Early retirement disincentives: Effectiveness and implications for distribution and welfare

Timm Bönke    Daniel Kemptner    Holger Lüthen

Netspar Pension Workshop – 30.01.2015
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction</td>
</tr>
<tr>
<td>2</td>
<td>Data and institutional setting</td>
</tr>
<tr>
<td>3</td>
<td>Conceptual framework</td>
</tr>
<tr>
<td>4</td>
<td>Estimation results</td>
</tr>
<tr>
<td>5</td>
<td>Policy Analysis</td>
</tr>
</tbody>
</table>
Motivation

- Pension systems are under financial pressure
- Germany: Reforms due to population aging, reunification and high unemployment
  1. Eligibility age elevated
  2. Replacement rates lowered
  3. Subsidies for private old-age provisions
  4. Introduction of disincentives for early retirement (our focus)

- Little evidence for effectiveness and (individual) welfare implications
- Reform evaluation serves as a blueprint for further reforms in Germany (e.g. baby boomers) or as example for other countries
Summary

- Research questions:
  1. Can disincentives steer retirement behavior?
  2. What are the distributional, individual welfare, and fiscal implications?

- Data: Administrative pension data for cohorts 1935-1945

- Conceptual framework:
  1. Estimation of a structural dynamic retirement model (DPDC)
  2. Use estimation outcomes to simulate different scenarios/reforms
  3. Compute differences in aggregate outcomes
1. Pension reform effects on labor markets:
   - Mastrobuoni (2009); Hanel (2010); Staubli und Zweimüller (2013); Haan und Prowse (2014); Laun und Wallenius (201X); Ataly and Barret (2014)

2. Incentives in pension systems:
   - Blundell, Meghir, und Smith (2002); Börsch-Supan (2002); Hirte (2002); Schnabel (1999); Siddiqui (1997)

3. Incentives in dynamic retirement models:
   - Stock and Wise (1990), Rust and Phelan (1997); French and Jones (2011)
1 Introduction

2 Data and institutional setting

3 Conceptual framework

4 Estimation results

5 Policy Analysis
The German statutory pension scheme (until 2011) and sample selection

(1) Pay-as-you-go system of Bismarckian variety: Strong link between pension level and prior contributions

(2) Mandatory for the vast majority of employees

(3) Scheme offers various retirement possibilities depending on the retiree’s situation (unemployment, disability, invalidity, women)

(4) **Here**: Focus on regular old-age pension (age 65) and pension for long-term insured (age 63 and 35 years in the pension system)

⇒ Individuals are able to retire at 63
**Data:** Insurance account samples 2002 to 2012 (VSKT, process generated administrative data).

Precise monthly information from age 14 to 67: earnings, (un-)employment, retirement entry, sickness, pension points ...

**Sample:**

1. Mandatorily insured West German men born between 1935 and 1945

2. Employed before retirement and eligible for retirement at age 63 (not disabled/unemployed)

3. Number of obs.: Between 43 and 144 per cohort (946 in total)
Once fully implemented, the reform introduced deductions of 0.3% per month retiring before age 65.

Deductions are phased-in gradually:

<table>
<thead>
<tr>
<th>Date of birth</th>
<th>Retirement age without deduction</th>
<th>Distance to 65 without deductions (in month)</th>
<th>Maximal deduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1937</td>
<td>63</td>
<td>24</td>
<td>0%</td>
</tr>
<tr>
<td>Januar 1937</td>
<td>63 + 1 month</td>
<td>23</td>
<td>0.3%</td>
</tr>
<tr>
<td>June 1937</td>
<td>63 + 6 month</td>
<td>18</td>
<td>1.8%</td>
</tr>
<tr>
<td>Januar 1938</td>
<td>64 + 1 month</td>
<td>11</td>
<td>3.9%</td>
</tr>
<tr>
<td>June 1938</td>
<td>64 + 6 month</td>
<td>5</td>
<td>5.7%</td>
</tr>
<tr>
<td>After 1938</td>
<td>65</td>
<td>0</td>
<td>7.2%</td>
</tr>
</tbody>
</table>
### Descriptives of key determinants (sample averages)

