HOW MUCH DOES IT PAY?
THE RETURN TO EDUCATION IN ITALY

Gian Carlo Cainarca♦, Francesca Sgobbi♣

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♦ DIST, University of Genova, Viale Causa, 13 - 16145 Genova - I
e-mail giancarlo.cainarca@unige.it, tel. +39.010.3532070, fax +39.010.3532948

♣ DIMI, University of Brescia, Via Branze, 38 - 25123 Brescia - I
e-mail francesca.sgobbi@unibs.it, tel. +39.030.371.5644, fax +39.030.370.2448

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Abstract

Based on a representative sample of over 3,600 Italian employees, the paper assesses the existence and the characteristics of the educational mismatch in Italy. Results show that educational mismatch is not a negligible fact and the observed patterns reflect those already reported for other countries of continental Europe. Nonetheless, the Italian case is characterised by the prevalence of undereducation over overeducation and by consistently high levels of matching. The exam of the return to educational mismatch confirms the relative penalisation of overeducation and the absolute penalisation of undereducation. Moreover, the inclusion of additional explanatory variables proves that the focus on the sole human capital masks the impact of other important factors such as gender, professional occupation, or employer industry. The patterns observed for the full sample significantly change with the age of employees. The Job Competition Model can shape the wage equation of younger workers, while the Assignment model proves to be superior for other age groups. Younger workers suffer from consistent wage penalisations due to labour contracts, but gender gaps and occupational gaps tend to blur. Substitution effects between training and formal education take place only among older workers.

1. *Introduction*

Educational mismatch in the labour market has long been a concern for policy makers, managers, and employees. In general terms, an educational mismatch could depend on the excess supply of the skills and competences provided by the education system, but also on the shortage of demand for those skills. As a matter of fact, the causes of educational mismatch are intimately connected with the specific features of the examined productive system. Overeducation in traditional environments signals the inefficiency of the economic system, which allocates to education more resources than those actually demanded for by employers. On the contrary, when firms actively explore the opportunities provided by new markets and new technologies, overeducation could reflect the search for those redundant skills required to support innovation when change is rapid and obsolescence rates are fast.

Economic and social policies in line with the evolution of economic activities are needed to cut down the costs caused by educational mismatch in the labour market. However, the effects of those policies display in the long run and can be hardly modified in the short term (Shaw, 1987). Wise decisions should accordingly base on updated information about overeducation, undereducation, and, above all, on their origins. Unfortunately, in the case of Italy the available evidence based on micro-data about the mismatch between labour demand and offer is still recent and scarce (Istat, 2005; Brynin *et al.*, 2006; Cainarca and Sgobbi, 2007).

Given the importance of the education of human resources for the development of national economic systems (CEC, 2001), the paper aims at improving the available evidence on the educational mismatch in Italy. First, the paper assesses the alignment between the demand and offer of education in the Italian labour market by measuring the occurrence of educational mismatch. This analysis allows to quantify overeducation and undereducation in Italy, as well as to perform international benchmarking. Second, the paper evaluates the economic return to investment in education. This analysis bases on the model of human capital proposed by Mincer (1974) and subsequently tuned by Duncan and Hoffman (1981). The caused of educational mismatch in Italy are explored according to the hypotheses suggested by the most popular economic interpretive frameworks (i.e., the Human Capital Theory, the Job Competition Model, and the Assignment Model). Besides the critical assessment of those models, the proposed empirical analysis point out several critical issues in the Italian labour market.

The OAC archive[1] developed by Isfol, the Italian institute for vocational education and training, provides the empirical test bed. The OAC archive collects information about 3,605 interviews held in 2004 with a representative sample of employees from Italian private manufacturing and service industries. Collected information allows to evaluate educational mismatch in Italy, as well as the return of overeducation and undereducation on wages.

The paper includes five additional Sections. Section 2 surveys the theoretical literature on educational mismatch. Given the importance of procedural issues in measuring and apprising educational mismatch, the exam of methodological tools constitutes the premise to any subsequent analysis. Section 3 presents the OAC archive, while Section 4 bases on the Isfol data to sketch the educational mismatch in Italy. Section 5 estimates the return of educational mismatch on wages. The last Section summarises the main results and provides some concluding remarks.

[1] OAC is the acronym for "Organizzazione, Apprendimento, Competenze" (Organisation, Learning, Competencies),.

