

FORMAL AND INFORMAL ASSETS IN THE ITALIAN LABOUR MARKET

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Motivating evidence

Thanks to adult surveys (IALS, PIAAC) it has become possible to analyse the labour market return of formal (schooling) and informal (test scores) education.

In the most recent PIAAC survey (2012) Italy scored among the lowest in both literacy and numeracy, together with other Mediterranean countries.

One would like to understand whether this is attributable to

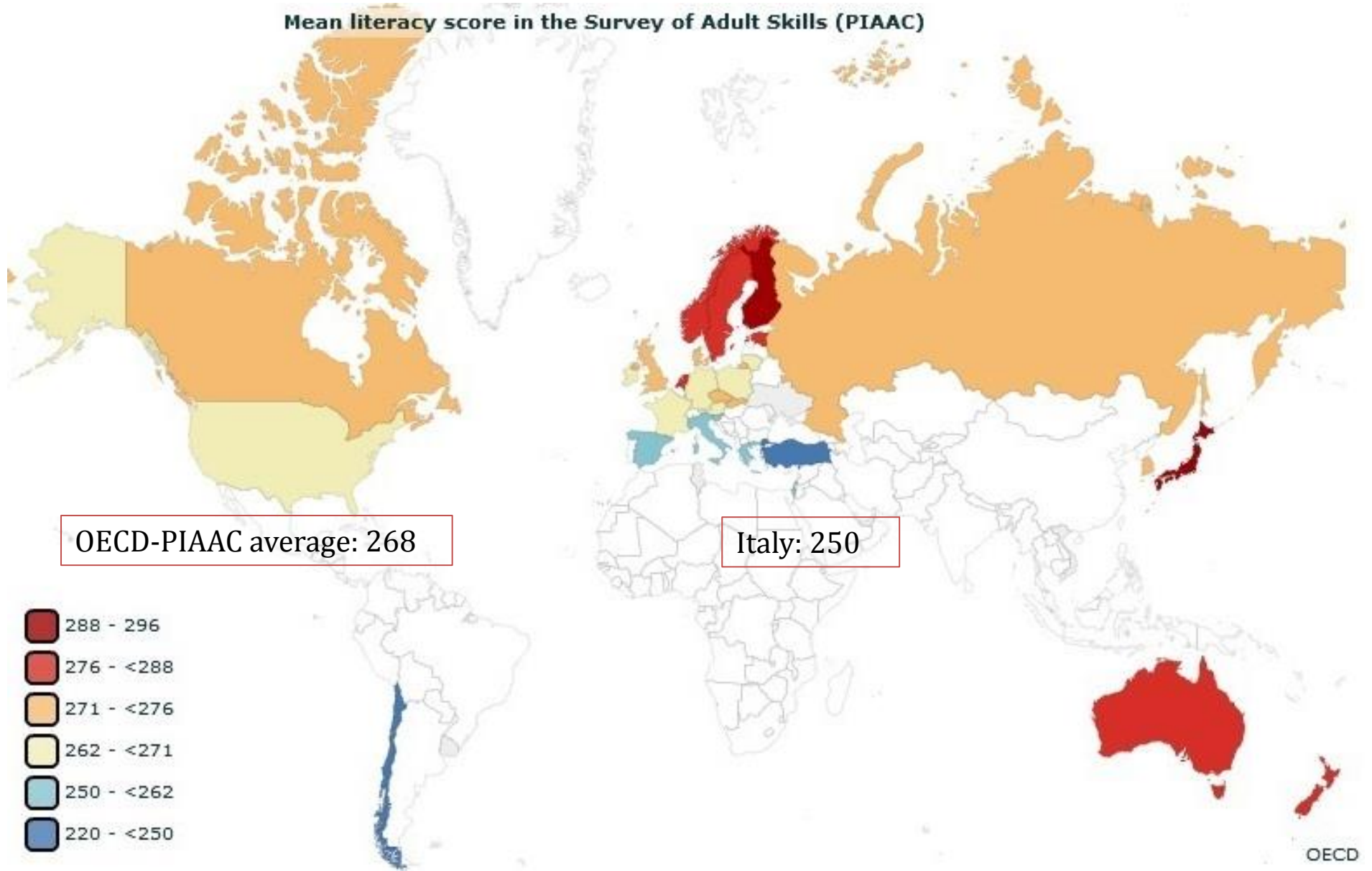
⇒ country of late scholarisation

⇒ lower quality of the educational system

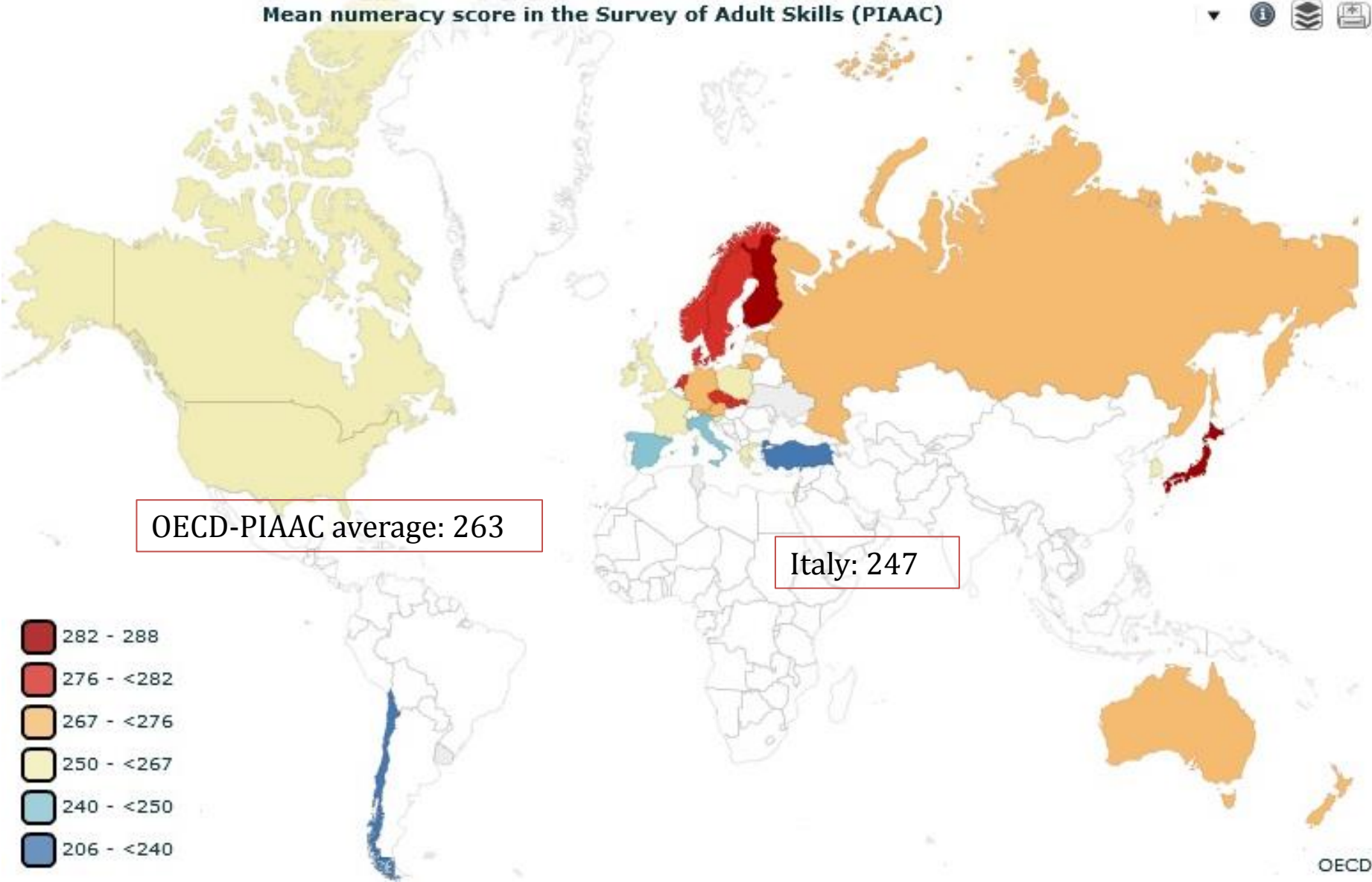
⇒ reduced participation to the labour market

