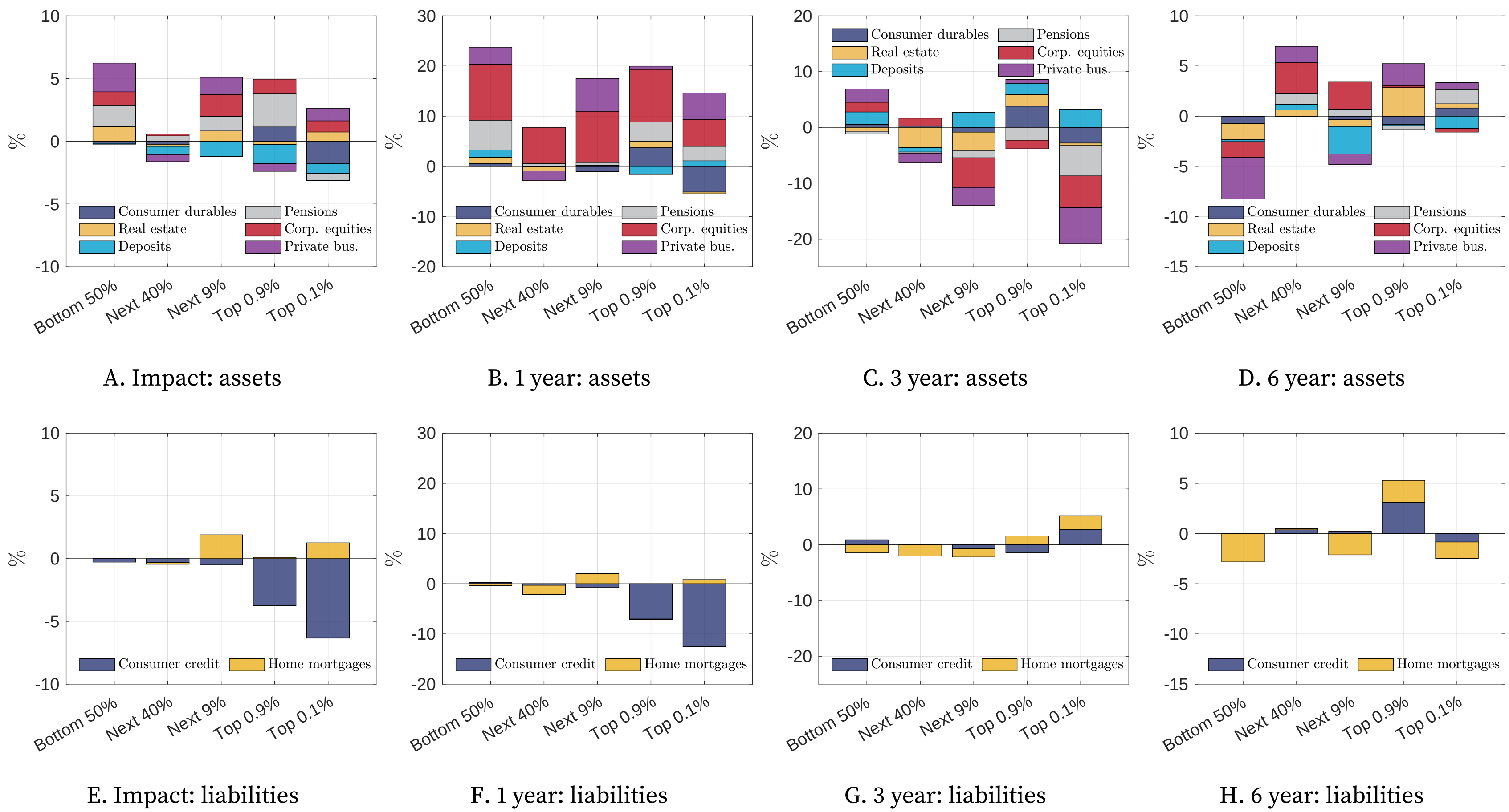


FIGURE E.2. The effects of an asset purchase rate shock across the balance sheet: selected horizons

Notes: Impulse response functions to an asset purchase shock estimated using Bayesian VAR described in Table 2, panel B. Stacked bars correspond to the median impulse responses from the posterior distribution. Impulse responses are normalized to generate a 1% response of real GDP after 3 quarters. Balance sheet components are deflated using the consumer price index.

