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

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Key points

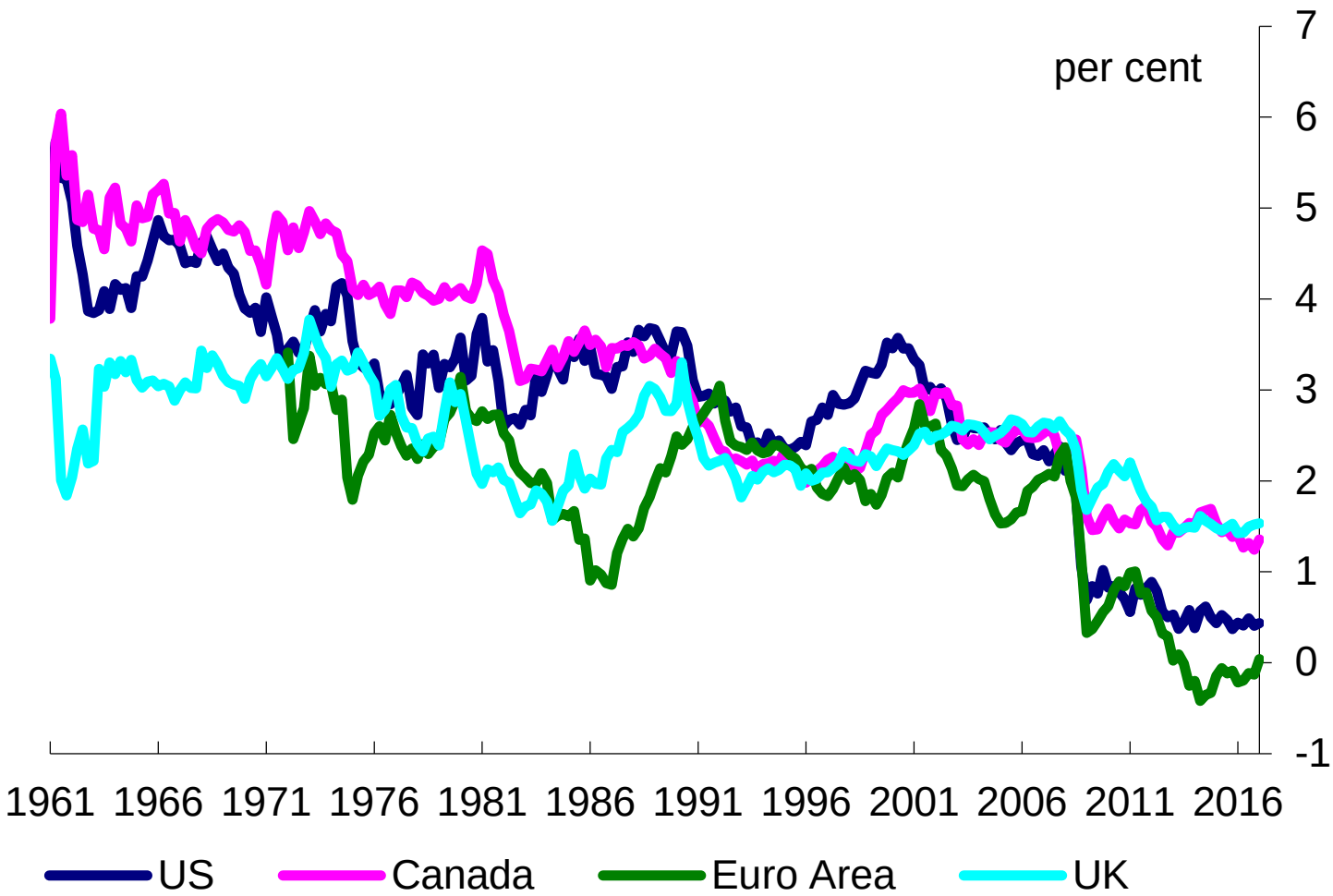
- Real interest rates have fallen to unprecedented lows
- We quantify in an OLG model the extent to which this can be explained by population ageing
- We find that ageing can explain:
  - About 160bp of fall in advanced-country interest rates since 1980, with 40bp still to come.
  - More than 3/4 of 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 substantial risks
- Many other things affecting past and future interest rates

