How Does Monetary Policy Affect Income and Wealth Inequality?
Evidence from the Euro Area

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Motivation:

Recent public debate on impact of quantitative easing on inequality

- ECB has since 2014 undertaken quantitative easing (QE)
  ("Asset Purchase Programmes")

- Various perspectives on why QE affects inequality:
  - ▶ Younger households, net borrowers benefited as interest rates fell,
    older households with interest-bearing assets lost (eg McKinsey, 2013)

  - ▶ QE boosted asset prices and financial wealth, it "made the rich richer"
    (eg FT, Oct 21, 2014)

- ECB (various speeches)
  - ▶ Expansionary mon policy reduces unempl, benefits poorer households most

  - ▶ QE also boosted house prices: these gains are more widely spread, as
    homeowners more evenly distributed than stock-holders

This paper

- What are the effects of such monetary policy on **inequality**?
  - ▶ Income vs wealth inequality

- Use aggregate and household-level data on income/wealth:
  European Household Finance and Consumption Survey, **HFCS**

- Estimate how individual households are affected by QE

- A bit on monetary transmission to consumption

Next steps

Step 1: Aggregate data

- **ⓐ** Estimate **multi-country VAR** with aggregate unempl & asset prices
- **ⓑ** Quantify **impulse responses** of asset prices / unemployment to QE

Step 2: Household-level data

- **ⓒ** Transpose IRFs over **household-level HFCS data** on wealth, income and their components
- **ⓓ** For employment, use simulation based on a probit for empl status
- **ⓔ** Estimate effects of QE on wealth **and income** inequality (Gini . . .)
- **ⓕ** (Implications for consumption)

Existing literature

- **Macro effects of nonstandard MP—VARs:**
  Baumeister and Benati (IJCB, 2013); Altavilla et al. (IJCB, 2016); . . .

- **VARs with income / consumption Ginis:**
  Coibion et al. (JME, 2017); Mumtaz and Theophilopoulou (EER, 2017)
  - ▶ No wealth inequality, don't estimate effects of nonstandard MP

- **Household wealth portfolios, inflation and asset prices:**
  Doepke and Schneider (JPE, 2006); Adam and Zhu (JEEA, 2016); Adam and
  Tzamourani (EER, 2016); Doepke et al. (2016)
  - ▶ Assume hypothetical scenarios, eg "10% increase in price level"

- **Model-based simulations:**
  Casiraghi et al. (2018) [BdI]; Bunn et al. (2018) [BoE]
  - ▶ More calibrated than estimated

- **So far little quantitative work on effects of nonstandard MP on inequality**

Gaps in existing work

Not much work with micro data on:

- House prices / housing wealth

- Employment effects / income inequality

- Little estimated quantitative evidence in general

- Even less on non-standard MP

Step 1: Multi-country VAR to estimate aggr effects of nonstndrd MP

$$y_t = C + B_1 y_{t-1} + \cdots + B_p y_{t-p} + \epsilon_t$$
$$\epsilon_t = N(0, \Sigma)$$

- Mix of EA and country-level variables; 4 countries: DE, FR, IT, ES

- $\Rightarrow$ **Common MP + country heterogeneity in responses**

- Variables y_t:
  - ▶ Country-specific: real GDP, GDP defl, **wages, unempl, house prices**
  - ▶ EA: short- and long-term interest rates, **stock prices**
  - ▶ US: GDP, short-term interest rates

- Large dimension $\Rightarrow$ **Bayesian estimation** (Litterman, 1979; Giannone, Lenza and Primiceri, 2015)

- Quarterly data: 1999Q1–2016Q4, $p = 5$ lags

VAR: Identification à la Baumeister and Benati (2013)

1. Identify exogenous asset purchase shock with **zero and sign restrictions** (Arias et al., 2017)

   Sign restrictions—Expansionary **QE (APP) shock** on impact:
   - Decreases term IR spread
   - Increases real GDP

