Mandatory Pension Saving and Homeownership

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Talk based on joint work with Marcel Fischer and Bjarne Astrup Jensen

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Motivation

- Important financial decision for individuals: **saving for retirement**
- Pension systems struggle with sustaining reasonable levels of benefits for retirees due to
  - increasing life expectancy,
  - decreasing birth rates, and
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- Current solution approach of different countries: mandatory retirement savings scheme in which contribution is a constant share of labor income

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Why is it taken for granted that an individual's best retirement savings pattern is a constant share of labor income? Are there any alternatives?

Our work

- Set up of a quantitative **life cycle model** of consumption, savings, and housing decisions with rational and myopic individuals (Cocco, 2005, RFS; Fischer and Stamos, 2013, RFS; Larsen and Munk, 2023, JFQA)

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- Constant minimum contributions to retirement accounts, among others,
  - decrease welfare for rational individuals,
  - increase welfare for myopic individuals, and
  - increase loan-to-value ratios.

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- Constant minimum contributions to retirement accounts, among others,
  - decrease welfare for rational individuals,
  - increase welfare for myopic individuals, and
  - increase loan-to-value ratios.
- Proposal of **three alternative savings schemes** that alleviate the unintended side effects of constant minimum contributions
  - Age-dependent minimum contributions
  - Early withdrawals to acquire homeownership
  - Flexible savings scheme that imposes a total savings target

Related literature

- **Larsen and Munk, 2023, JFQA:** mandatory pension saving benefits individuals who are undersaving / not participating in the stock market
- **Schlafmann et al., 2024, RFS:** proposal of age- and wealth-dependent contribution rates to retirement accounts

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- **Larsen and Munk, 2023, JFQA:** mandatory pension saving benefits individuals who are undersaving / not participating in the stock market
- **Schlafmann et al., 2024, RFS:** proposal of age- and wealth-dependent contribution rates to retirement accounts
- **Contribution:**
  - Implications of pension system design for homeownership decisions
  - Modeling of rent-versus-own decisions and mortgages
  - Proposal of a savings scheme that does not solely focus on savings in retirement accounts

▸ More related literature

Pension system and retirement account

- Focus on **defined-contribution pension systems**
- Retirement accounts (RA): set up as **tax-deferred accounts**

Taxation of	taxable account (TA)	RA
contributions	×	
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- Withdrawals from RA prior to retirement age: generally not possible or subject to heavy penalty taxes
- Important difference between TA and RA: **illiquidity of RA** prior to retirement age

Model features

- **Goal**
  - Identify impact of constant minimum contributions to retirement accounts on homeownership decisions by comparing two different settings:
    1. Minimum contribution requirement: constant share of labor income
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- **Capital market**
  - Two investment opportunities: risky and risk-free asset
  - Homeowners can use owner-occupied home as collateral
  - Renters: no borrowing opportunity

Optimization problem

- Individual's goal: **maximization of expected present discounted lifetime utility**

$$\max_{\{C_t, Z_t, \alpha_{R,t}, Q_t, h_t, S_t, B_t\}} V_t(X_t) =$$

$$\left((1-\beta)\left(\left(\frac{C_t}{(1+i)^t}\right)^{1-\theta}\left(Q_t(1+\zeta h_t)\right)^{\theta}\right)^{1-\frac{1}{\psi}} + \beta\left(f(t)\,\mathbb{E}_t\left[V_{t+1}(X_{t+1})^{1-\gamma}\right]\right)^{\frac{1-\frac{1}{\psi}}{1-\gamma}}\right)^{\frac{1}{1-\frac{1}{\psi}}}$$

- Individual's decisions:
  - Consumption level (C_t)
  - Contributions to / withdrawals from retirement account (Z_t)
  - Asset allocation in retirement and taxable account ($\alpha_{R,t}$, S_t, B_t)
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- Optimization problem: subject to various budget constraints ▸ RA ▸ Full optimization

Calibration

- Preference parameters chosen to match empirically-observed growth of wealth
- Financial market parameters: historical estimates
- Empirical estimates from the literature:
  - Housing market parameters (Yao and Zhang, 2005, RFS; Fischer and Stamos, 2013, RFS)
  - Dependence structure (Cocco, 2005, RFS)
  - Labor income prior to retirement age (following Cocco et al., 2005, RFS)
- Assumption: no labor income after retirement age but withdrawal constraint from RA
- Borrowers face an interest rate margin
- Taxes: top tax rates in the U.S.
- Constant minimum contributions: 12.4% of labor income ▸ Precise calibration ▸ RA dynamics

Constant minimum contributions: welfare effects

- Calculation of welfare effects: comparing expected present discounted lifetime utilities

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- Drivers of welfare losses:
  - Procrastination when building up retirement savings
  - In younger years: over-consumption and under-investing in housing

