Redistributive effects of public education and pensions over the life cycle

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Introduction and motivation

- **OBJECTIVE**: approximate the intragenerational redistributive effects of the pension and education expenditure programs throughout the life cycle.
  - Social welfare system: working age provide the economic resources both for the young and for the elderly.
  - Such a system can be conceptualized not only as redistribution between age groups (main objective of the programmes), but, from a life-cycle perspective, as intragenerational redistribution.

- **MOTIVATION**: shift of public resources to the elderly as observed in most welfare states (see, for example, Abio et al., 2015 and Patxot et al., 2012)
  - The analysis of intragenerational inequalities from a life-cycle perspective can contribute to a better identification of the programs’ winners and losers and, thus, complement the perspectives held by various generations seeking to obtain public resources.
The redistributive effects of public education and pensions

- **PUBLIC EDUCATION EXPENDITURE**: Ambiguous effect of education expansion
  - raising the average level of schooling of a population have traditionally been seen as a mechanism for reducing wage inequalities.
  - higher education is associated with greater wage dispersion (Martins and Pereira (2004), Buchinsky (1994) for the USA, Gosling, Machin and Meghir (2000) for the United Kingdom, and Hartog, Pereira and Vieira (2001) for Portugal; Budria and Moro-Egido (2008))

- **PENSION SYSTEM**: complexity of schemes (contributiveness, and minimum and maximum thresholds in pensions and contribution rates)

- the degree of intragenerational redistribution of pension systems in many OECD countries has declined over the past two decades (see, for example, Krieger and Traub, 2008; Linderk and Persson 2003; Queisser, 2000; Werding, 2003)
Empirical approach (I)

- Comparison of two scenarios for the same cohort (born 1955-1975): with social programmes and (contrafactual) without public education and pensions

  Descriptive analysis of income distribution

- Comparison of different cohorts (with different education expenditure and pensions)

  Inequality analysis (decomposition)
Empirical approach (II)

Three steps:

- Elaborate the Data base 1980-2060, with data on wages, contribution bases and pensions (observed past data and simulated with DyPeS)

  + Education expenditure as benefit in kind (Abió, Patxot, Renteria, Souto; 2017)

- Obtain the life cycle adjusted income (that includes education and pensions transfers)

- Inequality analysis (descriptive results, Gini index and decomposition)
Data: MCVL
(Wages or contribution bases from 1980, pensions, education and personal characteristics and working conditions).

Starting sample for microsimulation:

Microsimulation model
DYPES: simulates wages, contribution bases and pensions up to 2060

Econometric analysis of retirement and labour market models:
Retirement model
Wage growth model
Unemployment model

DATABASE: 1980-2060
(education, wages, pensions)
Model structure of DyPeS

Main events

Birth → Entry in the Labour market → Change in qualification group Empl (gr) /unemployment → Retirement 1/6 Pathway → Mortality

Wage growth model (Mincer)

1st assign Educ level, 2nd entry wage and qualification level

Behaviour:

- Retirement probability.
- Unemployment probability
Modelling issues (Dypes): Model characteristics

**Dynamic population microsimulation model**

1. Runs on continuous time - some events occur in discrete time

2. Based on an administrative data set: subsample of 800,000 individuals (not households) from Social Security registers (2007 wave). Future individuals simulated.

3. **Longitudinal**: simulates each case from birth to death before the simulation of the next case begins (case-based model, we have individual data), but is has also been adapted to simulate successive cross-sections (time-based).

4. Mainly probabilistic, with some behavioural components (more behavioural elements in the near future)
Modelling issues: Using Modgen programming language

- ModGen way of working:
  - It creates an event queue
  - Computes time to event (using behavioural or fixed probabilities)
  - Once and event happens, all times (queue) reevaluated

- Application with tables containing all input/outputs:
  - Inputs: Parameters organized in groups
  - Outputs: Results
  - Possible to run the application from the www
Variables

- "Life cycle adjusted income" (includes education and pension transfers)

\[
AI = \sum_{t=0}^{T} \frac{NBE_t}{(1+r)^{T-t}} + \sum_{t=0}^{T} \frac{NBP_t}{(1+r)^{T-t}} + \sum_{t=0}^{T} \frac{W_t}{(1+r)^{T-t}}
\]

\[
NBP_t = Pensions_t - Contributions_t
\]

\[
NBE_t = EdBenefits_t - Taxes to education_t
\]

**Education benefits** = cost (public expenditure by educational level and cohort).

**Taxes to education** = proportion of labour taxation to education

\[
Taxes to education = ATR \times \frac{Education expend}{Labour income} \times \frac{PIB}{Education expend} \times \frac{Labour income}{PIB}
\]
Decomposition

- We use a decomposition of inequalities of life-cycle income and labour income in line with Shorrocks (1982)

\[ s_k(I) = \frac{\text{cov}[Y^k, Y]}{\sigma^2(Y)} \]

- That allows to estimate an equation with characteristics as covariates and obtain the contribution of each characteristic (j) to income inequality can be defined as

\[ s_j(y) = \frac{\text{cov}[\hat{\beta}_{ij}, X_j, y]}{\hat{\sigma}^2(y)} \]
Figure 1. Public education spending per student by level of education. 1942-2015*

- **Level of education by cohort. Spain 1938-1978. Male**
  - Infantil y E. Primaria / E.G.B.
  - Secundaria, F. Profesional y EE. de Reg. Especial
  - Universitaria

- **Level of education by cohort. Spain 1938-1978. Female**
  - less than secondary
  - secondary
  - university
Descriptive results (I)

Figure 5. Net present values of transfers and adjusted income by education level

- The relatively little weight of education for the lowest education levels, compared to the weight of pensions.