2. **Offset response of EA policy rate** via series of standard MP shocks
   - ... because standard MP did not react to offset effects of asset purchases (policy rate remained at lower bound)

3. Standard MP shock identified via standard zero (Choleski) restrictions

Impulse responses—QE shock

- Size of QE shock to term spread scaled to **30 bp** on impact
  In line with Altavilla et al. (2015) and Andrade et al. (2016)

Impulse Responses of Financial Variables (Euro Area)
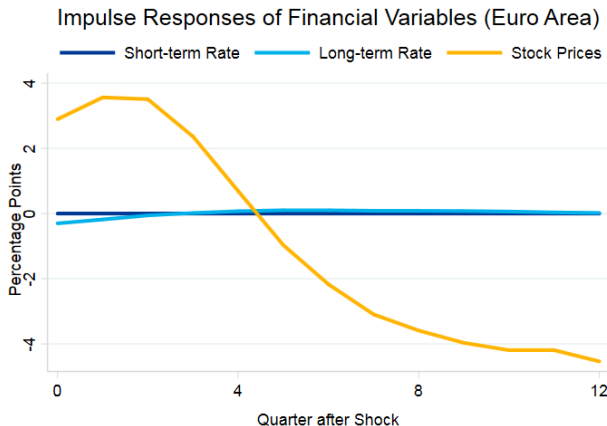
Impulse responses of aggregate variables

- UR, HP responses stronger in ES, milder in DE
- Link to ARM, mortgage / labor market institutions?
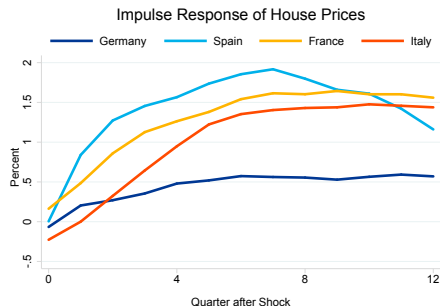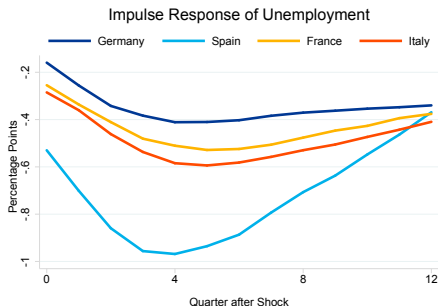
- Stock prices included at EA level

Step 2: Bringing IRFs to HFCS micro data—Wealth

- Estimate effects on household-level net wealth using holdings of housing wealth, stocks and bonds (in €) ▸ Detail
- Housing, stock, bonds account for about 80% of value of wealth
- Assumes no rebalancing of portfolios   [May be reasonable (?)]

Composition of wealth

Legend: household main residence, other real estate, self-employment business, shares, publicly traded, bonds, voluntary pension/life insur., other financial assets, deposits
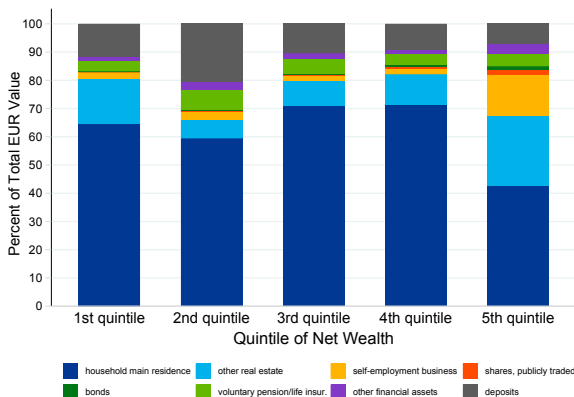
Step 2: Bringing IRFs to HFCS micro data

Income / Employment: 'Unemployment simulation'

❶ Extensive margin

Distribute aggregate decline in unemployment across households using a simple probit simulation