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Retirement Age</th>
<th>Monthly Pension*</th>
<th>Earnings Points [63]</th>
<th>Pension value [65]*</th>
<th>Penalty in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1935</td>
<td>63.55</td>
<td>1680.97</td>
<td>57.73</td>
<td>28.91</td>
<td>0.00</td>
</tr>
<tr>
<td>1936</td>
<td>63.67</td>
<td>1660.76</td>
<td>55.98</td>
<td>28.71</td>
<td>0.00</td>
</tr>
<tr>
<td>1937</td>
<td>63.61</td>
<td>1636.40</td>
<td>55.72</td>
<td>29.18</td>
<td>1.06</td>
</tr>
<tr>
<td>1938</td>
<td>63.75</td>
<td>1565.26</td>
<td>54.42</td>
<td>29.03</td>
<td>3.70</td>
</tr>
<tr>
<td>1939</td>
<td>63.89</td>
<td>1607.84</td>
<td>56.33</td>
<td>28.70</td>
<td>4.28</td>
</tr>
<tr>
<td>1940</td>
<td>64.03</td>
<td>1558.46</td>
<td>54.84</td>
<td>28.27</td>
<td>3.77</td>
</tr>
<tr>
<td>1941</td>
<td>64.06</td>
<td>1564.30</td>
<td>55.85</td>
<td>27.83</td>
<td>3.69</td>
</tr>
<tr>
<td>1942</td>
<td>64.34</td>
<td>1555.65</td>
<td>55.18</td>
<td>27.28</td>
<td>2.67</td>
</tr>
<tr>
<td>1943</td>
<td>64.37</td>
<td>1558.10</td>
<td>54.43</td>
<td>26.81</td>
<td>2.56</td>
</tr>
<tr>
<td>1944</td>
<td>64.32</td>
<td>1538.50</td>
<td>53.96</td>
<td>27.18</td>
<td>2.73</td>
</tr>
<tr>
<td>1945</td>
<td>64.27</td>
<td>1532.81</td>
<td>54.71</td>
<td>27.20</td>
<td>2.91</td>
</tr>
</tbody>
</table>

* 2010 real values.
Table of Contents

1. Introduction
2. Data and institutional setting
3. Conceptual framework
4. Estimation results
5. Policy Analysis
Main features

(1) Dynamic retirement model of mandatorily insured employees in Germany

(2) Individuals are forward-looking and make retirement choices by optimizing leisure-consumption trade-off

(3) Detailed modeling of the German tax code, the social security contributions and the pension system

(4) Focus on individuals retiring through regular old age pension scheme (no pensions due to disability/unemployment)
Expected lifetime utility

$$E \left\{ \sum_{j=0}^{T-t} p_{t+j,b} \beta^j U(s_{nt+j}, d_{nt+j}) \right\}$$

- Monthly choices, individuals die no later than period $T = 100$
- $p_{t+j,b}$: individual conditional survival probability of cohort $b$
- $\beta^j$: subjective time discount factor
- $s_{nt}$: vector of state variables (age, birth cohort, accumulated pension points, wage, previous period’s choice)
- $d_{nt}$: individual’s retirement choice
Utility function

\[ U(s_{nt}, d_{nt}) = \alpha_1 \frac{c(s_{nt}, d_{nt})^{(1-\rho)} - 1}{(1 - \rho)} + \alpha_{2n} \text{retirement}(d_{nt}) + \epsilon_{nt}(d_{nt}) \]

\[ \alpha_{2n} = \alpha_{21n} + \alpha_{22} \text{ret63}_1(d_{nt}) + \alpha_{23} \text{ret65}_1(d_{nt}) \]

- \( c(s_{nt}, d_{nt}) \): consumption
- \( \rho \): coefficient of risk aversion
- \( \text{ret63}_1(d_{nt}) \) and \( \text{ret65}_1(d_{nt}) \) capture preference for first and last possible months of retirement
- \( \epsilon_{nt}(d_{nt}) \) follows a type 1 extreme value distribution
Value function

\[ V_t(s_{nt}) = \max_{d_{nt} \in D(s_{nt})} \left\{ U(s_{nt}, d_{nt}) + p_{t+1} \beta \int_{\epsilon} \left[ \sum_{s_{nt+1}} V_{t+1}(s_{nt+1}) q(s_{nt+1}|s_{nt}, d_{nt}) \right] g(\epsilon_{nt+1}) \right\} \]