in order to identify appropriate policies to catch up.

Mean literacy score in the Survey of Adult Skills (PIAAC)



Mean numeracy score in the Survey of Adult Skills (PIAAC)



Existing literature

Blau and Kahn (2005) claim that the greater dispersion of cognitive test scores in the United States plays a role in explaining higher U.S. wage inequality.

Hanusheck et al (2015) claim that numeracy is more relevant than years of schooling in affecting (log)wages, especially at the entry of the labour market.

Cappellari et al. (2017) try to address the issue of joint endogeneity of schooling and achievements, using the timing of educational reforms as instrument. Their preferred specification considers a recursive structure, where schooling affects skill formation, which in turns impacts on wages.

All papers have a comparative cross-country perspective, preventing an adequate treatment of two interrelated problems: *self-selectivity into paid employment* and *endogeneity of achievements* (both schooling and competences).

The present contribution

In the present paper we offer three contributions:

- ① we model self-selection into paid employment according to a traditional Heckman model where female labour supply depends on children burden. But we show that income non-reporting may be as relevant as being formally employed in sample distortion.
- ② we treat the joint endogeneity of test scores and schooling using educational reforms and literacy recorded in census at the municipality level in the decade of birth. When restricting to dependent employment, we find that numeracy is the only educational asset that seems to matter in the Italian labour market. This can be taken as causal effect.

③ [in progress] for a selected subsample we possess measures of personality traits. When included in previous models (one by one), they dominate other measures of achievements and render statistically insignificant any measure of achievement. If in turn they are considered as endogenous, they are strongly associated to parental background.

Data

Our data source, restricted to Italy, comes from the Programme for the International Assessment of Adult Competencies (PIAAC) and in particular from the Survey of Adult Skills, which represents the main output of the Programme. The first round of PIAAC, which involving 24 countries, was carried out between August 2011 and March 2012.

PIAAC provides internationally comparable data about skills of the adult populations between 16 and 65 years of age. In each country, a representative sample of adults was interviewed at home in the language of their country of residence.

PIAAC is designed to measure key cognitive and workplace skills needed for individuals to advance in their jobs and participate in society.

The skill assessment test consists of a set of exercises organized into domains. The Italian survey included the assessment of cognitive skills in two domains, literacy and numeracy. Problem solving was not tested because half of the interviewees chose pen and paper testing.

The domains, described more completely in OECD (2013), refer to key information-processing competencies and are defined as:

- Literacy: Ability to understand, evaluate, use and engage with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential;
- Numeracy: Ability to access, use, interpret, and communicate mathematical information and ideas in order to engage in and manage the mathematical demands of a range of situations in adult life.

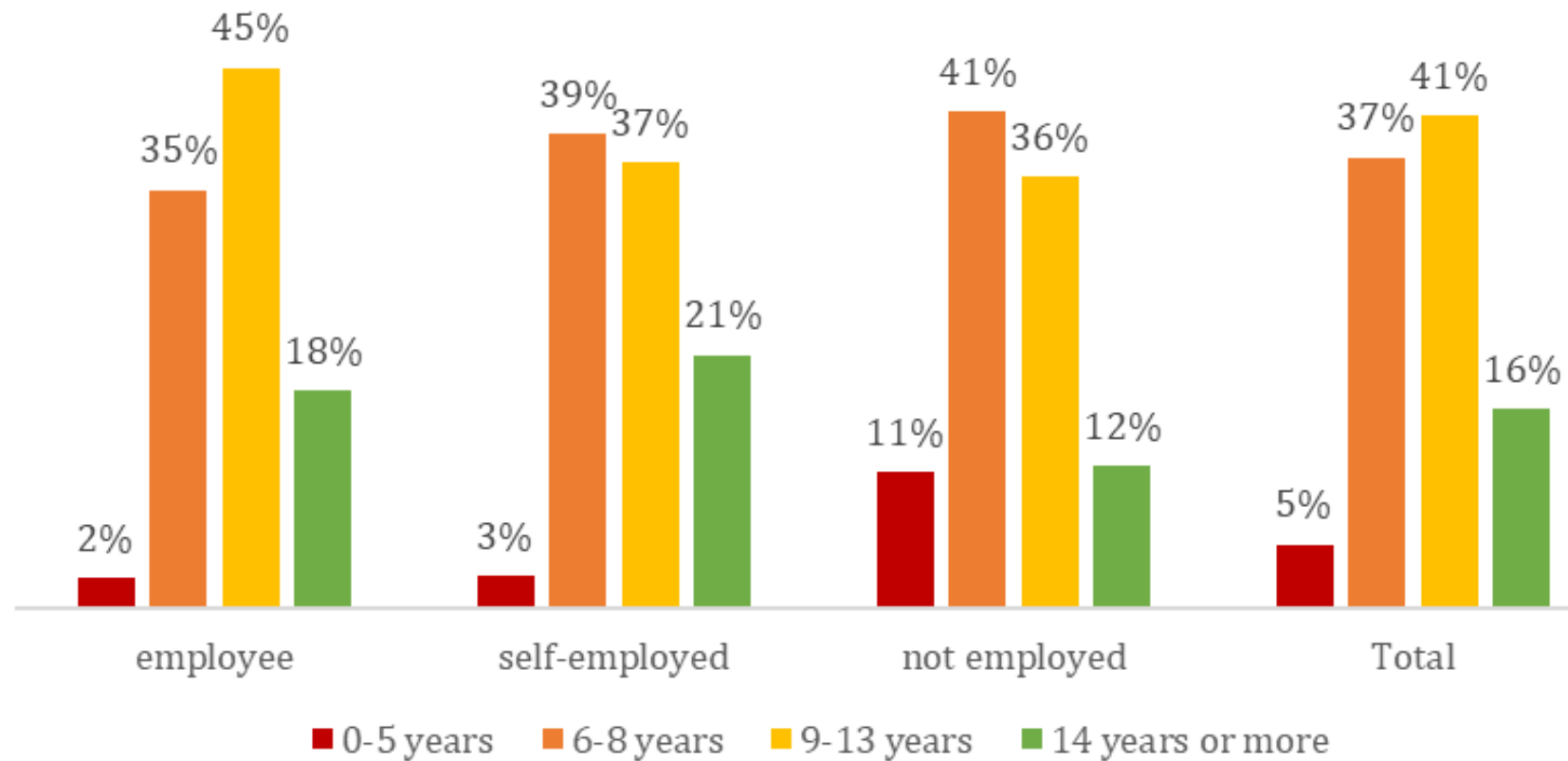
Before the skill assessment, all participants respond to a background questionnaire that gather several information about labour-market status, earnings, education, experience, and demographic characteristics of the respondents.

