The share of housing wealth and the decline in real interest rates

Markus Knell

Oesterreichische Nationalbank
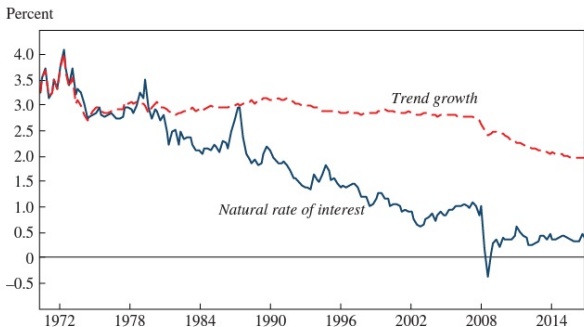
EEA-ESEM 2024,
Rotterdam, 27th August 2024

Secular decline in real interest rates

- Laubach/Williams (2003): Decrease for the United States since 1980: around 3%.
- Rachel/Summers(2019): Decrease for advanced economies since 1970: around 3%.

Figure 4. Changes in AE R^* and Trend Growth, 1971–2016

Increase in aggregate wealth

- Wealth-to-Income Ratio: From 340% (1980) to 570% (2017). Similar for US and Europe (EU4).
- Share of Housing Wealth: From 47% (1980) to 50% (2017). Larger increase from 1970 (39% → 50%). Very different for US (44% → 37%) and Europe (49% → 69%)

(a) Wealth-to-Income Ratio   (b) Share of Housing Wealth
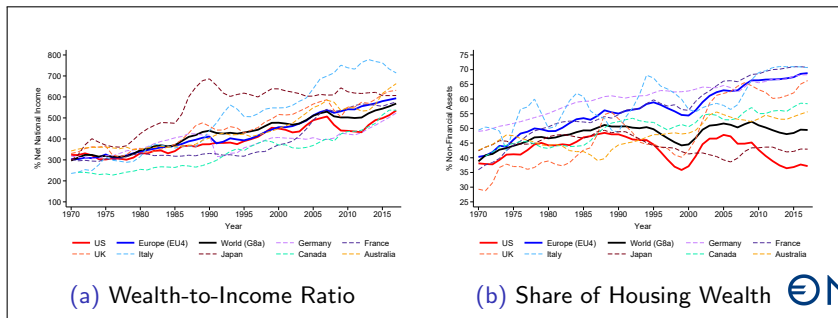
This paper

- Central question: Is it possible to reconcile the three trends in the framework of a standard model?
- Features of the model:
    - The decline in the interest rate by 3 pp to 4 is treated as given (explanations: aging, inequality, global savings glut,... ◂ See)
    - Two main assets:
        ○ Physical capital K_t
        ○ Housing stock $\overline{H}_t$ (rented and owner-occupied)
        ○ Public debt $\mathcal{D}_t$
    - Theoretical analysis and calibrated steady state comparisons (between 1980 and 2017)

ONB

Benchmark model

- GDP_t: $\boxed{Y_t = Y_{Nt} + P_{st}^r \overline{H}_t^r + P_{st}^o \overline{H}_t^o}$
    - Y_{Nt} ... non-housing production
    - $\overline{H}_t^r$ ... rented stock, $\overline{H}_t^o = \overline{H}_t^{om} + \overline{H}_t^{oo}$ ... owned stock
    - P_{st}^r: rent (*service* price), P_{ht}^r: *purchasing* price
- Model assumptions:
    - Owners with mortgages [*om*]:
      continuously refinance their purchases (no transaction costs)
    - Outright owners [*oo*]:
      do not put their houses on the market. Short-cut for:
        ○ Houses that people are not *allowed* to sell (trusts etc.)
        ○ Houses that people are not *willing* to sell ("old family
          property" etc.)
        ○ Sluggishness over the lifecycle ("aging in place" etc.)

ⒺNB

Non-housing production

- Output of "normal" (non-housing) goods and services via assembling intermediate goods:

$$Y_{Nt} = \left(\int_0^1 Y_{It}(j)^{\frac{1}{\mu}} \, \mathrm{d}a \right)^{\mu}$$

- Each intermediate good is produced with:

$$Y_{It}(j) = K_t(j)^{\alpha} \left[\mathcal{A}_t L_t(j) \right]^{1-\alpha}$$

- Productivity $\mathcal{A}_t$ grows at rate g, labor supply L_t at rate n.
- Factor markets are competitive.
- The net return on capital:

$$r_{kt} = \frac{\alpha}{\mu} \frac{Y_{Nt}}{K_t} - \delta_k$$

- The capital-to-income ratio in steady state (with $r_{kt} = r_k$):

$$\boxed{\beta_K^N \equiv \frac{K_t}{Y_{Nt}} = \frac{\alpha/\mu}{r_k + \delta_k}}$$

ƏNB

Housing

- Housing supply: $\overline{H}_t = \overline{H}_t^r + \overline{H}_t^o$
  - The housing stocks grow at rate n.

