Delay the Pension Age or Reduce the Pension Benefit? Implications for labor force participation and individual welfare

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Outline

Background

China's public pension system:

- **Basic Old Age Insurance (BOAI)**: employees in firms and public sectors
- Resident Pension: urban and rural residents

Basic Old Age Insurance:

- Coverage in 2018: 418.5 million participants
  - PAYG: 20% of employee's wage
  - Individual account: 8% of employee's wage
- Target replacement rate: 59.2%
- Eligibility age:
  - by law: 60 for males, 55 for white collar women and 50 for blue collar women

Motivation

Policy change:

- Proposed in 2016, implementation expected in 2022. (Ministry of Human Resource and Social Security).
- Gradually raising the public pension age ('retirement age') to age 65.
- Main objectives:
  - Improve sustainability of the pension system
  - Encourage people to work longer

Research questions

- What are the effects of delaying the pension eligibility age in China on:
  - labor force participation
  - consumption
  - individual welfare

  for **heterogeneous** agents?
- The effects of delaying pension age on the fiscal balance of the BOAI

Literature review

One representative agent

- Effect of pension eligibility on retirement in life-cycle models: Coile et al., 2002; Gustman and Steinmeier, 2005; Hubener et al., 2016; Haan and Prowse, 2014; Mitchell and Phillips, 2000; Rust and Phelan, 1997

But: do not take into account the heterogeneity among workers

Structural models allowing for heterogeneity

- French and Jones, 2011; Laun and Wallenuis, 2015, 2016; Laun et al., 2018; Börsch-Supan et al., 2018

But: focus on the United States and Europe

Literature review

In China

- Giles et al. (2012, 2015): show empirically that there is a strong association between pension eligibility age and exit from the labor force
- Jin (2016): structural model that studies the labor supply among older women in China and analyzes the effects of increasing the female pension age to 60

There are currently no micro-level structural models quantifying the impact of the proposed increase in the statutory retirement age in China.

Outline

The life-cycle model: Overview

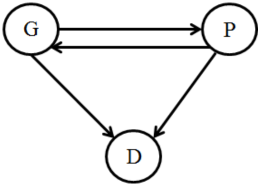
Two skill typers: high-skilled and low-skilled: $s = \{\mathrm{h}, \mathrm{l}\}$

For each group:

- urban males, age 45 with known health, wealth, income; maximum age 100
- derive utility from consumption, incur disutility from working
- bequest motives
- make (binary) labor supply and (continuous) consumption decisions in each period

Health dynamics

Three heath states: Similar to Fong et al.(2015)



- G: good health, $H_t = g$
  - no limitation in performing any Activities of Daily Living; and
  - self-reported health better than "Poor"
- P: poor health, $H_t = p$
- D: dead, $H_t = d$
- The transition probabilities are modelled as polynomial functions of age

Labor supply

- τ_t denotes the employment status

$$\tau_t = \begin{cases} 1, & \text{if working in period } t; \\ 0, & \text{if not working in period } t. \end{cases} \tag{1}$$

- Compulsory retirement at age 75

$$\tau_t = 0, \text{ for } t + 45 \geq 75. \tag{2}$$

Preference

- Cobb-Douglas function of consumption and leisure:

$$u(C_t, \tau_t, H_t) = \frac{1}{1-\gamma}\left[C_t^{\alpha}\left(1-\omega(H_t)\tau_t\right)^{(1-\alpha)}\right]^{1-\gamma} \tag{3}$$

  - γ: relative risk aversion
  - C_t: consumption of non-medical goods
  - $\omega(H_t, s)$: loss of leisure from work, total amount normalized to 1

$$\omega(H_t, s) = \begin{cases} \omega_1, & \text{for } H_t = g; \\ \omega_2, & \text{for } H_t = p. \end{cases} \tag{4}$$

Preference

- Bequest motive: De Nardi (2004), French and Johns (2011)

$$v(W_t) = \theta^{-\gamma} \frac{(W_t + \kappa)^{\alpha(1-\gamma)}}{1-\gamma}, \quad (5)$$

  - θ: strength of the bequest motive
  - κ: the extent to which bequests are luxury goods
- Subjective discount factor: β