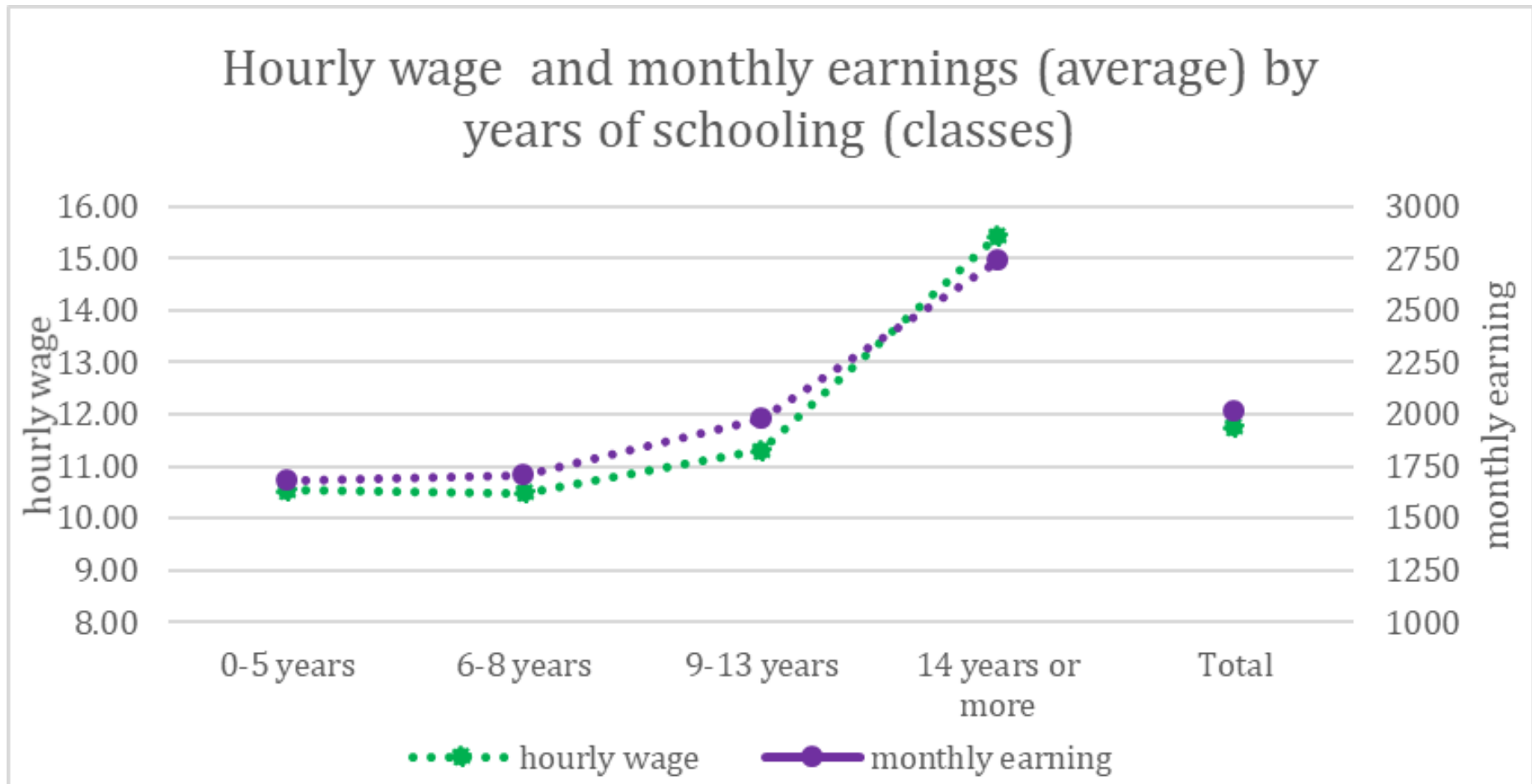
Our selection rule: **population aged 23-55** (core ages for labour force)

Table 1 – Descriptive statistics: population aged 23-55 (sample weights) - Italy PIAAC 2012

	not employed (self-declared)		employed (self-declared)		Total	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
female (percentage)	74.11		39.80		50.22	
foreign born (percentage)	10.29		8.72		9.20	
age (years)	39.45	8.85	39.73	7.99	39.65	8.26
years of schooling	12.42	14.01	11.65	3.81	11.89	8.35
numeracy (mean of plausible values)	236.14	45.20	258.53	45.34	251.86	46.43
literacy (mean of plausible values)	245.14	39.10	257.33	41.46	253.70	41.14
worked hours (usual weekly hours - 2335 obs)			38.90	12.03		
hourly wage (dependent employee - 1662 obs)			11.73	7.40		
hourly wage (including self-employed - 1873 obs)			12.54	10.78		
monthly earnings (incl. self-employed - 1875 obs)			2014.48	1839.53		
observations	774		2348		3122	

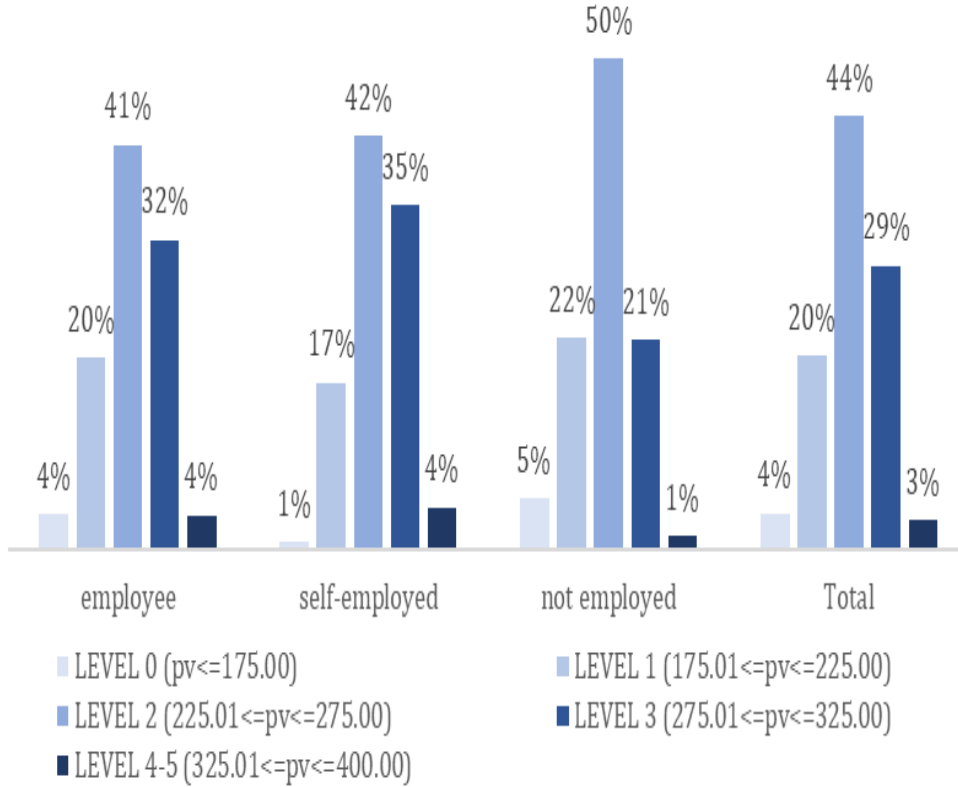
Population by years of schooling (classes) and self-declared employment status