2. Background

Maybe due to the more immediate consequences on policy measures, research on educational mismatch has traditionally focused on overeducation. The milestone which marks the beginning of the debate on over-qualification is usually recognised in Freeman's study (1976), which discusses how the declining wage premium recognised to US post-graduates in the seventies affected the propensity to invest in education. Duncan and Hoffman (1981) marked the shift from assessing the educational mismatch to estimating its impact on wages by rewriting Mincer's wage equation on the returns of education and experience (1974). The achieved qualification is decomposed into the sum of required education and educational surplus (or deficit) due to actual qualification.

Several conceptual and empirical issues hamper the appraisal of the economic returns to educational mismatch, including the problem of modelling the dynamic relationship between educational mismatch and wage, or the risk to bias the estimates by omitting relevant explanatory variables of wage levels other than education (McGuinness, 2006). Moreover, the results of empirical analyses strongly depend on how the mismatch is operationally defined and measured (Sloane, 2002). However, education mismatch constitutes at best the explicit and codified share of the wider (positive or negative) knowledge gap that the mismatch is called to capture (Green *et al.*, 2002; Braun, 2002; Cainarca and Sgobbi, 2006).

The different solutions for apprising the qualification required to perform a specific job basically fall within the opposed categories of subjective measures, focused on self-appraisal by employees, and objective measures, based on the opinion expressed by an external observer. Subjective measures ask the worker to declare the qualification needed for an effective performance in his/her job (and the comparison with the attained education reveals the possible mismatch), or to assess one's own overeducation/undereducation (Allen and van der Velden, 2005). Objective criteria measure the mismatch by comparing job contents with standard job descriptions provided by directories such as the *Standard Occupational Classification* (UK) or the *Dictionary of Occupational Titles* (USA). A statistical-grounded solution identifies mismatching when the attained education is more than one standard deviation above or below the mean, the mode or the median of a sample of employees in the same job (Kiker *et al.*, 1997). While the correlation between the levels of educational mismatch measured by different criteria is comparatively low, literature does not report systematic biases in the estimate of the associated economic returns[2] (McGuinness, 2006).

2. 1. The theoretical models

[2] See also the meta-analysis on 25 studies developed by Groot and Maassen van den Brink (2000a).

Despite articulated, the debate on overeducation still centres on the hypotheses supported by three popular theoretical approaches, namely the Human Capital Theory (HCT), the Job Competition Model (JCM), and the Assignment models (Sloane, 2002; McGuinness, 2006).

In order to explain the distribution of waged in developed economies, Becker (1964) represents workers as "human capital", which firms optimally employ and consequently reward at its marginal value. The HCT is usually tested via the empirical model proposed by Mincer (1974), which explains the return to labour efforts, *i.e.* the wage level, with the employee's human capital, measured as the sum of education level and experience in the labour market. According to the HCT, educational mismatch depends on imbalances on the offer side, because firms always optimise their usage of human capital. Consequently, permanent mismatching can only occur when the attained qualifications do not properly reflect the actual skills of heterogeneous employees.

Opposite to the HCT, the JCM switches the attention to the demand side of the labour marked and questions the capability of firms to optimise their usage of human capital by adapting production facilities and methods to the skills of their employees[3] (Duncan and Hoffman, 1981; Hartog and Oosterbeek, 1988). Based on the empirical finding that most skills develop on the job (Thurow, 1975), the JCM argues that labour productivity depends on the job rather than on the employee. Wages are consequently driven by job contents and possible misalignments between required and provided qualifications have no economic consequences. Given the explicit importance attached to on-the-job training and the lower emphasis on formal education, the JCM argues that employees select their job according to career opportunities rather than by an initial wage in line with their attained educational level. The latter simply improves the initial placement in the "queue" to access the desired job by signalling better skills to employers.

While the HCT focuses on employees' features, *i.e.* on the demand side of the labour market, the JCM switches the attention to the demand side and constraints the relationship between productivity and reward on job rather than individual features. By emphasising the relative position of workers in the access queues to different jobs the JCM justifies mismatching, at least in the case of overeducation, which anyway has no significant impact on wage. As a matter of fact, the attained qualification facilitates, but does not guarantee, the access to the desired job. Consequently, the higher the education level among job seekers, the more investing in education becomes a defensive strategy

[3] Additional sources of rigidities in the labour market recognised by the JCM also include institutional norms.

to protect one's position in the access queue to a "good" job, independently form actually required qualifications.