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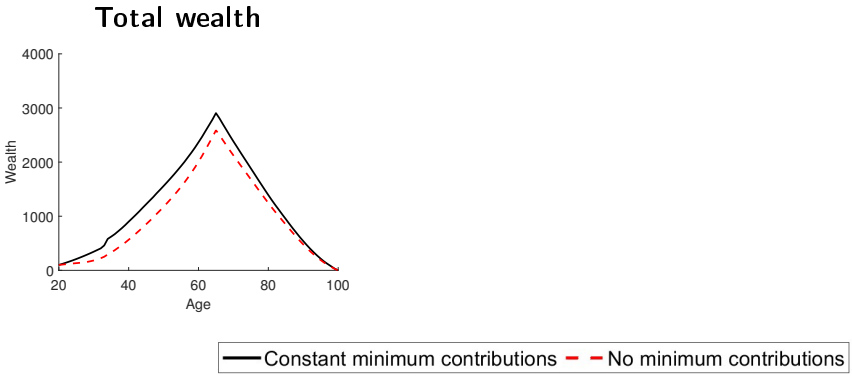
  - In younger years: over-consumption and under-investing in housing
- Proposal of alternatives that help myopic individuals but harm rational individuals less

▸ Sim. rational 1 (base case) ▸ Sim. rational 2 (base case) ▸ Housing market entry

Simulation results for myopic individuals 1/2



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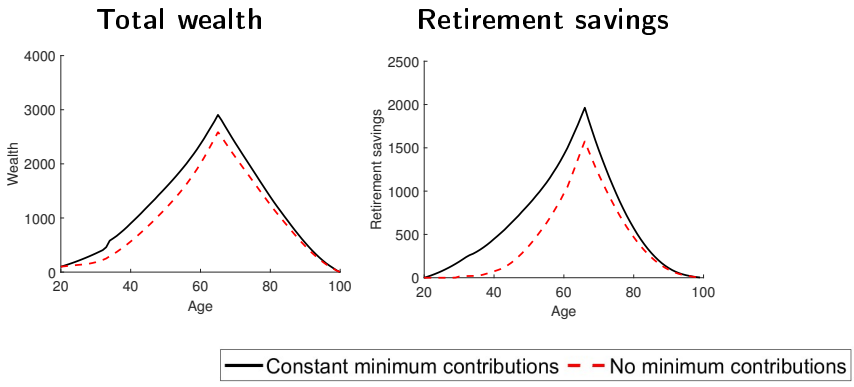

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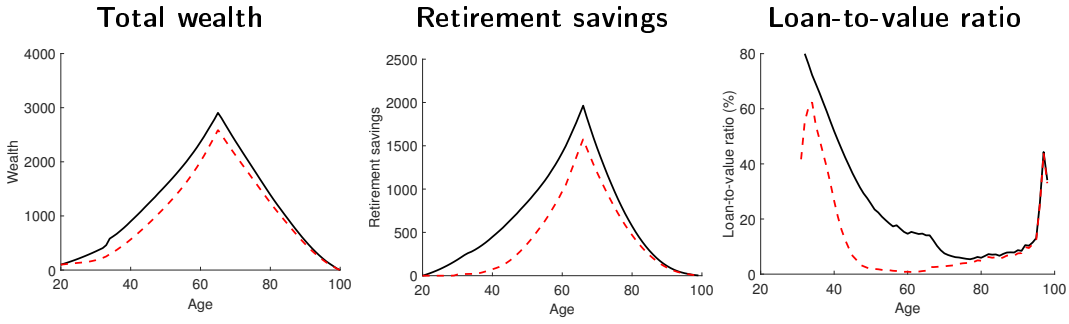

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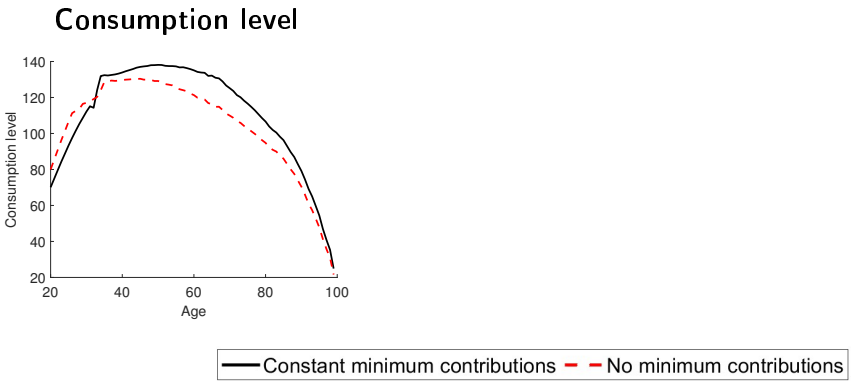

