EUROPEAN COMMISSION
Employment, Social Affairs and Equal Opportunities
Social Protection and Integration
Social Protection, Social Services

CAPP
Centro di Analisi delle Politiche Pubbliche

ESTIMATION AND SIMULATION OF EARNINGS USING IT-SILC

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Dissemination of research results

"Assessing adequacy and long term distributive effects of the Italian Pension System. A Microsimulation Approach"

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Aim(s)

Prediction of individual earnings

Ideally, we would like to :

1. Estimate a model of mean earnings, taking into account dynamics
2. Predict the evolution of an individual's earning, accounting for:
   - the evolution of observables
   - serial correlation in the earnings residuals
   - increases in productivity

However:

1. We have limited and long- and up-to-date panel that would also be appropriate as initial population
2. Some DMM use cross-sectional estimates. See DESTINIE (INSEE, 1999), MIDAS (Dekkers et al, 2010) and MIRTODIN (Maitino & Sciclone, 2009)
3. Other use panel data. See PenSim2 (Emmerson et al., 2004), CORSIM (Favreault & Caldweel, 1998), the Dynamod (2002) and CeRPSIM (Borella & Coda Moscarola, 2006, 2009)

Data

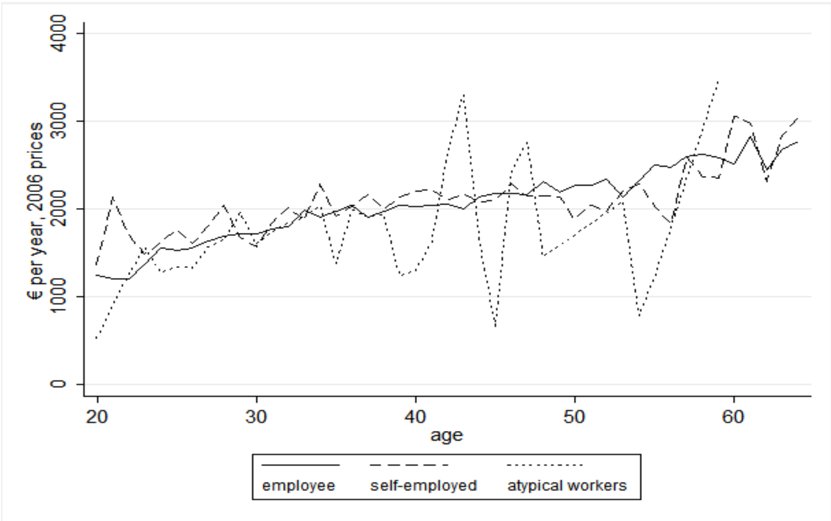
Cross-sectional and longitudinal component of IT-SILC

- Pros:
  - Large sample size, representative at the regional level
  - Link with administrative data
  - Earnings are provided both gross and net of taxes and SSC
- Cons:
  - Short rotating panel

Data

- Sample selection rules:
  - Employed individuals
  - Aged restriction [20, SPA]
  - Bottom and top-coding
- Definition of earnings:
  - Employee cash income and cash benefits or losses from self-employment
  - Gross of taxes and social contribution paid by the workers
  - (log) monthly earnings in euro 2006

Mean gross monthly earnings by age and employment status



Cross-sectional estimates, log earnings

	Men, not graduated, employees	Women, not graduated, employees	Men, graduated, employees	Women, graduated, employees	Graduated, self-employed	Men, not graduated, self-employed	Women, not graduated, self-employed
North	0.1006***	0.1187***	0.0651*	0.0595*	0.2425***	0.0646**	0.0442
	(0.023)	(0.027)	(0.039)	(0.033)	(0.057)	(0.032)	(0.050)
South	-0.1458***	-0.0961***	-0.1686***	-0.0772**	0.0023	-0.2655***	-0.3025***
	(0.027)	(0.034)	(0.046)	(0.038)	(0.070)	(0.036)	(0.059)
Private	-0.0845***	-0.1619***	-0.0694*	-0.0625*			
	(0.012)	(0.014)	(0.036)	(0.034)			
Part-time	-0.6440***	-0.5145***	-0.5826***	-0.5718***	-0.4604***	-0.2742***	-0.2830***
	(0.034)	(0.015)	(0.147)	(0.040)	(0.080)	(0.078)	(0.054)
Secondary	0.0507***	0.1402***				0.1926***	0.1990***
	(0.019)	(0.025)				(0.026)	(0.043)
Immigrant	-0.2228***	-0.2118***	-0.4556***	-0.3970***	-0.4060***	-0.0313	-0.2395**
	(0.020)	(0.032)	(0.074)	(0.081)	(0.139)	(0.079)	(0.110)
Age	0.0336***	0.0147***	0.0736***	0.0493***	0.0247***	-0.0029	0.0340**
	(0.004)	(0.005)	(0.015)	(0.012)	(0.005)	(0.010)	(0.017)
Age squared	-0.0004***	-0.0002***	-0.0006***	-0.0004***		0.0001	-0.0004**
	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)
Contributions	0.0120***	0.0154***	0.0024	0.0111***	0.0396***	0.0060**	0.0082**
	(0.001)	(0.002)	(0.004)	(0.003)	(0.011)	(0.003)	(0.003)
Contributions squared					-0.0009***		
					(0.000)		
Women					-0.1621***		
					(0.054)		
Atypical					-0.0002	-0.2127***	-0.1089
					(0.062)	(0.077)	(0.070)
Observations	7478	5349	1005	1169	911	2627	1124
R^2	0.334	0.427	0.293	0.349	0.265	0.112	0.119
RESET (p-value)	0.6852	0.4375	0.5726	0.4482	0.5171	0.8156	0.6057