- The rental housing-wealth-to-income ratio:

$$\boxed{\beta_{Hr}^N \equiv \frac{P_{ht}^r \overline{H}_t^r}{Y_{Nt}} = \frac{P_{st}^r \overline{H}_t^r}{Y_{Nt}} \frac{P_{ht}^r}{P_{st}^r} = \phi \frac{P_{ht}^r}{P_{st}^r} = \frac{\phi}{r_h + \delta_h - g}}$$

Derivation:
- Assumption: Constant expenditure share on housing: $P_{st}^r \overline{H}_t^r = \phi Y_{Nt}$.
- r_{ht}: Rate of return on investments into rental housing:
$$r_{ht} = \frac{P_{st}^r}{P_{ht}^r} - \delta_h + \frac{\dot{P}_{ht}^r}{P_{ht}^r} \rightarrow P_{ht}^r = \frac{P_{st}^r}{r_{ht} + \delta_h - \frac{\dot{P}_{ht}^r}{P_{ht}^r}}$$
- In the steady state $\frac{\dot{P}_{ht}^r}{P_{ht}^r} = g$ and $r_{ht} = r_h$.

ⒺNB

Equilibrium share of housing wealth

- Abstract from owner-occupied housing ($\overline{H}_t^o = 0$): $\beta_H^N = \beta_{Hr}^N$

- Note that $\beta = \frac{\text{Wealth}_t}{NDP_t} = \beta^N \frac{Y_{Nt}}{NDP_t}$, $\beta_K = \beta_K^N \frac{Y_{Nt}}{NDP_t}$ etc.

- The ratio of housing wealth to capital wealth:

$$\boxed{\frac{\beta_H}{\beta_K} = \frac{\phi\mu}{\alpha} \frac{r_k + \delta_k}{r_h + \delta_h - g}}$$

- Note: $\frac{\beta_H}{\beta} = \frac{\beta_H}{\beta_H + \beta_K} = \frac{1}{\left(\frac{\beta_H}{\beta_K}\right)^{-1} + 1}$

- Example for reasonable parameter values (and $r_h = r_k$):
    - $\frac{\beta_H}{\beta} = 42.1\%$ for $r_k = 10\%$ (and $g = 3.11\%$)
    - $\frac{\beta_H}{\beta} = 42.0\%$ for $r_k = 7\%$ (and $g = 1.93\%$)
    - $\frac{\beta_H}{\beta} = 43.3\%$ for $r_k = 6\%$ (and $g = 1.93\%$)

ⵔNB

Why the weak reaction of β_H/β to change in r_k?

$$\frac{\beta_H}{\beta_K} = \frac{\phi\mu}{\alpha} \frac{r_k + \delta_k}{r_h + \delta_h - g}$$

- The interest rates affects both β_K and β_H (ambiguous impact on the *share* $\frac{\beta_H}{\beta}$)
- The size of the effect depends on the *level* of interest rate. A change from 5% to 2% has a different effect than a change from 10% to 7% (51% $\rightarrow$ 55.4% instead of 42.1% $\rightarrow$ 42%). Problems with assuming lower r_k: (i) empirical return on equity is higher, (ii) low r_k implies unrealistically high value for aggregate wealth.
- Simultaneous decrease in r_k and g mutes the response of r_k. If g would stay constant: $\frac{\beta_H}{\beta_K} = 42.1\% \rightarrow \frac{\beta_H}{\beta_K} = 46.1\%$. Problem: interest rate movements are the consequence of general economic developments.

ＯNB

Introducing owner-occupied housing

- The share of dwellers is denoted by κ_N^j,
  the share of dwellings by κ_H^j for $j \in \{r, om, oo\}$.

- The ratio β_{Ho}^N can be derived as before now with the
  mortgage interest rate r_m and δ_m.

- Assume that in equilibrium κ_H^r and κ_H^{om} adjust such that the
  actual and imputed rents are identical ($P_{st}^r = P_{st}^o$).