▸ Some unemployed become employed—**quantitatively of key importance**

❷ Intensive margin

Empl income of empl households goes up by amount given in IRF for wages

Composition of income

Income composition
percentages over total income
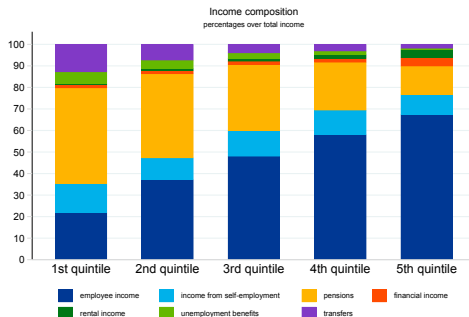
Source: HFCS 2nd wave. Countries: Euro area countries.

Unemployment simulation—Extensive margin [Ampudia et al. (2016)]

Some unemployed become employed and receive wage given by Heckman

1. Probit for employment status

- Country (c)-specific at individual level (not Hh):

$$\Pr(Y = 1|X = x) = \Phi(x'_{c,i}\hat{\beta}_c)$$

  Y empl status, X demographics (gender, edctn, age, mar status, chldrn)

- Collect fitted values $\hat{Y}_{c,i}$; draw uniformly distributed shock $\epsilon_{c,i}$
- If $\epsilon_{c,i}$ sufficiently below $\hat{Y}_{c,i} \Rightarrow$ unempl individual i becomes employed
- $\sum$ newly employed people $=$ aggregate decline in unempl implied by VAR
- Repeat many times for different draws of $\epsilon_{c,i}$, average across sims

2. Heckman selection model to estimate unobserved wages

- Income of the newly employed **increases** as implied by Heckman:
  They receive wage instead of (lower) unempl benefits
  Exclusion restrictions: marital status, children

Unemployment
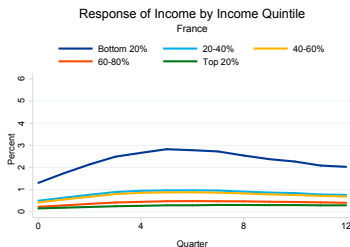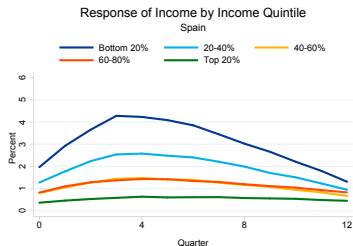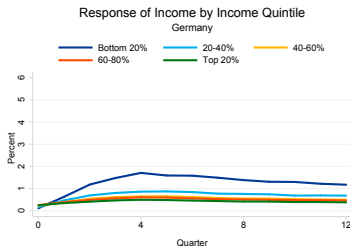## Disproportionate decrease for low income
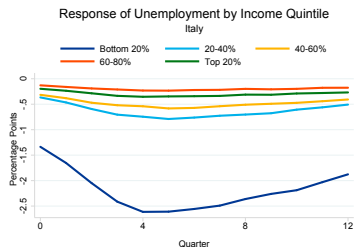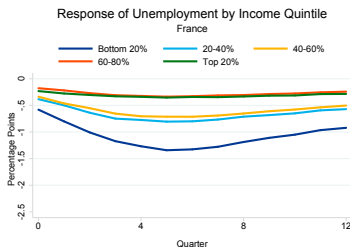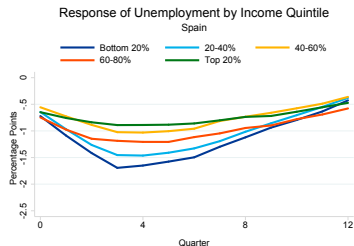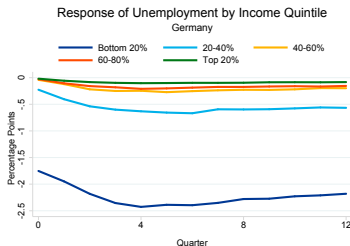
Unemployment

ES: Unemployed affected in all quintiles b/c distributed more evenly
DE: UR strongly skewed toward lowest income quintile

