

Why Are Interest Rates So Low? The Role of Demographic Change

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Bank of England

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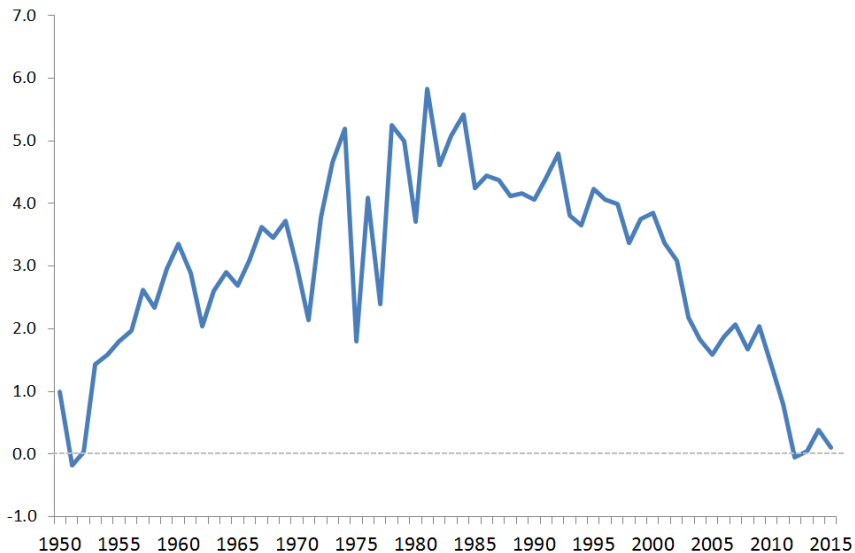
Key points

- Real interest rates have fallen to unprecedented lows
- Many things affecting past and future interest rates
- We quantify in an OLG model the extent to which the fall in interest rates can be explained by population ageing
- We find that ageing can explain:
 - About 160bp of fall in advanced-country interest rates since 1980, with 40bp still to come.
 - More than 3/4 of the rise in house prices, housing wealth to GDP ratio and private credit to GDP ratio
 - Some labour productivity slow down from the 2000s on
 - About 30% of global NFA positions
- These effects would be larger without the presence of housing and tradable claims to monopoly profits
- Rising retirement age and international capital-market integration pose risks

Plan of talk

- Key facts and intuition
- Model
- Results
- Sensitivities, extensions and caveats

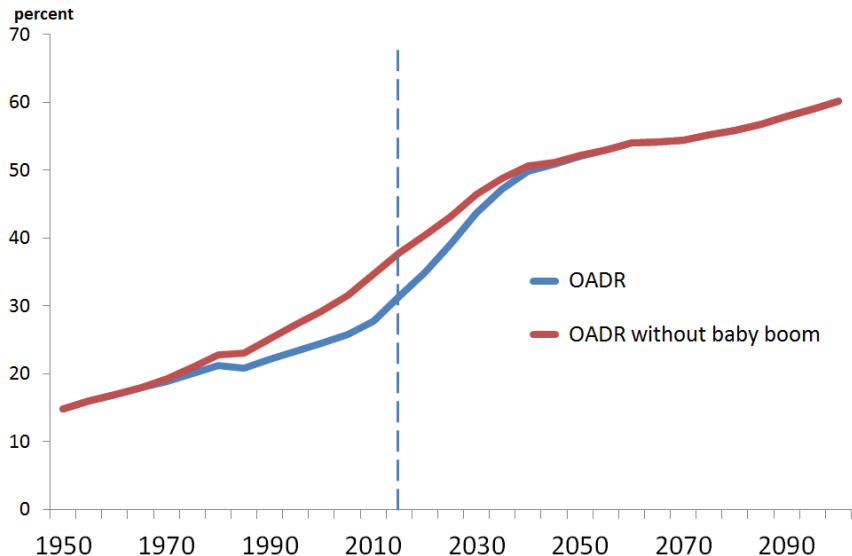
World real interest rate since 1950



source: King and Low (2014), Rachel and Smith (2015)