F. Monetary policy and heterogeneous capital gains

The role of asset prices in shaping the dynamics of wealth and its distribution has been widely recognized in the literature (Blanchet and Martínez-Toledano 2022). At the same time, the most direct effects of monetary policy are often observed in financial markets (Bernanke and Kuttner 2005). In this Appendix, we examine the relationship between monetary policy, asset prices, and unequal wealth growth across the distribution. In particular, we show that the effects of monetary policy on capital gains are highly heterogeneous across wealth groups, with wealthier groups experiencing larger increases in capital gains following both shocks.

F.1. Measuring capital gains

To emphasise the role of capital gains in the dynamics of wealth accumulation, we consider a simple law of motion for net wealth where W_t^i is net wealth of group i at time t:

$$W_{t+1}^i = W_t^i + \Pi_t^i + O_t^i. \tag{F.1}$$

where Π_t^i are total capital gains of group i between time t and $t+1$, and O_t^i captures any other factor that affects wealth at time t, such as savings, other returns, dividends, and any other unobserved factor. In addition, we assume that capital gains and other factors affecting wealth accumulation occur simultaneously. This law of motion can be extended to any gross asset A_j^i on the balance sheet of group i:

$$A_{jt+1}^i = A_{jt}^i + \Pi_{jt}^i + O_{jt}^i. \tag{F.2}$$

In this equation, A_{jt}^i is the level of asset j for group i at time t, Π_{jt}^i are capital gains or losses generated by that asset between time t and $t+1$, and O_{jt}^i captures any other factor contributing to the accumulation of that specific asset. Equations F.1 and F.2 show that capital gains resulting from changes in asset prices contribute to the accumulation of both net wealth and asset accumulation. However, the magnitude of capital gains or losses depends on the exposure to a particular asset, which can be measured by the share of that asset in total assets. As a result, capital gains from changes in the price of a particular asset should be heterogeneous due to differences in portfolio composition across groups.

To better illustrate the role of portfolio composition, let's consider the standard formula used to calculate capital gains. Assuming that wealth group i holds a portfolio of J assets denoted by $\left\{A_{jt}^{i}\right\}_{j=1}^{J}$ at time t, the total (dollar) capital gains between time t and $t+1$ can be computed as $\Pi_{t}^{i}=\sum_{j=1}^{J} \Pi_{jt}^{i}=\sum_{j=1}^{J}\left({p_{jt+1}}/{p_{j,t}}-1\right) A_{jt}^{i}$, where p_{jt} is the price index for asset j. This formula is commonly used in the literature to calculate asset-specific capital gains and to assess their role in wealth accumulation (Kuhn, Schularick, and Steins 2020). However, extending this formula to total capital gains requires the choice of a price index for each asset on the balance sheet, including assets that are not traded in financial markets or for which there is no market price readily available.

In this study we use a different approach to overcome the limitation of choosing a price index for each asset on the balance sheet. To calculate capital gains, we begin by noticing that at the aggregate level, changes in any asset j between the beginning of time t and the beginning of time $t+1$ can be decomposed as follows:

$$A_{jt+1}-A_{jt}=F_{jt}+R_{jt}+V_{jt}, \tag{F.3}$$

where F_{jt} represents transactions, which capture the exchange of assets, R_{jt} represents revaluations, which measure holding gains and losses (capital gains), V_{jt} represents other volume changes, which capture other events (e.g., natural disasters). This decomposition separates the economic flow that reflects the change in asset levels over time, into its constituent components. In the context of national accounts, expression F.3 also applies to aggregate wealth, where R_t represents changes in wealth due to nominal holding gains and losses.