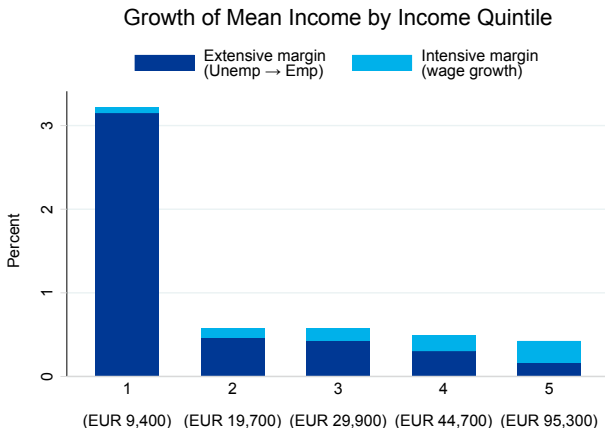Unemployment Rate by Income Quintile
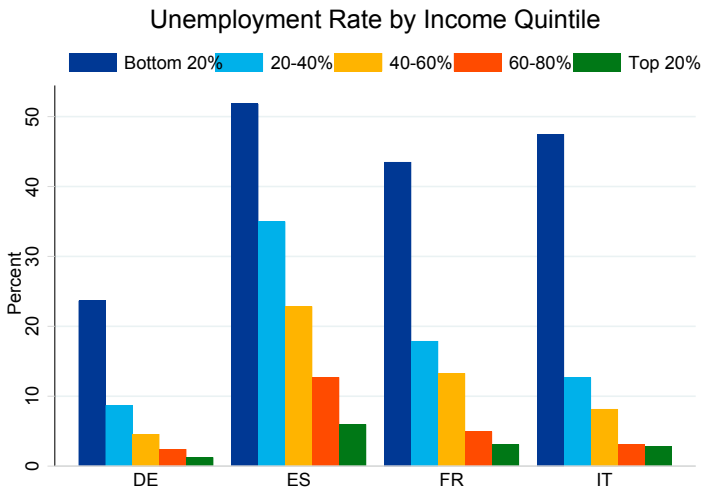
Income inequality

Unempl benefits more generous in DE, FR than in ES and **IT**
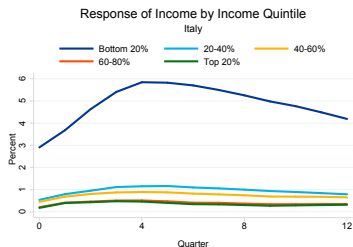
EA Income inequality

Lower inequality: Gini goes down from 43.1 to 42.8
Key importance of extensive margin (Unemp → Emp)

Growth of Mean Income by Income Quintile

Response of mean income 4 quarters after QE shock. Numbers in brackets: Initial levels of mean gross Hh income.

Wealth inequality

Very small effect: Gini goes down from 68.09 to 68.07

Important to account for house prices ▸ Decomposition

[Assumes: no portfolio rebalancing; in line with literature on inertia in Hh portfolios (Ameriks, Zeldes, 2004; Bilias et al. (2010)]

Growth of Median Net Wealth by Net Wealth Quintile
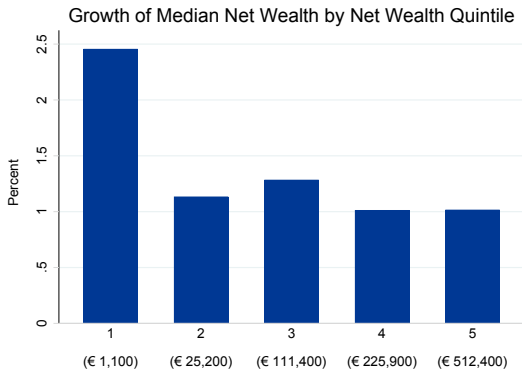
Response of median net wealth 4 quarters after QE shock. Numbers in brackets: Initial levels of median net wealth.

