Labor Supply and the Pension Contribution-Benefit Link

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Outline for section 1

Introduction

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Appendix
Question: Are Social Security Contributions a Tax?

- Social security contributions (SSCs) are a large component of ‘tax’ burden in OECD countries (23% of labor costs in 2010)
  - Potential labor supply disincentive

- But pension contributions (largest part of SSCs) lead to higher future pension entitlements

- Policy proposals (from WB, IMF) have advocated tight link between pension contributions and benefits to encourage work

- Does current labor supply respond to future incentives?
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This Paper

• Massive literature showing how labor supply close to retirement age responds to pension incentives
  • Surveys in Lumsdaine and Mitchell (1999), Gruber and Wise (2008), Blundell et al. (2016), many others

• Little is know about how labor supply far from retirement age responds to pension incentives

• We provide an empirical assessment of how pension incentives affect labor supply far from retirement age
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Polish Pension Reform 1999

- **Pre-reform** Defined Benefit

\[ b_{db} \approx r_{db} \cdot \text{AIME} \approx \text{over best 10 years} \]

- **Post-reform** Notional Defined Contribution

\[ b_{dc} \approx r_{dc} \cdot \frac{1}{N} \sum_{s=18}^{65} y_{is} \approx \text{over all years} \]

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An Implication of ‘Best Years’ Type Rules

• Individuals with high wage growth more likely to have ‘best’ earnings relative to national average later in life (in 50s/60s)

• In DB system, incentives for labor supply late in working life:
  • greater for high-wage-growth individuals
  • worse for low-wage-growth individuals
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**Zasady wypłaty emerytur z ZUS**

Prawo do emerytury i jej wysokość zależy od daty urodzenia

- osoby urodzone **przed 1 stycznia 1949 r.** mają obliczane świadczenia na starych zasadach z uwzględnieniem części socjalnej oraz kwoty bazowej (3536,87 zł)
- tylko osoby urodzone przed 1 stycznia 1949 r., za których były opłacone składki, a wniosek o emeryturę o jej przyznanie został złożony po 31 grudnia 2008 r., mają możliwość ustalenia świadczenia na nowych zasadach

---

**Ważne!**


- 5,2 mln osób pobiera emeryturę z ZUS
- 2257,64 zł - wysokość przeciętnej emerytury z ZUS
- 849,3 tys. osób pobiera rentę z tytułu niezdolności do pracy
- 1605,22 zł - przeciętna wysokość renty z tytułu niezdolności do pracy

---

**Gdzie są nasze pieniądze?**

ZUS zainwestował fundusz emerytalny prawie 500 mln zł
Choice for the future

Zasady wpłaty emerytur z ZUS

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1948 1949 1968 1969
Salience

Important! A pension is award on application from the insured individual.

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1948  1949  1968  1969

Choice for the future
Important! A pension is awarded on application from the insured individual.

Choice for the future

Where is our money?

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1948 1949 1968 1969

Ważne!
**Salience**

**Choice for the future**

Important! A pension is awarded on application from the insured individual.

Rules for being awarded the state pension: the right to a pension and its size depend on the date of birth.

Where is our money?
Wiek emerytalny | Wariant 1 | Wariant 2
--- | --- | ---
67 (lata/miesiące) | 856,59 zł | 1758,26 zł

Dla ubezpieczonego, który przekroczył powszechny wiek emerytalny i nie wystąpił o ustalenie emerytury, hipotetyczną emeryturę podaje się dla jego faktycznego wieku oraz kolejnych pięciu lat.

• na koncie (I filar) i subkoncie (II filar) łącznie: 1072,55 zł
Outline for section 2

Introduction

Data and Design

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Appendix
Did Labor Supply respond to the Pension Reform?

We want:

\[ \Delta \text{Labor Supply Caused by the Reform} \]
\[ \Delta \text{Financial Work Incentives Due to the reform} \]

We need:

1. Data
2. Approach for measurement of the change in incentives
3. Research Design to identify causal impact of the policy
Did Labor Supply respond to the Pension Reform?

We want:

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We need:

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   - We use admin data on entire Polish population from 2000

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Did Labor Supply respond to the Pension Reform?