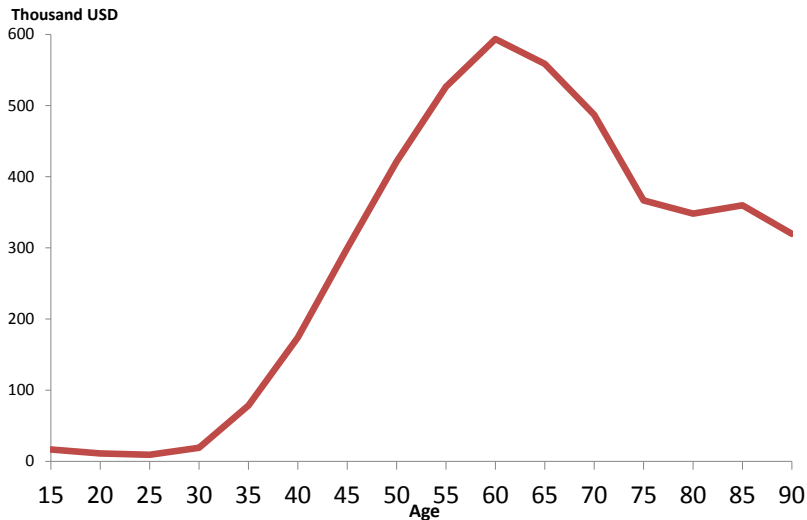
Ageing and the baby boom

Aging of baby boomers cannot explain the persistent rise in the OADR

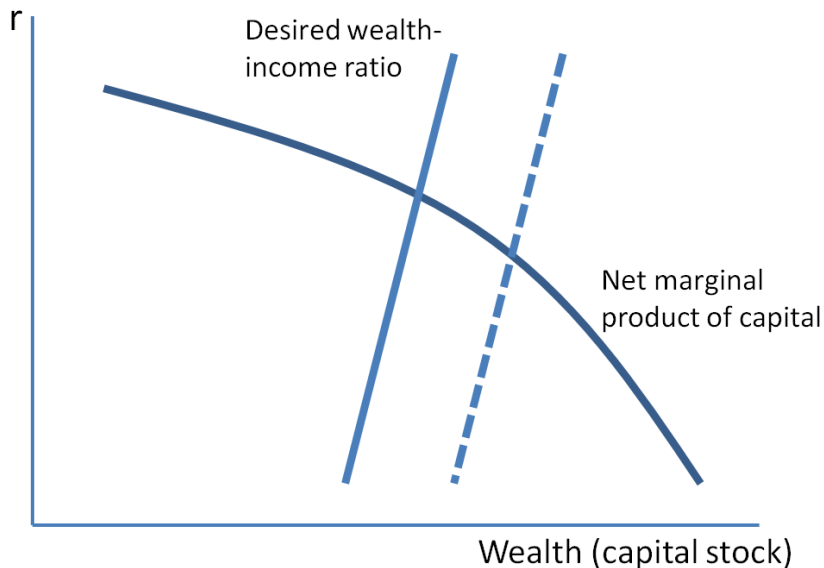


Age-wealth profile

(Survey of Consumer Finances, Average Net Worth excl. Housing)



Intuition: How demographics affect interest rates



- Closed economy: Carvalho et al (2016), Eggertsson et al (2017), Gagnon et al (2016), , Marx et al (2016)
- Open economy: Backus et al (2014), Domeij and Floden (2006), Krueger and Ludwig (2007)

- Calibrated neoclassical overlapping generations model
- Consumers value consumption, housing and bequests
- Net savings of households invested by firms
- Variable birth rates and life expectancy
- Solved assuming perfect foresight

Model: Household's Problem

The household born at time t maximises:

$$\max_{\{c_{\tau,t}, a_{\tau,t}, h_{\tau,t}\}_{\tau=1}^T} \sum_{\tau=1}^T \beta_{\tau} \tilde{\psi}_{\tau,t} (\ln c_{\tau,t} + \theta_{\tau} \ln h_{\tau,t}) + \beta_T \tilde{\psi}_{T,t} \phi \ln a_{T,t}$$

subject to, for $\tau = 1, \dots, T$:

$$c_{\tau,t} + a_{\tau,t} + p_{t+\tau-1}^h (h_{\tau,t} - h_{\tau-1,t}) \leq w_{t+\tau-1} \epsilon_{\tau} l_{\tau,t} + (1 + r_{t+\tau-1}) a_{\tau-1,t} + \pi_{\tau,t}$$

τ : age ; t : birth year

$\tilde{\psi}_{\tau,t}$: survival probability up to age τ

Labor supply is inelastic

Fixed number of periods when the household is able to “move”; otherwise, we impose $h_{\tau,t} = h_{\tau-1,t}$.

Model: Firm's Problem

At each period t , the firm maximises:

$$\max_{L_t, K_t} F(K_t, L_t) - w_t L_t - (r_t + \delta) K_t$$

$$F(K, L) = A \left[(1 - \alpha) L^{\frac{\sigma-1}{\sigma}} + \alpha K^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

► FOC

Model: Market Clearing

\tilde{X}_t : value of X_t per aggregate capita.