Robustness

- To what extent other variables respond to QE shock?
  Local linear projections: Holdings of assets, local house prices,
  financial income, . . .
- Uniform employment probability ▸
- Same VAR response in all countries ▸
- Financial income ↑ by 5% ▸
- Portfolio rebalancing—some trading in stocks:
  Buy 5% of your stock holdings ▸

## Implications: Consumption behavior & MP transmission

- Consensus in recent lit on C [also HANK; Brinca & Krusell (2016); ...]:
  Many households (20–30%) are constrained

- Constrained Hhs have large MPCs: ≥ 0.3

- This paper: **Employment of constrained Hhs responsive to MP**

- "MPC $\times \Delta$ Employment" matters for strength of **indirect channel of monetary transmission** (aggregate demand)

- Other effects (via wealth effects, net nominal positions) probably less important in EA

Effects of MP on consumption—HANK decomposition

HANK decomposition à la Kaplan et al. (2018); Auclert (2017):

$$\frac{\Delta C}{C} = \underbrace{\underbrace{MPC \cdot \frac{\overbrace{\text{Interest Exposure}}^{\text{(Net) Interest Rate-Sensitive Assets}}}{C} \cdot \Delta R}_{} - \underbrace{\sigma \cdot (1 - MPC) \cdot \Delta R}_{\text{Intertemporal Substitution}}}_{\text{Direct Effects}} + \underbrace{MPC \cdot \frac{Y}{C} \cdot \overbrace{\frac{\Delta Y}{Y}}^{\text{Reaction of Income to } \Delta R}}_{\text{Indirect Effect}}$$

Effects of 100 bp cut in R on C, by hand-to-mouth status (Ampudia et al., 2018)
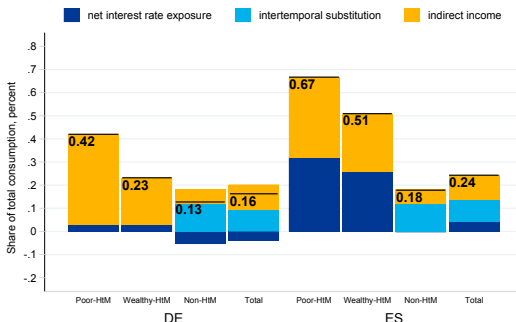
Note: share of total population.
Poor-HtM: 12.82% (DE), 6.09% (ES); Wealthy-HtM: 11.81% (DE), 18.60% (ES); Non-HtM: 75.37% (DE), 75.31% (ES).
Source: HFCS 2nd wave. Countries: DE and ES.

Summary

Main result

- QE reduces income inequality; effect on wealth inequality small
- Substantial impact on employment at bottom tail
- Quantitatively in line with structural models
  (Bayer et al., 2016; Lütticke, 2017; . . .)

Notes:
Nonstandard vs Standard MP

- Targeting the same peak GDP response, VAR gives:
  30 bp change in term spread $\approx$ 100 bp change in policy rate
- BUT also qualitative differences (ZLB, differential effects on prices of specific assets, . . .)

Background slides

Modelling response of wealth and income components to QE ▸ Back

Wealth / income component	Modeling procedure
Real Assets	
Household's main residence	Multiplied with response of house prices
Other real estate property	Multiplied with response of house prices
Self-employment businesses	Multiplied with response of stock prices
Financial Assets	
Shares, publicly traded	Multiplied with response of stock prices (in the baseline; robustness: some trading)
Bonds	Multiplied with response of bond prices (based on long-term rate)
Voluntary pension/whole life insurance	No adjustment
Deposits	No adjustment
Other financial assets	No adjustment
Debt	
Total liabilities	No adjustment
Gross Income	
Employee income	Multiplied with response of wages (compensation per employee)
Self-employment income	Multiplied with response of wages (compensation per employee)
Income from pensions	No adjustment
Rental income from real estate property	No adjustment
Income from financial investments	No adjustment (in the baseline; robustness: grows by 5%)
Unemployment benefits and transfers	If becomes employed, replace with wage (otherwise no adjustment)

