Distributional consequences of conventional and unconventional monetary policy

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Outline

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Motivation

- Monetary policy has redistributive effects:
  - via balance sheets (direct effects):
    e.g. surprise inflation redistributes away from owners of nominal assets (Doepke & Schneider 2006)
  - via its macroeconomic impact (indirect effects):
    e.g. higher unemployment after monetary tightening hurts relatively poor HHs (Heathcote et al. 2010; Kaplan et al. 2018)
- But:
  - Unconventional monetary policy less explored (exception: Lenza & Slacalek 2018)
  - Life-cycle dimension of heterogeneity and housing underexploited (exception: Wong 2018)
  - Most studies focus on US

This paper

- Construct a quantitative life-cycle model of the euro area with a rich asset structure
- Study the distributional consequences of monetary policy
  - Conventional (surprise interest rate shock)
  - Unconventional (imperfectly communicated forward guidance)
- Why a life-cycle GE model?
  - Captures an important (and well documented) dimension of HH heterogeneity
  - Allows to consider both direct and indirect effects
  - Allows to document the crucial difference between initial balance sheet effects and remaining lifetime welfare

Preview of results

1. Monetary policy redstributes welfare between age-cohorts
    1. Monetary expansion benefits young households and hurts old ones
    2. Both direct and indirect effects matter
    3. Nominal asset positions are most important
2. Conventional policy and forward guidance differ
    1. Not dramatically
    2. Depending on ELB
3. Welfare redistribution differs a lot from initial balance-sheet effects

Outline

Model structure: overview

- New Keynesian model with life-cycle features:
  - 80 cohorts of overlapping generations of households (age 20-99)
  - Age-dependent mortality risk
  - Age-specific productivity and labor disutility
  - Age-specific asset structure
- Rigidities: sticky prices, sticky wages, habits, investment adjustment costs
- Monetary policy:
  - Taylor-like rule with unexpected (conventional policy) and expected (forward guidance) deviations
  - Forward guidance imperfectly communicated (Campbell et al. 2019)
  - With or without ELB

Households

- Maximize expected lifetime utility

$$U_{j,t} = \mathbb{E}_t \sum_{i=0}^{J-j} \beta^i \frac{N_{j+i}}{N_j} \Bigg(\log(c_{j+s,t+s} - \varrho \bar{c}_{j+s,t+s-1}) + \psi_{j+s} \log \chi_{j+s+1,t+s+1} - \phi_{j+s} \frac{h_{j+s,t+s}(\iota)^{1+\varphi}}{1+\varphi} \Bigg)$$

subject to

$$c_{j,t} + p_{\chi,t}[\chi_{j+1,t+1} - (1-\delta_\chi)\chi_{j,t}] + a_{j+1,t+1} = w_t(\iota) z_j h_{j,t} + \frac{R^a_{j,t}}{\pi_t} a_{j,t} + tr_t$$

- Retired households do not work ($z_j = 0$ for $j \geq 45$)
- Financial assets managed by investment funds offering age-specific financial products
- Calvo-type wage stickiness

Investment funds

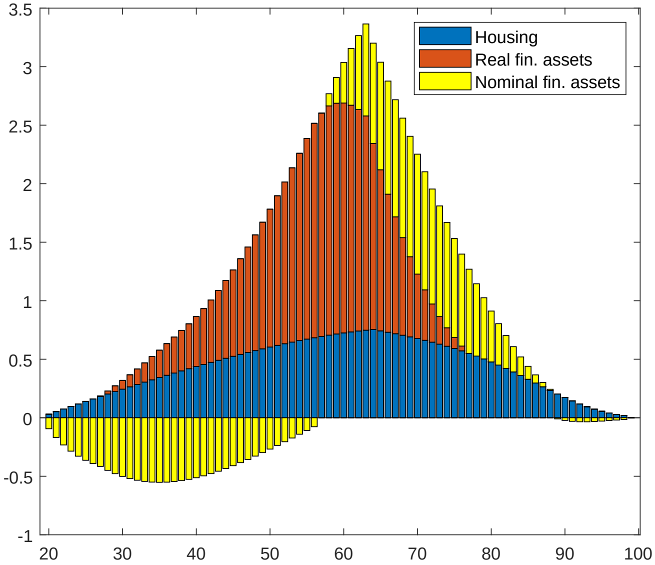
- Manage nominal and real financial assets owned by households
- Maximize expected return on total portfolio
- Distribute ex-post returns to HHs according to age-specific and exogenous portfolio composition

$$R^a_{j,t} = s_{j,t} R_{t-1} + (1 - s_{j,t}) R^a_t$$

HH balance sheet (incl. assets in investment funds)

