Illiquid Wealth and the Timing of Retirement

Job Boerma
University of Minnesota
FRB Minneapolis

Jonathan Heathcote
FRB Minneapolis

June 2019
Introduction

- Aging populations around the world ⇒ urgent public finance challenge
- Change policies to encourage later retirement?
- Need to understand retirement timing, how it responds to policy
- We build a model of retirement and use it to interpret Dutch data
Why the Netherlands?

- Large recent changes in retirement patterns and policies
- High quality administrative data on income, wealth, health status, retirement choices
Average Age of Dutch People Retiring

![Graph showing the average age of Dutch people retiring from 2000 to 2016. The graph indicates an increasing trend in the average retirement age.]
Distribution of Ages of People Retiring
Why Are the Dutch Retiring Later?

1. Changes in retirement policies:
   
   1. Increase in normal retirement age: 65 $\Rightarrow$ 66
   
   2. New taxes on early withdrawals from company pensions in 2005

2. Wealth losses during Great Recession

3. Increased longevity
Model Sketch

- Continuous time, no uncertainty
- Workers choose consumption / savings and timing of retirement
- Heterogeneity in wages and in taste for work
- Redistributive public pension system
- Costly to tap saving prior to normal retirement age
  - Unfavorable tax treatment of early pension withdrawals
  - (penalties for early 401(k) withdrawals)
  - Illiquid home equity
- ⇒ clustering at normal retirement age
Model

- Born at $a = 0$, maximum age $a = A$
- Period utility for type $i$
  \[ u_i(c(a), l(a)) = \log c(a) - \varphi_i(a) l(a) \]
- Choose retirement age $a_R$
  - $a < a_R \Rightarrow l(a) = 1$
  - $a \geq a_R \Rightarrow l(a) = 0$
- Earnings
  \[ y(a) = w_i(a) l(a) \]
- Lifetime utility
  \[ \int_0^A S_i(a) \exp(-\rho a) \left[ \log c(a) - \varphi_i(a) l(a) \right] da \]
• Start collecting pension $p(a_R)$ at normal retirement age, $a = A_N$

• Affine function of lifetime earnings

\[
p(a_R) = p + \beta Y(a_R)
\]

\[
Y(a_R) = \int_0^{a_R} e^{r(A_N-a)}w_i(a)\,da
\]

• Private wealth $b(a)$ with return $r$

• Two financial frictions:

1. **Credit friction:** No borrowing allowed: $b(a) \geq 0$

2. **Liquidity friction:** Tax $\chi$ on asset sales if $a < A_N$
Household Problem

\[
\max_{\{c(a)\}, a_R} \int_0^A S_i(a) \exp(-\rho a) \left[ \log c(a) - \mathbb{I}_{\{a<a_R\}} \varphi_i(a) \right] da
\]

subject to

\[
c(a) + s(a) = \mathbb{I}_{\{a<a_R\}} w(a) + \mathbb{I}_{\{a \geq A_N\}} p(a_R)
\]

\[
\dot{b}(a) = \begin{cases} 
  s(a) + rb(a) & \text{if } s(a) \geq 0 \\
  \frac{s(a)}{1-\chi(a)} + rb(a) & \text{if } s(a) < 0 
\end{cases}
\]

\[
b(a) \geq 0
\]

\[
b(0) = 0
\]

Focus today on \( \rho = r = 0 \) and \( \beta = 0 \) \( \Rightarrow p(a_R) = p \)
Heterogeneity

\[
\log \varphi_i = \eta_i + \eta(a) \\
\log w_i = z_i + z(a) \\
S_i(a) = S(a)^{s_i}
\]

Assumptions for today

\( \eta(a) = 0 \) \quad \text{flat wage profile} \\
\( z(a) = 0 \) \quad \text{flat disutility of work} \\
\( S(a) = 1 \) \quad \text{no mortality prior to } A

\[
\begin{pmatrix}
\log \varphi_i \\
\log w_i
\end{pmatrix}
= \begin{pmatrix}
\eta_i \\
z_i
\end{pmatrix}
\sim N
\begin{pmatrix}
\mu_{\eta} \\
\mu_z
\end{pmatrix},
\begin{pmatrix}
\sigma^2_{\eta} & \rho \sigma_{\eta} \sigma_z \\
\rho \sigma_{\eta} \sigma_z & \sigma^2_z
\end{pmatrix}
\]
1. Solve for optimal consumption / savings rule given $a_R$

2. Given that rule, solve for optimal $a_R$
Step 1: Consumption Plan Conditional on $a_R$

1. $a_R \geq A_N$

\[ c(a) = \bar{c} = \frac{1}{A} [a_R w + (A - A_N)p] \]

2. $a_R < A_N$

\[ c(a) = \begin{cases} 
\bar{c} & a \in [0, a_R] \\
(1 - \chi) \bar{c} & a \in [a_R, A_N]
\end{cases} \]

3. $a_R \ll A_N$

\[ c(a) = \begin{cases} 
\frac{a_R}{A_N} w & a \in [0, a_R] \\
(1 - \chi) \frac{a_R}{A_N} w & a \in [a_R, A_N] \\
p_0 & a \in [a_N, A]
\end{cases} \]
Step 2: Retirement Plan

- Retirement age FOC:

\[ w \cdot \frac{1}{A} [w a_R + p(A - A_N)] = \varphi + \mathbb{I}_{\{a_R < A_N\}} \log(1 - \chi) \]