Impact of QE on long-term IR—Literature review

Table 1 Empirical Estimates of the Effects of Nonstandard Monetary Policy Using Event Studies

Authors	Country	Type of Event	Typical Impact on 10-Year Rate (p.p.)	Notes
Altavilla et al. (2016)	DE, ES, FR, IT	OMT	0.2 to 1	
Altavilla et al. (2015)	EA, DE, ES, FR, IT	APP	0.3 to 0.5	
Andrade et al. (2016)	EA	APP	0.45	
Joyce and Tong (2012)	UK	APF1	1	
Christensen and Rudebusch (2012)	UK, US	APF1	0.43 to 0.89	
Lam (2011)	JP	CME+	0.24 to 0.27	
Fukunaga et al. (2015)	JP	QQE	0.33 to 0.47	
Gagnon et al. (2011)	US	LSAP1	0.55 to 1.05	
Krishnamurthy and Vissing-Jorgensen (2013)	US	LSAP1, LSAP2, MEP	0.07 to 1.07	
Bauer and Rudebusch (2014)	US	LSAP1	0.89	
Krishnamurthy and Vissing-Jorgensen (2011)	US	LSAP1, LSAP2	0.3 to 1.07	
Cahill et al. (2013)	US	LSAP1, LSAP2, MEP	0.089 to 0.131	for $100bn purchases

Notes: See also Andrade et al. (2016), Appendix B for other studies and details.
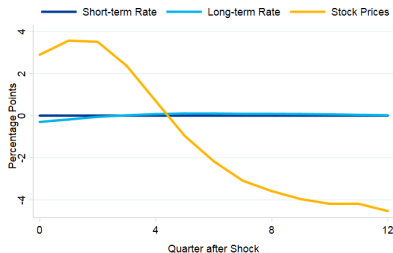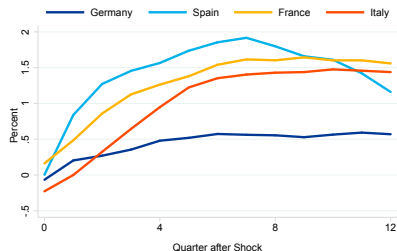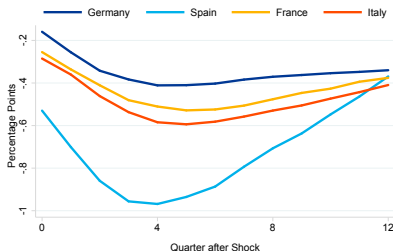
Impulse responses of aggregate variables

EA unemployment
Disproportionate decrease for low income
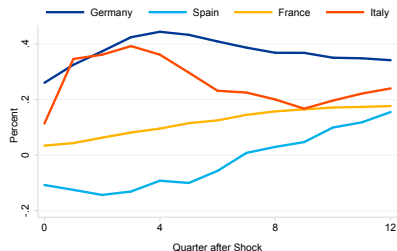
Decline in Unemployment Rate by Income Quintile
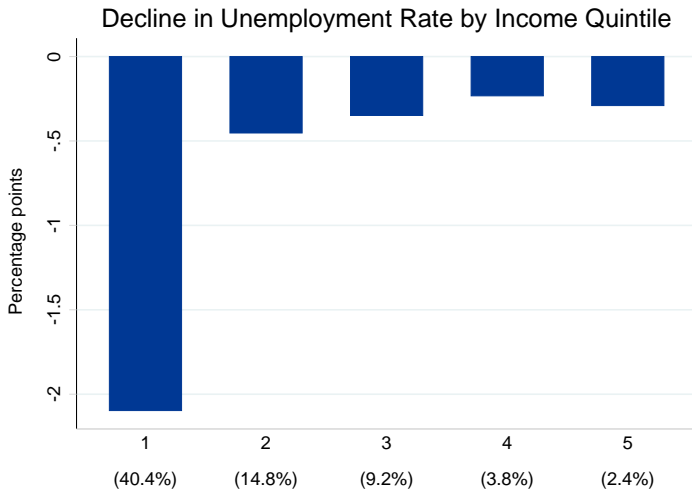
Decomposition of changes in net wealth

