Occupational Mobility: Theory and an Application to Italy

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Literature on Social Mobility

- **Occupation**: Cobalti and Schizzerotto (1994); Checchi et al. (1999); Pisati (2000); Corak and Piraino (2011); Franzini et al. (2013), Long and Ferie (2013).
- **Income**: Solon (2002); Bjrklund and Jntti (2009); Black and Devereux (2011); Bjrklund et al. (2012); Corak (2013).
- **Social Class**: Erikson and Goldthorpe (1992); Breen and Jonsson (2005).
- **Equality of opportunities versus equality of outcome**: Ooghe, Shokkaert and Van De Gaer (2007); Lefranc, Pistolesi and Trannoy (2008).

Our theoretical framework of analysis

- **Social mobility** proxied by **occupational mobility** (from sociology)
- **Occupational mobility** = **True occupational mobility** (individual choices) + **Occupational Shifts** (production side) (Prais, 1955)
- **True occupational mobility** = **Equality of opportunity - Lack of income incentives** (our novelty)

The road map of the presentation

- A (simple?) theoretical model on occupational mobility.
- An application to Italy.

A model of true occupational mobility

- Two classes of occupations (income and social status):
  - *Working and Lower Middle* (**WLM**) class;
  - *Upper Middle and Capitalist* (**UMC**) class.

- The life-time (indirect) utility of individual i, U_i, only depends on his/her occupation, i.e.:

$$U_i = \begin{cases} W_i & \text{if individual belongs to WLM class;} \\ \Pi_i & \text{if individual belongs to UMC class,} \end{cases}$$

- Life-time utility has a stochastic component:

$$\log W_i \sim \mathcal{N}\left(\mu_{WLM}; \sigma^2_{WLM}\right);$$

$$\log \Pi_i \sim \mathcal{N}\left(2\theta_i \mu_{UMC}; \sigma^2_{UMC}\right)$$

with $0 \leq \mu_{WLM} \leq \mu_{UMC}$ and $\sigma^2_{WLM} \leq \sigma^2_{UMC}$.

The incentives

- The individual decides to belong to UMC class *if and only if*:

$$\text{UMCc} \succsim \text{WLMc} \iff \mathbf{E}\left[\Pi_i\right] - c_e \geq \mathbf{E}\left[W_i\right] + \sigma^{RP},$$

  where σ^{RP} is the risk premium depending on the attitude towards risk of individual i (assumed to be equal across individuals).

- A risk-adverse (or risk-neutral) individual decides to belong to UMC class *if and only if*:

$$\text{UMCc} \succsim \text{WLMc} \iff$$

$$\theta_i \geq \lambda \equiv \underbrace{\frac{\mu_{WLM}}{2\mu_{UMC}}}_{\text{Component I}} + \underbrace{\frac{\sigma^{RP}\left(\frac{\sigma^2_{UMC}}{\sigma^2_{WLM}}\right)}{2\mu_{UMC}}}_{\text{Component II}} + \underbrace{\frac{c_e}{2\mu_{UMC}}}_{\text{Component III}} \geq 1/2. \quad (1)$$

- Given θ_i, λ is the threshold, which determines the **incentives** for individual i to move to class UMC .

The opportunities

- θ_i is an idiosyncratic factor that measures the **opportunities** of the individual i, and it is assumed to be known by the individual.

- If parents belong to WLM class, the probability distribution of θ_i is given by:

$$f(\theta_i|WLM) \sim \mathcal{U}\left(0, \theta^{\max}\right),$$

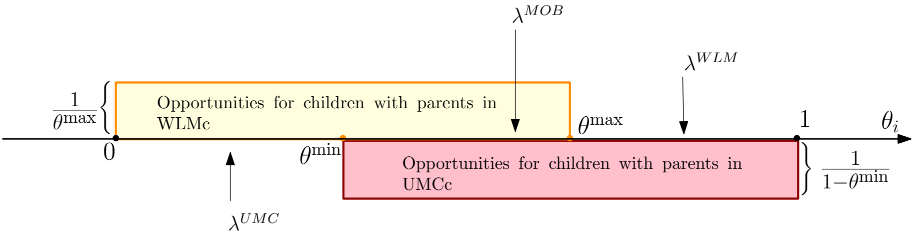
  with $\theta^{\max} \leq 1$.

- If parents belong to UMC class, the probability distribution of θ_i is given by:

$$f(\theta_i|UMC) \sim \mathcal{U}\left(\theta^{\min}, 1\right),$$

  with $\theta^{\min} \geq 0$.