Assets	Liabilities
Housing stock	Net worth
Real financial assets	Nominal financial liabilities
Nominal financial assets	

Asset distribution



Producers

- Final goods aggregated from differentiated intermediate products

$$c_t + i_t + \delta_\chi p_{\chi,t}\chi = \left[\frac{1}{N_t}\int_0^{N_t} y_t(i)^{\frac{1}{\mu}}\,\mathrm{d}i\right]^\mu$$

- Intermediate goods firms produce differentiated products

$$y_t(i) = k_t(i)^\alpha h_t(i)^{1-\alpha} - \Phi$$

- Zero profits in the steady state, Calvo-type price stickiness
- Capital producers are subject to investment adjustment cost

$$k_{t+1} = (1-\delta)k_t + \left[1 - S\left(\frac{i_t}{i_{t-1}}\right)\right] i_t$$

Monetary policy

- Taylor rule with ZLB

$$R_t = \begin{cases} R_t^{cb} & \text{if } R_t^{cb} > 1 \\ 1 & \text{if } R_t^{cb} \leq 1 \end{cases}$$

$$\frac{R_t^{cb}}{R} = \left(\frac{R_{t-1}}{R}\right)^{\gamma_R} \left[\left(\frac{\pi_t}{\pi}\right)^{\gamma_\pi} \left(\frac{y_t}{y_{t-1}}\right)^{\gamma_y}\right]^{1-\gamma_R} \exp(\varepsilon_t^R)$$

- Deviations ε_t^R can be unexpected or (imperfectly) communicated

Imperfect communication

- Noisy signal $\boldsymbol{s_t}$ about future policy deviations

$$\boldsymbol{s_t} = \boldsymbol{\varepsilon_t^R} + \boldsymbol{v_t}$$

  where $\boldsymbol{\varepsilon_t^R} = [\varepsilon_t^R ... \varepsilon_{t+H}^R]'$
- Kalman updating

$$E_t \boldsymbol{\varepsilon_t^R} = E_{t-1} \boldsymbol{\varepsilon_t^R} + \boldsymbol{\kappa} \left(\boldsymbol{s_t} - E_{t-1} \boldsymbol{\varepsilon_t^R} \right)$$

- Calibration of the Kalman gain matrix based on Campbell et al. (2019)

$$\boldsymbol{\kappa} = \begin{bmatrix} 0.2 & 0 & 0 \\ 0 & 0.6 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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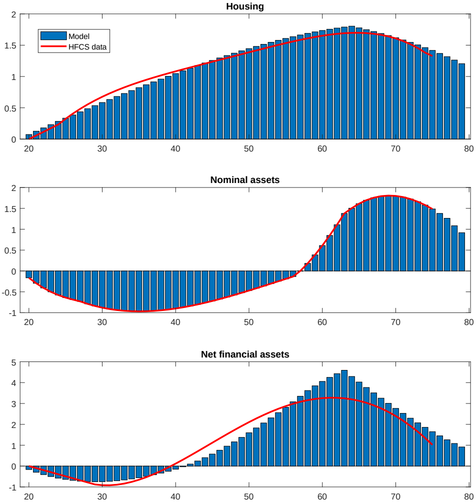
Calibration

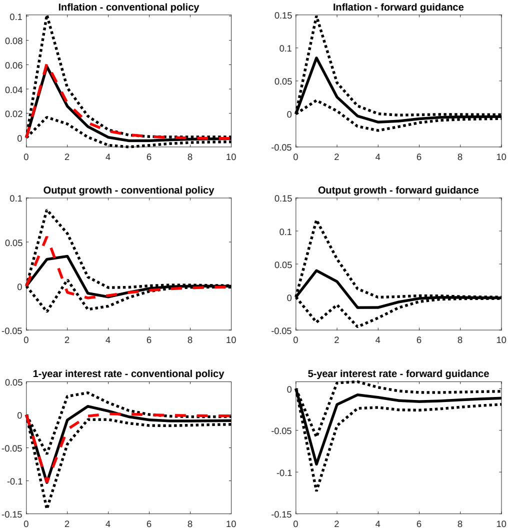
- Standard structural parameters: taken from literature or to match means (including aggregate asset composition)
- Taylor rule parameters: estimated
- Life-cycle features:
  - Demographic data: Eurostat and EUROPOP, period average: 1999-2018
  - Age-specific productivity, hours and asset structure: HFCS (2014)