- \( D(s_{nt}) \) is the choice set (no more choices after retirement)
- \( q(s_{nt+1}|s_{nt}, d_{nt}) \) is a Markov transition function
- \( g(\epsilon_{nt}) \) is the bivariate density function of random component
- Unobserved/Counterfactual wages: imputed by last observed wage in the respective month [allowing for cyclical variations]
- Working individuals accumulate pension claims proportional to real wages
- Budget constraint:

\[
c(s_{nt}, d_{nt}) = G(s_{nt}, d_{nt}) - savings(s_{nt}, d_{nt})
\]

\[
wealth(s_{nt+1}) = (wealth(s_{nt}) + savings(s_{nt}, d_{nt})) (1 + r)
\]

Note: In the current version, \( savings = wealth = 0 \)
Unobserved heterogeneity

- Unobserved heterogeneity is modeled semi-nonparametrically by allowing for a finite number of unobserved types $m \in 1, \ldots, M$
- Probability that individual $n$ is of type $m$ is given by $\gamma_m$, where $\gamma_M$ is normalized to zero and $\sum_{m=1}^{M} \gamma_m = 1$
- Individual-specific parameter $\alpha_{21n}$ is assumed to be equal to the respective type-specific parameter $\alpha_{21m}$
Solving the model

Expected value function:

\[ v_t(s_{nt}, d_{nt}) = u(s_{nt}, d_{nt}) + p_{t+1} \beta \]

\[
\sum_{s_{nt+1}} \log \left\{ \sum_{d_{nt+1} \in D(s_{nt+1})} \exp(v_{t+1}(s_{nt+1}, d_{nt+1})) \right\} q(s_{nt+1} | s_{nt}, d_{nt})
\]

Choice probabilities:

\[
Prob(d_{nt} | s_{nt}) = \frac{\exp(v_t(s_{nt}, d_{nt}))}{\sum_{j \in D(s_{nt})} \exp(v_t(s_{nt}, j))}
\]

Log-likelihood:

\[
\sum_{n=1}^{N} \log \left\{ \sum_{m=1}^{M} \gamma_m \prod_{t=1}^{T} \left[ \sum_{d_{nt}} Prob_m(d_{nt} | s_{nt}, \theta) \times I(d_{nt}) \right] \right\}
\]
<table>
<thead>
<tr>
<th>Utility function:</th>
<th>Estimates</th>
<th>Standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_1$ (consumption)</td>
<td>0.384</td>
<td>(0.0760)</td>
</tr>
<tr>
<td>$\rho$ (crra)</td>
<td>1.662</td>
<td>(0.1685)</td>
</tr>
<tr>
<td>$\alpha_{211}$ (leisure, type 1)</td>
<td>-0.758</td>
<td>(0.2823)</td>
</tr>
<tr>
<td>$\alpha_{212}$ (leisure, type 2)</td>
<td>0.279</td>
<td>(0.0312)</td>
</tr>
<tr>
<td>$\alpha_{22}$ (leisure $\times$ $ret63_1$)</td>
<td>1.898</td>
<td>(0.1172)</td>
</tr>
<tr>
<td>$\alpha_{23}$ (leisure $\times$ $ret65_1$)</td>
<td>3.954</td>
<td>(0.0146)</td>
</tr>
<tr>
<td>$\gamma_1$ (prob. of type 1)</td>
<td>0.144</td>
<td>(0.0338)</td>
</tr>
<tr>
<td><strong>Log-likelihood:</strong></td>
<td>-1,851.4</td>
<td></td>
</tr>
</tbody>
</table>
Table of Contents

1 Introduction
2 Data and institutional setting
3 Conceptual framework
4 Estimation results
5 Policy Analysis
Reform evaluation

(1) Effects relative to a scenario without disincentives

(2) Expected consumption: NPV of expected remaining lifetime consumption at age 63

(3) Compensating and equivalent variations refer to NPVs at age 63 (annuitized over the remaining lifetime)