A comparison between opportunities of individuals whose parents belong to different occupational classes.



- A higher $\theta^{\max}$ favours a change in occupational class for individuals whose parents are in WLM class.
- A lower $\theta^{\min}$ favours a change in occupational class for individuals whose parents are in UMC class.

Markov matrix for *occupational mobility*

Under assumption:

$$\theta^{\max} > \lambda \text{ and } \theta^{\min} < \lambda$$

$\Rightarrow$ occupational mobility is described by *Markov matrix* $\mathbf{Q}$:

Fathers\Children	WLM	UMC
WLM	$\dfrac{\lambda}{\theta^{\max}}$	$\dfrac{\theta^{\max}-\lambda}{\theta^{\max}}$
UMC	$\dfrac{\lambda-\theta^{\min}}{1-\theta^{\min}}$	$\dfrac{1-\lambda}{1-\theta^{\min}}$

Ergodic Distribution:

$$\pi_{\mathbf{Q}} = \left[\ \frac{1}{1+\gamma(\theta^{\min},\theta^{\max},\lambda)}, \frac{\gamma(\theta^{\min},\theta^{\max},\lambda)}{1+\gamma(\theta^{\min},\theta^{\max},\lambda)} \ \right],$$

where

$$\gamma = \frac{(\theta^{\max}-\lambda)(1-\theta^{\min})}{\theta^{\max}(\lambda-\theta^{\min})}.$$

Measures of occupational mobility

From **Q** we have a measure of occupational mobility (Shorrocks 1978):

$$I_S = 2 - \mathrm{tr}(\mathbf{Q}) = 2 - \frac{\lambda(1 - \theta^{\text{min}} - \theta^{\text{max}}) + \theta^{\text{max}}}{\theta^{\text{max}}(1 - \theta^{\text{min}})};$$

$\Rightarrow$ occupational mobility:

- increases with θ^{max};
- decreases with θ^{min}.

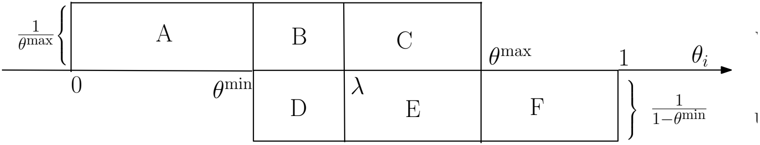
The relationship with λ is ambiguous:

- higher λ means less (upward) mobility for WLM children and higher (downward) mobility for UMC children.

BUT

- If $\theta^{\text{min}} + \theta^{\text{max}} < 1 \Rightarrow$ the first effect prevails on the second and I_S decreases with λ.

Disentangle the occupational mobility due to incentives and opportunities.



- A measure of socio-economic opportunities in the range [0-2]: B+C+D+E

$$I_{OPP} = 2 - \frac{\theta^{\min}(1-\theta^{\min}) + \theta^{\max}(1-\theta^{\max})}{\theta^{\max}(1-\theta^{\min})}.$$

- A measure of the incentives for children to **not** change their occupational class in the range [0-2], an index of lack of (income) incentives: B+E

$$I_{LOI} = \frac{\lambda - \theta^{\min}}{\theta^{\max}} + \frac{\theta^{\max} - \lambda}{1-\theta^{\min}}.$$

Three types of societies

1. *Perfect Mobile Society* The probability of entering a particular class is independent of the class of one's parents: $\theta^{\text{min}} = 0$ and $\theta^{\text{max}} = 1$

$$\mathbf{Q}_{\text{PMS}} = \begin{bmatrix} \lambda & 1-\lambda \\ \lambda & 1-\lambda \end{bmatrix}$$

2. *Perfect Immobile Society* No movements between classes take place: $\theta^{\text{min}} > \lambda$ and $\theta^{\text{max}} < \lambda$

$$\mathbf{Q}_{\text{PIS}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

3. *Ex-Post-Minimum Inequality Society* Class *WLM* is the absorbing class in the equilibrium distribution: $\theta^{\text{min}} < \lambda$ and $\theta^{\text{max}} < \lambda$

$$\mathbf{Q}_{\text{EPMIS}} = \begin{bmatrix} 1 & 0 \\ \dfrac{\lambda - \theta^{\text{min}}}{1 - \theta^{\text{min}}} & \dfrac{1-\lambda}{1 - \theta^{\text{min}}} \end{bmatrix}$$

The occupational structure (Prais, 1955)

- Prais (1955) suggests to consider the **observed** transition matrix $\mathbf{P}$ is the result of the *product* of two Markov transition matrices corresponding to two forces:

$$\mathbf{P}^\top = \mathbf{R}^\top \mathbf{Q}^\top \Rightarrow \mathbf{Q}^\top = (\mathbf{R}^\top)^{-1}\mathbf{P}^\top,$$

  where $\mathbf{Q}$ is the matrix of **true occupational mobility**, and $\mathbf{R}$ is the matrix of **occupational shifts**.