- high \( w \) ⇒ retire late
- high \( \varphi \) ⇒ retire early
Types of Retiree:

1. **Credit constrained** – very low $w$ / very high $\phi$

   $$a_R = \frac{A}{\phi + \log(1 - \chi)} - \frac{p(A - A_N)}{w} \ll a_N$$  and $b(A_N) = 0$

2. **Early** – low $w$ / high $\phi$

   $$a_R = \frac{A}{\phi + \log(1 - \chi)} - \frac{p(A - A_N)}{w} < a_N$$  and $b(A_N) > 0$

3. **Normal** – moderate $w$ / $\phi$

   $$a_R = A_N$$

4. **Late** – high $w$ / low $\phi$

   $$a_R = \frac{A}{\phi} - \frac{p(A - A_N)}{y} > A_N$$
Sensitivity of Retirement Age to Policy Parameter

<table>
<thead>
<tr>
<th></th>
<th>credit cons.</th>
<th>early</th>
<th>normal</th>
<th>late</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p$</td>
<td>0</td>
<td>$-(A-A_N) \over w$</td>
<td>0</td>
<td>$-(A-A_N) \over w$</td>
</tr>
<tr>
<td>$A_N$</td>
<td>$\frac{1}{\log(1-\chi)+\varphi}$</td>
<td>$p \over w$</td>
<td>1</td>
<td>$p \over w$</td>
</tr>
<tr>
<td>$\chi$</td>
<td>$\frac{A_N}{(1-\chi)(\varphi+\log(1-\chi))^2}$</td>
<td>$A$</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- Only early and late retirees respond to $p$
  - low wage workers most responsive
- Credit constrained & normal retirees most responsive to $A_N$
- Liquidity friction plays key role:
  - Increase $\chi$ $\Rightarrow$ early retirees increase $a_R$
  - Increase $\chi$ $\Rightarrow$ more normal retirees
  - $\Rightarrow$ average retirement age more sensitive to $A_N$
Administrative Data

- All Dutch individuals born in 1948
- Define as working in year $t$ if earnings $> 2,000$ euros
- Define as retiring in year $t$ if not working for all $j > t$
- Sample excludes self-employed and those not working in any year after 2003
## Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Data Targeted</th>
<th>Data Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A$</td>
<td>65</td>
<td>Life expectancy</td>
<td>85</td>
</tr>
<tr>
<td>$\mu_z$</td>
<td>10.47</td>
<td>Mean of log income</td>
<td>10.47</td>
</tr>
<tr>
<td>$\sigma_z$</td>
<td>0.23</td>
<td>Std dev of log wage</td>
<td>0.204</td>
</tr>
<tr>
<td>$\mu_\eta$</td>
<td>0.340</td>
<td>Mean retirement age</td>
<td>62.4</td>
</tr>
<tr>
<td>$\sigma_\eta$</td>
<td>0.107</td>
<td>Std dev retirement age</td>
<td>3.90</td>
</tr>
<tr>
<td>$\rho$</td>
<td>0.30</td>
<td>Corr (wage, retirement age)</td>
<td>0.1</td>
</tr>
<tr>
<td>$A_N$</td>
<td>45+1/12</td>
<td>Normal retirement age</td>
<td>65+1/12</td>
</tr>
<tr>
<td>$\rho$</td>
<td>10,500</td>
<td>Dutch govt. pension</td>
<td>10,500</td>
</tr>
<tr>
<td>$\chi$</td>
<td>0.045</td>
<td>Density at $A_N$</td>
<td>15%</td>
</tr>
</tbody>
</table>
Income and Retirement Age

The graph illustrates the relationship between income and retirement age. The data points are represented by dots, with one set in orange labeled "model" and another in blue labeled "data." The x-axis represents income, ranging from 0 to 150, while the y-axis represents age, ranging from 59 to 64. The data shows a trend where higher income is associated with later retirement age.
### Explaining Observed Change

<table>
<thead>
<tr>
<th>Policy</th>
<th>Change Avg. Retirement Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.00</td>
</tr>
<tr>
<td>(1) ( A'_N = A_N + 1 )</td>
<td>+0.30</td>
</tr>
<tr>
<td>(2) 18% wealth loss</td>
<td>+0.62</td>
</tr>
<tr>
<td>(3) ( \chi' = 0.10 )</td>
<td>+1.19</td>
</tr>
<tr>
<td>(1)+(2)+(3)</td>
<td>+2.34</td>
</tr>
</tbody>
</table>
### Role of Illiquidity

<table>
<thead>
<tr>
<th>$\chi$</th>
<th>$A'_N = A_N + 1$</th>
<th>$p' = p - (1/20)p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>+0.33</td>
<td>+0.31</td>
</tr>
<tr>
<td>0.045</td>
<td>+0.38</td>
<td>+0.29</td>
</tr>
<tr>
<td>0.10</td>
<td>+0.47</td>
<td>+0.26</td>
</tr>
</tbody>
</table>
A simple model with a liquidity friction replicates well the Dutch retirement distribution

- High income workers retire later
- Clustering around “normal” retirement age

Higher illiquidity, rise in normal retirement age and wealth losses explain most of observed increase in mean retirement age

Making retirement saving illiquid and increasing normal retirement age are powerful complementary policies to induce later retirement