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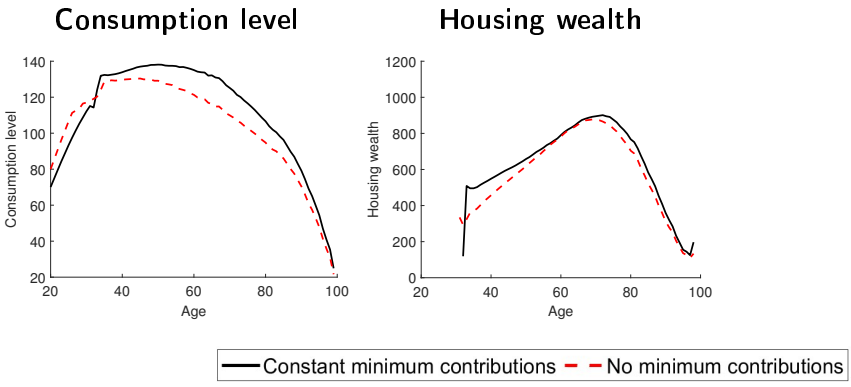

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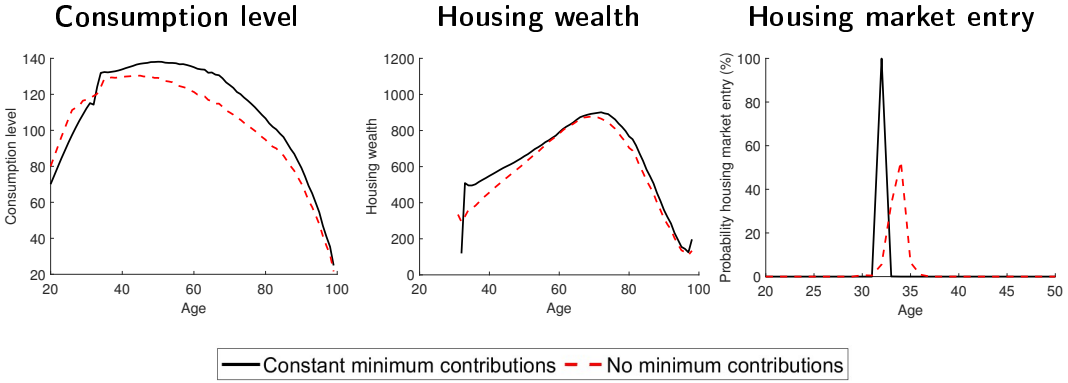

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- **Flexible savings scheme:** individuals have to meet a total savings target and can accumulate savings in the taxable account, the retirement account, or via home equity ▸ Details ▸ Bound

Alternative savings schemes: welfare effects

	Age-dep. contributions	Early withdrawals	Flexible scheme
Myopic individuals	2.5%	2.2%	2.1%
Rational individuals	4.5%	2.4%	2.6%

All welfare effects are measured in comparison to constant minimum contribution requirements.

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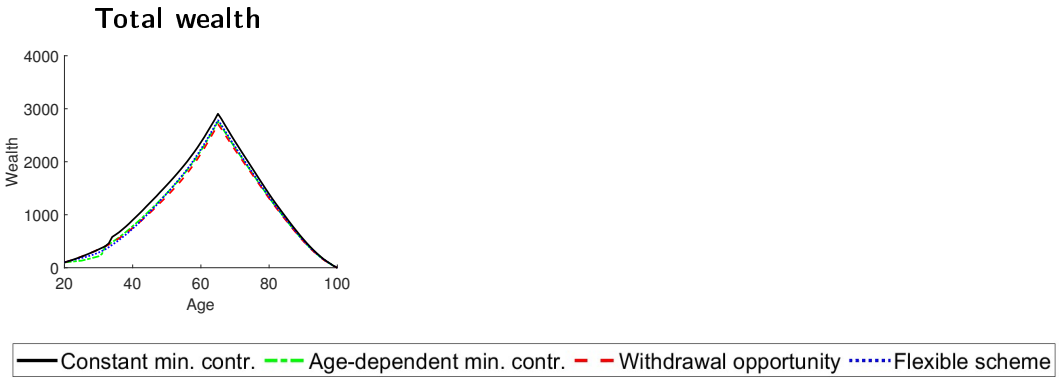
Alternative savings schemes: simulation results for myopic individuals 1/2



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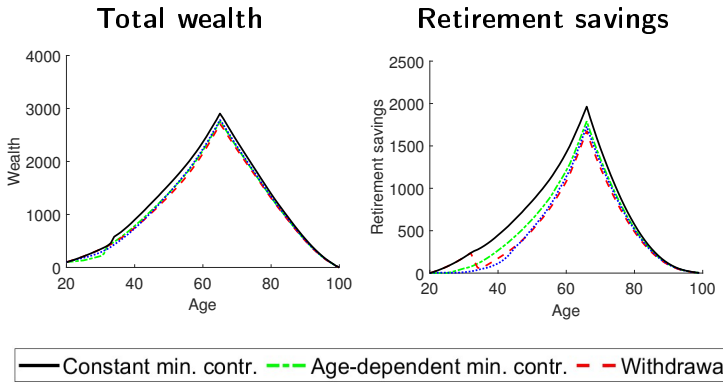