Out-of-pocket healthcare expenditure

Following Ameriks et al.(2011) but allow the possibility of zero healthcare expenditure:

$$M_t(s) = \begin{cases} 0, & \text{with probability } p(H_t, s); \\ m(H_t, s), & \text{with probability 1-} p(H_t, s) \end{cases} \tag{6}$$

where

$$m(H_t, s) = \begin{cases} m1, & \text{if } H_t\text{=g;} \\ m2, & \text{if } H_t\text{=p;} \\ m3, & \text{if } H_t\text{=d;} \end{cases} \tag{7}$$

Labor income

- Labor earnings L_t in period t (Yu and Zhu, 2013, Capatina, 2015)

$$\log(L_t) = l(H_t, t) + \bar{\mu} + \lambda_t + \mu_t, \tag{8}$$

$$l(H_t, t) = \beta_0(s) + \beta_1(s)t + \beta_2(s)t^2 + \beta_3(s)I_{H_t=p}, \tag{9}$$

$$\mu_t = \rho(s)\mu_{t-1} + \eta_t. \tag{10}$$

  - deterministic part $l(H_t, t,)$: function of age and health
  - stochastic part:
    - ex ante heterogeneity $\bar{\mu} \sim N(0, \sigma^2_{\bar{\mu}}(s)$, given at birth
    - idiosyncratic transitory shock $\lambda_t \sim N(0, \sigma^2_{\lambda_t}(s))$
    - persistent shock μ_t, an AR(1) process with $\eta_t \sim N(0, \sigma^2_{\eta_t}(s))$

Pension income

In practice, pension income $P(t, s)$ depends on

- individual wage history before retirement
- province average wage of all workers
- the ratio of the above two during all working years

In our model: given eligibility age X (**the policy parameter, currently 60**), pension income is modeled as a linear function of $\bar{w}_t$ and y_t

$$P_t(s) = \begin{cases} 0, & \text{if } t + 45 < X. \qquad \forall t = 0, 1, 2, ..., T-1; \\ P(\bar{w}_t, y_t) & \text{if } t + 45 \geq X. \qquad \forall t = 0, 1, 2, ..., T-1. \end{cases} \tag{11}$$

Pension income

$$y_t = \begin{cases} y_{t-1}, & \text{if } t+45 \geq X. \qquad \forall t = 0,1,2,...,T-1; \\ y_{t-1}+1, & \text{if } t+45 < X \ \& \ \tau_t = 1. \qquad \forall t = 0,1,2,...,T-1. \end{cases} \tag{12}$$

$$\bar{w}_t = \begin{cases} \frac{\bar{w}_{t-1}y_{t-1}+L_t}{y_t}, & \text{if } t+45 < x \ \& \ \tau_t = 1. \qquad \forall t = 0,1,2,...,T-1; \\ \bar{w}_{t-1}, & \text{if } t+45 \geq x. \qquad \forall t = 0,1,2,...,T-1. \end{cases} \tag{13}$$

Budget Constraints

Total income:

$$Y_t = L_t + P_t \qquad \forall t = 0, 1, 2, ..., T-1. \tag{14}$$

Consumption floor and government transfer

$$C_t \geq C^f \qquad \forall t = 0, 1, 2, ..., T-1, \tag{15}$$

$$G_t = \max\left\{0, C^f - (W_t + Y_t - M_t)\right\} \qquad \forall t = 0, 1, 2, ..., T-1. \tag{16}$$

Budget constraint for after-consumption wealth

$$\overline{W}_t = W_t + Y_t - M_t + G_t - C_t \geq 0 \qquad \forall t = 0, 1, 2, ..., T-1. \tag{17}$$

Wealth dynamics

$$W_{t+1} = \begin{cases} \overline{W}_t(1+r), & \text{if } G_t = 0 \qquad \forall t = 0, 1, 2, ..., T-1; \\ 0, & \text{if } G_t > 0 \qquad \forall t = 0, 1, 2, ..., T-1. \end{cases} \tag{18}$$