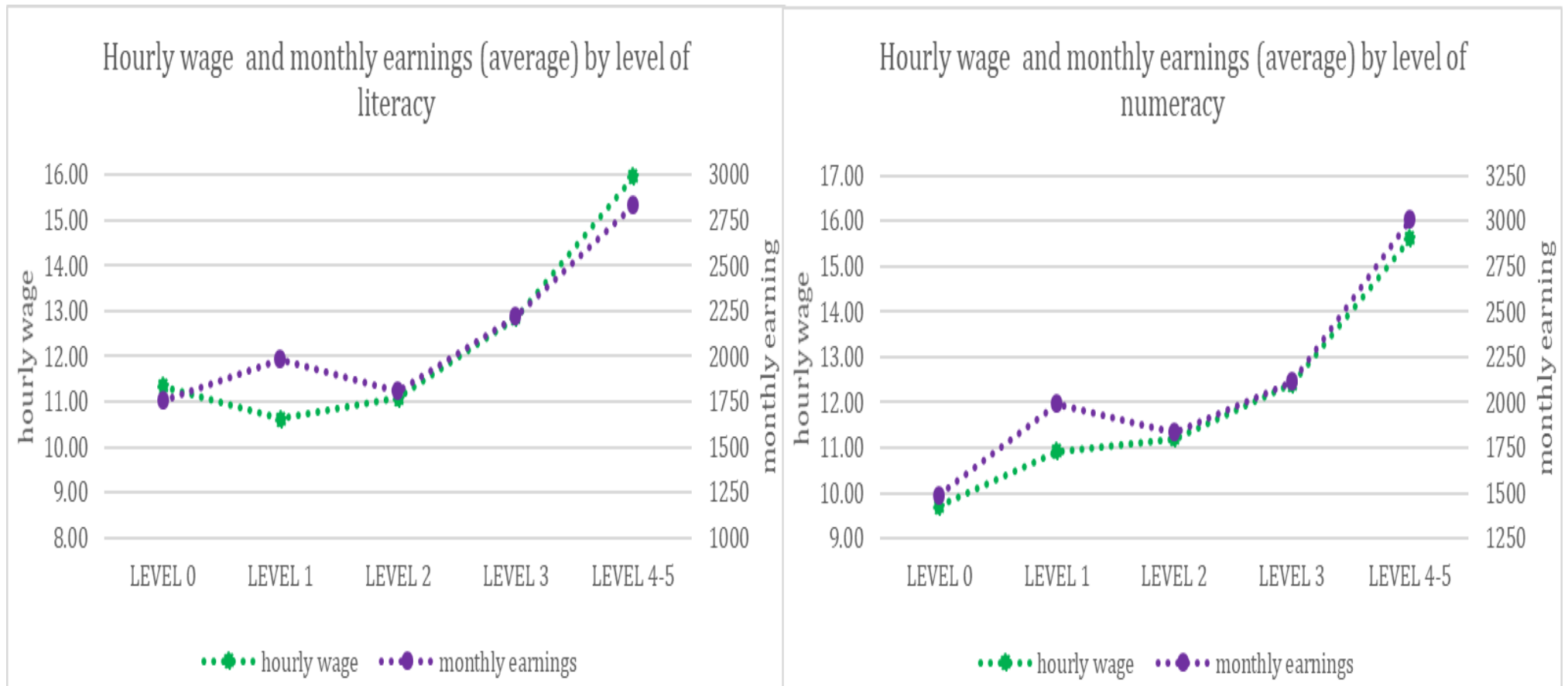
As expected, employment probability and earnings are positively correlated with formal education

Population by levels of literacy and self-declared employment status



Population by levels of numeracy and self-declared employment status





Less expectable, employment probability and earnings are also positively correlated with competences

There is a clear underreporting of earnings, which is correlated to the regional divide, the type of employment and the attitudes of the relevant population.

Table 2 – Population by macro-regions and self-declared employment status
(sample weights) - Italy PIAAC 2012

	dependent employee	self-employed	not employed	missing	Total	share of self-employment on total employment	non-employment rate
north west	522	119	179	7	828	0.186	0.218
north east	367	115	110	8	600	0.238	0.186
centre	348	96	164	3	611	0.216	0.270
south	288	95	355	3	741	0.247	0.481
islands	138	42	158	4	342	0.233	0.467
Total	1664	467	966	25	3122	0.219	0.312

Table 3 – Fraction of population reporting earnings information by macro-regions and self-declared employment status (sample weights) - Italy PIAAC 2012

	dependent employee	self-employed	Total
north west	0.910	0.732	0.877
north east	0.939	0.517	0.839
centre	0.942	0.728	0.896
south	0.913	0.659	0.850
islands	0.917	0.618	0.847
Total	0.924	0.654	0.865

Trust is decreasing with latitude (northern and central regions are better endowed with social capital).

Table 4 – Trust in others by macro-regions (sample weights) - Italy PIAAC 2012

	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree	Total
	<i>There are only a few people you can trust completely</i>					
north west	41.79	38.35	9.58	6.73	3.54	100
north east	35.53	40.86	14.14	8.08	1.39	100
centre	37.36	46.86	7.00	7.02	1.76	100
south	47.88	34.01	10.15	5.64	2.32	100
islands	58.41	29.11	7.27	3.72	1.50	100
Total	42.99	38.46	9.83	6.45	2.27	100
	<i>If you are not careful, other people will take advantage of you</i>					
north west	37.70	39.25	14.48	5.44	3.12	100
north east	37.06	41.58	15.38	5.35	0.63	100
centre	37.73	43.70	11.99	5.11	1.47	100
south	52.72	33.93	5.82	5.27	2.26	100
islands	60.75	28.95	4.62	4.12	1.55	100
Total	43.68	38.18	11.02	5.17	1.95	100

Table 5 – Fraction of population reporting earnings information by macro-regions and trust (sample weights) - Italy PIAAC 2012

	strongly agree	agree	neither agree nor disagree	disagree	strongly disagree	Total
	<i>If you are not careful, other people will take advantage of you</i>					
north west	0.669	0.687	0.692	0.814	0.626	0.686
north east	0.639	0.685	0.750	0.762	0.794	0.683
centre	0.601	0.671	0.657	0.787	1.000	0.654
south	0.392	0.503	0.309	0.556	0.757	0.442
islands	0.463	0.381	0.618	0.536	0.609	0.452
Total	0.542	0.619	0.649	0.712	0.727	0.595

Non reporting earnings varies with macro-regions and trust opinions.