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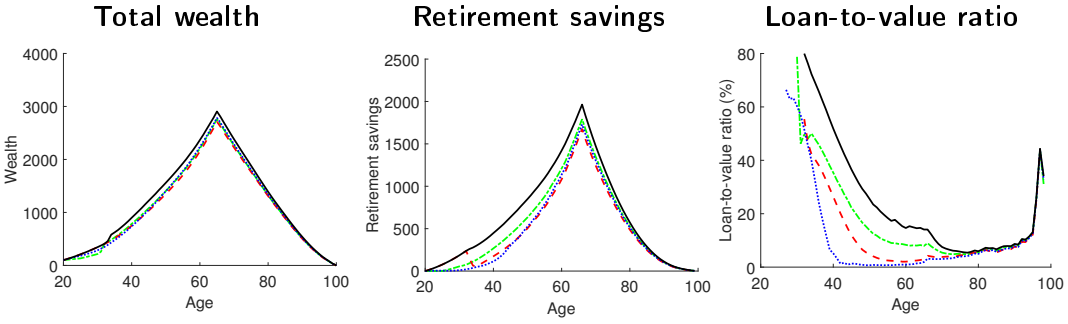

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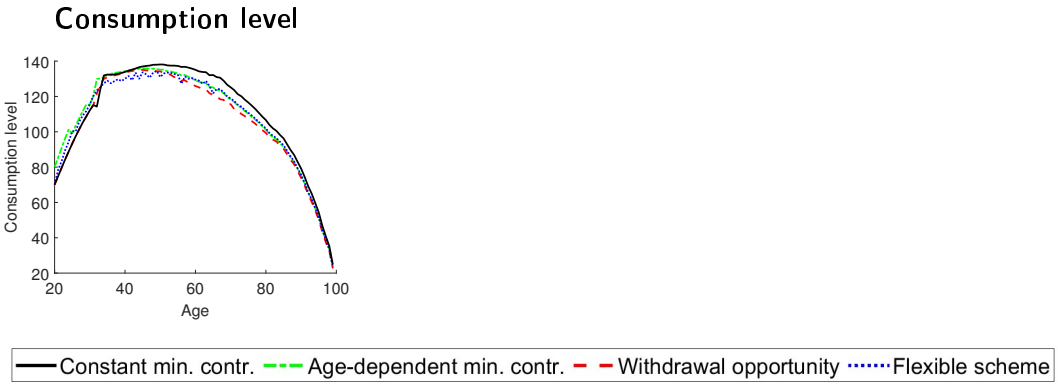

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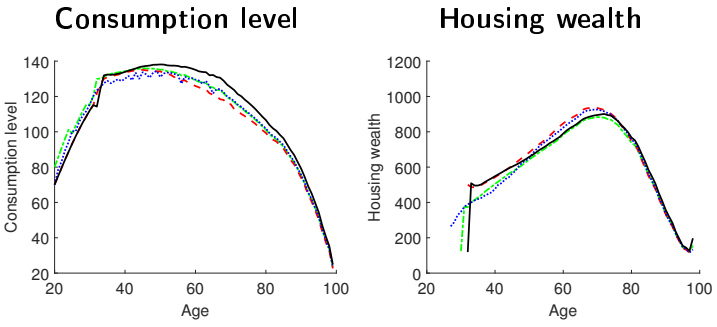

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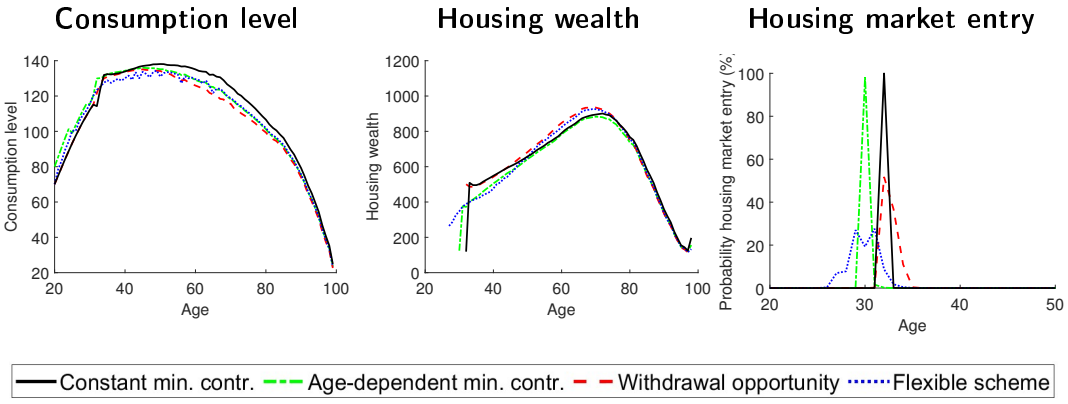

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Conclusion

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Thank you for your attention!