Plan of talk

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

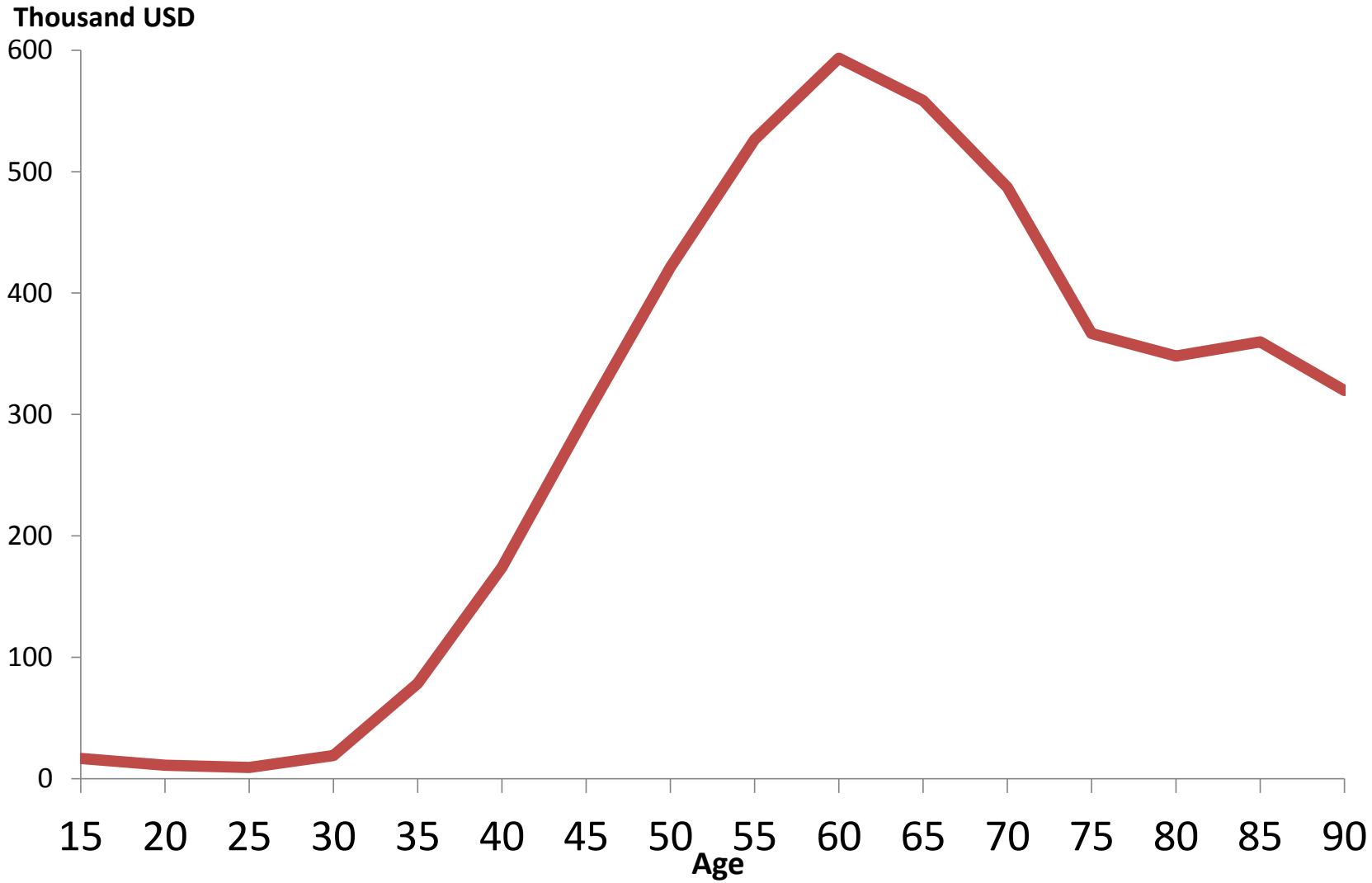
World real interest rate since 1961

Source: Holston, Laubach and Williams



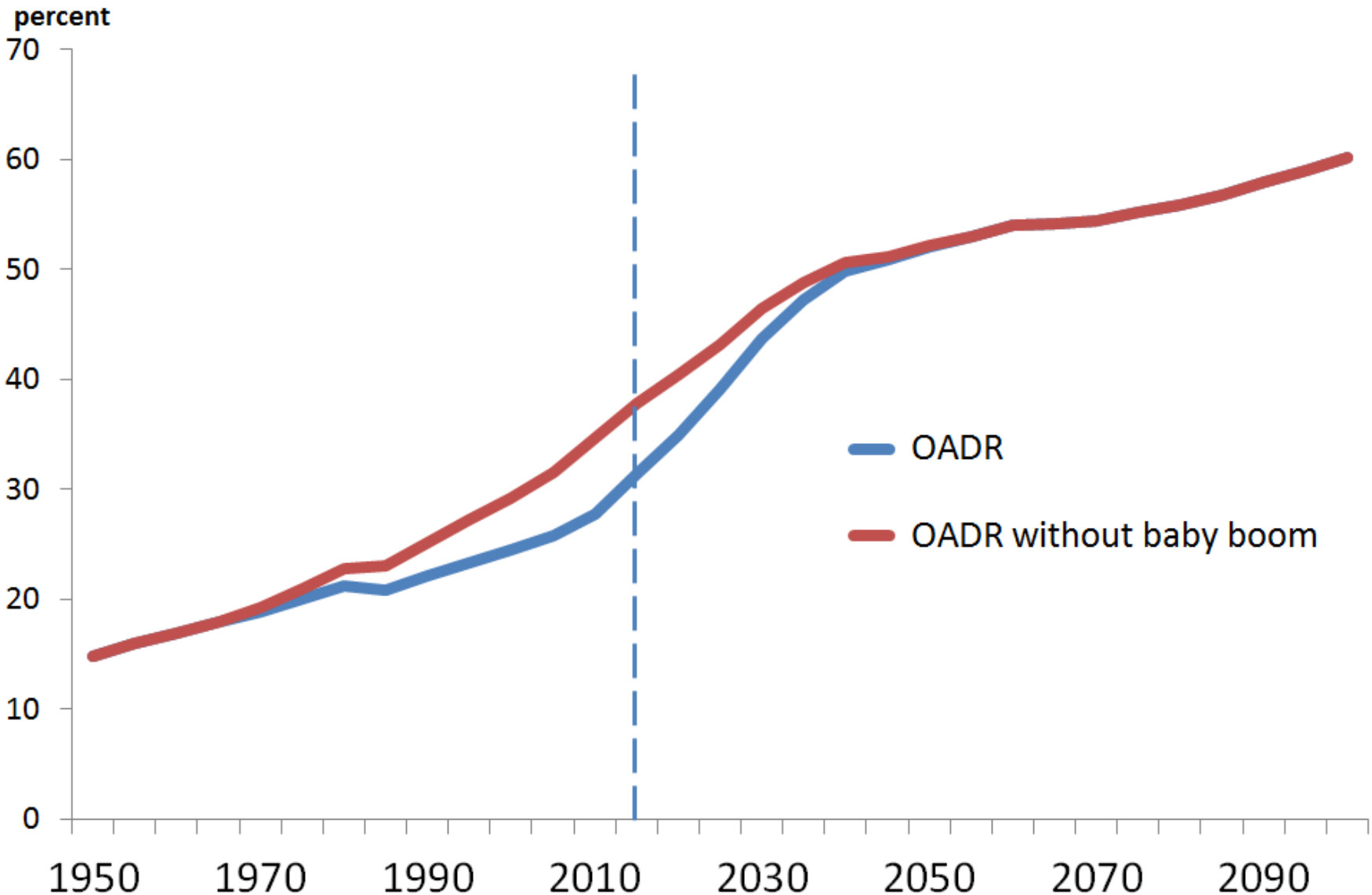
Age-wealth profile

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

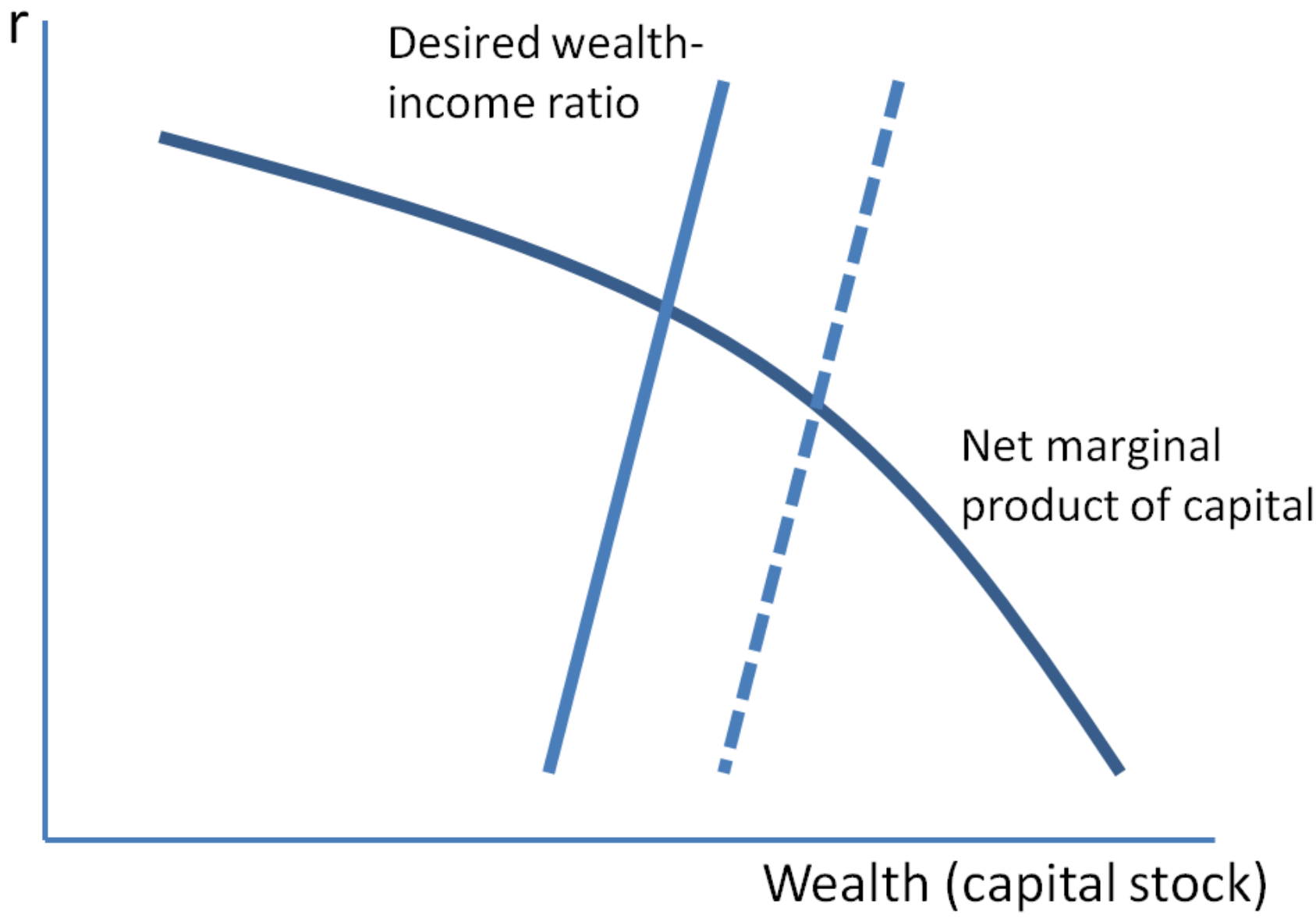


Ageing and the baby boom

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



Intuition: How demographics affect interest rates



Related literature

- 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)

Model: overview

- 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:

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

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

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

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 $h_{\tau,t} = h_{\tau-1,t}$.