Different sources of self-selection in observed data:

⇒ reporting to be employed (main source of variation are local labour markets)

⇒ conditional on being employed, reporting earnings information (main source of variation are type of employment and trust opinions)

But opinions can be endogenous (cognitive dissonance).

Conditional sample correlation indicates that **both schooling and achievements are correlated with earnings**, but the former seems dominant.

Cognitive competences affects hourly wages (relevant for employees), but is non-significant for the population of self-employed (see total earnings). **So the population of self-employed declaring incomes is rather different from the population of dependent employees.**

Return to schooling seems low compared to international evidence, but in line with other dataset. It is partly compensated by age, working as proxy for experience.

Women and foreign born people are penalized in the labour market. But the stronger reduction comes from leaving and working in the South of the country.

The hour elasticity being less than one suggests that also **worked hours respond to education.**

Table 6 – Conditional correlation with hourly wages or monthly earnings –
OLS (sample weights) – Italy PIAAC 2012

	1	2	3	4	5	6
VARIABLES	log hourly wage	log hourly wage	log hourly wage	log monthly earnings	log monthly earnings	log monthly earnings
numeracy (mean of plausible values)	0.001***		0.001*	0.001		0.001
	[0.000]		[0.001]	[0.000]		[0.001]
literacy (mean of plausible values)		0.001**	0.000		0.000	-0.001
		[0.000]	[0.001]		[0.000]	[0.001]
years of schooling	0.036***	0.037***	0.036***	0.043***	0.045***	0.044***
	[0.004]	[0.004]	[0.004]	[0.006]	[0.005]	[0.006]
female	-0.144***	-0.153***	-0.142***	-0.220***	-0.227***	-0.215***
	[0.024]	[0.024]	[0.024]	[0.042]	[0.041]	[0.044]
age	0.036**	0.035**	0.036**	0.046**	0.046**	0.047**
	[0.015]	[0.015]	[0.015]	[0.020]	[0.020]	[0.020]
foreign born	-0.200***	-0.200***	-0.203***	-0.233***	-0.239***	-0.241***
	[0.040]	[0.041]	[0.042]	[0.053]	[0.054]	[0.055]
region of residence=north east	-0.084***	-0.077**	-0.084***	-0.122***	-0.114***	-0.122***
	[0.030]	[0.030]	[0.030]	[0.040]	[0.042]	[0.040]
region of residence=centre	-0.103***	-0.097***	-0.103***	-0.243***	-0.236***	-0.245***
	[0.034]	[0.035]	[0.034]	[0.049]	[0.049]	[0.048]
region of residence=south	-0.187***	-0.189***	-0.187***	-0.297***	-0.300***	-0.298***
	[0.040]	[0.040]	[0.040]	[0.046]	[0.046]	[0.046]
region of residence=islands	-0.196***	-0.196***	-0.197***	-0.409***	-0.411***	-0.412***

	[0.048]	[0.049]	[0.049]	[0.081]	[0.082]	[0.081]
(log of) worked hours				0.637***	0.638***	0.636***
				[0.069]	[0.069]	[0.068]
Observations	1654	1654	1654	1837	1837	1837
R ²	0.203	0.201	0.203	0.311	0.310	0.311

Robust standard errors in brackets – constant and age² included - *** p<0.01, ** p<0.05, * p<0.1

But these results are biased for

- there is self-selection into observing earnings (double self-selections)
- education and/or cognitive competences are potentially endogenous

In order to cope with both self-selection and endogeneity, we follow Wooldridge (2010, pg.567 ss). The selection bias in the estimation of the returns to education (schooling and achievements) is therefore modelled as an omitted variable problem (Heckman 1979), where the omitted variable is defined as the inverse Mills ratio obtained from the selection equation that includes the instruments used to cope with potential endogeneity.

In symbols our model consists of three equations

$$y_{1i} = \mathbf{x}_{1i}\boldsymbol{\delta}_1 + \boldsymbol{\beta}y_{2i} + v_{1i} \quad (1)$$

$$\mathbf{y}_{2i} = [\mathbf{x}_1 \mathbf{x}_2]_i \boldsymbol{\delta}_2 + v_{2i} \quad (2)$$

$$y_{3i} = 1([\mathbf{x}_1 \mathbf{x}_2 \mathbf{x}_3]_i \boldsymbol{\delta}_3 + v_{3i} > 0) \quad (3)$$

The first equation is the structural equation of interest (determinants of earnings), the second equation is a linear projection for the potentially endogenous variables \mathbf{y}_2 (schooling and test scores), and the third equation is the selection equation (presence in the labour market and/or reporting earnings).

The proposed solution is estimating

$$y_{1i} = \mathbf{x}_{1i}\boldsymbol{\delta}_1 + \boldsymbol{\beta}\hat{\mathbf{y}}_{2i} + \gamma\hat{\lambda}_i + \epsilon_i \quad (4)$$

where the inverted Mills ratio $\hat{\lambda}_i = \frac{f(\mathbf{x}_i\hat{\boldsymbol{\delta}}_3)}{F(\mathbf{x}_i\hat{\boldsymbol{\delta}}_3)}$ is obtained from estimating equation (3) on the entire sample including the entire vector of \mathbf{x} 's in the regression, and $\hat{\mathbf{y}}_2$ is the projection of the (suspected) endogenous variables obtained from equations (2) including the inverse Mills ratio among the regressors.

The vectors of regressors that we have chosen are the following:

\mathbf{x}_1 (demographics) = gender; age; age²; foreign born; macro-regions of residence; trust

\mathbf{x}_2 (instruments for education) = illiteracy rate (of the corresponding gender) in the municipality of birth during the decade of birth (from population census); full day schooling (applies if born after 1966); separation of BA and MA (known as *Bologna process* – applies if born after 1980)

\mathbf{x}_3 (identification of selection equation) = spouse unemployed; number of children; having a child aged below 10.

Table 7 – Self-selection into employment or reporting positive wages or earnings –
probit (sample weights) – Italy PIAAC 2012

dependent variable	self declared employed	self declared employed	non missing earnings (includes self- employed, excludes non- reporting)	non missing earnings (includes self- employed and non-reporting)	non missing hourly wage (excludes self- employed and non- reporting)	non missing hourly wage (excludes self- employed but includes non- reporting)
employment rate (positive outcome)	0.758	0.758	0.715	0.643	0.677	0.537
female	-0.852*** [0.074]	-0.858*** [0.074]	-0.813*** [0.074]	-0.583*** [0.064]	-0.769*** [0.077]	-0.344*** [0.061]
age	0.233*** [0.064]	0.228*** [0.064]	0.242*** [0.067]	0.197*** [0.060]	0.241*** [0.069]	0.127** [0.058]
age ²	-0.003*** [0.001]	-0.003*** [0.001]	-0.003*** [0.001]	-0.003*** [0.001]	-0.003*** [0.001]	-0.002** [0.001]
foreign born	-0.290*** [0.104]	-0.287*** [0.105]	-0.237** [0.105]	-0.093 [0.101]	-0.233** [0.109]	-0.071 [0.098]
region of residence=north east	0.190* [0.104]	0.202* [0.104]	0.135 [0.105]	0.009 [0.090]	0.137 [0.108]	0.021 [0.085]
region of residence=centre	-0.126 [0.102]	-0.117 [0.102]	-0.091 [0.103]	-0.034 [0.090]	-0.111 [0.107]	-0.065 [0.086]
region of residence=south	-0.671*** [0.102]	-0.652*** [0.102]	-0.709*** [0.103]	-0.568*** [0.090]	-0.755*** [0.107]	-0.523*** [0.087]
region of residence=islands	-0.575***	-0.544***	-0.606***	-0.469***	-0.643***	-0.416***