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Additional related literature

Additional related literature 1/2

Model features:

- Stochastic labor income (e.g., Cocco et al., 2005, RFS)
- Rent-versus-own decision (e.g., Cocco, 2005, RFS; Yao and Zhang, 2005, RFS)
- Taxable and tax-deferred account (e.g., Dammon et al., 2004, JF; Fischer and Gallmeyer, 2017, RF)

Back to related literature

Additional related literature 2/2

Optimal (retirement) savings decisions:

- Optimal life cycle profile of savings without a tax-deferred account (e.g., Carroll, 1997, QJE; Cocco et al., 2005, RFS)
- Optimal life cycle profile of savings with a taxable and a tax-deferred account (e.g., Amromin, 2003, European Finance Review; Dammon et al., 2004, JF; Fischer and Gallmeyer, 2017, RF)
- **Contribution:**
  - Highlighting of undesirable side effects of minimum contribution requirements
  - Proposition of a new flexible retirement savings scheme that ensures a sufficient built up of savings

Back to related literature

Model details

Withdrawal constraint from RA during retirement phase

It has to hold:

$$Z_t = -W_{R,t} / \left(\sum_{i=t}^{100} \left(\frac{1}{1+r} \right)^{i-t} \prod_{j=t+1}^{i} f(j-1) \right), \quad t \geq t_{ret}, \tag{1}$$

where r denotes the risk-free interest rate, $f(i)$ the individual's probability of survival from time i to time $i+1$, and $W_{R,t-}$ the individual's balance in the retirement account before decisions in period t are made.

▸ Back to optimization problem ▸ Back to calibration

Full optimization problem

$$\max_{\{C_t, Z_t, \alpha_{R,t}, Q_t, h_t, S_t, B_t\}} V_t(X_t) =$$

$$\left((1-\beta) \left(\left(\frac{C_t}{(1+i)^t} \right)^{1-\theta} (Q_t (1+\zeta h_t))^{\theta} \right)^{1-\frac{1}{\psi}} + \beta \left(f(t) \mathbb{E}_t \left[V_{t+1} (X_{t+1})^{1-\gamma} \right] \right)^{\frac{1-\frac{1}{\psi}}{1-\gamma}} \right)^{\frac{1}{1-\frac{1}{\psi}}}$$

subject to

$$W_{R,t-} = W_{R,(t-1)+} \left(\alpha_{R,t-1} G_{R,t-1} + \left(1 - \alpha_{R,t-1}\right) R_R \right)$$

$$W_{R,t+} = W_{R,t-} + Z_t$$

$$W_{T,t} = (1-\tau) L_t + S_{t-1} G_{T,t-1} + B_{t-1} \left(\chi_{\{B_{t-1} \geq 0\}} R_T + \chi_{\{B_{t-1} < 0\}} R_D \right)$$

$$= C_t + S_t + B_t + m(h_t) Q_t H_t + n\left(Q_t, h_t, h_{t-1}\right) + h_t Q_t H_t - h_{t-1} Q_{t-1} H_t + Z_t(1-\tau)$$

$$C_t, Q_t > 0, S_t \geq 0, \alpha_{R,t} \in [0,1], W_{R,t+} \geq 0$$

▸ Back to optimization problem

Normalized optimization problem 1/3

Defining $V_t(X_t) = v_t(x_t)\frac{W_t/(1+i)^t}{\left(H_t/(1+i)^t\right)^\theta}$, the objective function can be rewritten as follows:

$$v_t(x_t) = \left((1-\beta)\left(\left(\frac{C_t}{W_t}\right)^{1-\theta}\left(\frac{Q_t H_t}{W_t}\right)^{\theta}\right)^{1-\frac{1}{\psi}} + \beta\left(f(t)\,\mathbb{E}_t\left[\left(v_{t+1}(x_{t+1})\frac{\frac{W_{t+1}}{W_t(1+i)}}{\left(\frac{H_{t+1}}{H_t(1+i)}\right)^{\theta}}\right)^{1-\gamma}\right]\right)^{\frac{1-\frac{1}{\psi}}{1-\gamma}}\right)^{\frac{1}{1-\frac{1}{\psi}}}.$$

Without loss of generality, H_t (and W_t) can be normalized to one. Hence, in the normalized optimization problem, $c_t = \frac{C_t}{W_t}$ and $q_t = \frac{Q_t H_t}{W_t}$ are the decision variables that affect utility from immediate consumption of both non-durable and durable consumption. The new vector of state variables is

$$x_t = \left[t, \frac{W_{R,t-}}{W_t}, \frac{L_t}{W_t}, \frac{Q_{t-1}H_t}{W_t}, h_{t-1}\right].$$

▸ Back to optimization problem

Normalized optimization problem 2/3

When setting up a grid, using $\frac{W_{R,t-}}{W_t}$, $\frac{L_t}{W_t}$, and $\frac{Q_{t-\mathbf{1}} H_t}{W_t}$ as state variables has the disadvantage that not all of them can simultaneously take very large or very small values. It would therefore be desirable, to set up a grid on variables that have this property, but from which the above three state variables can immediately be constructed. One such vector of alternative state variables is

$$x_t = \left[t, \frac{W_{R,t-} + (1-\delta)\, h_{t-\mathbf{1}}\, Q_{t-\mathbf{1}} H_t}{W_t - L_t}, \frac{L_t}{W_t}, \frac{W_{R,t-}}{W_{R,t-} + (1-\delta)\, h_{t-\mathbf{1}}\, Q_{t-\mathbf{1}} H_t}, h_{t-\mathbf{1}} \right].$$