To estimate total capital gains, we allocate the aggregate revaluation R_t to different wealth groups using their respective wealth shares as weights:

$$\Pi_{t}^{i}=\left(\frac{W_{t}^{i}}{W_{t}}\right) R_{t}, \tag{F.4}$$

where Π_{t}^{i} is the capital gains for group i at time t, W_{t}^{i} is the wealth of group i at time t, and W_t is aggregate wealth. We obtain the aggregate revaluation R_t from Table R.101 of the Financial Accounts of the US, which provides information on changes in aggregate net wealth resulting from holding gains and losses recorded on all financial and nonfinancial asset on the aggregate household balance sheet. This approach allows us to estimate total capital gains without assuming a specific price index for each asset class on the balance sheet, as is typically done in other studies (Kuhn, Schularick, and Steins 2020). Figure F.3 compares the capital gains on real estate and on corporate equities and mutual funds obtained using the traditional formula with our approach of

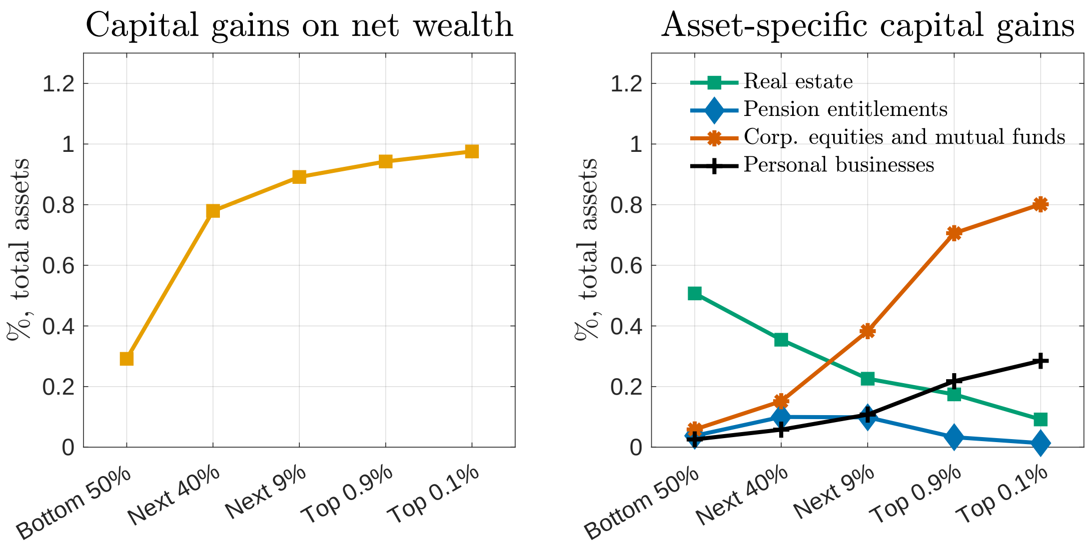


FIGURE F.1. Scale dependence (average capital gains to total assets, 1989-2022)

Notes: The figure plots average capital gains on (lagged) total assets for each wealth group. The average is computed over the full sample (1989-2022). For the computation of capital gains see the main text.

distributing the aggregate revaluation. We find that the two measures of capital gains are qualitatively similar.

In Figure F.1, the left panel shows the feature of scale dependence in capital gains, indicating that wealthier groups tend to experience higher capital gains relative to poorer ones. The graph shows the average capital gains to total assets across the wealth distribution from 1989 to 2022. To avoid distorting the ratio for groups with minimal wealth, capital gains are normalized to total assets (or gross wealth). The formula for capital gains to total assets, $\pi_t^i = \frac{\Pi_t^i}{A_{t-1}^i}$, quantifies the "income" generated per dollar of assets. However, it should not be interpreted as a return on assets because dividends, realised capital gains, and debt service costs are not observed. The right panel of Figure F.1 plots the average capital gains from a selected set of asset classes. Not surprisingly, the magnitude of capital gains (relative to total assets) is larger for wealth groups whose portfolios are predominantly composed of the asset class in question. For example, as we move toward the top of the distribution, where the importance of real estate declines, the magnitude of capital gains generated by real estate holdings also declines. Scale dependence in returns to wealth can contribute to wealth inequality (Piketty 2014) and has also been confirmed by studies using data from Norway (Fagereng et al. 2020), Sweden (Bach, Calvet, and Sodini 2020) and the US (Xavier 2021).