(4) Confidence intervals based on parametric bootstrapping (200 draws)
Average reform effects for birth cohorts 39-45 ($E[\cdot]$ at age 63)

<table>
<thead>
<tr>
<th>Reform effects</th>
<th>CI (95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta E$[retirement age] (months)</td>
<td>5.24 [4.46,6.09]</td>
</tr>
<tr>
<td>$\Delta E$[NPV of consumption]</td>
<td>€ -839 [€ -2331,€ 416]</td>
</tr>
<tr>
<td>$\Delta E$[NPV of consumption] (%)</td>
<td>-0.37% [-0.88%,0.02%]</td>
</tr>
<tr>
<td>$\Delta Gini$ coefficient (%)</td>
<td>3.28% [1.75%,4.87%]</td>
</tr>
<tr>
<td>$\Delta$Monthly retirement income</td>
<td>€ -32.8 [€ -37.7,€ -28.1]</td>
</tr>
<tr>
<td>Average compensating variation</td>
<td>€ 6823 [€ 6089,€ 7623]</td>
</tr>
<tr>
<td>NPV of net public returns</td>
<td>€ 25,017 [€ 22,764,€ 27,146]</td>
</tr>
<tr>
<td>$\Delta E$[NPV of pension benefits]</td>
<td>€ 13,677 [€ 12,932,€ 14,391]</td>
</tr>
<tr>
<td>$\Delta E$[NPV of pension contributions]</td>
<td>€ 4075 [€ 3441,€ 7623]</td>
</tr>
<tr>
<td>$\Delta E$[NPV of other contr. &amp; taxes]</td>
<td>€ 7264 [€ 6178,€ 8147]</td>
</tr>
</tbody>
</table>
Effects of reform on expected retirement age by birth cohort

<table>
<thead>
<tr>
<th>Month</th>
<th>1935</th>
<th>1940</th>
<th>1945</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohort</td>
<td>Predicted change</td>
<td>95%-CI</td>
<td></td>
</tr>
<tr>
<td>1935</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1940</td>
<td>4.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1945</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Timm Bönke (FU Berlin)
Early retirement disincentives
30.01.2015 26 / 33
Counterfactual scenarios

What are the effects of higher or lower disincentives?

(1) Compute counterfactual scenarios with disincentives ranging between 0.1% and 1% per month for all cohorts

(2) Calculate outcome measures for each scenario
Expected retirement age by disincentive level

Average age of retirement: 63, 64, 65

Disincentives in % per month of early retirement

Model prediction

95%-CI

Timm Bönke (FU Berlin)
Early retirement disincentives
30.01.2015 28 / 33
NPVs by disincentive level

(a) Average old age pension
(b) NPV at age 63

Disincentives in % per month of early retirement

EUR in year 2010 values

Timm Bönke (FU Berlin)
Distribution of compensating variations

Mean: 6823 EUR

Timm Bönke (FU Berlin)
Early retirement disincentives
Predicted CVs and E(retirement age) by NPVs

![Graph showing the relationship between NPV of expected consumption in 100,000 EUR and Expected Retirement Age vs CV in EUR. The x-axis represents the NPV of expected consumption in 100,000 EUR, ranging from 1 to 5. The y-axis represents the Expected Retirement Age and CV in EUR, ranging from 64.1 to 64.5 and 1000 to 8000, respectively. The graph includes two curves: one for Expected Retirement Age and another for CV. The expected retirement age is highest at a NPV of approximately 3, while the CV is highest at a NPV of approximately 2 and decreases as the NPV increases.]

Timm Bönke (FU Berlin) Early retirement disincentives 30.01.2015 31 / 33
(1) Disincentives in general able to steer individuals’ retirement behavior

(2) 0.3% penalty increased retirement age by 5.24 months

(3) Costs: lower retirement income (€ -32.8), increase in inequality and non-negligible welfare losses especially for medium income earners

(4) Private-pension subsidies: only partial compensation, difficulties due to heterogeneity

(5) Average net public returns of €25,017 (about 10% of average expected net pension benefits) ⇒ pension system’s financial stability can be increased substantially