# A large scale OLG model for France, Italy and Sweden: assessing the interpersonal and intrapersonal redistributive effects of public policies

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# What kind of model do we need to assess the redistributive effects of public policies?

We think that a model aimed at studying the redistributive effects of public policies should strike a balance between the following modeling features:

- Households as the units of analysis;
- a life cycle dimension;
- a sizeable degree of inter and intragenerational heterogeneity;
- a large number of public policies;
- "structural" behavioral responses.

# The model: basic structure

- (Small open or closed) economy populated by $\overline{J}$ overlapping generations.
- $j = \left\{1, 2, ..., j^R, ..., \overline{J}\right\}$ the age of an individual;

  where:
  - $j^R$ = exogenous retirement age;
  - $\overline{J}$ maximum age;

    Individuals may die before $\overline{J}$ (survival probability).

# The model: basic structure (continued)

- Intragenerational heterogeneity along the following dimensions:
  - gender: male and female
  - marital status: singles and married agents
    - Couples are comprised by individuals of the same age
    - Marital status is "constant" along the life cycle
  - presence of children:
    - zero or two
    - in period $j = 1$ and for couples only
  - educational level: with and without a high degree;
  - productivity level.

# The model: basic structure (continued)

- The decisional unit is the household:
  - A single individual maximizes his/her intertemporal utility
  - Individuals within a couple pool together their resources and maximize the sum of their intertemporal utilities (with equal weights).
  - Control variables: consumption and labor supply

**Single agent:** $\max_{c_j^g, z_j^g} u(c_j^g, z_j^g) + \psi_{j+1}(g)\beta V^g(x_{j+1}^g)$.

**Couples:**

$$\max_{c_j^m, c_j^f, z_j^m, z_j^f} \Big\{ u(c_j^m, z_j^m) + u(c_j^f, z_j^f) +$$

$$\psi_{j+1}(m)\beta\Big(\psi_{j+1}(f)V^m(x_{j+1}^{co}) + (1-\psi_{j+1}(f))V^m(x_{j+1}^m)\Big) +$$

$$\psi_{j+1}(f)\beta\Big(\psi_{j+1}(m)V^f(x_{j+1}^{co}) + (1-\psi_{j+1}(m))V^f(x_{j+1}^f)\Big)\Big\}$$

- $c_j^g$ - Consumption;
- $z_j^g$ - Leisure;
- $V^g$ - Value function;
- $x_{j+1}^g$ - State vector.
- $\psi_{j+1}(g)$ - Survival probability.

# The model: public policies

- We model the main institutional features of the following set of public policies:
  - Personal income tax
  - Capital income tax
  - Commodity tax
  - Pension system
  - Child care subsidies
  - Child benefit
  - Health subsidies

# Budget constraint

$$a_{j+1} = (1 + (1 - \tau_r)r)a_j + I_m(g)\big((1 - \tau_{ss})Y_j^m - T_j^m - \bar{H}_j^m + H_j^m\big) + I_f(g)\big((1 - \tau_{ss})Y_j^f - T_j^f - \bar{H}_j^f + H_j^f\big) + ANF_j - p_d(1 - \tau_d)d - (1 + \tau_q)q + TR_j.$$

- $a_j$ - Assets
- $Y_j^g$ - Income (wage or pensions)
- $T_j^g$ - Income taxes
- $\bar{H}_j^g$ - Health expenditures
- $H_j^g$ - Health subsidies
- $ANF_j$ - Child subsidy
- $p_d$ - price of non-parental daycare
- $q$ - Consumption
- $TR_j$ - Transfers

# Pension system

Young: $sc^g_{j+1} = (1 + r^{ss})(sc^g_j + \tau^{ss} e^g_{j,h} wl^g_j)$.

Old: $P = \frac{sc_{JR}}{\sum_{j=jR}^{\bar{J}} \frac{\prod_{s=jR}^{j} \psi^g_s}{(1+r^{ss})^{j-jR}}}$.

- $sc^g$ - Amount of social contributions.
- $P$ - Pensions.
- $w$ - Wage rate per efficiency unit.
- $e^g_{j,h}$ - Efficiency units.
- $l^g_j$ - Labour supply.
- $\psi_{j+1}(g)$ - Survival probability.

# Policy experiments: an example

- We study the effects of a shift from the current progressive PIT to a proportional income tax (keeping revenues constant)

  This a "prototypal" computational experiment: already done in the literature for the USA using large scale OLG models.

- We study the redistributive effects of this reform looking at:
  - the percentage of individuals who are worse off after the reform: 42%
  - the compensating variation (CV) for each type of household:

    CV= % of additional money an agent shall pay to reach its initial utility after a change in prices after the policy reform
  - Other

# Policy experiments: an example (continued)

Table: Compensating variations: couples

| | Type | | | |
|---|---|---|---|---|
| | Male: L Female: L | Male: H Female: L | Male: L Female: H | Male: H Female: H |
| Male: nd, Female: nd, Children: yes | -0.08 | 0.15 | -0.03 | 0.21 |
| Male: nd, Female: nd, Children: no | -0.04 | 0.17 | -0.08 | 0.24 |
| Male: ud, Female: nd, Children: yes | -0.04 | 0.24 | 0.05 | 0.33 |
| Male: ud, Female: nd, Children: no | 0.00 | 0.27 | 0.08 | 0.35 |
| Male: nd, Female: ud, Children: yes | -0.06 | 0.21 | 0.22 | 0.17 |
| Male: nd, Female: ud, Children: no | -0.01 | 0.23 | 0.25 | 0.19 |
| Male: ud, Female: ud, Children: yes | -0.04 | 0.26 | 0.20 | 0.30 |
| Male: ud, Female: ud, Children: no | 0.01 | 0.29 | 0.23 | 0.32 |

# Conclusion

- OLG model($\Rightarrow$ life cycle dimension and "structural" behavioral responses), calibrated on Italian data, with: a sizeable degree of inter and intragenerational heterogeneity; a large number of public policies; the household as the unit of analysis.
- The model can be used to simulate a wide range of policy experiments