F.2. The effects of monetary policy shocks

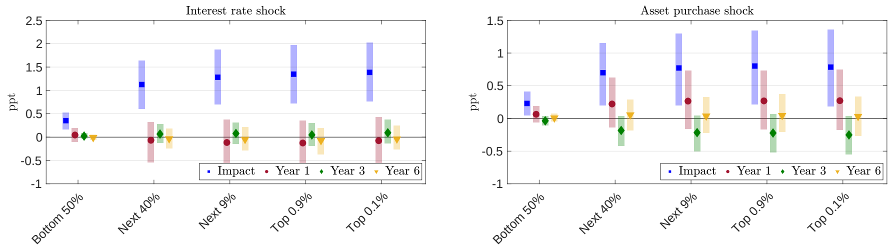
When interest rates are lowered, the discount rate falls, leading to an increase in the present value of future cash flows generated by assets. Similarly, central bank asset purchase programs can reduce long-term yields and increase the valuation of long-lived assets. Depending on the composition of households' portfolios and the sensitivity of their assets to monetary policy, these changes in asset prices can have heterogeneous effects across the wealth distribution. As a result, if asset prices are the only channel through which monetary policy affects wealth, when interest rates are cut or asset purchase programs are implemented, wealth tends to increase more for households at the top of the wealth distribution than for those at the bottom.[23]

We quantify the role of monetary policy in generating heterogeneous capital gains across the distribution by estimating a VAR model augmented with capital gains on total assets ($\pi_t^i = \frac{\Pi_t^i}{A_{t-1}^i}$) for wealth group i (Table F.1). We estimate a separate model for each monetary policy type, with identification and estimation following the approach outlined in Section 3.

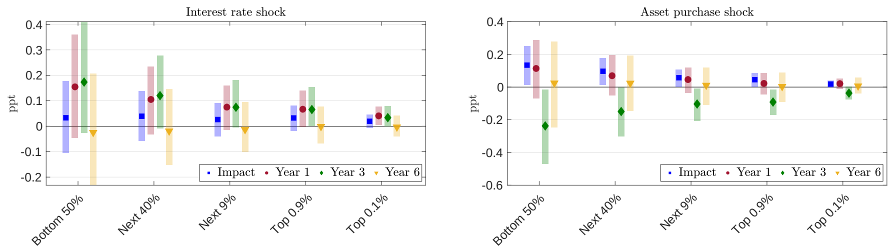
Figure F.2 plots the effect of monetary policy on capital gains, expressed as a share of total assets, across the wealth distribution and at three different time horizons: the immediate impact, six months after the shock, and one year after the shock. The results show that the effects of monetary policy become more pronounced as we move up the wealth distribution. Note that for an interest rate shock, the peak response is immediate, while for an asset purchase shock it is delayed by a few quarters. Interestingly, most of the heterogeneity in the response of capital gains to monetary policy shocks is observed between the bottom 50% and the top 50% of the wealth distribution. These disparities in the response of capital gains to monetary policy shocks diminishes over the medium run.