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1. Data

2. Approach for measurement of the change in incentives
   - We simulate whole-life earnings trajectories, distinguishing between high-earnings-growth and low-earnings-growth regions

3. Research Design to identify causal impact of the policy
Reform impact on incentives

<table>
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<th>Region type</th>
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Reform impact on wealth

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**Wealth effect of reform**: expected pension wealth at age 65, absent changes in behavior.
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Empirical Strategy: Cohort Based Regression Discontinuity

Meet Jan and his twin brother Pawel:

Jan born
11:50pm on 31 Dec 1948

Pawel born
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Until age 50, they lived parallel lives. In 1999, the pension system changed for Pawel (not Jan).
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Outline for section 3

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Appendix
2000-2002: high-growth regions

Switching to NDC

Staying in DB

Change in Empl./Pop. = -0.015 at cut-off (0.003)

Regression table
2000-2002: low-growth regions

Regression table

Switching to NDC
Change in Empl./Pop. = 0.001 at cut-off (0.002)

Staying in DB

Age at the time of reform (01/01/1999)
Reform impact on employment rate

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# Implied elasticities

**Table:** Elasticity estimates

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\[
\eta^P = \frac{%\Delta \text{Employment}_t}{%\Delta \text{Net return from work}_t}
\]
Robustness

- Placebo tests: estimated effects for neighbouring cohorts small and not statistically significant

- Robust to:
  - Finer regions
  - Alternative estimation methods
  - Alternative assumptions on earnings process
Robustness

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Also in the paper

1. Compare to later reform where the return to work changed but where effect of change in incentives is on **immediate income**
   - Labor supply effects of a qualitatively similar elasticities

2. Use the results to estimate the parameters of a lifecycle model to look at the effects **over the whole lifecycle**
   - The reform improved work-incentives earlier in working life, disimproved them late in working life
   - Negative LS late in working life only partially offset by positive LS effect earlier
   - People later in life are closer to participation margin - incentives particularly matter then
Outline for section 4

Introduction

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Conclusions

- Empirical assessment of labor supply effects induced by a pension reform
- We find substantial LS effects 15 years before retirement
- Implications for when in the life-cycle to target incentives
Thank you!
Outline for section 5

Introduction

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Appendix
Simulations: “best-years” by region type

![Bar chart showing fraction using earnings in best-10/best-20 for ages 51 to 54, with high-growth regions and low-growth regions indicated.

- Ages: 51, 52, 53, 54
- High-growth regions: Fraction using earnings in best-10/best-20
- Low-growth regions: Fraction using earnings in best-10/best-20

Bar chart with four bars for each age, with bars for high-growth regions in red and bars for low-growth regions in blue.

- Age 51: 0.46
- Age 52: 0.44
- Age 53: 0.51
- Age 54: 0.48

Legend:
- Low-growth regions
- High-growth regions
Finer regional variation: incentives and wealth effect

Panel A. Incentives.

<table>
<thead>
<tr>
<th>Change in return from work (ages 51-53)</th>
<th>Average annual earnings growth (relative to mean), 2000-2015</th>
</tr>
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<tbody>
<tr>
<td>-0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
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</tr>
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<td>0.02</td>
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</table>

Panel B. Wealth effect.

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<tr>
<th>Wealth effect of reform (pension at age 65)</th>
<th>Average annual earnings growth (relative to mean), 2000-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.25</td>
<td>-0.25</td>
</tr>
<tr>
<td>-0.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>-0.15</td>
<td>-0.15</td>
</tr>
<tr>
<td>-0.1</td>
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</tr>
<tr>
<td>-0.02</td>
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</table>
Finer regional variation: employment effect

Slope (Emp. elasticity) = 0.45 (0.26)
Formulas

\[
b_{i65}^{DB} = \begin{align*}
&= \alpha + r \cdot f \left( \frac{y_i}{\bar{y}} \right) \cdot \bar{y}_{65} \\
&\approx \text{AIME}
\end{align*}
\]

\[
b_{i65}^{NDC} = \begin{align*}
&= \frac{1}{E[T_t | t = 65]} \sum_{s=18}^{65} \left( \prod_{j=s}^{65} (1 + r_j^{NDC}) \right) \tau^{ss} y_{is}
\end{align*}
\]
Assuming Low Eligibility

Table: Elasticity Estimates using Contemporaneous Incentives

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<tr>
<th>Region type</th>
<th>Change in net return to work (%)</th>
<th>Change in net wealth (%)</th>
<th>Change in empl. (%)</th>
<th>Implied elasticity</th>
</tr>
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<tbody>
<tr>
<td>All regions</td>
<td>-46.06</td>
<td>0.0</td>
<td>-29.37</td>
<td>0.64</td>
</tr>
<tr>
<td>High-growth</td>
<td>-50.63</td>
<td>0.0</td>
<td>-32.03</td>
<td>0.63</td>
</tr>
<tr>
<td>Low-growth</td>
<td>-42.99</td>
<td>0.0</td>
<td>-28.27</td>
<td>0.66</td>
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Assuming Middle Eligibility