Asset structure



VAR evidence

- Monetary shocks from high-frequency identification
- Source: Altavilla et al. (2019)
- Impulse responses: VAR for EA estimated over 2002-2018



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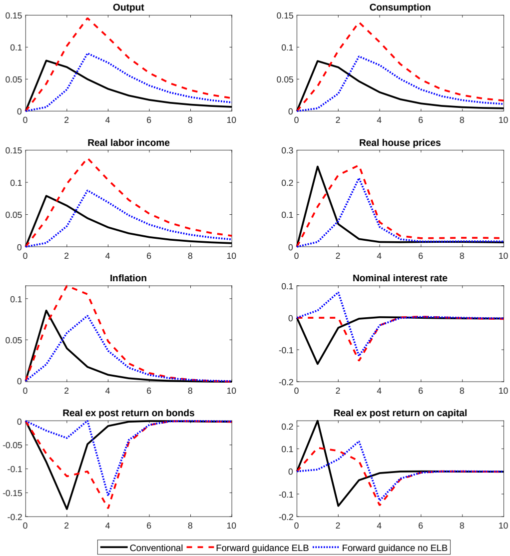
Overview of simulations

- Monetary shocks:
  - Conventional: unexpected deviation from policy rule (-25 bp)
  - Unconventional (with or without ELB): signal about -25 bp deviation from policy rule, issued 2 years ahead, repeated 1 year ahead, and implemented as announced

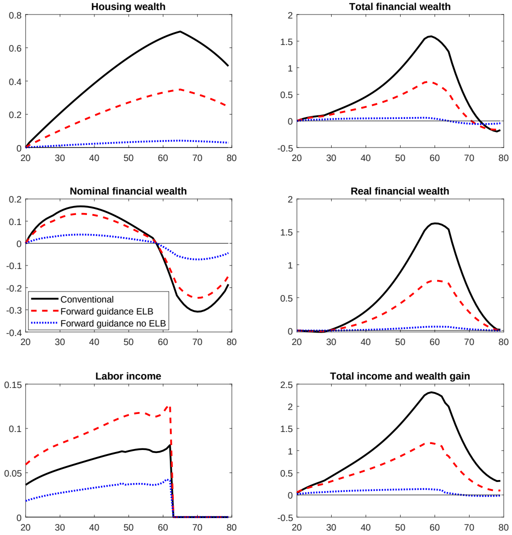
$$\boldsymbol{s}_1 = \begin{bmatrix} 0 \\ 0 \\ -0.0025 \end{bmatrix} \quad \boldsymbol{s}_2 = \begin{bmatrix} 0 \\ -0.0025 \\ 0 \end{bmatrix} \quad \boldsymbol{s}_3 = \begin{bmatrix} -0.0025 \\ 0 \\ 0 \end{bmatrix}$$

- Effects of conventional and unconventional monetary policy:
  - Aggregate effects
  - Balance sheet effects by cohort
  - Impact on remaining lifetime wealth by cohort
  - Impact on welfare by cohort

Aggregate effects of monetary policy easing



Balance-sheet and income effects on impact



Balance sheet vs remaining life-time effects

- What matters for redistribution are price changes of maturing assets (Auclert 2017)
- Asset holdings are mainly driven by life-cycle aspects, less so by price changes
  - Example: even if housing becomes expensive, young households continue accumulating it
- Higher asset prices may not necessarily benefit those who hold them
  - Example: higher house prices are bad for a 40-year old HH despite positive balance sheet effects, because it is in the process of accumulating housing

Definitions of remaining life-time effects

- House price effect

$$\Gamma^{\chi}_{j,t} = \mathbb{E}_t \sum_{i=0}^{J-j} \beta^i \frac{N_{j+i}}{N_j} \left(p_{\chi,t+i} - p_{\chi}\right) \left[(1-\delta_{\chi})\chi_{j+i} - \chi_{j+i+1}\right]$$

- Financial returns effect

$$\Gamma^{a}_{j,t} = \mathbb{E}_t \sum_{i=0}^{J-j} \beta^i \frac{N_{j+i}}{N_j} \left(\frac{R^a_{j+i,t+i}}{\pi_{t+i}} - \frac{R^a_{j+i}}{\pi} \right) a_{j+i}$$