Market Clearing at every period t :

- Capital/Asset Market

$$\tilde{A}_{t-1} = \tilde{K}_t$$

- Labour Market

$$\tilde{\rho}' \mathbf{1}_t = \tilde{L}_t$$

- Housing Market

$$\tilde{H}_t = \tilde{H}$$

- Goods Market

$$\tilde{Y}_t = \tilde{C}_t + \tilde{I}_t$$

Steady state exists in per capita terms.

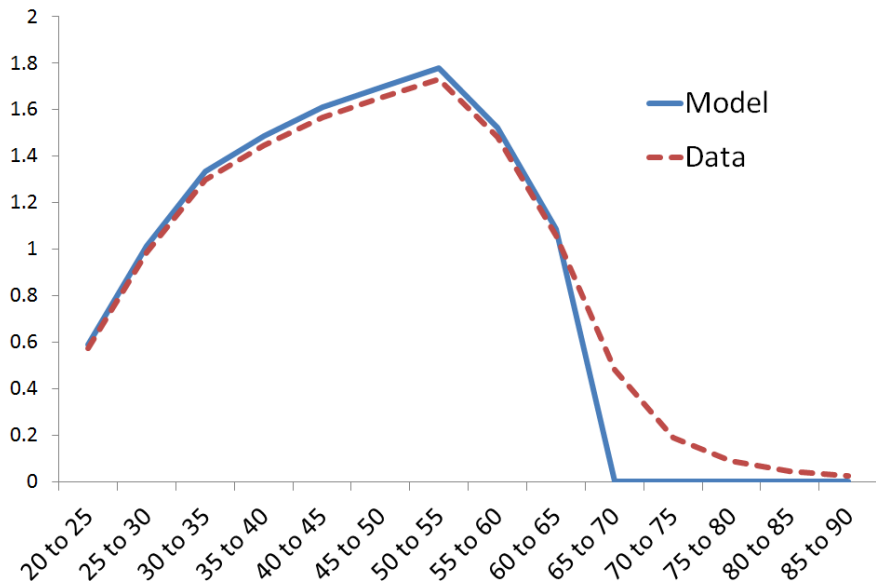
Housing supply exogenously increases with total population size.

Population data for advanced economies: Western Europe, North America, Japan, Australia, New Zealand [▶ details](#)

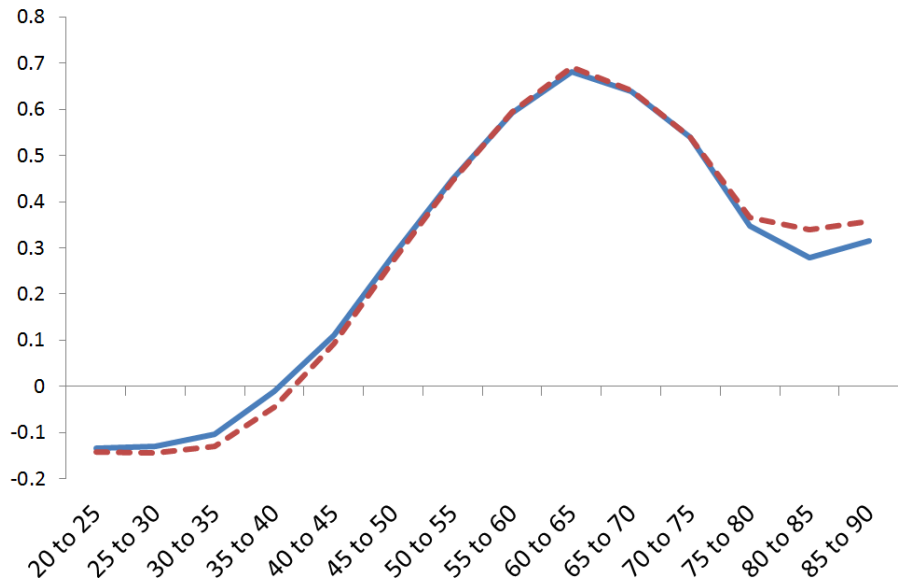
Calibration to match moments from the data:

- Average aggregate values in the 1970s
 - World interest rate: 3.7%
 - Housing wealth/GDP ratio: 145%
 - Credit/GDP ratio: 35%
- Life-cycle patterns from the US Survey of Consumer Finances, from 1989 to 2013
 - Labour productivity
 - Net wealth (excluding housing)
 - Housing wealth