- The ratio of housing wealth to capital wealth:

$$\frac{\beta_H}{\beta_K} = \frac{\phi\mu}{\alpha} \left[\kappa_N^r \frac{r_k + \delta_k}{r_h + \delta_h - g} + \left(\frac{1 - \kappa_N^{oo}}{1 - \kappa_H^{oo}} - \kappa_N^r \right) \frac{r_k + \delta_k}{r_m + \delta_m - g} \right]$$

ƟNB

The influence of outright owners

$$\frac{\beta_H}{\beta_K} = \frac{\phi\mu}{\alpha}\left[\kappa_N^r\frac{r_k+\delta_k}{r_h+\delta_h-g} + \left(\frac{1-\kappa_N^{oo}}{1-\kappa_H^{oo}} - \kappa_N^r\right)\frac{r_k+\delta_k}{r_m+\delta_m-g}\right]$$

- If $r_m < r_h$ (or $\delta_m < \delta_h$) then a smaller share of renters will increase $\frac{\beta_H}{\beta_K}$

- $\frac{\beta_H}{\beta_K}$ also increases if the outright owners possess a larger proportion of dwellings ($\kappa_H^{oo} > \kappa_N^{oo}$).

- Example: Same calibration as before. Write $\kappa_H^{oo} = z \times \kappa_N^{oo}$.
  - z=1: $\frac{\beta_H}{\beta} = 42.1\%$
  - z=1.2: $\frac{\beta_H}{\beta} = 44.6\%$
  - z=1.6: $\frac{\beta_H}{\beta} = 50.5\%$

- Intuition: Reduction in traded houses $\overline{H}_t^{om}$ increases prices P_{st}^o and P_{ht}^o. The expenditure share $P_{st}^o\overline{H}_t^{om}$ of mortgaged houses stays the same and thus also their valuation. The increase in P_{ht}^o, however, drives the valuation of outrightly owned houses $P_{ht}^o\overline{H}_t^{oo}$.

ЄNB

Calibration

- Focus on steady-state comparisons between an "initial" situation (around 1980) and a "current situation" (around 2017).

- The values refer to the group of advanced countries

- Note:
    - Mark-up: $10\% \rightarrow 20\%$
    - Outright ownership: $\kappa_H^{oo}/\kappa_N^{oo}\ 1 \rightarrow 1.2$.

Description	Symbol	Value (1980)	Value (2017)	Source
Housing expenditure share	γ	17%	17.5%	OECD (2023)
HH total consumption share	ε	60%	60%	National Accounts
Depreciation rate of capital	δ_k	5%	7%	Dalgaard & Olsen (2021)
Depreciation rate of housing	δ_h, δ_m	2.5%	2%	Kaplan et al. (2020)
(Gross) Markup	μ	1.1	1.2	De Loecker & Eeckhout (2021)
Labor Share	φ_L	66%	60%	Gutiérrez & Piton (2020)
Risk wedge (commercial real estate)	ξ_h	0%	0%	Jordà et al. (2019)
Risk wedge (mortgage interest rate)	ξ_m	2%	2%	Jordà et al. (2019)
Risk wedge (government bonds)	ξ_d	5%	5%	Jordà et al. (2019)
Share of renters	κ_N^r	45%	38%	Jordà et al. (2016)
Share of outright owners	κ_N^{oo}	29%	30%	OECD (2023)
Share of outrightly owned houses	κ_H^{oo}	29%	36%	OECD (2023), ECB (2021)
Elasticity of housing supply	χ	0.5	0	Benchmark values

ÖNB

Numerical results (world average)

	β (in %)		$\frac{\beta_H}{\beta}$ (in %)	
Model (Changes in)	**1980** ($r_k = 10\%$)	**2017** ($r_k = 7\%$)	**1980** ($r_k = 10\%$)	**2017** ($r_k = 7\%$)
g, n and β_D	**340**	**483**	**47**	**48**

ƎNB

Numerical results (world average)

Model (Changes in)	β (in %)		$\frac{\beta_H}{\beta}$ (in %)	
	1980 ($r_k = 10\%$)	**2017** ($r_k = 7\%$)	**1980** ($r_k = 10\%$)	**2017** ($r_k = 7\%$)
g, n and β_D	**340**	**483**	**47**	**48**
also in μ, $\kappa_H^{oo}/\kappa_N^{oo}$	340	480	47	52

ㄷNB

Numerical results (world average)

Model (Changes in)	β (in %)		$\frac{\beta_H}{\beta}$ (in %)	
	1980 ($r_k = 10\%$)	**2017** ($r_k = 7\%$)	**1980** ($r_k = 10\%$)	**2017** ($r_k = 7\%$)
g, n and β_D	**340**	**483**	**47**	**48**
also in μ, $\kappa_H^{oo}/\kappa_N^{oo}$	340	480	47	52
also in other param.	340	489	47	59