▸ Back to optimization problem

Normalized optimization problem 3/3

It holds that

$$\frac{W_{R,t-}}{W_t} = \frac{W_{R,t-}}{W_{R,t-} + (1-\delta)\, Q_{t-\mathbf{1}} H_t} \frac{W_{R,t-} + (1-\delta)\, Q_{t-\mathbf{1}} H_t}{W_t} \left(1 - \frac{L_t}{W_t - L_t}\right)$$

$$\frac{Q_{t-\mathbf{1}} H_t}{W_t} = \frac{1}{(1-\delta)} \left(\frac{W_{R,t-} + (1-\delta)\, Q_{t-\mathbf{1}} H_t}{W_t - L_t} \left(1 - \frac{L_t}{W_t - L_t}\right) - \frac{W_{R,t-}}{W_t} \right)$$

which shows that the state variables in the alternative x_t vector can be used to compute all state variables in the original x_t vector.

▸ Back to optimization problem

Calibration details

Calibration: numbers

- Preference parameters: $\gamma = 3,\ \psi = 0.15,\ \beta_{rat} = 0.96,\ \beta_{myo} = 0.85$
- Financial market: $\mu_S = 6.9\%,\ \sigma_S = 16.6\%,\ i = 3.9\%, r = 3.9\%$
- Housing market: $\theta = 0.2,\ \delta = 80\%,\ r_D = 6.2\%, m_r = 6.4\%,$ $m_o = 1.5\%,\ f_p = 6\%,\ \zeta = 10\%,\ \mu_H = 5\%,\ \sigma_H = 15\%$
- Dependence structure: $\rho_{S,L} = 0.047,\ \rho_{H,L} = 0.55,\ \rho_{H,S} = 0$
- Taxes: $\tau_g = 20\%,\ \tau = 35\%$
- Labor income process for male high school graduates using PSID data from 1980 to 2019

▸ Back to calibration

Model predictions and empirical data 1/3

- Simulated model predictions match key features in the data
- Comparison of wealth in PSID data with model-predicted wealth
- Data sample: 2011-2019
- Difficult comparison due to two reasons:
  1. Social Security benefits are not part of wealth reported in the data
  2. High degree of dispersion of wealth in the PSID data

Model predictions and empirical data 2/3

- For a meaningful comparison between model predictions and the data, we add the present value of Social Security benefits to PSID wealth.
- We use median wealth in the data and only consider individuals that are high school graduates and have positive total wealth.

Model predictions and empirical data 3/3

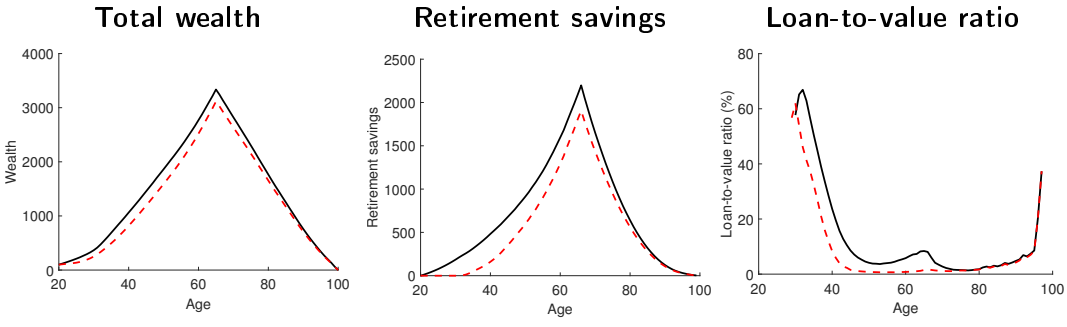
- Self-reported median wealth at age 20: USD 10,000
- Self-reported median wealth at age 65: USD 110,000
- Median present value of Social Security benefits at age 65: USD 250,035.70
- Growth factor in the data: 36.0
- Growth factor in the model (for case with constant mandatory minimum contributions and rational individuals): around 33.9

Calculation of Social Security benefits

1. Calculate AIME (average indexed monthly earnings) for age 26 to 60
2. Calculate PIA (primary insurance amount) when retiring at age 62
3. Consider COLA (cost-of-living adjustments) (as individuals in our model retire at age 65)
4. Calculate replacement ratio
5. Calculate present value of Social Security payments