- For the lowest education level, the NPV of pensions practically equals that of the lifetime wages.

- Differences in the NPV of pensions (in the public system) by education level are clearly inferior to the wage differences, which points to the equalizing role of pensions in the life-cycle
Figure 6. Share of transfers (NPV) to adjusted income (AI) by education level and income quintile

- The relative weight of net transfers received from the education system in proportion to the life-cycle income is higher for those at the higher education levels.

- The outcome is the opposite when individuals are grouped by adjusted private (work) income quintiles.

- The relative proportion of pensions to life-cycle income is higher for the less educated and also for those with lower incomes.
Inequality analysis (I)

Gini indexes by cohort of the life cycle income. Public versus private financing of education and pensions

- With public programs, inequality is reduced at each education level.
- Inequality levels are higher among the less educated and, paradoxically, redistribution is lower in this group. However, this exercise has been carried out without considering a complete counterfactual scenario with behavioural changes.

Gini indexes of private income and adjusted income (present values). Cohorts 1955-1975
Inequality analysis (II)

Decomposition of life-cycle inequality by income source

<table>
<thead>
<tr>
<th>Share of income inequality (%)</th>
<th>Male</th>
<th>Education (present value of transfers)</th>
<th>Female</th>
<th>Education (present value of transfers)</th>
<th>All</th>
<th>Education (present value of transfers)</th>
<th>Pensions (present value of transfers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>46.3977</td>
<td>0.8572</td>
<td>52.745</td>
<td>61.5282</td>
<td>1.1833</td>
<td>37.2885</td>
<td>52.7313</td>
</tr>
<tr>
<td>-0.0619</td>
<td>-0.031</td>
<td>0.0929</td>
<td>0.0428</td>
<td>-0.0365</td>
<td>-0.0062</td>
<td>-0.0149</td>
<td>-0.0335</td>
</tr>
<tr>
<td>Less than secondary studies</td>
<td>44.8003</td>
<td>-0.0393</td>
<td>55.2389</td>
<td>56.9104</td>
<td>-0.13</td>
<td>43.2196</td>
<td>49.2076</td>
</tr>
<tr>
<td>-0.0718</td>
<td>-0.0107</td>
<td>0.0825</td>
<td>0.0086</td>
<td>-0.0153</td>
<td>0.0067</td>
<td>-0.0361</td>
<td>-0.0123</td>
</tr>
<tr>
<td>Secondary studies</td>
<td>45.7083</td>
<td>0.0611</td>
<td>54.2306</td>
<td>61.4931</td>
<td>-0.0224</td>
<td>38.5294</td>
<td>52.0089</td>
</tr>
<tr>
<td>-0.068</td>
<td>-0.04</td>
<td>0.108</td>
<td>0.0431</td>
<td>-0.0471</td>
<td>0.004</td>
<td>-0.0199</td>
<td>-0.0427</td>
</tr>
<tr>
<td>University</td>
<td>46.8413</td>
<td>-0.0212</td>
<td>53.1799</td>
<td>63.9676</td>
<td>-0.2944</td>
<td>36.3269</td>
<td>55.2828</td>
</tr>
<tr>
<td>-0.0718</td>
<td>-0.0623</td>
<td>0.1341</td>
<td>0.0609</td>
<td>-0.0694</td>
<td>0.0085</td>
<td>-0.0046</td>
<td>-0.0658</td>
</tr>
</tbody>
</table>

The strong correlation between pensions and contributions (the “Bismarckian” part of the system) and, therefore, to labour income, account, for the fact that pensions represent 46% of total income inequality.

In the case of pensions, its share of income inequality is virtually equal to its share of life-cycle income.

The net benefits of education have an equalizing effect on life-cycle income for lower and higher education levels and are significantly stronger for women.
Share of inequality by adjusted life-cycle income source and cohort (1955-1975)*

- The increasingly equalizing role played by education (negative values represent equalizing contribution).
- The dis-equalizing contribution of pensions falls, contrary to what we saw with wages.

*contributions of education in the secondary axis.

Source: author’s elaboration
Inequality analysis (V)

Share of characteristics in life-cycle labour income inequalities*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Share of Life-Cycle Income Inequalities (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual</td>
<td>44.1043</td>
</tr>
<tr>
<td>Sex</td>
<td>0.5637</td>
</tr>
<tr>
<td>Length of working careers</td>
<td>16.7084</td>
</tr>
<tr>
<td>Secondary studies</td>
<td>-0.1877</td>
</tr>
<tr>
<td>University studies</td>
<td>32.1984</td>
</tr>
<tr>
<td>Net education transfers</td>
<td>-20.7311</td>
</tr>
</tbody>
</table>

*(regression-based methodology based on Felds, 2003)*

Having a university degree is the variable that explains the greatest share of labour income inequality.

Confirms the equalizing role of education transfers, which means that increases in net benefits per student (increases in education quality) of the public education system have a positive effect on labour income inequality over the life cycle.

Although labour income wage differentials by sex are substantial, their contribution in accounting for life-cycle wage differentials is relatively small (0.6%).

Finally, length of working career contributes positively (17%) to labour income inequalities.

*Controlled by cohort

Source: author's elaboration
Inequality analysis (V)

Contribution of education transfers on life-cycle labour income inequality by cohort*

Contrary to what observed for life-cycle income, education have an equalizing role in labour-income inequalities for the oldest cohorts, and loses this positive contribution for more recent cohorts (1971 and above).

*positive values mean dis-equalizing effect
Source: author’s elaboration
Future work

- Country comparison / welfare state regimes (instead of counterfactual scenario without public transfers)

- Introducing differences by education level not only in life-cycle income but in life expectancy and health and long term care consumption.

- (WELTRANSIM Project- JPI More Years Better Lives)
Thanks

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