Key role of housing ▸ Back

Growth of Net Wealth and Its Components
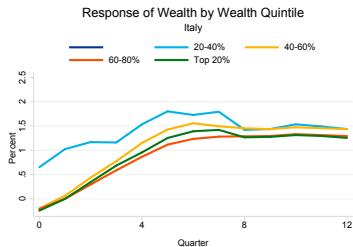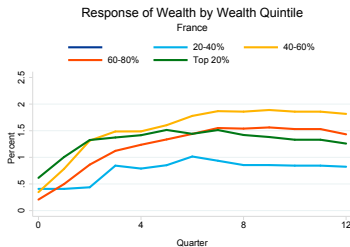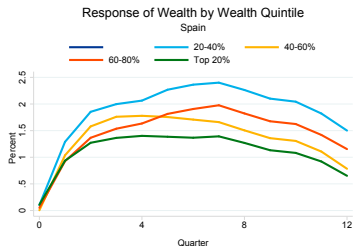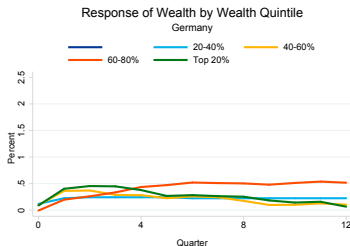by Net Wealth Quantile (Mean)
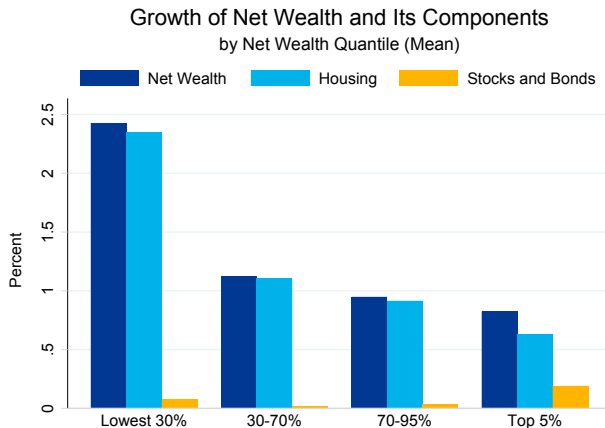
Response of mean net wealth and its components 4 quarters after QE shock.

Net wealth

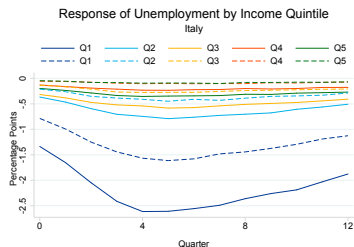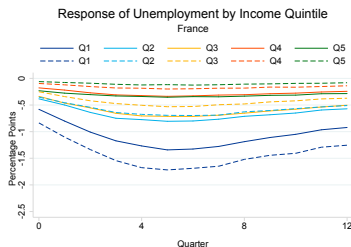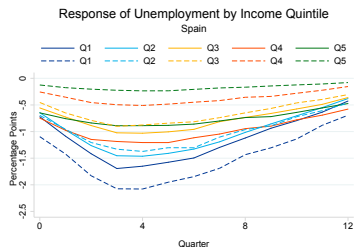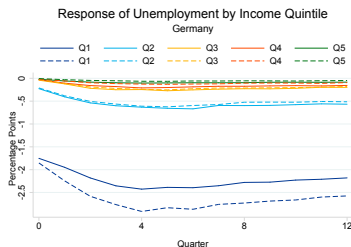Caveat: Some increase in wealth above P90, but transitory (see IRF for stock prices)