▸ FOC

Model: Firm's Problem

At each period t, the firm maximises:

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

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

▸ 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
$$\tilde{\rho}' \epsilon \mathbf{l}_t = \tilde{L}_t$$
- 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.

▸ details

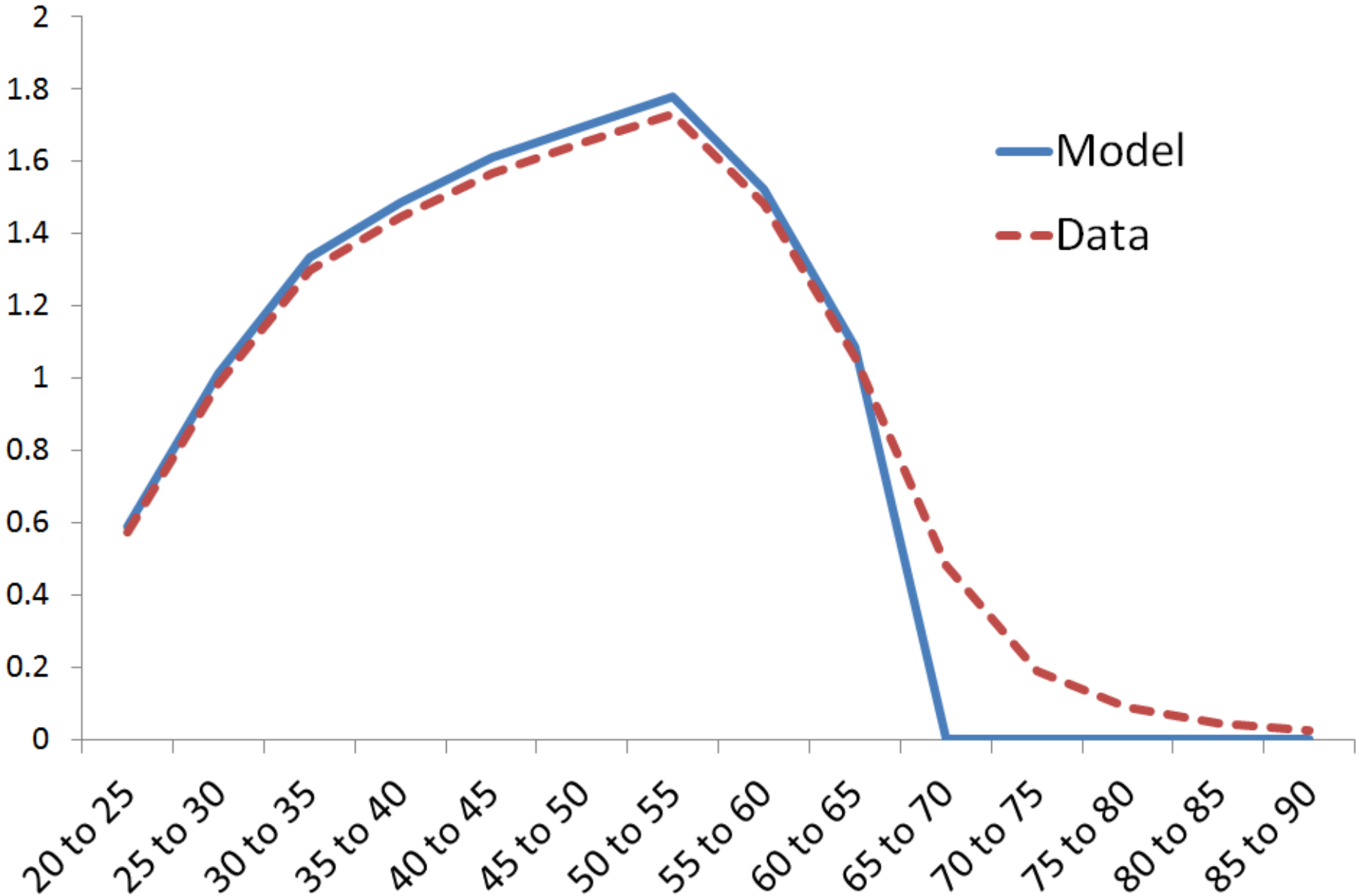
Calibration

Population data for advanced economies: Western Europe, North America, Japan, Australia, New Zealand ▸ details

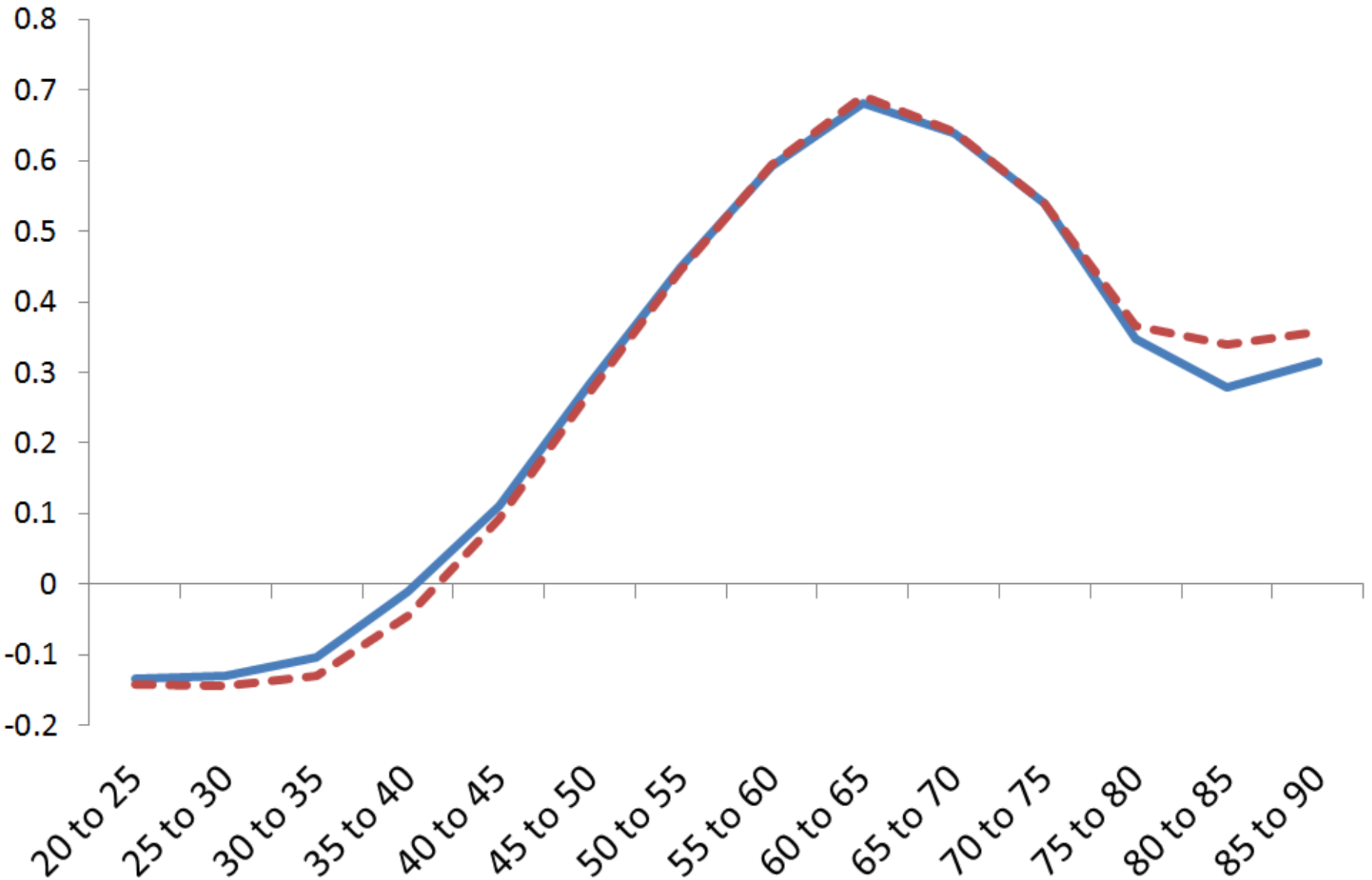
Calibration to match moments from the data:

- 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

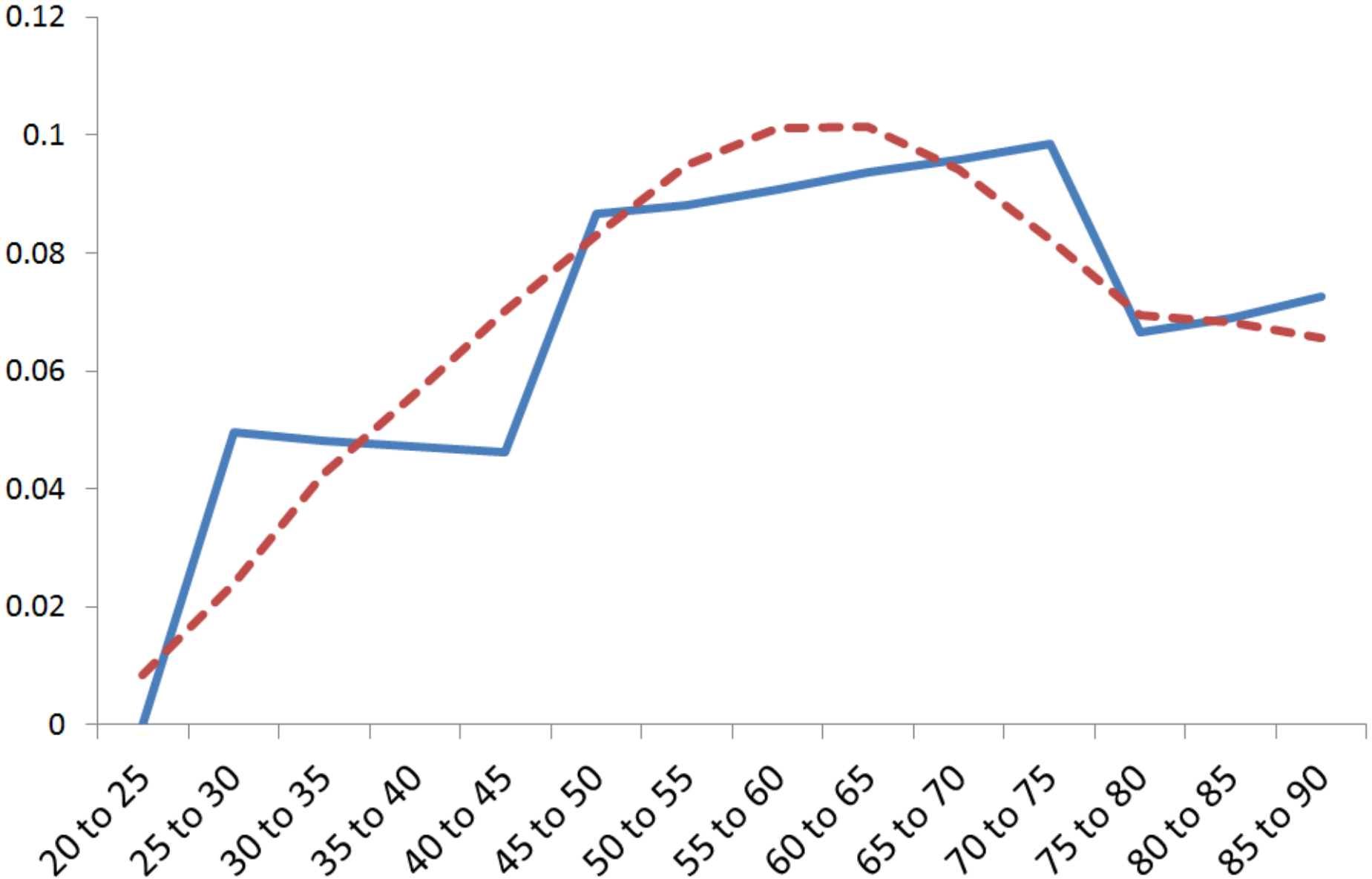
Calibration: Labour productivity



Calibration: Net Worth (excl. housing)



