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

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April 2017
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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)
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

Desired wealth-income ratio

Net marginal product of capital

Wealth (capital stock)
Related literature

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:

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

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

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

$\tau$: age ; $t$: birth year

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

Labor supply is inelastic

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

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

$$F(K, L) = A \left[ (1 - \alpha) L^{\frac{\sigma-1}{\sigma}} + \alpha K^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$
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**
  \[ \tilde{\rho}' \tilde{\epsilon}_t = \tilde{L}_t \]

- **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

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

- Model
- Data

Age groups:
- 20 to 25
- 25 to 30
- 30 to 35
- 35 to 40
- 40 to 45
- 45 to 50
- 50 to 55
- 55 to 60
- 60 to 65
- 65 to 70
- 70 to 75
- 75 to 80
- 80 to 85
- 85 to 90
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

The graph shows the model outcome and data for the old age dependency ratio from 1950 to 2090. The ratio increases steadily over time, with a significant rise after 2010.
Model outcome: Annual interest rate
Model outcome: Housing and credit

annual interest rate

housing wealth/GDP ratio

Housing Price, pp deviation from 1970

Household debt/GDP ratio
Deviations 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
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

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.