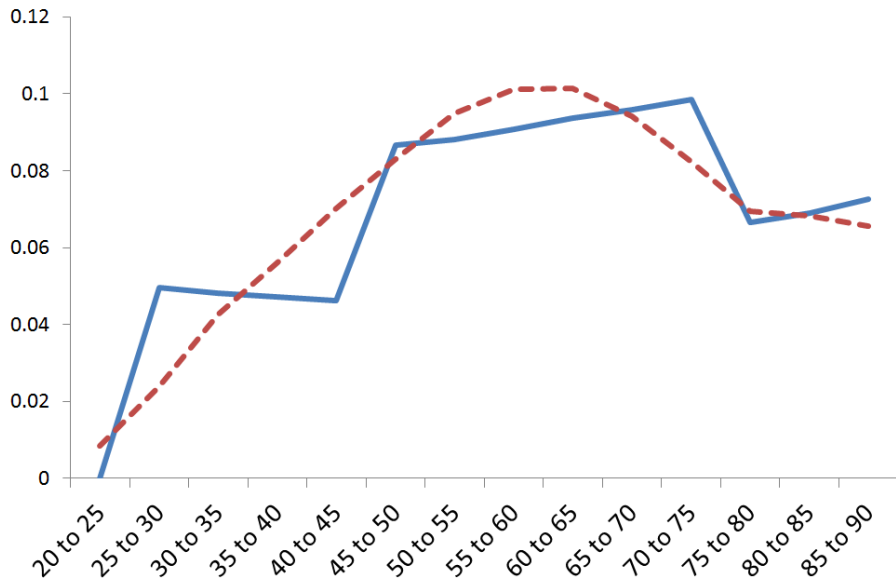
Calibration: Labour productivity



Calibration: Net Worth (excl. housing)