- Given the individual choices and the shares of observations at period t,

$$s_{t+1}^{UN} = \mathbf{Q}^\top s_t,$$

  is the vectors of allocations of individuals in each occupational class at period $t+1$ when there are no constraints from the demand side.

- The observed vector at period $t+1$ is given by:

$$s_{t+1} = \mathbf{R}^\top s_{t+1}^{UN} = \mathbf{R}^\top \mathbf{Q}^\top s_t = \mathbf{P}^\top s_t,$$

  where $\mathbf{R}$ reflects these possible differences due to occupational shifts.

Three possible matrices of occupational shifts

- *No occupational shifts* happened, i.e. $s_{t+1,WLM} = s_{t,WLM}$ and $s_{t+1,UMC} = s_{t,UMC}$; then:

$$\mathbf{R}^*_{\mathbf{NOS}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

- *Occupational shifts* happened in favour of WLM class, i.e. $s_{t+1,WLM} > s_{t,WLM}$ and $s_{t+1,UMC} < s_{t,UMC}$; then:

$$\mathbf{R}^*_{\mathbf{WLM}} = \begin{bmatrix} 1 & 0 \\ \frac{s_{t,UMC} - s_{t+1,UMC}}{s_{t,UMC}} & \frac{s_{t+1,UMC}}{s_{t,UMC}} \end{bmatrix}.$$

- *Occupational shifts* happened in favour of UMC class, i.e. $s_{t+1,WLM} < s_{t,WLM}$ and $s_{t+1,UMC} > s_{t,UMC}$; then:

$$\mathbf{R}^*_{\mathbf{UMC}} = \begin{bmatrix} \frac{s_{t+1,WLM}}{s_{t,WLM}} & \frac{s_{t,WLM} - s_{t+1,WLM}}{s_{t,WLM}} \\ 0 & 1 \end{bmatrix}.$$

The estimation of the matrix of occupational shifts

- We depart from Prais (1955) estimating **R** under the criterion of the *jointly minimum* occupational mobility (measured by the opposite of trace of **R** subject to the observed occupational shifts):

$$\max_{\mathbf{R}} \quad \mathrm{tr}(\mathbf{R}) \qquad \text{subject to} \begin{cases} s_{t+1} = \mathbf{R}^\top s_t, & \\ \sum_{j=1}^{k} r_{ij} = 1 & \forall i = 1...k; \\ r_{ij} \geq 0 & \forall ij. \end{cases}$$

The sample

- **Source**: *"Survey on Household Income and Wealth"*, Bank of Italy.
- **Period**: 1998-2012; eight waves: 1998, 2000, 2002, 2004, 2006, 2008, 2010 and 2012.
- **Sample size**: 11807 observations (all **heads of household** aged from 22 up to 65).
- **Variable**: **Occupational status** of children and their fathers.

Occupational mobility

Three Cohorts:

- 4015 obs in **Cohort I:** $1947 - 1956$,
- 4848 obs in **Cohort II:** $1957 - 1966$,
- 2944 obs in **Cohort III:** $1967 - 1976$.

Two occupational classes:

- *Working* and *Lower Middle* (**WLM**) class,
- *Upper Middle* and *Capitalist* (**UMC**) class.

Occupations are ranked according to their social prestige:
WLM class: unemployed, blue collar, clericals and teacher;
UMC class: managers, member of professions and self-employed workers.