	[0.125]	[0.125]	[0.127]	[0.113]	[0.131]	[0.110]
spouse unemployed	-0.17	-0.157	-0.248**	-0.213*	-0.237*	-0.190*
	[0.124]	[0.125]	[0.125]	[0.115]	[0.132]	[0.115]
number of children	0.009	0.01	0.012	0.002	0.015	0.007
	[0.013]	[0.013]	[0.014]	[0.012]	[0.014]	[0.011]
having a child younger than 10	-0.221***	-0.227***	-0.175**	-0.164**	-0.216**	-0.249***
	[0.079]	[0.079]	[0.081]	[0.073]	[0.084]	[0.071]
illiteracy rate	-0.738**	-0.683*	-0.647*	-0.296	-0.546	-0.122
	[0.352]	[0.353]	[0.359]	[0.322]	[0.370]	[0.314]
Bologna process (3+2)	0.105	0.09	0.088	0.038	0.115	0.03
	[0.154]	[0.156]	[0.162]	[0.147]	[0.169]	[0.145]
full day schooling	-0.015	-0.002	-0.058	-0.136	-0.023	0.012
	[0.159]	[0.158]	[0.160]	[0.137]	[0.166]	[0.131]
trust		0.112***		0.104***		0.097***
		[0.032]		[0.029]		[0.028]
Observations	3042	3042	2735	3042	2410	3042
Pseudo R ²	0.16	0.164	0.153	0.0911	0.148	0.055

Robust standard errors in brackets – constant included - *** p<0.01, ** p<0.05, * p<0.1

Females and younger/older people suffer a reduced employability.

Regional divide is evident when looking at territorial dummies.

Having young children works as exclusion restriction, as well as having an unemployed partner (though in a negative direction, a sort of assortative mating).

Trust is positively associated to the probability of reporting non missing values for earnings. However, considering the regional variation of trust (already controlled by regional dummies) it may be associated to nice traits that could be positively correlated with employability.

Moving now to the estimation of the final model we find that most of the positive correlation between wage/earnings and education (schooling and test scores) was driven by endogeneity: only literacy is weakly associated to positive hourly wages.

There is no evidence of self-selection (the Mills ratio is statistically insignificant),

Most of the results on monetary rewards are driven by regional dummies.

Despite this lack of statistical significance, **the first stage regressions make a lot of sense:**

→ foreign born people (8.9% in the sample) are at a disadvantage both in terms of cognitive competences and formal schooling

→ workers in north-eastern and central regions have a higher level of competences,

→ formal schooling has been positively affected by the Bologna process

Table 8 – Determinants of hourly wages and monthly earnings –
IV estimation (sample weights) – Italy PIAAC 2012

VARIABLES	hourly wage	hourly wage	hourly wage	monthly earnings	monthly earnings	monthly earnings
years of schooling	-0.048	-0.061	-0.055	-0.034	-0.094	-0.159
	[0.048]	[0.061]	[0.060]	[0.045]	[0.077]	[0.153]
numeracy (mean of pl.values)	0.009**		0.007	0.005		-0.018
	[0.005]		[0.012]	[0.004]		[0.025]
literacy (mean of pl. values)		0.012*	0.004		0.013	0.041
		[0.007]	[0.017]		[0.009]	[0.042]
female	-0.063	-0.270**	-0.117	-0.163	-0.227	-0.515
	[0.129]	[0.113]	[0.281]	[0.158]	[0.153]	[0.473]
age	0.052*	0.069**	0.057	0.061**	0.066*	0.078
	[0.027]	[0.031]	[0.035]	[0.030]	[0.038]	[0.061]
age ²	-0.001	-0.001*	-0.001	-0.001	-0.001	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]
foreign born	-0.034	0.065	0.003	-0.228*	-0.001	0.322
	[0.133]	[0.213]	[0.238]	[0.128]	[0.251]	[0.613]
region of residence=north east	-0.246**	-0.230*	-0.249**	-0.185*	-0.273*	-0.308
	[0.106]	[0.117]	[0.111]	[0.100]	[0.144]	[0.235]
region of residence=centre	-0.224***	-0.217**	-0.226***	-0.292***	-0.314***	-0.279**
	[0.078]	[0.085]	[0.081]	[0.074]	[0.085]	[0.138]
region of residence=south	-0.191*	-0.329***	-0.227	-0.343***	-0.365***	-0.488*
	[0.113]	[0.121]	[0.201]	[0.126]	[0.139]	[0.262]
region of residence=islands	-0.153	-0.228*	-0.17	-0.422***	-0.385**	-0.396*
	[0.117]	[0.118]	[0.141]	[0.138]	[0.159]	[0.233]
mills ratio	0.168	0.476*	0.256	0.193	0.363	0.781
	[0.217]	[0.289]	[0.457]	[0.267]	[0.339]	[0.782]
(log of) worked hours				0.617***	0.610***	0.625***
				[0.069]	[0.085]	[0.122]
Observations	1641	1641	1641	1823	1823	1823
R ²	-0.328	-0.557	-0.389	0.181	-0.192	-1.562

Robust standard errors in brackets – constant included - *** p<0.01, ** p<0.05, * p<0.1