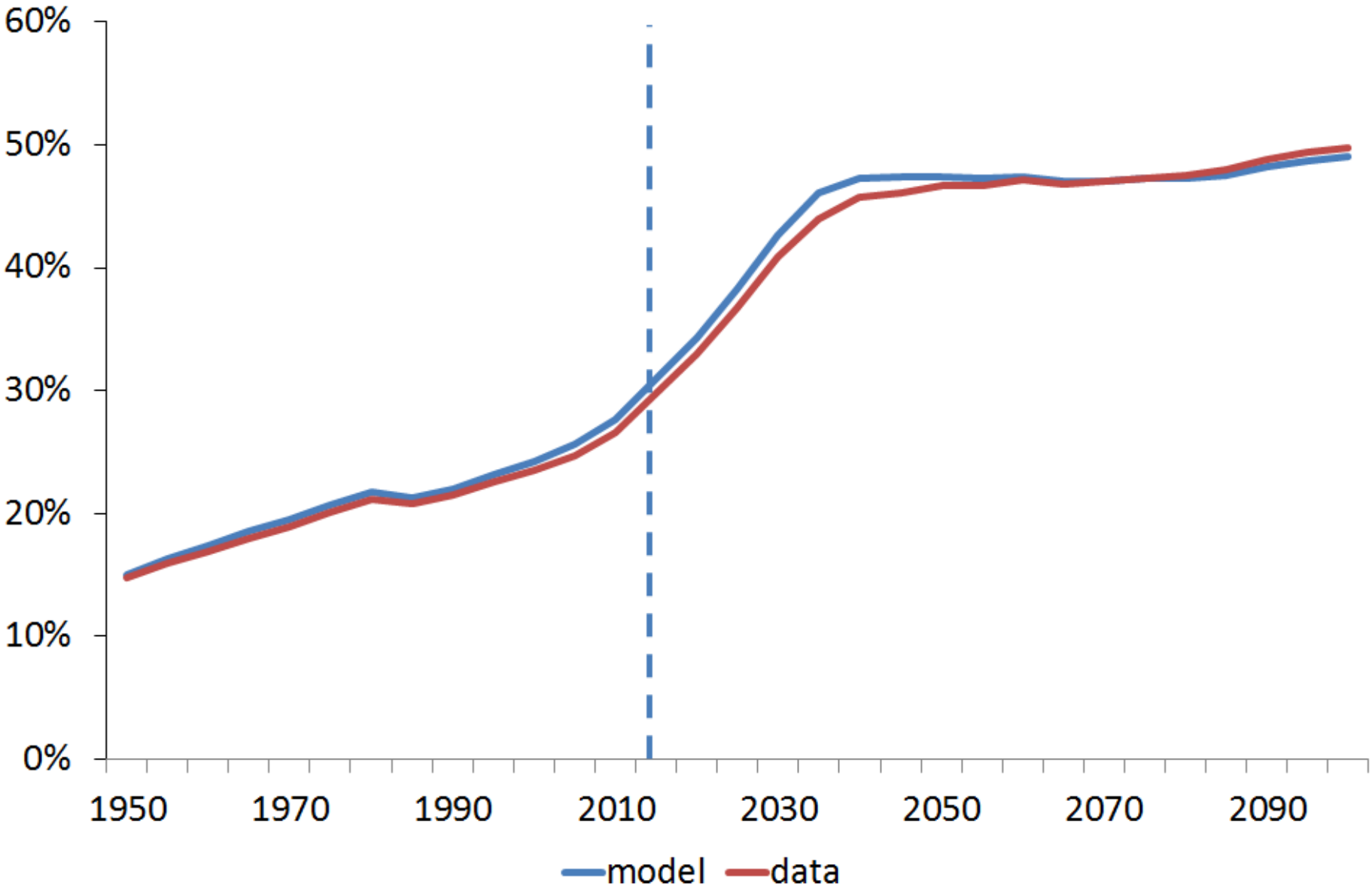
Calibration: Housing Wealth



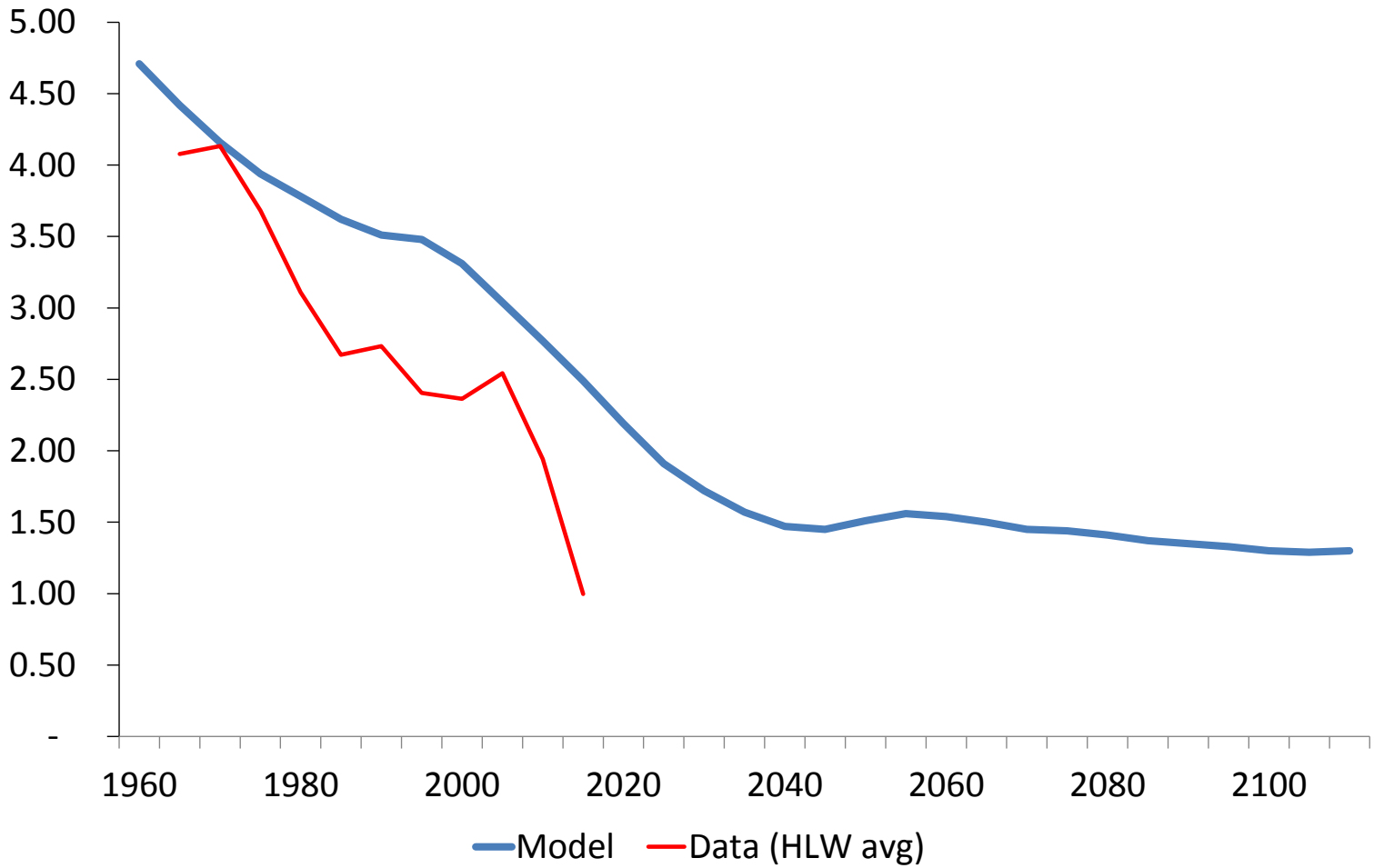
Using the model

- 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

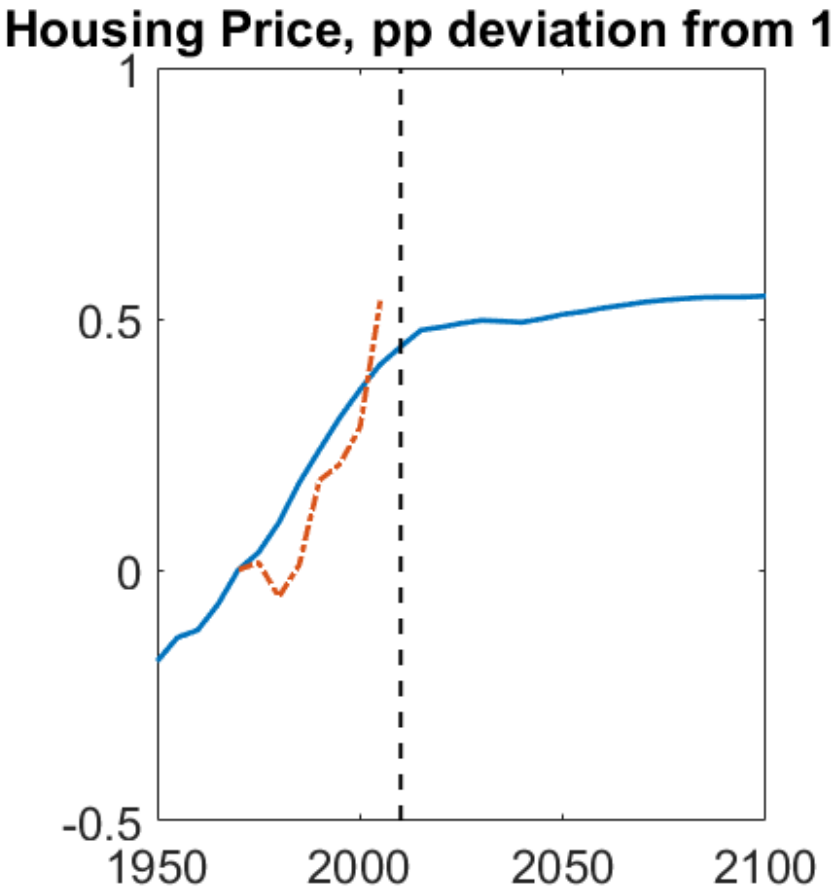
Model outcome: Old age dependency ratio

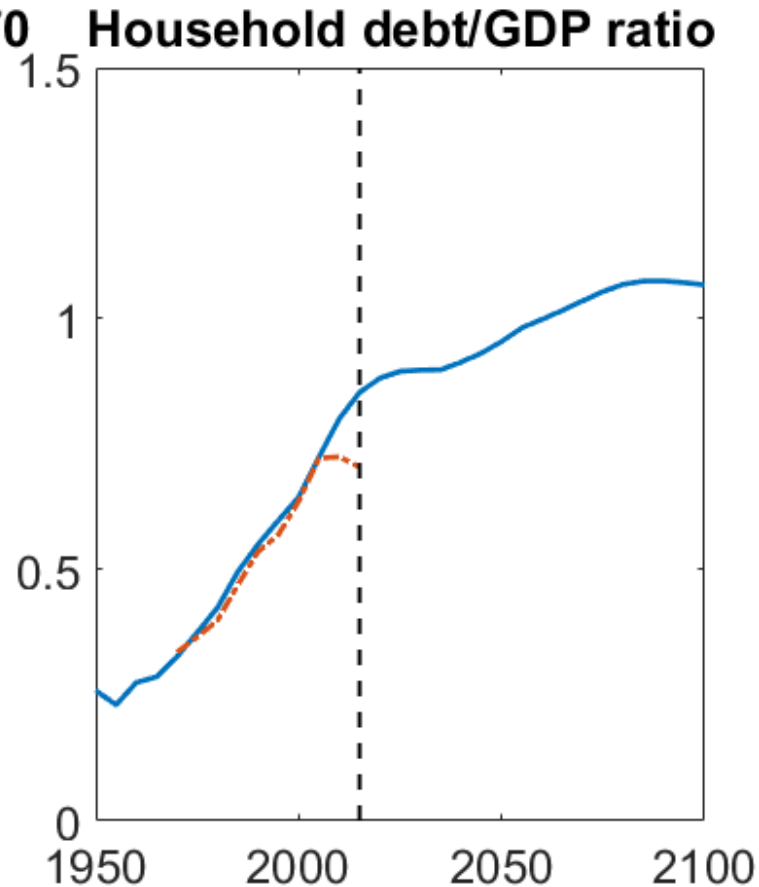


Model outcome: Annual interest rate



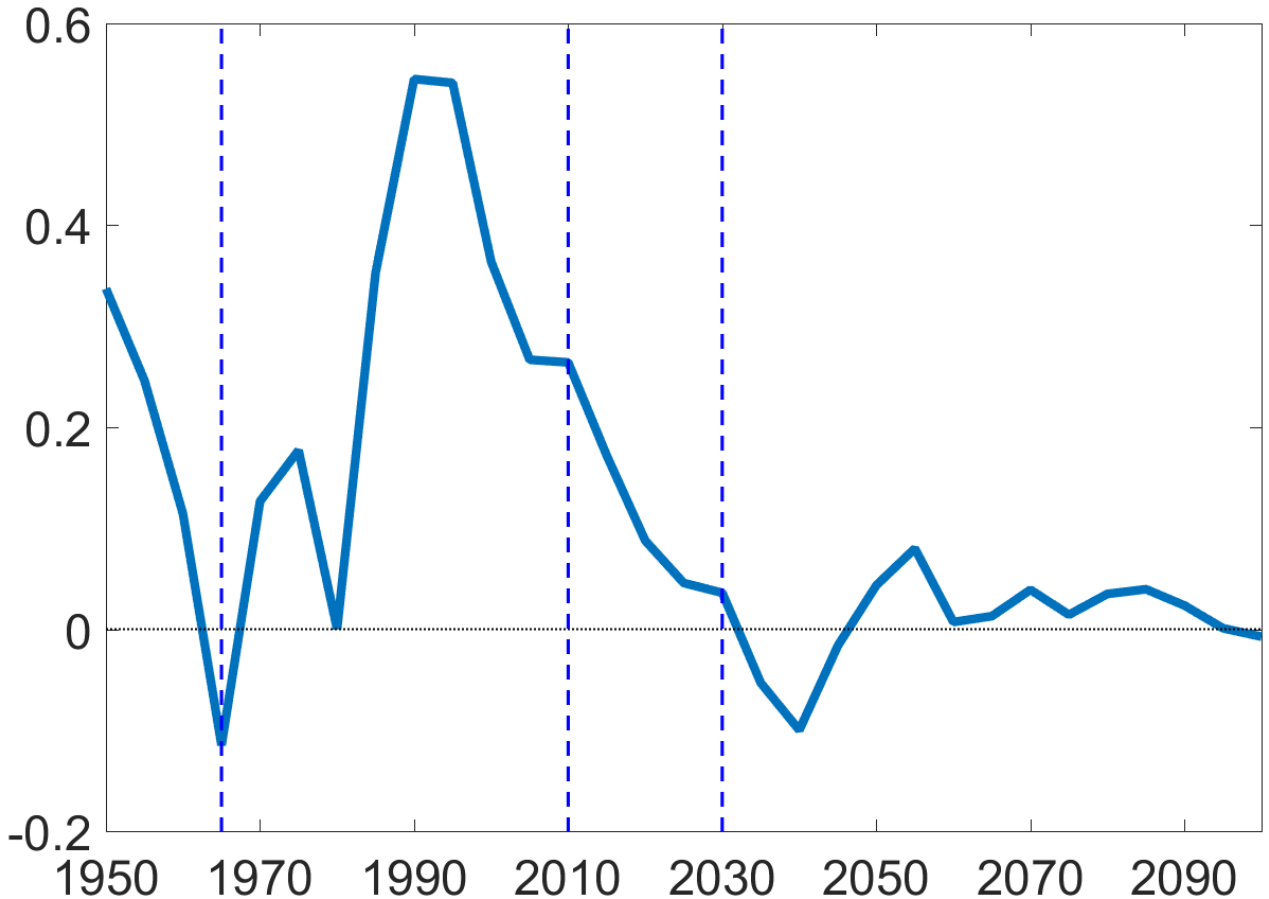
Model outcome: Housing and credit





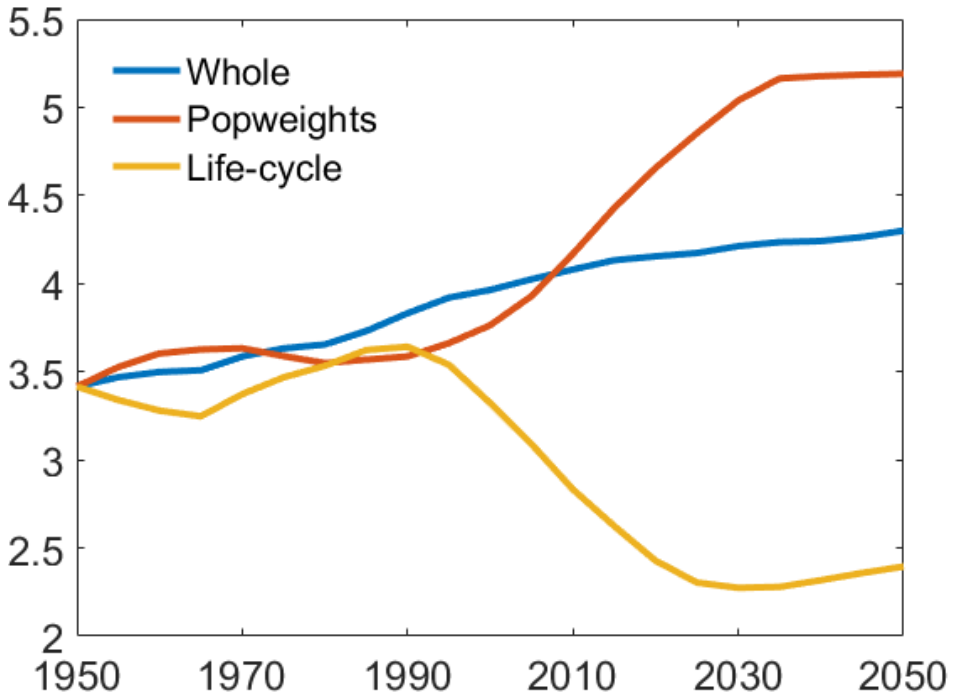
Model outcome: Labour productivity

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