Markov matrices of socio-economic mobility

	P				R				Q		
Cohort I	**WLM**	**UMC**	**N.Obs**	**Cohort I**	**WLM**	**UMC**	**N.Obs**	**Cohort I**	**WLM**	**UMC**	**N.Obs**
WLM	0.74	0.26	2742	**WLM**	0.98	0.02	2742	**WLM**	0.74	0.26	2742
UMC	0.52	0.48	1273	**UMC**	0	1	1273	**UMC**	0.52	0.48	1273
N.Obs	2713	1302	4015	**N.Obs**	2713	1302	4015	**N.Obs**	2713	1302	4015
Cohort II	**WLM**	**UMC**	**N.Obs**	**Cohort II**	**WLM**	**UMC**	**N.Obs**	**Cohort II**	**WLM**	**UMC**	**N.Obs**
WLM	0.77	0.23	3406	**WLM**	1	0	3406	**WLM**	0.77	0.23	3406
UMC	0.55	0.45	1442	**UMC**	0.02	0.98	1442	**UMC**	0.55	0.45	1442
N.Obs	3435	1413	4848	**N.Obs**	3435	1413	4848	**N.Obs**	3435	1413	4848
Cohort III	**WLM**	**UMC**	**N.Obs**	**Cohort III**	**WLM**	**UMC**	**N.Obs**	**Cohort III**	**WLM**	**UMC**	**N.Obs**
WLM	0.86	0.14	2112	**WLM**	1	0	2112	**WLM**	0.85	0.15	2112
UMC	0.63	0.37	832	**UMC**	0.24	0.76	832	**UMC**	0.55	0.45	832
N.Obs	2308	636	2944	**N.Obs**	2308	636	2944	**N.Obs**	2308	636	2944

Looking at **P**:

- Cohort I and II are similar.
- Cohort II and III are different: p_{11} increases, p_{22} decreases and p_{21} increases.

Looking at **Q**:

- Cohort I and II are similar.
- Cohort II and III are different: q_{11} increases.

$\Rightarrow p_{22} \neq q_{22}$ since $r_{22} << 1$

Table: **Estimate of I^P (observed occupational mobility), I^Q (true social mobility) and I^R (structural mobility).** *Notes:* standard errors computed via 1000 bootstraps are reported in parenthesis.

Cohort	I^P	I^Q	I^R
$I(1947-56)$	**0.78** (0.016)	**0.776** (0.017)	0.004
$II(1957-66)$	0.783 (0.014)	0.779 (0.015)	0.004
$III(1967-76)$	**0.782** (0.048)	**0.701** (0.059)	0.081

Estimate of the Parameters of the Model

Table: **Estimate of λ, $\theta^{\min}$, $\theta^{\max}$, I_S^Q, I_{OPP} and I_{LOI}.** *Notes:* standard errors computed via 1000 bootstraps are reported in parenthesis.

Cohort	$\hat{\lambda}$	$\hat{\theta}^{\min}$	$\hat{\theta}^{\max}$	$\hat{I}_S^Q$	$\hat{I}_{OPP}$	$\hat{I}_{LOI}$
$I(1947-56)$	**0.52** (0.013)	**0.010** (0.0008)	**0.70** (0.020)	**0.77** (0.017)	**1.68** (0.020)	**0.91** (0.040)
$II(1957-66)$	0.54 (0.013)	0.008 (0.0002)	0.713 (0.019)	0.779 (0.015)	1.70 (0.005)	0.92 (0.002)
$III(1967-76)$	**0.51** (0.06)	**0.001** (0.01)	**0.639** (0.08)	**0.701** (0.059)	**1.64** (0.06)	**0.93** (0.04)

- The incentives (λ) increases, the opportunities for WLM to move upward ($\theta^{\max}$) decreases, and increases the opportunities for UMC to move downward ($\theta^{\min}$).
- From Cohort I to II I_S doe not change, but from Cohort II to Cohort III decreases.
- From Cohort I to II I_{OPP} increases, but from Cohort II to Cohort III decreases.

The Determinant of Income Incentives

A risk-adverse (or risk-neutral) individual decides to belong to UMC class *if and only if*:

$$\text{UMCc} \succsim \text{WLMc} \iff$$

$$\theta_i \geq \lambda \equiv \underbrace{\frac{\mu_{WLM}}{2\mu_{UMC}}}_{\text{Component I}} + \underbrace{\frac{\sigma^{RP}\left(\frac{\sigma^2_{UMC}}{\sigma^2_{WLM}}\right)}{2\mu_{UMC}}}_{\text{Component II}} + \underbrace{\frac{c_e}{2\mu_{UMC}}}_{\text{Component III}} \geq 1/2.$$

Table: **The decomposition of income incentives for the three cohorts.**

Cohort	$\hat{\lambda}$	μ_{WLM}	μ_{UMC}	σ^2_{WLM}	σ^2_{UMC}	$\frac{\mu_{WLM}}{2\mu_{UMC}}$	$\frac{\sigma^2_{UMC}}{\sigma^2_{WLM}}$
I	0.52	10.11	10.50	0.20	0.46	0.481	2.28
II	0.55	10.01	10.37	0.21	0.51	0.483	2.44
III	0.56	9.89	10.21	0.24	0.44	0.486	1.85

THANKS FOR YOUR ATTENTION!