The optimization problem

- Receive pension income if age $\geq X$
- Pay out-of-pocket healthcare expenditure M_t
- Make labour supply decision τ_t
- Choose consumption C_t (subject to consumption floor C^f)
- State variables: $P_t = \{W_t, H_t, \bar{w}_t, y_t, \mu_{t-1}\}$
- Objective function

$$V_0(P_0) = \max_{\{\tau_t, C_t\}_{t=0}^{T-1}} \left\{ \mathbb{E}_0 \left[\sum_{t=0}^{T-1} \sum_{j=p,g} \pi_0^t(H_0, j) \beta^t [u(C_t, H_t, \tau_t) + \beta \pi_t(j, d) v(W_{t+1})] \right] \right\}, \quad (19)$$

- The Bellman equation: subject to Equations (15), (17), (18) and (2).

$$V_t(P_t) =$$

$$\max_{\{\tau_t, C_t,\}} \mathbb{E}_t \left\{ u(C_t, H_t, \tau_t) + \sum_{j=p,g} \pi_t(H_t, j) \beta V_{t+1}(W_{t+1}, H_{t+1} = j, Y_{t+1}) + \pi_t(H_t, d) \beta v(W_{t+1}) \right\}, \quad (20)$$

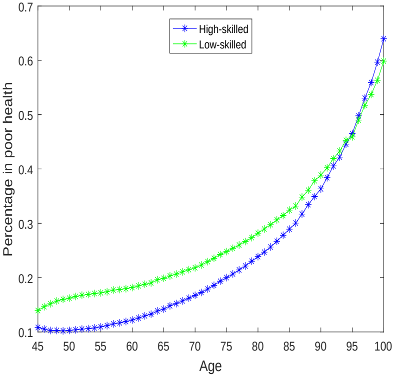
Outline

Data

- China Health and Retirement Longitudinal Study (CHARLS): a nationally representative sample of Chinese residents aged 45 and older
- Bi-annual data, 3 waves (2011, 2013, 2015)
- 11,097 person-year observations

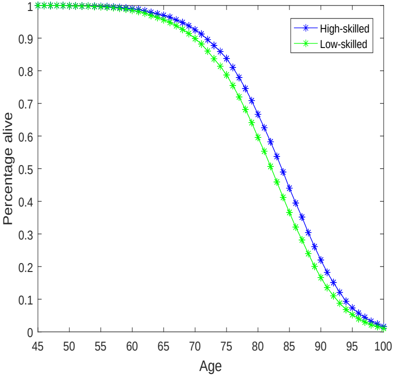
Health dynamics: Estimation

Figure: Predicted percentage of men in poor health by age and skill type



Health dynamics: Estimation

Figure: Predicted percentage of men alive by age and skill type



Out-of-pocket healthcare expenditure: in RMB

	High-Skilled	Low-Skilled
Good Health		
Mean	6,166	4,441
Standard deviation	21,424	14,496
99th percentile	113,400	60,360
Proportion of zero OOP costs	50.6%	51.0%
Bad Health		
Mean	18,251	13,644
Standard Deviation	54,932	46,163
99th percentile	137,360	138,800
Proportion of zero OOP costs	18.9%	22.2%
Death		
Mean	69,475	36,701
Standard deviation	71,624	84,837
99th percentile	200,000	500,000
Proportion of zero OOP costs	4.9%	2.1%

Notes: The OOP costs for death is estimated from the exit survey of CHARLS 2013.

Initial Conditions

	High-Skilled	Low-Skilled
Wealth (in thousands of RMB)		
Mean	17.44	10.57
Wage (in thousands of RMB)		
Mean	24.73	20.68
Years worked before age 45		
Mean	20	20
% in good health	89.95%	85.98%
% in bad health	10.05%	14.02%
% working	76.19%	64.84%

- Solved numerically by backward induction, EGM (Carroll, 2006) to construct grids for after-consumption wealth
- Two-step strategy to estimate our model
    - health transition matrix, mortality rate, out of pocket expenditure, and parameters to approximate pension income
    - all the remaining parameters within the model

Outline

Next steps

- Calibration: optimal parameters
- Calibration moments: average labor supply, wealth, labor income and variance of log earnings by skill type
- Policy experiment:
  increase pension age or reduce pension benefit?