If there were no differences in the composition of households' portfolios, the impact of monetary policy shocks on capital gains would be homogeneous across the wealth distribution, with no distributional consequences through asset prices. In reality, however, this is not the case. Capital gains are scale dependent, meaning that wealthier groups tend to experience higher capital gains. The effects of monetary policy shocks on capital gains also exhibit scale dependence, with wealthier groups experiencing

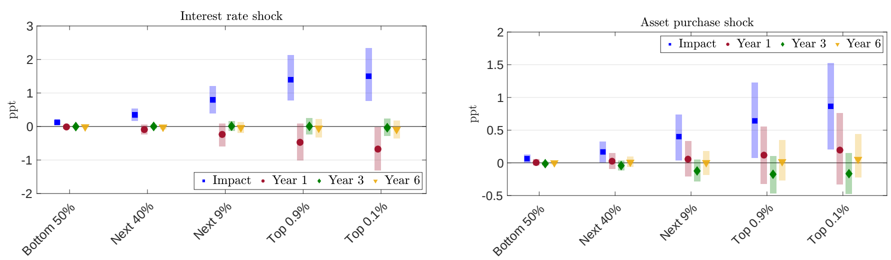
[23]It is important to note that the measures of capital gains used in this paper, which are based on revaluation data from national accounts, do not directly account for the heterogeneous composition of portfolios. However, the ratio of capital gains to total assets does reflect the underlying portfolio heterogeneity. In particular, $\pi_t^i = \Pi_t^i / A_{t-1}^i = \sum_1^J \left(A_{jt}^i / A_{t-1}^i \right) \left(R_{jt} / A_{jt-1} \right)$, where $\left(A_{jt}^i / A_{t-1}^i \right)$ reflects the exposure of group i to asset j and this exposure differs across groups (portfolio heterogeneity).



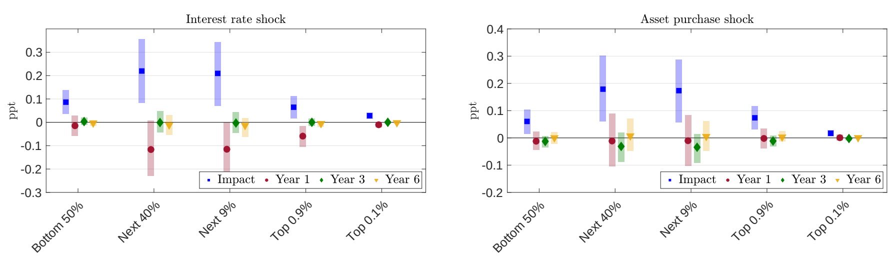
A. Capital gains on net wealth



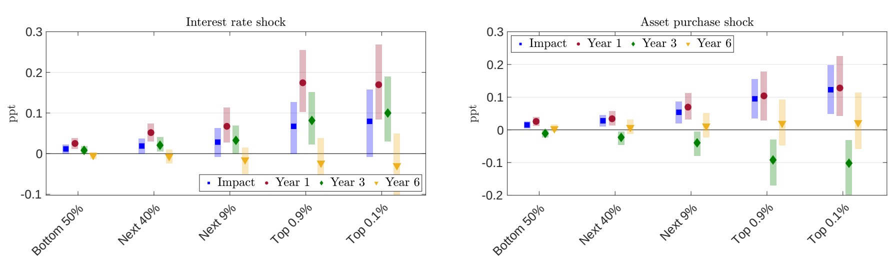
B. Capital gains on real estate



C. Capital gains on corporate equities and mutual funds



D. Capital gains on pension entitlements



E. Capital gains on private businesses

FIGURE F.2. Monetary policy and capital gains

Notes: This figures plots the response of capital gains (as share of total assets). Impulse responses for each wealth group are retrieved from a baseline VAR model augmented with capital gains to total assets for each wealth group. Impulse responses are scaled to imply a 1% response of real GDP. Intervals are 68% posterior coverage bands.