VARIABLES	FIRST STAGE					
	numeracy	literacy	years of schooling	numeracy	literacy	years of schooling
female	-12.925 [10.851]	6.278 [10.053]	0.693 [0.937]	-13.622 [9.471]	3.261 [8.993]	0.834 [0.862]
age	3.863 [4.539]	1.7 [4.301]	0.577 [0.370]	5.763 [4.100]	3.611 [3.868]	0.614* [0.335]
age ²	-0.045 [0.056]	-0.02 [0.053]	-0.008* [0.005]	-0.069 [0.051]	-0.045 [0.048]	-0.008** [0.004]
foreign born	-40.675*** [6.124]	-41.678*** [5.650]	-1.694*** [0.434]	-40.007*** [5.485]	-41.146*** [5.163]	-1.729*** [0.390]
region of residence=north east	24.571*** [4.271]	18.415*** [3.826]	0.445 [0.316]	26.107*** [3.841]	19.119*** [3.522]	0.497 [0.306]
region of residence=centre	16.051*** [3.982]	12.134*** [3.628]	0.328 [0.317]	16.107*** [3.608]	10.043*** [3.336]	0.429 [0.291]
region of residence=south	-12.848 [11.677]	-0.059 [11.143]	-0.197 [1.004]	-11.385 [9.148]	-3.154 [8.902]	-0.109 [0.805]
region of residence=islands	-8.842 [10.299]	-1.367 [9.786]	0.526 [0.888]	-7.808 [8.421]	-3.609 [8.041]	0.419 [0.751]
mills ratio	27.485 [27.058]	0.473 [25.264]	1.673 [2.387]	28.777 [23.504]	7.543 [22.459]	1.634 [2.146]
illiteracy rate	-57.274*** [19.348]	-45.131*** [17.123]	-2.832* [1.492]	-61.806*** [18.206]	-46.835*** [16.595]	-3.120** [1.450]
Bologna process (3+2)	11.047 [6.812]	6.671 [6.718]	1.558*** [0.573]	15.892** [6.431]	9.572 [6.360]	1.381** [0.572]
full day schooling	4.974 [6.574]	2.851 [5.673]	-0.091 [0.473]	1.271 [5.895]	0.507 [5.221]	-0.316 [0.450]
spouse unemployed	-8.433 [6.362]	-10.831* [6.455]	-1.140** [0.489]	-6.651 [5.693]	-8.38 [5.980]	-1.196*** [0.442]
number of children	-1.067 [0.688]	-1.062* [0.640]	-0.156*** [0.047]	-0.955 [0.590]	-1.047* [0.543]	-0.150*** [0.042]
having a child younger than 10	2.878	1.56	0.072	3.613 [3.675]	1.761 [3.489]	-0.096 [0.320]
(log of) worked hours				3.639 [2.984]	1.708 [3.483]	-0.011 [0.307]

Observations	1641	1641	1641	1823	1823	1823
R ²	0.144	0.152	0.109	0.154	0.148	0.116

Robust standard errors in brackets – constant included - *** p<0.01, ** p<0.05, * p<0.1

Having been unable to adequately model the various sources of self-selection, we restrict to the pool of dependent employee, and we estimate the same model of return to education.

We now find stronger evidence that cognitive competences (especially numeracy) matter in the Italian labour market, while formal schooling is statistically insignificant, while the return to experience remains high (in the order of 4% per year).

Finally notice that the estimated elasticity of (log)hours increases towards unity, indicating that in dependent employment there is limited possibility of varying hours.

Table 9 – Determinants of hourly wages and monthly earnings – dependent employment
IV estimation (sample weights) – Italy PIAAC 2012

	1	2	3	4	5	6
VARIABLES	hourly wage	hourly wage	hourly wage	monthly earnings	monthly earnings	monthly earnings
years of schooling	-0.052	-0.018	-0.04	-0.067	-0.042	-0.065
	[0.049]	[0.043]	[0.054]	[0.058]	[0.050]	[0.060]
numeracy (mean of pl.values)	0.010**		0.013*	0.013**		0.014
	[0.005]		[0.008]	[0.006]		[0.011]
literacy (mean of pl. values)		0.006	-0.005		0.011*	-0.001
		[0.005]	[0.009]		[0.006]	[0.012]
female	0.015	-0.103**	0.036	-0.017	-0.156**	-0.009
	[0.093]	[0.051]	[0.100]	[0.113]	[0.071]	[0.134]
age	0.037*	0.030*	0.042**	0.047*	0.036*	0.048*
	[0.020]	[0.017]	[0.021]	[0.024]	[0.021]	[0.026]
age ²	0.00	0.00	0.00	0.00	0.00	0.00
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
foreign born	-0.006	-0.057	-0.076	0.067	0.081	0.053
	[0.136]	[0.152]	[0.179]	[0.170]	[0.193]	[0.211]
region of residence=north east	-0.262**	-0.160*	-0.251**	-0.361**	-0.261**	-0.361**
	[0.108]	[0.086]	[0.109]	[0.142]	[0.114]	[0.141]
region of residence=centre	-0.216***	-0.136**	-0.221***	-0.257***	-0.176**	-0.260***
	[0.080]	[0.056]	[0.080]	[0.094]	[0.069]	[0.097]
region of residence=south	-0.112*	-0.154***	-0.117*	-0.155**	-0.178***	-0.156**
	[0.064]	[0.052]	[0.062]	[0.070]	[0.063]	[0.069]
region of residence=islands	-0.083	-0.118	-0.11	-0.126	-0.125	-0.132
	[0.084]	[0.081]	[0.093]	[0.092]	[0.095]	[0.102]
(log of) worked hours				0.710***	0.735***	0.709***
				[0.080]	[0.084]	[0.079]
Observations	1641	1641	1641	1529	1529	1529
R ²	-0.381	0.003	-0.351	-0.131	0.097	-0.13

Robust standard errors in brackets – constant included - *** p<0.01, ** p<0.05, * p<0.1

VARIABLES	FIRST STAGE					
	numeracy	literacy	years of schooling	numeracy	literacy	years of schooling
female	-2.448	6.458**	1.331***	-1.534	7.297**	1.421***
	[3.035]	[2.727]	[0.238]	[3.188]	[2.980]	[0.255]
age	0.434	1.641	0.368	1.415	2.196	0.468*
	[2.872]	[2.660]	[0.229]	[2.997]	[2.794]	[0.240]
age ²	-0.002	-0.019	-0.005*	-0.016	-0.027	-0.006**
	[0.036]	[0.033]	[0.003]	[0.037]	[0.034]	[0.003]
foreign born	-37.518***	-41.623***	-1.502***	-38.394***	-42.176***	-1.486***
	[5.342]	[4.803]	[0.354]	[5.453]	[4.911]	[0.362]
region of residence=north east	23.125***	18.391***	0.357	26.353***	20.783***	0.435
	[3.837]	[3.419]	[0.289]	[3.924]	[3.504]	[0.306]
region of residence=centre	17.385***	12.157***	0.409	18.245***	12.975***	0.481
	[3.876]	[3.549]	[0.302]	[3.953]	[3.652]	[0.310]
region of residence=south	-1.728	0.133	0.48	0.888	1.699	0.512
	[4.446]	[4.127]	[0.323]	[4.524]	[4.259]	[0.332]
region of residence=islands	0.499	-1.206	1.094**	1.874	-0.683	1.009**
	[5.523]	[4.997]	[0.439]	[5.684]	[5.268]	[0.457]
illiteracy rate	-47.356***	-44.961***	-2.229*	-50.262***	-46.835***	-2.497**
	[15.744]	[14.048]	[1.176]	[16.166]	[14.643]	[1.214]
Bologna process (3+2)	9.536	6.645	1.466***	10.365	6.962	1.525***
	[6.628]	[6.430]	[0.557]	[6.916]	[6.707]	[0.590]
full day schooling	5.48	2.859	-0.06	2.9	1.094	-0.222
	[6.559]	[5.660]	[0.474]	[6.647]	[5.769]	[0.489]
spouse unemployed	-5.087	-10.774*	-0.937**	-7.8	-12.518**	-1.092**
	[5.287]	[5.584]	[0.419]	[5.375]	[5.939]	[0.435]
number of children	-1.339**	-1.066*	-0.172***	-1.194*	-0.85	-0.166***
	[0.619]	[0.557]	[0.039]	[0.644]	[0.571]	[0.041]
having a child younger than 10	5.811	1.611	0.251	5.343	1.746	0.182
	[3.579]	[3.228]	[0.285]	[3.695]	[3.333]	[0.295]
(log of) worked hours				4.253	2.363	0.118

				[3.678]	[4.316]	[0.367]
Observations	1641	1641	1641	1529	1529	1529
R ²	0.143	0.152	0.109	0.155	0.161	0.112

Robust standard errors in brackets – constant included - *** p<0.01, ** p<0.05, * p<0.1

For half of the sample we have information on personality traits, collected by answering self-perception questions:

- ⇒ Internal locus of control
- ⇒ External locus of control
- ⇒ Openness (big 5)
- ⇒ Conscientiousness (big 5)
- ⇒ Proactivity (big 5)
- ⇒ Performance orientation
- ⇒ Learning orientation
- ⇒ Positivity

They tend to be positively correlated among them.