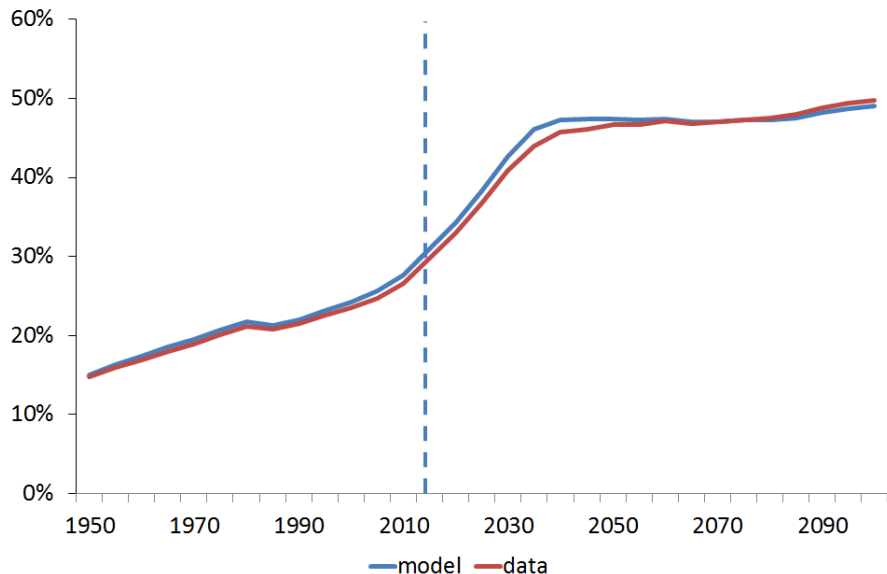
Calibration: Housing Wealth



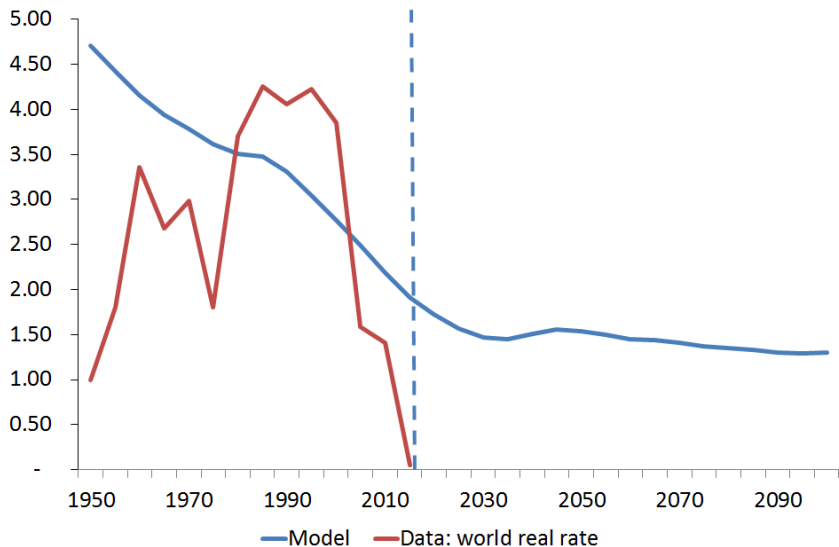
Using the model

- Incorporate both the baby boom and the increase in life expectancy in our model
- Compute the transition from the 1950s to the 2100s according to the UN population predictions
- Match the data in the 1970s
- Let the model speak before and after these dates

Model outcome: Old age dependency ratio



Model outcome: Annual interest rate

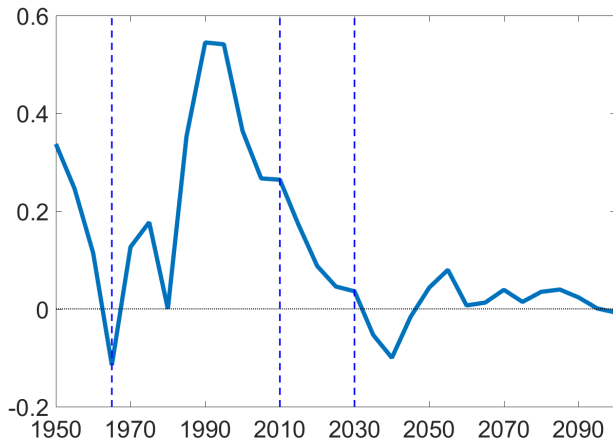


Model outcome: Housing and credit



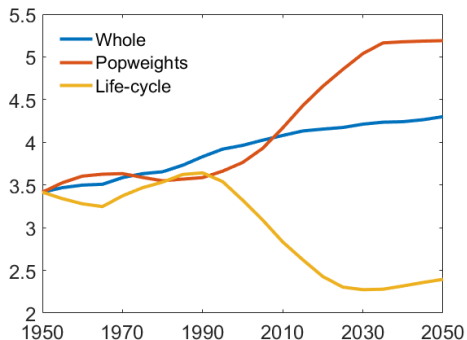
Model outcome: Labour productivity

Deviation from trend of labour productivity (annualised growth)



Life-cycle pattern of labour productivity generates some of recent slowdown

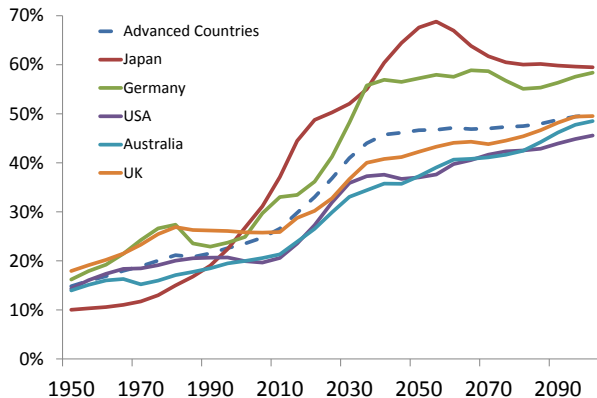
Decomposing the drivers of the capital-output ratio



Powerful general equilibrium effects in the model from prices to saving

- Popweights: changing only the population age structure
- Life-cycle: changing only the household's optimal behaviour