Lower percentiles: Role of leverage
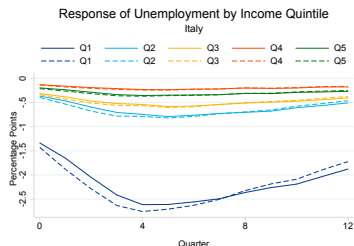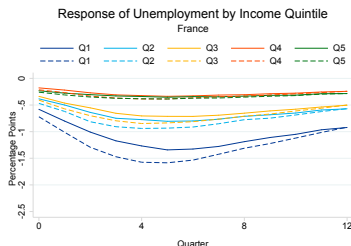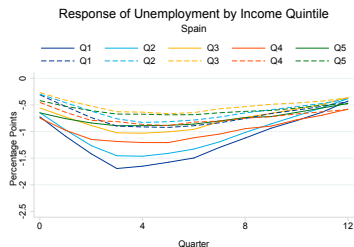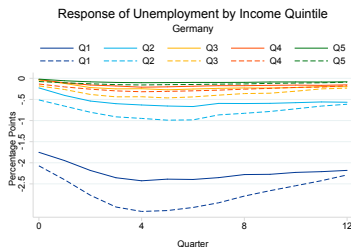
Robustness: Uniform employment probability

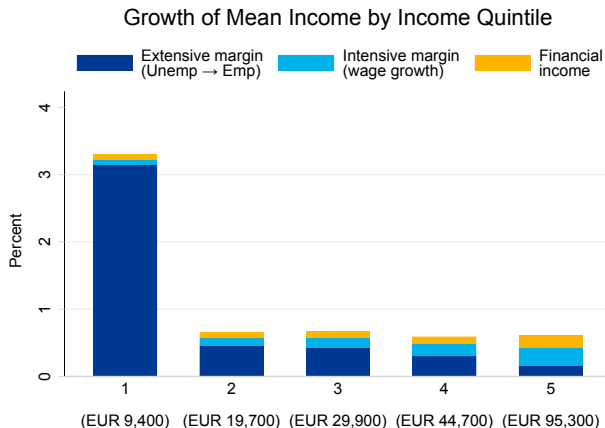Baseline IRFs (Solid) vs IRFs under uniform probability of getting employed (Dashed) ▸ Back

Robustness: Same VAR response in all countries

Baseline IRFs (Solid) vs IRFs restricted to be the same across countries (Dashed) ▸ Back

Robustness: Financial income ↑ by 5%

Financial income matters most in the upper tail ▸ Back
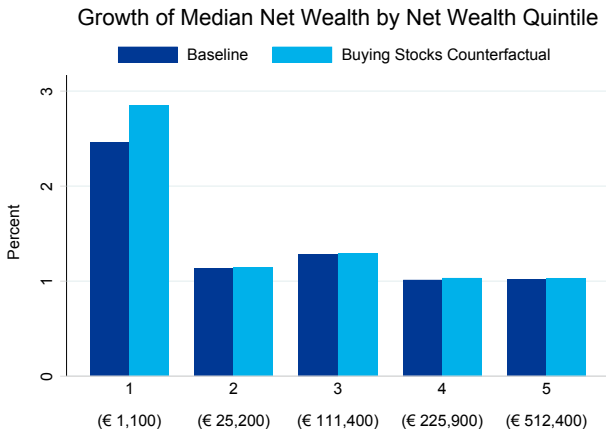
Growth of Mean Income by Income Quintile

Numbers in brackets: Initial levels of mean gross Hh income.

Robustness: Holdings of stocks ↑ by 5%

Similar overall results ▸ Back

High leverage at the bottom

Growth of Median Net Wealth by Net Wealth Quintile

Numbers in brackets: Initial levels of median net wealth.

Net nominal positions

Net nominal position (as a share of gross income)
by hand-to-mouth status, mean

■ Poor-HtM ■ Wealthy-HtM ■ Non-HtM

HFCS 2nd wave. Countries: DE, ES and Euro area.