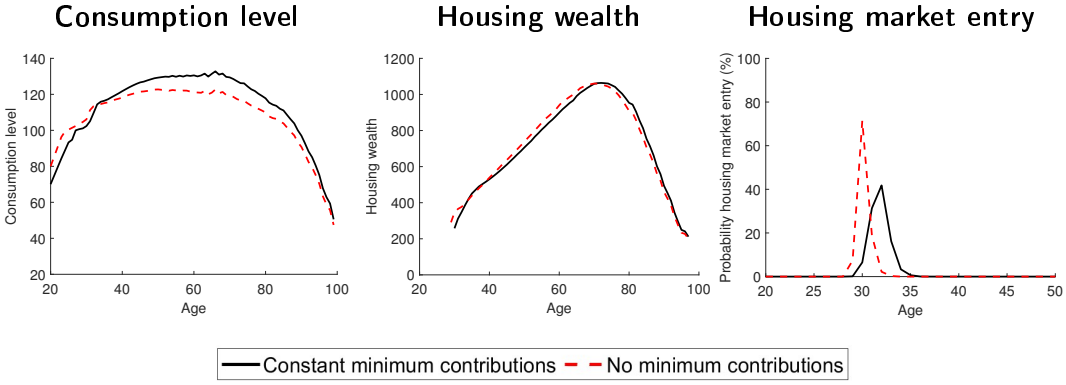
Additional base case results

Simulation results for rational individuals 1/2



▸ Back to welfare (base case) ▸ Back to simulation results 1 (base case) ▸ Back to simulation results 2 (base case)

Simulation results for rational individuals 2/2



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Alternative savings scheme: details and results

Age-dependent minimum contributions: details

The contribution requirement to the retirement account before retirement age becomes

$$Z_t \geq \xi_{dep,t} L_t, \quad t < t_{ret}.$$

Following the current contribution requirements of Swiss occupational pension systems (see, e.g., OECD, 2021), we choose

$$\xi_{dep,t} = 0\% \chi_{\{t \in [0,5]\}} + 7\% \chi_{\{t \in [6,15]\}} + 10\% \chi_{\{t \in [16,25]\}} + 15\% \chi_{\{t \in [26,35]\}} + 18\% \chi_{\{t \in [36,46]\}}.$$

▸ Back to alternative schemes

Early withdrawals: details

Let $\eta_t \in \{0, 1\}$ be a binary variable that takes value one if the individual acquires a new owner-occupied home at time t and zero otherwise. Then the contribution constraint to the retirement account prior retirement age is

$$Z_t \geq \begin{cases} \xi L_t, & t < t_{ret} \text{ and } \eta_t = 0 \\ \max\left(-W_{R,t-}, -\lambda Q_t H_t\right), & t < t_{ret} \text{ and } \eta_t = 1, \end{cases}$$

where $\lambda \in [0\%, 100\%]$ denotes the maximum share of the value of the to-be-acquired home that can be withdrawn from the retirement account.

▸ Back to alternative schemes

Flexible savings scheme: details

Upper bound on labor-to-wealth ratio after (non-durable) expenses, $l_{t,MAX} \Leftrightarrow$ **upper bound on expenses-to-wealth ratio**:

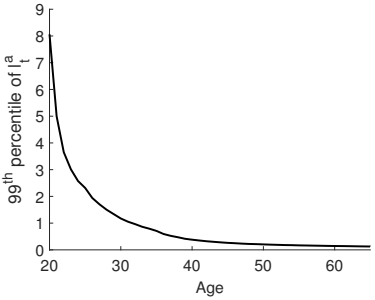
$$\underbrace{\frac{L_t}{W_t - E_t} \leq l_{t,MAX}}_{\substack{\text{upper bound on} \\ \text{labor-to-wealth ratio}}} \iff \underbrace{\frac{E_t}{W_t} \leq 1 - \frac{\frac{L_t}{W_t}}{l_{t,MAX}}}_{\substack{\text{upper bound on} \\ \text{expenses-to-wealth ratio}}}, \quad t < t_{ret}$$

W_t is the individual's total wealth at the beginning of period t, already including labor income, L_t, earned in this period, and E_t are (non-durable) expenses, i.e., consumption, rents, maintenance, and transaction costs.

▸ Back to alternative schemes

Flexible savings scheme: upper bound

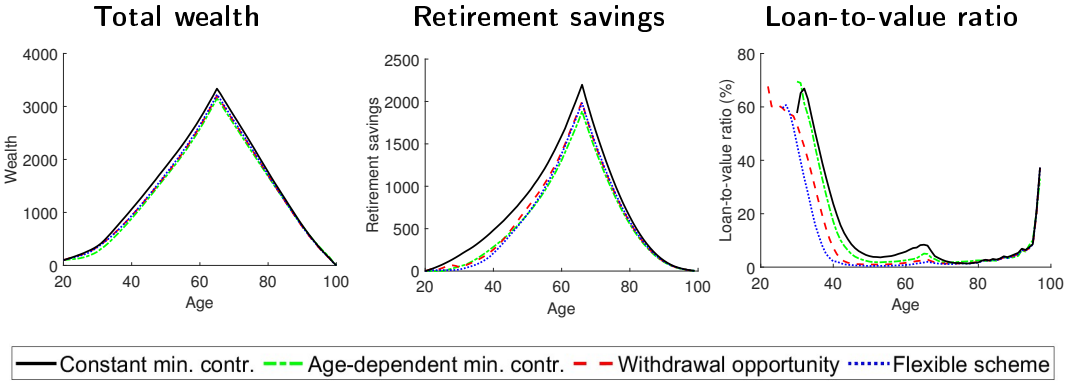
First percentile of the labor-to-wealth ratio after expenses for the case with mandatory constant minimum contributions as upper bound for the individual's labor-to-wealth ratio after expenses:



l_t^a is the labor-to-wealth ratio after expenses for the case with mandatory minimum contributions.