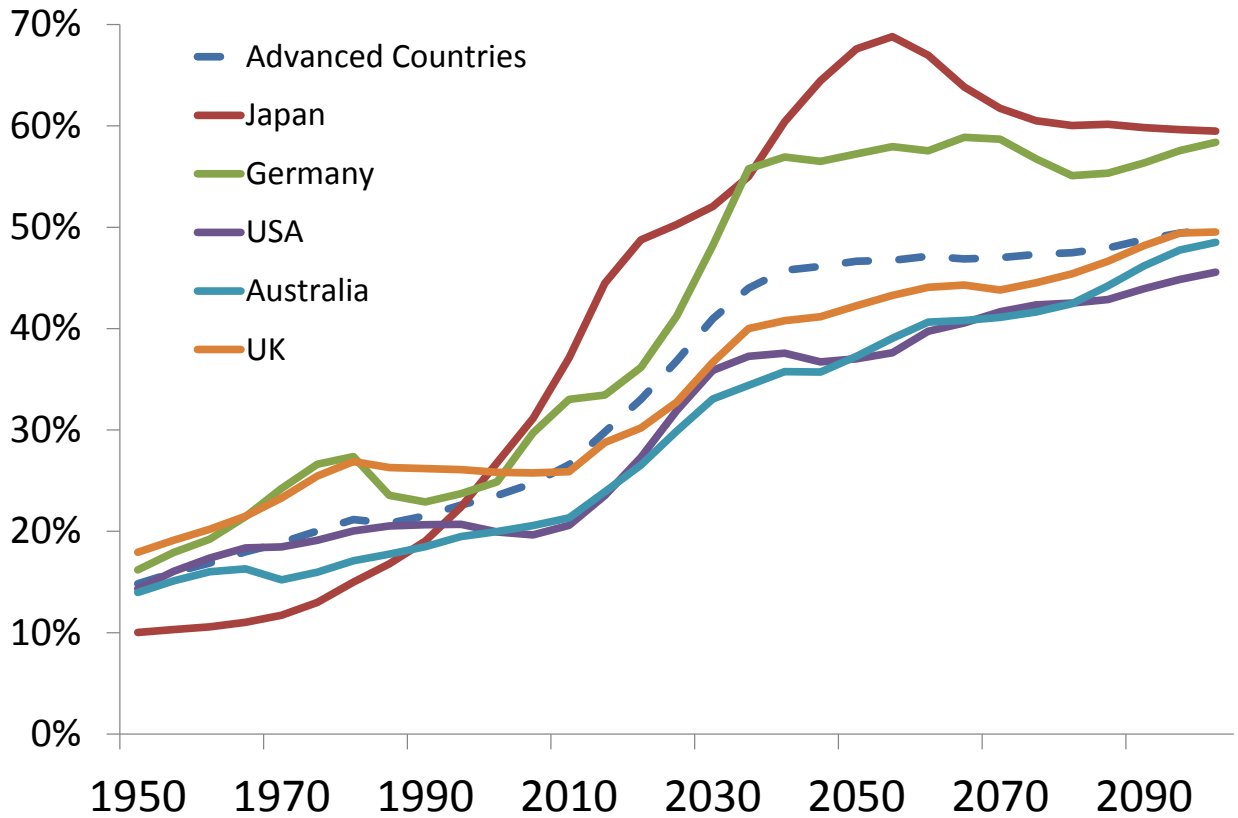


Powerful general equilibrium effects in the model from prices to saving

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

Open economy

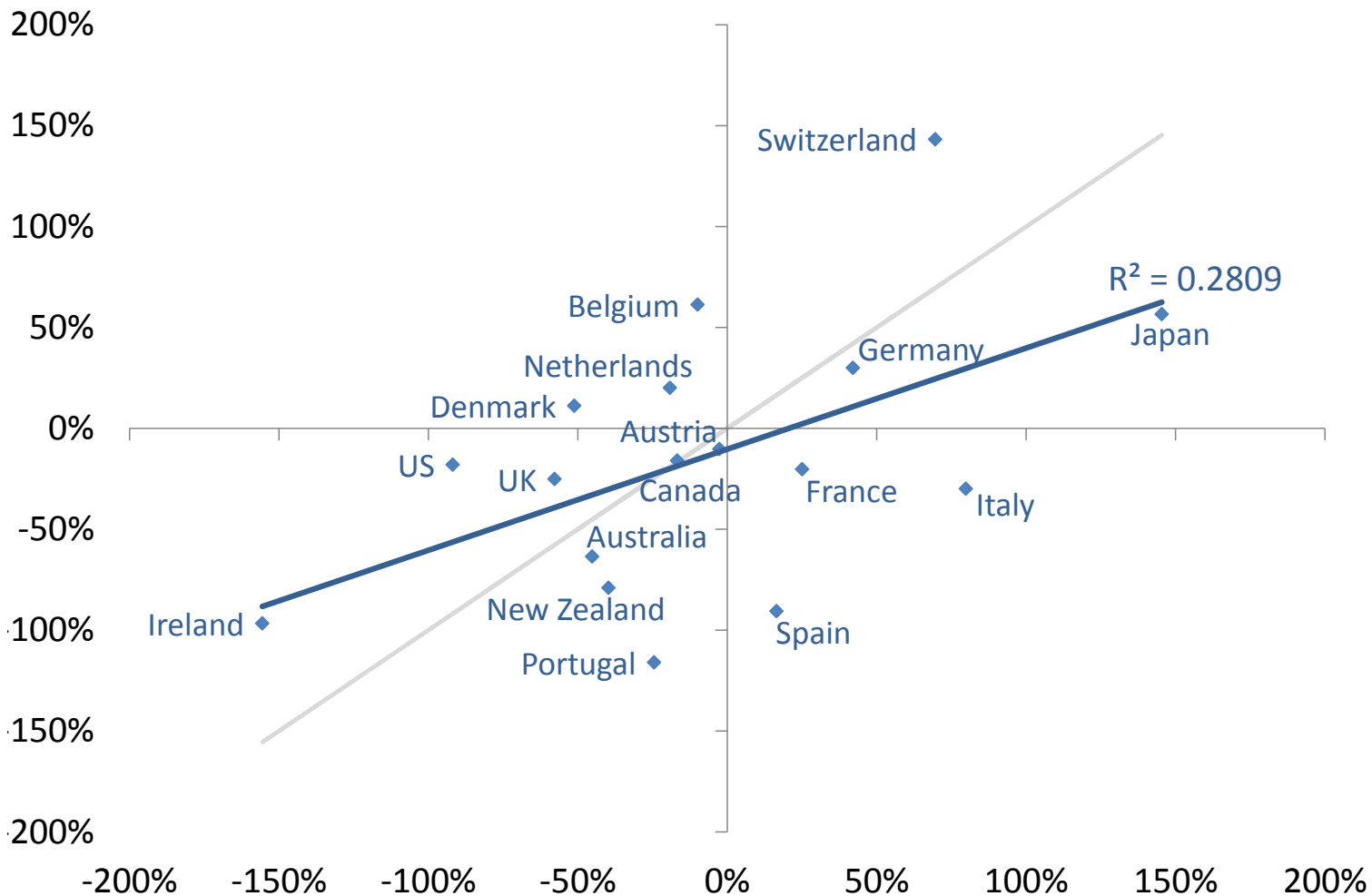
OADR Across Countries



Ageing trends are very different across the industrialised world

Open economy: model vs data

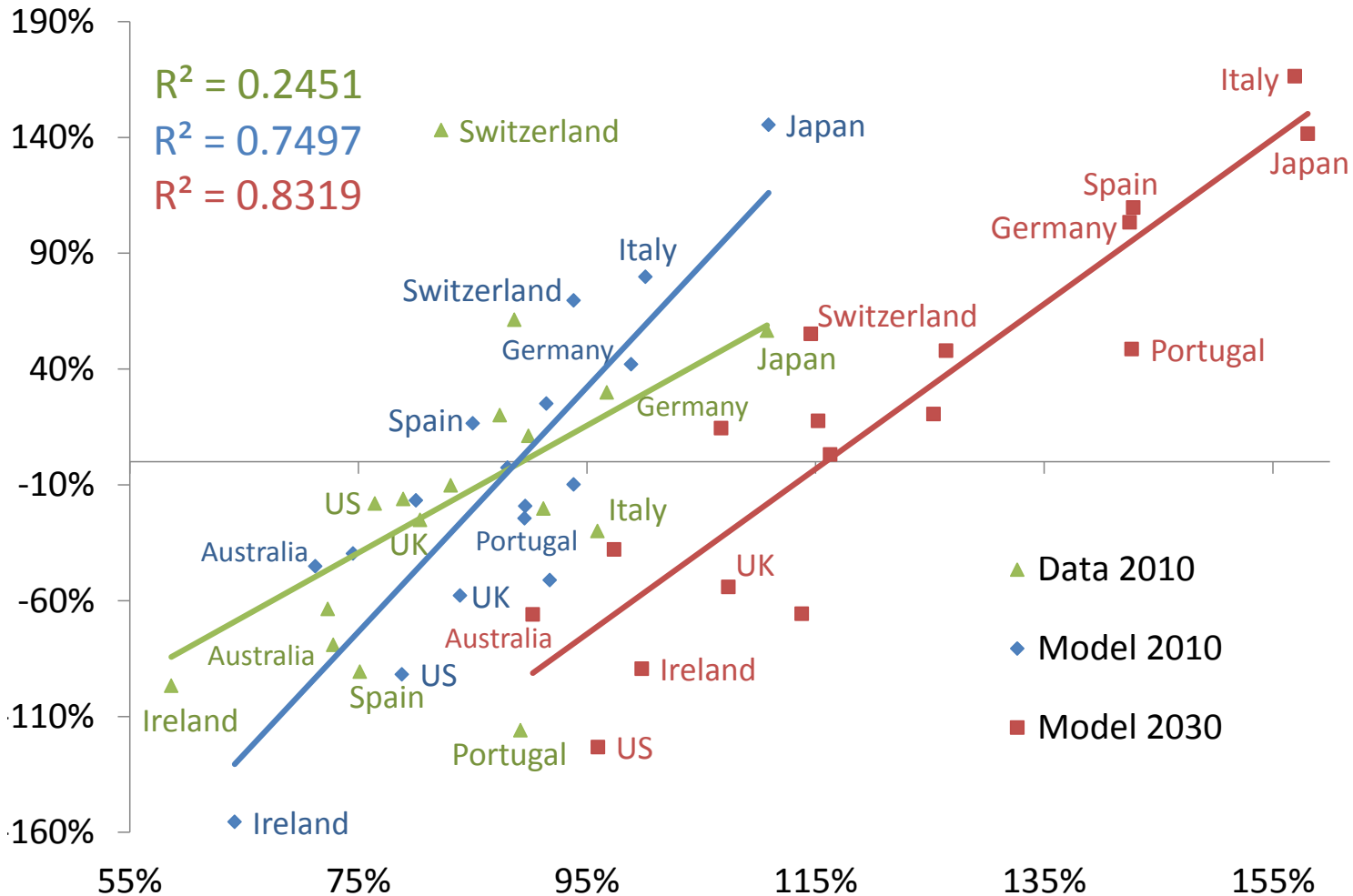
NFA/GDP in the Model vs Data



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.

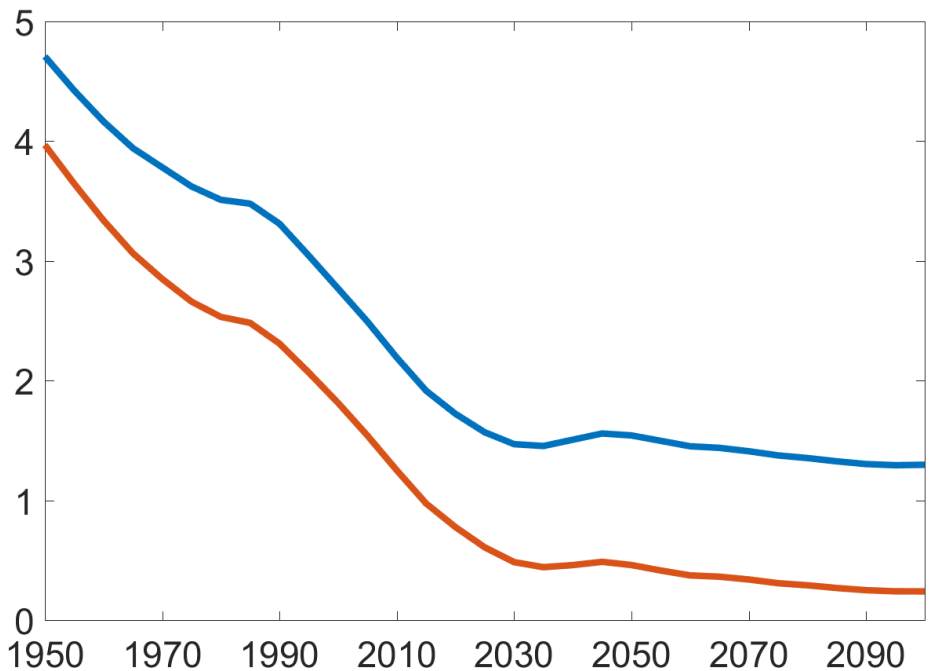
Sensitivities and extensions

- Housing