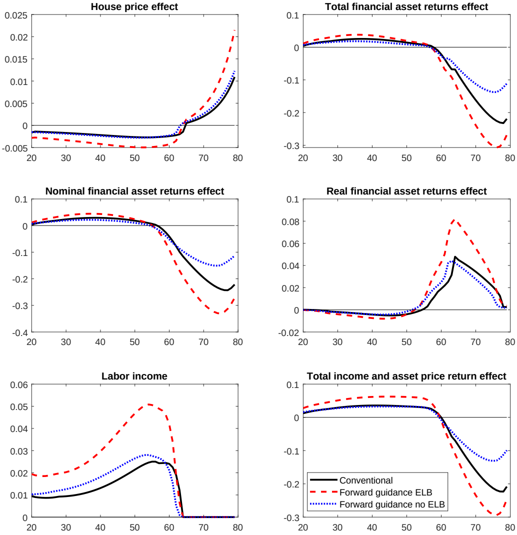
- Labor income effect

$$\Gamma^{w}_{j,t} = \mathbb{E}_t \sum_{i=0}^{JR-1-j} \beta^i \frac{N_{j+i}}{N_j} \left(w_{t+i} z_{j+i} h_{j+i,t+i} - w z_{j+i} h_{j+i}\right)$$

- Consumption streams (for normalization)

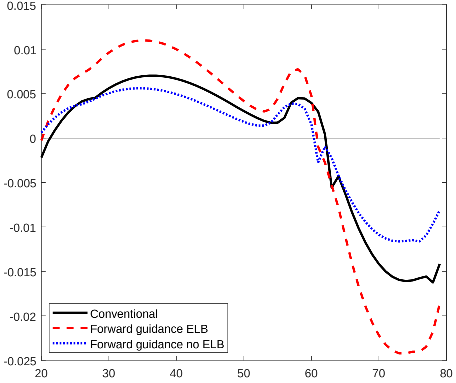
$$\Gamma^{c}_{j} = \sum_{i=0}^{J-j} \beta^i \frac{N_{j+i}}{N_j} c_{j+i}$$

Redistributive effects



Welfare effects

- Most comprehensive measure
- Captures i.a. negative effect of higher labor supply on utility



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Conclusions

1. Monetary policy redstributes welfare between age-cohorts: Monetary expansion benefits young HHs (at the expense of old HHs)
2. Welfare redistribution differs crucially from initial balance-sheet effects
3. Conventional policy and forward guidance differ, but not dramatically
4. Forward guidance at ELB can have larger redistributive effects than conventional policy

Outline

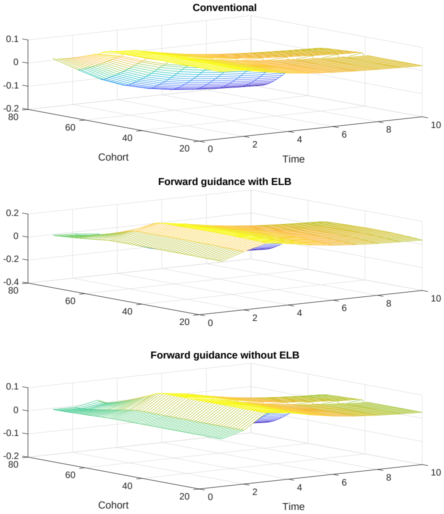
Calibration

Parameter	Value	Description
β	0.988	Discount factor
φ^{-1}	0.5	Frisch elasticity of labor supply
ϱ	0.8	Habit persistence
δ_{χ}	0.015	Housing depreciation rate
δ	0.12	Capital depreciation rate
α	0.3	Capital share in output
S_1	4	Investment adjustment cost curvature
μ	1.2	Product markup
θ	0.2	Calvo probability (prices)
μ_w	1.2	Wage markup
θ_w	0.32	Calvo probability (wages)
π	1.02	Inflation target
γ_R	0.41	Interest rate smoothing
γ_{π}	1.97	Reaction to inflation
γ_y	0.42	Reaction to GDP growth

Asset structure

- Aggregate data from financial and non-financial balance sheets (Eurostat, % of GDP w/o government expenditures):
    - Housing stock (170% GDP)
    - Nonresidential fixed assets (230% GDP)
    - HH loans / deposits (84% GDP)
- Age profiles from HFCS:
    - Housing = HH main residence + other non-business real estate property
    - Fixed assets = HH business wealth + non self-employment private business + shares + bonds + mutual funds
    - Nominal assets = deposits – mortgage loans – non-mortgage loans. Positive part adjusted proportionally so that net supply is zero

Impact on allocations: consumption



Impact on allocations: housing