	Internal locus of control	External locus of control	Openness	Conscientiousness	Proactivity	Performance orientation	Learning orientation	Positivity
Internal locus of control	1							
External locus of control	0.0111	1						
Openness (big 5)	0.1770*	-0.0501	1					
Conscientiousness (big 5)	0.3086*	-0.0958*	0.4102*	1				
Proactivity (big 5)	0.3216*	0.0940*	0.4989*	0.4417*	1			
Performance orientation	0.3026*	0.3143*	-0.0443	0.1212*	0.1450*	1		
Learning orientation	0.2776*	-0.0687*	0.5482*	0.4407*	0.4898*	0.0911*	1	
Positivity	0.2956*	-0.2003*	0.3666*	0.3929*	0.3523*	0.0137	0.3804*	1

We first check potential sample distortions among the respondents, which does not seem the case.

Table 10 – Descriptive statistics: population aged 23-55 (sample weights) - Italy PIAAC 2012

	NCS absent		NCS present		Total	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
female (percentage)	41.12		44.46		42.79	
foreign born (percentage)	9.50		8.82		9.16	
age (years)	38.89	8.18	40.18	7.85	39.54	8.04
years of schooling	11.72	3.73	11.60	3.76	11.66	3.74
numeracy (mean of plausible values)	257.15	45.91	257.59	46.60	257.37	46.24
literacy (mean of plausible values)	255.54	42.07	256.35	42.15	255.95	42.10
worked hours (usual weekly hours - 1787 obs)	38.10	10.10	36.73	10.58	37.41	10.37
hourly wage (dependent employee - 1654 obs)	11.54	7.39	11.96	7.43	11.75	7.41
observations	888		906		1794	

We then check their potential correlation with labour market outcomes, leaving aside the issue of self-selection (restricting to dependent employees). There are little gains in terms of goodness of fit.

Table 11 – Conditional correlation with hourly wages – OLS (sample weights) – Italy PIAAC 2012

VARIABLES	dep.hourly wage full sample	dep.hourly wage ncs sample	dep.hourly wage	dep.hourly wage	dep.hourly wage	dep.hourly wage	dep.hourly wage
numeracy (mean of pl.values)	0.001***	0.001**	0.001*	0.001**	0.001**	0.001**	0.001**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
years of schooling	0.036***	0.036***	0.034***	0.036***	0.036***	0.035***	0.034***
	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.004]	[0.005]
Openness			0.071**				0.073**
			[0.030]				[0.033]
Conscientiousness				0.03			-0.013
				[0.038]			[0.047]
Proactivity					0.002		-0.069
					[0.039]		[0.044]
Positivity						0.075***	0.077***
						[0.025]	[0.028]
female	-0.144***	-0.152***	-0.147***	-0.151***	-0.151***	-0.147***	-0.147***
	[0.024]	[0.034]	[0.034]	[0.034]	[0.034]	[0.034]	[0.034]
age	0.036**	0.002	-0.001	0.001	0.002	0	-0.003
	[0.015]	[0.023]	[0.024]	[0.024]	[0.024]	[0.023]	[0.023]
age ²	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
foreign born	-0.200***	-0.207***	-0.203***	-0.211***	-0.208***	-0.212***	-0.198***
	[0.040]	[0.054]	[0.054]	[0.055]	[0.054]	[0.054]	[0.053]
region of residence=north east	-0.084***	-0.073	-0.06	-0.072	-0.073	-0.077*	-0.07
	[0.030]	[0.044]	[0.045]	[0.044]	[0.045]	[0.044]	[0.045]
region of residence=centre	-0.103***	-0.144***	-0.139***	-0.142***	-0.144***	-0.143***	-0.138***
	[0.034]	[0.049]	[0.048]	[0.048]	[0.049]	[0.048]	[0.047]

region of residence=south	-0.187***	-0.152**	-0.160***	-0.153**	-0.153**	-0.155**	-0.149**
	[0.040]	[0.060]	[0.060]	[0.061]	[0.062]	[0.061]	[0.061]
region of residence=islands	-0.196***	-0.188***	-0.195***	-0.188***	-0.188***	-0.191***	-0.181**
	[0.048]	[0.072]	[0.070]	[0.072]	[0.072]	[0.072]	[0.071]
Constant	0.866***	1.518***	1.351***	1.409***	1.512***	1.293***	1.394***
	[0.299]	[0.466]	[0.451]	[0.464]	[0.451]	[0.464]	[0.451]
Observations	1654	840	840	840	840	840	840
R ²	0.203	0.196	0.203	0.197	0.196	0.205	0.211

Robust standard errors in brackets - *** p<0.01, ** p<0.05, * p<0.1

Finally we consider personality traits as purely exogenous, since psychologists claim that they are malleable until the age of 20. But we do not find impressive results.

Table 12 – Determinants of hourly wages – dependent employment - IV estimation (sample weights) – Italy PIAAC 2012

VARIABLES	iv1	iv2	iv3	iv1-2-3
numeracy (mean of pl.values)	0.000	0.040	0.000	0.005*
	[0.008]	[0.046]	[0.003]	[0.003]
years of schooling	-0.047	-0.309	0.083**	0.021
	[0.117]	[0.394]	[0.039]	[0.029]
female	-0.059	0.595	-0.213***	-0.105
	[0.182]	[0.864]	[0.080]	[0.067]
age	-0.01	0.168	0.003	0.018
	[0.045]	[0.221]	[0.028]	[0.024]
age2	0.000	-0.002	0.000	0.000
	[0.001]	[0.003]	[0.000]	[0.000]
foreign	-0.408	0.911	-0.136	-0.061
	[0.367]	[1.453]	[0.094]	[0.086]
Observations	833	840	840	833
R ²	-0.212	-9.981	0.085	0.11

Robust standard errors in brackets - *** p<0.01, ** p<0.05, * p<0.1 – macro-regional controls and constant included

IV1 = illiteracy, Bologna process, full-day schooling

IV2 = spouse unemployed, number of children, at least one child aged below 10

IV3 = Internal locus of control, External locus of control, Openness, Conscientiousness, Proactivity, Performance orientation, Learning orientation, Positivity

Conclusions

Cognitive competences and formal education matter in the Italian labour market, though less so for self-employed (OLS evidence).

However there is clear evidence of self-selection (working/not working and reporting/not reporting incomes) as well as endogeneity of both competences and schooling (instrumented with educational reforms and illiteracy rates).

When trying to cope with both problems we find (limited) evidence of importance of competences, especially numeracy.