€NB

Numerical results (world average)

Model (Changes in)	β (in %)		$\frac{\beta_H}{\beta}$ (in %)	
	1980 ($r_k = 10\%$)	**2017** ($r_k = 7\%$)	**1980** ($r_k = 10\%$)	**2017** ($r_k = 7\%$)
g, n and β_D	**340**	**483**	**47**	**48**
also in μ, $\kappa_H^{oo}/\kappa_N^{oo}$	340	480	47	52
also in other param.	340	489	47	59
also (part of) future profits	**340**	**561**	**47**	**52**

ᴓNB

Numerical results (regional differences) 1

- There are considerable cross-country differences in the level and change of specific structural parameters.
- Focus on two of them:
  - Mark-up (De Loecker & Eeckhout, 2021):
    - US: 15% → 30%
    - Europe: 5% → 10%
  - Outright ownership $\kappa_H^{oo}/\kappa_N^{oo}$ ◂ Data :
    - US: 0.8 → 0.8
    - Europe: 1.2 → 1.6

ӨNB

Numerical results (regional differences) 2

Region	β (in %)		$\frac{\beta_H}{\beta}$ (in %)	
	1980 $(r_k = 10\%)$	**2017** $(r_k = 7\%)$	**1980** $(r_k = 10\%)$	**2017** $(r_k = 7\%)$
	Results of the calibrated model			
World	340	561	47	52
US	364	574	44	43
Europe (EU4)	332	646	50	68

ӨNB

Numerical results (regional differences) 2

Region	β (in %) 1980 ($r_k = 10\%$)	β (in %) 2017 ($r_k = 7\%$)	$\frac{\beta_H}{\beta}$ (in %) 1980 ($r_k = 10\%$)	$\frac{\beta_H}{\beta}$ (in %) 2017 ($r_k = 7\%$)
	Results of the calibrated model			
World	340	561	47	52
US	364	574	44	43
Europe (EU4)	332	646	50	68
	Empirical Data (Wealth Inequality Database, WID)			
World (G8)	346	568	47	50
US	332	536	44	37
Europe (EU4)	333	595	49	69

ꞒNB

Conclusions

- Study whether the decline in real interest rates can be reconciled with the increases in wealth-to-income ratios and housing wealth shares within a standard economic model.

- This is impossible in a benchmark setting where only the interest rate, productivity, population growth, and public debt change. In this case the model counterfactually implies almost no change in the housing wealth share between 1980 and 2017.

- Incorporating additional factors, such as the role of outright owners and higher markups, improves the model's alignment with empirical data.

- The model is also in line with regional differences between the US and Europe if one takes regional variations in the markups and the prevalence of outright owners into account.

ⓈNB

# Appendix

Explanations for the decline in real interest rates

- Demographic aging increased the need for old age provision
  (Eggertson et al., 2019; Auclert et al., 2021)
- Increasing income inequality and the "saving glut of the rich"
  (Mian et al., 2020)
- Global saving glut and safe assets shortage
  (Bernanke, 2005; Caballero et al., 2017)
- Calibrated models confirm the importance of these factors:
  - Mankiw (2022): A simple Solow model with only s and $g + n$
  - Rachel/Summers (2019): A Blanchard/Yaari/Gertler model
  - Platzer/Peruffo (2022): A large-scale model

◂ Back

ᏇNB

Outright owners

- Wide variation of κ_N^{oo} across countries: 15%-25% (AT, DE, NL) to $> 75\%$ (Eastern Europe).
- In the US the share κ_N^{oo} decreased from 26% to 22% while it increased for the UK from 37% (1980) to 41% (2018)
- Positive correlation of outright ownership rates with aggregate wealth and with housing wealth share.

◂ Back
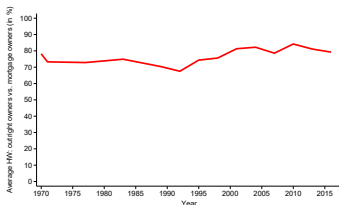
(a) Housing wealth of outright owners vs. mortgage owners (US)
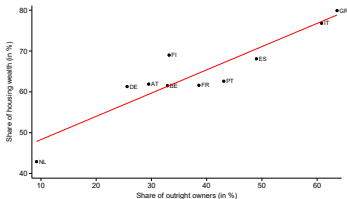
(b) Share of outright owners vs. share of housing wealth (Europe)