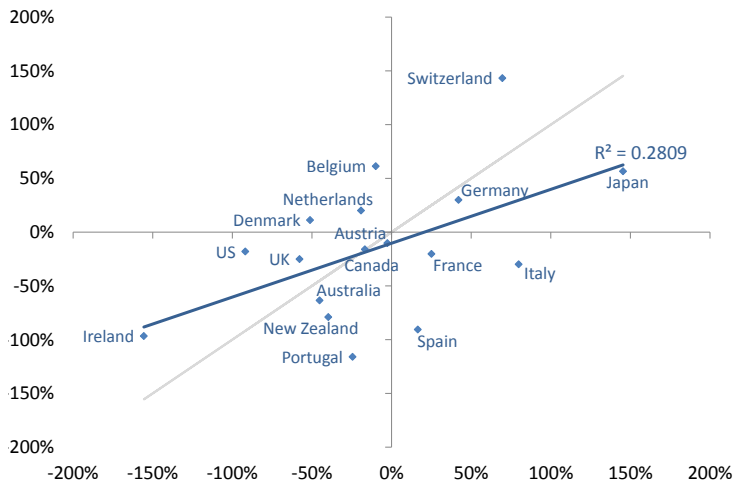
OADR Across Countries



Ageing trends are very different across the industrialised world

Open economy: model vs data

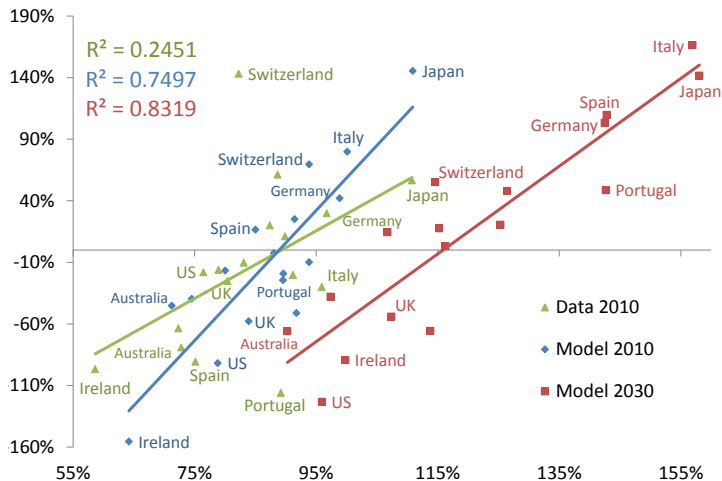
NFA/GDP in the Model vs Data



Note: Model on x-axis and Data on y-axis, grey line is the 45 degree line.

Open economy: model predictions

Demographic Changes and NFA accumulation

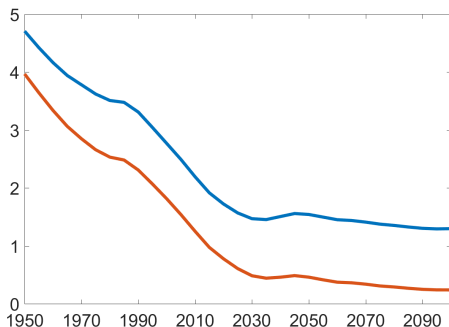


Note: HWR on x-axis and NFA/GDP on y-axis.

- Housing
- Monopoly profits
- Retirement age

Sensitivities and extensions: housing

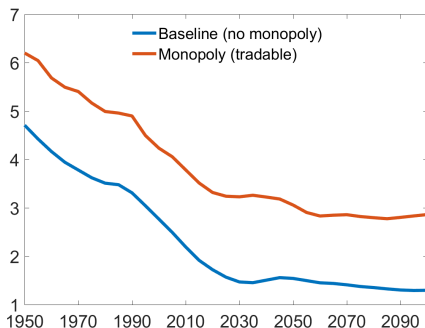
- Housing facilitates life-cycle saving, somewhat attenuating effects of demographics
- Prevents negative interest rates



- Red line - baseline model
- Blue line - same calibration, no housing

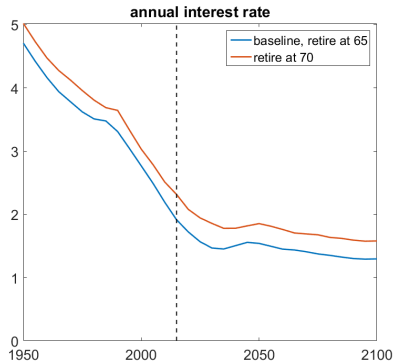
Sensitivities and extensions: monopoly profits

- Add monopolistic competition and supernormal profits to the corporate sector.
- In partial equilibrium, this pushes down on the interest rate $r_t = \frac{1}{\mu} \frac{\partial Y_t}{\partial K_t}$
- Tradable claims constitute an additional store of value, again attenuating fall in interest rates and preventing them going negative



Sensitivities and extensions: retirement age

Simulations varying retirement age by 5 years



Effects of retirement age increase surprisingly small

Conclusions and next steps

- The population share over 50 is a reasonable summary statistic of the demographic pressure on the level of interest rates
- Demographic pressures explain around half the fall in real interest rates since the 1970s, most of the rise in house prices and household debt and about 30% of cross-sectional variation in NFA positions.
- Housing and tradable claims on supernormal profits attenuate these effects, and - absent frictions - prevent rates going negative
- Not a forecast that rates will remain low - many other factors in play