TABLE F.1. Models and variables description

	Series	Unit	Source
Panel A: *Baseline models with capital gains*			
1	Policy shock:		
	Conventional shock ($\hat{s}_t^R$)		Sections 3.2
	Unconventional shock ($\hat{s}_t^{LSAP}$)		Sections 3.3
2	Real GDP	BoC 2012$	Bureau of Economic Analysis
3	Consumer price index	2015 = 100	Bureau of Economic Analysis
4	Excess bond premium	Percent	Gilchrist and Zakrajšek (2012)
5	Interest rate or spread:		
	1-year Treasury Rate	Percent	McCracken, Ng et al. (2021)
	Term spread	Percent	McCracken, Ng et al. (2021)
6	Capital gains, bottom 50%	%, total assets	Own estimates (Section F)
7	Capital gains, next 40%	%, total assets	Own estimates (Section F)
8	Capital gains, next 9%	%, total assets	Own estimates (Section F)
9	Capital gains, top 0.9%	%, total assets	Own estimates (Section F)
9	Capital gains, top 0.1%	%, total assets	Own estimates (Section F)

Notes: DFA is Distributional Financial Accounts. Bil. is billions. Capital gains are computed using wealth shares from the Distributional Financial Accounts and nominal holding gains and losses on aggregate wealth from Table R.101 of the Financial Accounts of the United States. See Section F for a detailed treatment of the estimation of capital gains.

larger increases in capital gains following these shocks, with these differences reflecting heterogeneity in portfolio composition across the wealth distribution. In particular, exposure long-term and price-sensitive assets is associated to larger capital gains following a monetary policy shock (Greenwald et al. 2021).

F.3. Estimating capital gains: further details

In this section, we provide further details on the original series used to obtain capital gains. To compute group-specific total capital gains (that is, capital gains on net wealth), we use the following formula:

$$\Pi_t^i = \left(\frac{W_t^i}{W_t}\right) R_t. \tag{F.5}$$

where ${W_t^i}/{W_t}$ is the share of wealth owned by wealth group i and R_t is aggregate capital gains. For capital gains on net wealth, R_t is computed as:

- **Total capital gains (capital gains on net wealth)** = Households and Nonprofit Organizations: Assets Less Liabilities with Revaluations, Revaluation (FR158000005Q) - Nonprofit Organizations; Equipment, Current Cost Basis, Revaluation (FR165015205Q)

- Nonprofit Organizations; Nonresidential Intellectual Property Products, Current Cost Basis, Revaluation (FR165013765Q).

To compute group- and asset-specific capital gains (that is, capital gains on specific asset classes), we use the following formula:

$$\Pi^i_{j,t} = \left(\frac{A^i_{j,t}}{A_{j,t}}\right) R_{j,t}. \tag{F.6}$$

where ${A^i_{j,t}}/{A_{j,t}}$ is the share asset j owned by wealth group i and $R_{j,t}$ is aggregate capital gains generated by asset j. More specifically, $R_{j,t}$ is computed as:

- **Capital gains from holding real estate** = Households and Nonprofit Organizations; Real Estate at Market Value, Revaluation (FR155035005Q).
- **Capital gains from holding corporate equities and mutual funds** = Households and Nonprofit Organizations; Corporate Equities; Asset, Revaluation (FR153064105Q) + Households and Nonprofit Organizations; Mutual Fund Shares; Asset, Revaluation (FR153064205Q).
- **Capital gains from private businesses** = Households and Nonprofit Organizations; Proprietors' Equity in Noncorporate Business, Revaluation (FR152090205Q).
- **Capital gains from holding pension entitlements** = Households and Nonprofit Organizations; Pension Entitlements; Asset, Revaluation (FR153050005Q).

F.4. Comparing estimates of capital gains

In this section, we compare our method of estimating capital gains with the traditional formula used in the literature for obtaining asset specific capital gains (Kuhn, Schularick, and Steins 2020). We focus on real estate and on corporate equities and mutual funds. Let RE identify real estate while CE identify corporate equities and mutual funds such that j is alternatively RE or CE, we compute capital gains as follows:

$$\Pi^i_{j,t} = \left(\frac{A^i_{j,t}}{A_{j,t}}\right) R_{j,t} \quad \text{: revaluation-based capital gains generated by asset } j \tag{F.7}$$