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<td>0.0</td>
<td>-17.62</td>
<td>0.38</td>
</tr>
<tr>
<td>High-growth</td>
<td>-50.63</td>
<td>0.0</td>
<td>-19.22</td>
<td>0.38</td>
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Assuming High Eligibility

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<tr>
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<td>-50.63</td>
<td>0.0</td>
<td>-12.01</td>
<td>0.24</td>
</tr>
<tr>
<td>Low-growth</td>
<td>-42.99</td>
<td>0.0</td>
<td>-10.60</td>
<td>0.25</td>
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Appendix: Wage process

Wage process estimated:

$$\log y_{irt} = \alpha + \sum_{k=1}^{4} \beta_r^k \text{age}_{irt}^k + \gamma_r \cdot t + \omega_{it} + \varepsilon_{irt}$$  \hspace{1cm} (1)

where $y_{irt}$ are earnings from work, $r$ denotes whether individual $i$ is in high or low-growth region. Permanent component of earnings $\eta_{irt}$ follows AR(1):

$$\eta_{it} = \rho \eta_{i,t-1} + \varepsilon_{it}, \quad \varepsilon_{it} \sim N(0, \sigma_\varepsilon^2).$$  \hspace{1cm} (2)

while $\omega_{it}$ evolves according to MA(1) process:

$$\omega_{it} = \xi_{it} + \theta \xi_{i,t-1}, \quad \xi_{it} \sim N(0, \sigma_\xi^2).$$  \hspace{1cm} (3)

AR(1) and MA(1) process parameters are estimated on 2000-2015 Polish tax data.
Regression discontinuity design: histogram

Histogram of births unrestricted around cutoff:

![Histogram of births unrestricted around cutoff](image-url)
Regression discontinuity design: histogram

Histogram of births restricted around cutoff.
# Results

<table>
<thead>
<tr>
<th>Income growth region</th>
<th>Donut Linear</th>
<th>Donut Local</th>
<th>Full sample Linear</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-growth</td>
<td>-0.0145***</td>
<td>-0.0144***</td>
<td>-0.0188***</td>
</tr>
<tr>
<td></td>
<td>(0.0027)</td>
<td>(0.0049)</td>
<td>(0.0024)</td>
</tr>
<tr>
<td>Low-growth</td>
<td>0.0014</td>
<td>0.0029</td>
<td>-0.0010</td>
</tr>
<tr>
<td></td>
<td>(0.0022)</td>
<td>(0.0040)</td>
<td>(0.0020)</td>
</tr>
</tbody>
</table>

- Donut RDD excludes those born Jan 1-5 ’49 and Dec 16-31 ’48.
- Triangular kernel used for local linear estimation.
Placebo tests

![Graph showing placebo estimates and effect of reform over different cohorts](image)

- Placebo Estimates (Older Cohorts)
- Effect of Reform (1948-1949)
- Placebo Estimates (Younger Cohorts)

**Change in Emp./Pop.**

- 1946-1947
- 1947-1948
- 1948-1949
- 1949-1950
- 1950-1951

**Cohorts**

- Low-growth region
- High-growth region
Table: Elasticity estimates under different specifications

<table>
<thead>
<tr>
<th>Region type</th>
<th>Change in net return to work (%)</th>
<th>Change in net wealth (%)</th>
<th>Change in empl. (%)</th>
<th>Implied elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Baseline</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>-8.52</td>
<td>-0.6</td>
<td>-2.85</td>
<td>0.33 (0.80)</td>
</tr>
<tr>
<td><strong>Panel B: Estimation methods (not net of placebo)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear (full sample)</td>
<td>-8.52</td>
<td>-0.6</td>
<td>-4.05</td>
<td>0.48 (0.52)</td>
</tr>
<tr>
<td>Linear (donut RDD)</td>
<td>-8.52</td>
<td>-0.6</td>
<td>-3.67</td>
<td>0.43 (0.58)</td>
</tr>
<tr>
<td>Robust (donut RDD)</td>
<td>-8.52</td>
<td>-0.6</td>
<td>-4.03</td>
<td>0.47 (1.06)</td>
</tr>
<tr>
<td><strong>Panel C: Simulations of incentives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR(1) earnings (from French, 2005)</td>
<td>-12.70</td>
<td>-0.4</td>
<td>-2.85</td>
<td>0.22 (0.80)</td>
</tr>
<tr>
<td>AR(1) + WN earnings</td>
<td>-8.66</td>
<td>-0.4</td>
<td>-2.85</td>
<td>0.33 (0.85)</td>
</tr>
<tr>
<td><strong>Panel D: Perception of PV</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$d = 0.9$</td>
<td>-7.14</td>
<td>-0.6</td>
<td>-2.85</td>
<td>0.35 (0.80)</td>
</tr>
<tr>
<td>$d = 0.5$</td>
<td>-4.18</td>
<td>-0.6</td>
<td>-2.85</td>
<td>0.58 (0.80)</td>
</tr>
</tbody>
</table>
Treatment and placebo comparison