Note: the regressions also include a constant, SecondaryXcontributions, NorthXcontributions, SouthXcontributions

Panel estimates

- We model the earnings residuals (Lillard and Willis, 1978)

$$\ln y_{it} = z_{it}\beta + \varepsilon_{it}$$
$$\varepsilon_{it} = \mu_i + \xi_{it}$$
$$\xi_{it} = \rho\xi_{it-1} + \omega_{it},\ \omega_{it} \sim iid(0, \sigma^2_\omega),\ |\rho| < 1$$
$$\mu_i \sim iid(0, \sigma^2_\mu)$$

- We focus on the estimates for the error component
- Comparable results can be found in:
  - Ramos (2003) for the UK using BHPS
  - Lillard and Willis (1978) using the American PSID panel
  - Borella and Coda-Moscarola (2009) using INPS administrative data for Italy

Panel estimates

IT-SILC results, net log earnings

	Men, not graduated, employees	Women, not graduated employees	Men, graduated, employees	Women, graduated, employees	Graduated, self-employed	Men, not graduated, self-employed	Women, not graduated, self-employed
$\sigma^2_\mu/\sigma^2_\varepsilon$	0.627	0.543	0.728	0.642	0.550	0.539	0.538
ρ	0.322	0.346	0.249	0.282	0.123	0.171	0.237
δ(2,1)	0.747	0.701	0.795	0.743	0.605	0.618	0.647
$\sigma^2_\mu+\sigma^2_\xi$	0.092	0.108	0.138	0.127	0.373	0.295	0.339

Results in Borella and Coda Moscarola (2009), gross log earnings

	Males			Females		
	Blue collar	White collar	Self-employed	Blue collar	White collar	Self-employed
$\sigma^2_\mu/\sigma^2_\varepsilon$	0.750	0.870	0.407	0.748	0.799	0.353
ρ	0.432	0.529	0.165	0.419	0.440	0.070
δ(2,1)	0.858	0.869	0.543	0.787	0.813	0.465
$\sigma^2_\mu+\sigma^2_\xi$	0.078	0.129	0.170	0.147	0.162	0.148

Simulation

- If the individual is employed in the initial sample
  1. his/her log earnings are split into the deterministic component and a residual
  2. in the following years, the deterministic components evolves following the change in observables
  3. we simulate the evolution of the residual using the autoregressive component
- When an individual starts his/her first job
  1. the deterministic component is predicted using cross-sectional or panel estimates *(and multiply by 12)*
  2. we impute a residual assuming that the errors are normally distributed
  - Aggregate increase in productivity are assigned to all workers in each simulation period

Simulating the evolution of unobserved individual effect

- Following Pudney (1992)

$$\varepsilon_{it} = \mu_i + \xi_{it}$$

$$\xi_{it} = \rho\xi_{it-1} + \omega_{it}, \omega_{it} \sim N(0, \sigma_\omega^2), |\rho| < 1$$

$$\mu_i \sim N(0, \sigma_\mu^2)$$

- the autoregressive component implies that:

$$cov(\xi_{it}, \xi_{it-\mathrm{k}} | 1, z_i) = \rho^k \sigma_\xi^2$$

- using normality:

$$E(y_{is} | y_{it}, z_{it}, z_{is}) = z_{is}\beta + \delta(s,t)(y_{it} - z_{it}\beta)$$

- where:

$$\delta(s,t) = \frac{\sigma_\mu^2 + \rho^{|s-t|}\sigma_\xi^2}{\sigma_\mu^2 + \sigma_\xi^2}$$

The increase in productivity

- Y is multiplied by a factor $(1+\tau_s)$ allowing the individual earning in s to be linked to the medium-long term productivity growth
- But… the demographic evolution and the increase in the stock of human capital in the coming decades increase the average earning level, since age and education have a positive effect on average labour earnings
- we avoid over/under-estimations of earnings growth rates, using:

$$\tau_s = m_s - \left(\frac{E(y_s)}{E(y_{s-1})} - 1\right)$$

official productivity growth

Endogenous growth generated by the model

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