$$\tilde{\Pi}^i_{j,t} = \left(\frac{p_{j,t+1}}{p_{j,t}} - 1\right) A^i_{j,t} \quad \text{: price-based capital gains generated by asset } j \tag{F.8}$$

where $A^i_{j,t}$ is the stock of asset j held by group i, $A_{j,t}$ is the aggregate stock of asset j held by the household sector, $R_{j,t}$ is the aggregate revaluation (or capital gain) on asset

j according to the Revaluation Accounts (see above), $p_{j,t}$ is the (real) price index of asset j which is assumed to be common across groups. The price index is the Case-Shiller house price index for real estate and S&P 500 index for corporate equities and mutual funds. To ease interpretation and comparison, we work with capital gains expressed as share of total group-specific group, that is:

$$\pi^i_{j,t} = \frac{\Pi^i_{j,t}}{A^i_t} \quad \text{: revaluation-based capital gains generated by asset } j \tag{F.9}$$

$$\tilde{\pi}^i_{j,t} = \frac{\tilde{\pi}^i_{j,t}}{A^i_t} \quad \text{: price-based capital gains generated by asset } j \tag{F.10}$$

In Figure F.3, we compare the two approaches in estimating average capital gains on real estate (left panel) and corporate equities and mutual funds (right panel). Both the revaluation-based and price-based approaches yield quantitatively similar results for average capital gains on real estate. In contrast, the two approaches diverge in measuring capital gains on corporate equities and mutual funds with the divergence increasing across the wealth distribution. This happens because the price-based measure is not able to capture the influence of mutual funds and of equity prices not tracked by the S&P 500 index. This finding suggests that previous studies may have had underestimated the magnitude of capital gains across the wealth distribution if a price index like the S&P 500 index is used.

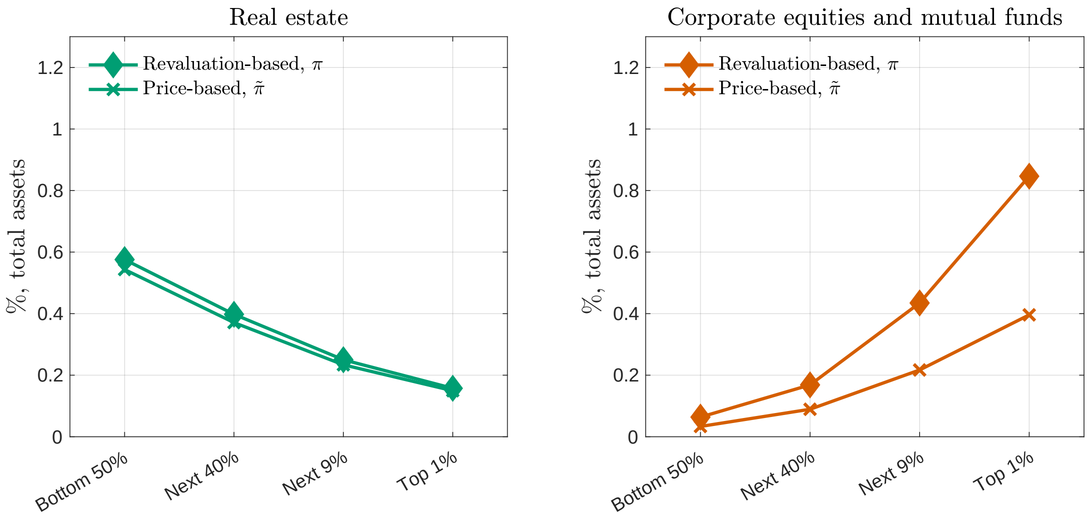


FIGURE F.3. Comparing estimates of capital gains: revaluation-based vs. price-based approach

Notes: The figure compares two measures of average capital gains (as share of lagged total assets) from holding real estate assets (left panel) and corporate equities and mutual funds (right panel) for the household sector as a whole. Averages are obtained for the 1989-2022 period.