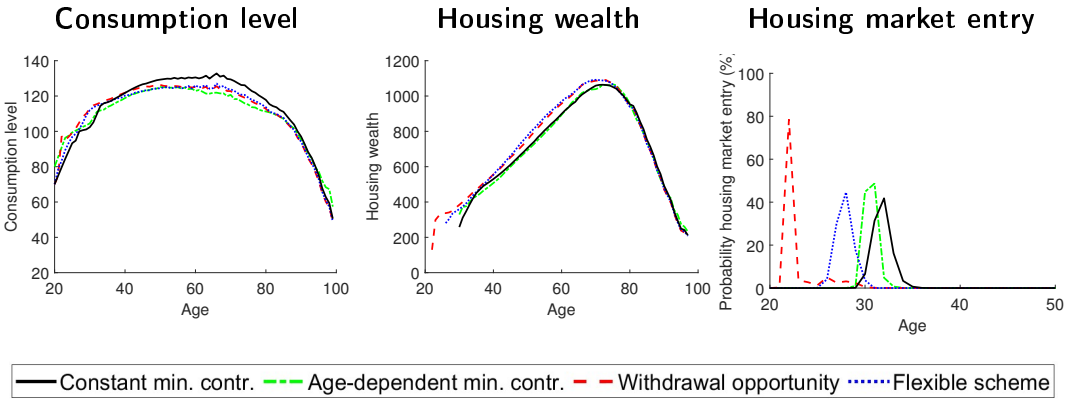
▸ Back to alternative schemes

Alternative savings schemes: simulation results for rational individuals 1/2



▸ Back to welfare (alternatives) ▸ Back to simulation results 1 (alternatives) ▸ Back to simulation results 2 (alternatives)

Alternative savings schemes: simulation results for rational individuals 2/2



▸ Back to welfare (alternatives) ▸ Back to simulation results 1 (alternatives) ▸ Back to simulation results 2 (alternatives)

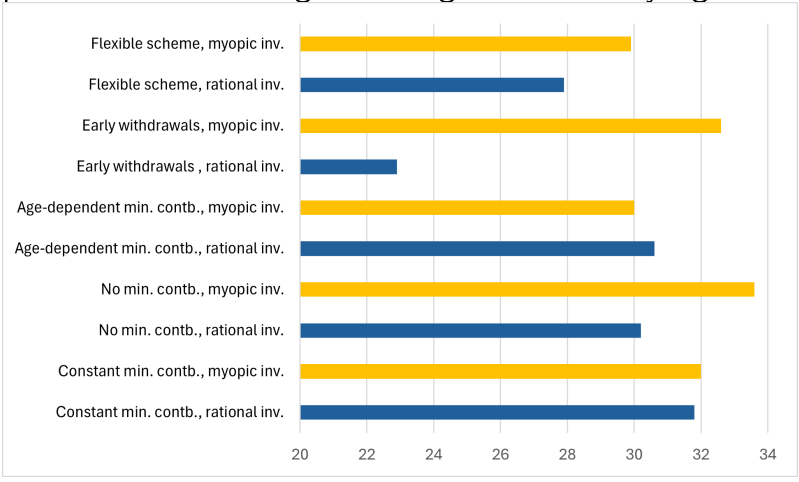
Other results

Average housing market entry age

- Constant min. contr., rational individuals: 31.8 years
- Constant min. contr., myopic individuals: 32.0 years
- No min. contr., rational individuals: 30.2 years
- No min. contr., myopic individuals: 33.6 years
- Age-dependent min. contr., rational individuals: 30.6 years
- Age-dependent min. contr., myopic individuals: 30.0 years
- Early withdrawals for acquiring real estate, rational individuals: 22.9 years
- Early withdrawals for acquiring real estate, myopic individuals: 32.6 years
- Flexible scheme, rational individuals: 27.9 years
- Flexible scheme, myopic individuals: 29.9 years

▸ Back to welfare effects (base case) ▸ Back to simulation 1 (base case) ▸ Back to simulation 2 (base case)
▸ Back to welfare effects (alternatives) ▸ Back to simulation 1 (alternatives) ▸ Back to simulation 2 (alternatives)

Graphical representation: average housing market entry age



▸ Back to welfare effects (base case) ▸ Back to simulation 1 (base case) ▸ Back to simulation 2 (base case)
▸ Back to welfare effects (alternatives) ▸ Back to simulation 1 (alternatives) ▸ Back to simulation 2 (alternatives)