- Monopoly profits
- Retirement age

Sensitivities and extensions: housing

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

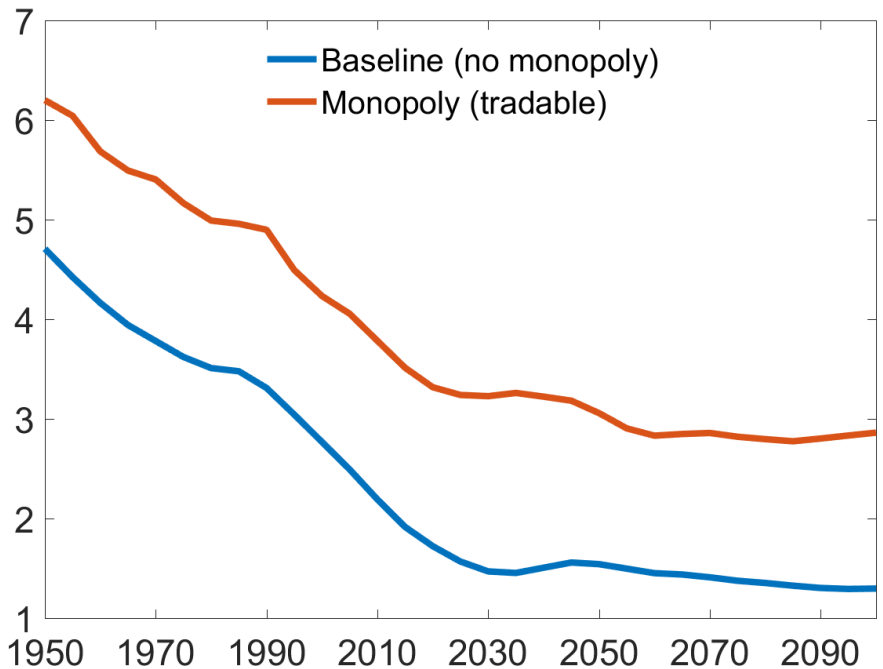
Figure : Simulations With and Without Housing



Sensitivities and extensions: monopoly profits

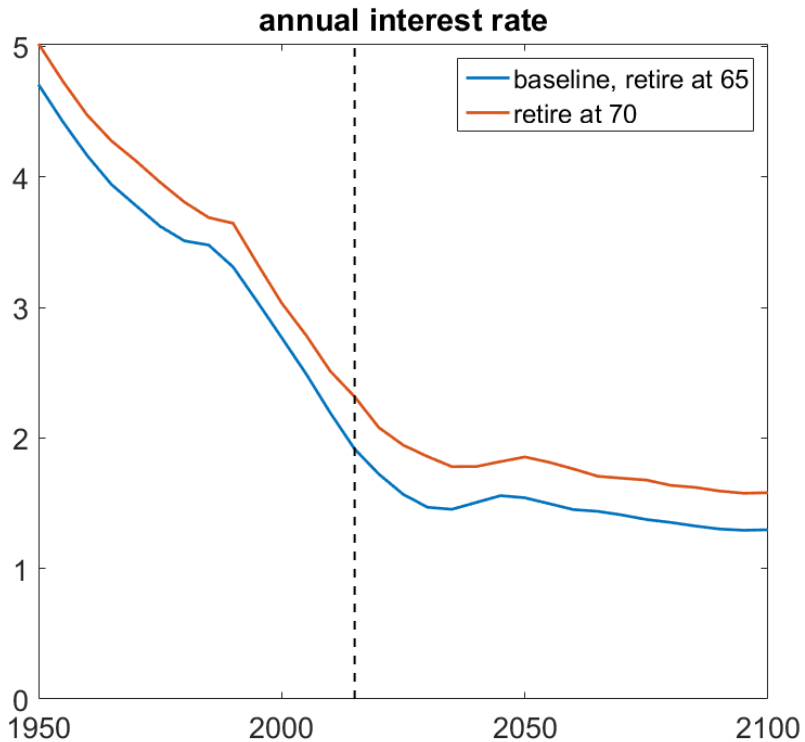
- Add monopolistic competition and supernormal profits to the corporate sector.
- In partial equilibrium, this pushes down on the interest rate $r_t = \frac{1}{\mu}\frac{\partial Y_t}{\partial K_t}$
- Tradable claims constitute an additional store of value, again attenuating fall and

Figure : Simulations With and Without Monopoly Power



Sensitivities and extensions: retirement age

Simulations varying retirement age by 5 years



Effects of retirement age increase surprisingly small

Conclusions and next steps

- Demographic pressures may explain around half the fall in real interest rates since the 1970s, high house prices and credit and about 30% of cross-sectional variation in NFA positions.
- These effects are due to persist or increase
- Model does not explain previous rise in rates