Panel A. Treatment.

Panel B. Placebo.
## Comparison of regions

<table>
<thead>
<tr>
<th></th>
<th>High-growth</th>
<th>Low-growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural (%)</td>
<td>65.0%</td>
<td>59.1%</td>
</tr>
<tr>
<td>Age &lt; 25 (%)</td>
<td>19.9%</td>
<td>18.8%</td>
</tr>
<tr>
<td>Age 25-60 (%)</td>
<td>58.8%</td>
<td>57.0%</td>
</tr>
<tr>
<td>Age &gt; 60 (%)</td>
<td>22.3%</td>
<td>23.0%</td>
</tr>
<tr>
<td>Earnings Growth p25</td>
<td>3.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Earnings Growth p50</td>
<td>4.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Earnings Growth p70</td>
<td>4.3%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>
Pensions

- $pen^k(t, r, y, P)$ is estimated as containing two components:
  - $pen^k_1(t, r, y)$, which agents accrue whether you work or not
  - $pen^k_2(t, r, y, P)$, which agents only accrue if they do work
- We estimate these using our simulated data for each year, each year calculating the increment if the agent works or not
Pre-Retirement Allowance: Effect in High-Growth Regions

Pre-retirement discontinuity (empl./pop.)

No pre-retirement

Pre-retirement available

Change in Empl./Pop. = \(-0.042\) at cut-off (0.004)
Pre-Retirement Allowance: Effect in Low-Growth Regions

Pre-retirement discontinuity (empl./pop.)

No pre-retirement

Pre-retirement available

Change in Empl./Pop. = -0.034 at cut-off (0.003)
Comparing effects of two incentives

To compare elasticities, need to consider one further detail:

- Eligibility requires employment terminated by employer
- Elasticity of employment w.r.t. net return from work:
  \[ \eta^P = \frac{\Delta \text{Employment}_t}{P(P_t=1 \cap \text{Elig}=1)} \times \frac{\% \Delta \text{Net return from work}_t}{1} \]

- Unknown to us what proportion is vulnerable to (or can engineer!) employment termination
- We consider 3 scenarios \( P(\text{Elig} = 1 \mid P_t = 1) \):
  - Low (40%), High (80%)
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## Estimates

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<tr>
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<th>Change in net return to work (%)</th>
<th>Change in net wealth (%)</th>
<th>Change in empl. (%)</th>
<th>Implied elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>40% Eligibility</td>
<td>-26.72</td>
<td>0.0</td>
<td>-14.68</td>
<td>0.82</td>
</tr>
<tr>
<td>60% Eligibility</td>
<td>-26.72</td>
<td>0.0</td>
<td>-14.68</td>
<td>0.55</td>
</tr>
</tbody>
</table>
## Estimates

<table>
<thead>
<tr>
<th>Fraction eligible</th>
<th>Change in net return to work (%)</th>
<th>Change in net wealth (%)</th>
<th>Change in empl. (%)</th>
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</table>
Revenue equivalent DB vs. DC systems

-2 -1 0 1
Age

-2 -1 0 1
Percentage Point Change in Labor Supply

Low Growth
High Growth
Average
Investigating effects of pension reforms over the lifecycle

Effect of switching from DB to NDC

- Net change in lifecycle labor supply, all: -1.8 months
- Net change in lifecycle labor supply, high-growth: -3.3 months
- Net change in life-cycle labor supply, low-growth: -0.4 months

Frisch Employment Elasticity

- Frisch Employment Elasticity at age 30: 0.52
- Frisch Employment Elasticity at age 40: 0.57
- Frisch Employment Elasticity at age 50: 0.68
- Frisch Employment Elasticity at age 60: 0.90