The Assignment model tries to merge the attention to the offer side provided by the HCT with the focus on the demand side by the JCM (Sattinger, 1993). The strict dependence of productivity and wage on education and experience argued by the HCT, as well as the dependence of wages on the sole job maintained by the JCM, which equals the employees' destiny to a lottery, do not fully justify overeducation and, more broadly, the dynamics observed in labour markets. The Assignment Theory acknowledges those limits and resorts to both sides of the labour market to explain wage distribution and dynamics. Jobs and industrial sectors affect earning levels, which in turn drive employees to choose jobs that maximise their return according to allocative criteria, and not by chance (McGuinness, 2006).

2.2. *The empirical evidence*

The international literature has provided a large amount of evidence on the issue of educational mismatch, despite mainly focused on a small number of industrialised countries[4]. Nonetheless, the available evidence sketches a diversified picture of the incidence and the consequences of educational mismatch and, in particular, overeducation.

Among the consequences of educational mismatch, economic return is by large the most studied aspect. Empirical evidence usually resorts to the equation introduced by Duncan and Hoffman (1981), which calculates the return to overeducation and undereducation by discriminating between required and attained qualification. The model explains the logarithm of wage (lg w) with the drivers of the employee productivity, namely education and experience:

$$lg\ w_i = \beta_0 + \beta_1 S^r{}_i + \beta_2 S^o{}_i + \beta_3 S^u{}_i + \beta_4 Exp_i + \beta_5 Exp_i^2 + \beta_6 \chi_i + \varepsilon_i \qquad (1)$$

Where, for each i-th employee,

S^r is the qualification required by the job;

S^o measures overeducation;

S^u measures undereducation;

Exp appraises the experience in the labour market;

χ is a vector of individual and job-specific features;

ε is the error term.

[4] Sloane (2003) reports 33 studies, 9 on the USA, 8 on the UK, 6 on the Nederland, while the remaining 9 concern Spain (3 studies), Germany (2), Canada, France, Hong Kong, Ireland and Portugal. McGuinness (2006) reports 38 studies with a similar geographical concentration, with 15 analyses on the US case and 11 on the UK.

The dissimilar methodological approaches adopted by researchers (*i.e.* objective versus subjective criteria), as well as the differences among education *curricula* in different countries, explain the variance in the levels of educational mismatch encountered at the international level, and sometimes also at the national one. Also structural country-specific features could affect the levels of educational mismatch. Not surprisingly, the few existing direct international comparisons point out the importance of cultural and socio-economic aspects (Daly *et al.*, 2000; Büchel and Witte, 1997; Brynin *et al.*, 2006).

The meta-analysis developed by Groot and Maassen van den Brink (2000a) allows an overall assessment of the weight and the economic return of educational mismatch. Taking into account only the studies based on subjective criteria, which will be used also in the empirical part of the present paper, overeducation on average affects 28.6% of employees, while 15.5% are undereducated. As for the economic return of education, an additional year of required education on average increases the wage by 7.9%, an additional year of overeducation by 4.9%, while every year of undereducation involved a penalisation of 3.5%. In general terms, literature rejects the basic hypothesis of the HCT, *i.e.* the optimal usage of the employees' human capital by employers[5], because the returns of required education, overeducation, and undereducation on wage significantly differ. In particular, the lower return of the year of overeducation against those spent to achieve the required qualification signal a penalisation of overqualified employees against workers with the same educational title who hold a job in line with their studies. In a similar way, the negative sign usually estimated for the coefficient β_3 in Equation (1) signals the reward penalty suffered by undereducated employees against workers who occupy similar jobs but achieved the qualification actually required.

The available empirical evidence also tends to reject the JCM[6]: the significant difference between the return of overeducation and undereducation confirms the non-negligible role of the skills and capabilities acquired in the education systems, besides those developed after the entrance in the labour market.

In comparison with continental Europe, Anglophone countries show systematically and significantly higher rates of overeducation. When measured by educational qualifications, overeducation is always significantly higher than undereducation in the USA, the UK, and Canada, where it is estimated to affects between 17% and 42% of employ-

[5] The HCT implies the superior explanatory power of attained education over its decomposition into required education and over or undereducation. From the point of view of econometric tests, this equals to accept the restriction $\beta_1=\beta_2= -\beta_3$ in equation (1).

[6] The hypothesis of not significant role of both overeducation and undereducation argued by the JCM can be empirically tested by assessing the null hypothesis $\beta_2=\beta_3=0$ in equation (1).

ees, while the same figure is lower in Germany, the Nederland, and Spain (between 17 and 28%)[7].

Maybe due to its mirror-like nature, undereducation has been much less investigated by literature. Under the perspective of the HCT, undereducation is coherent with the hypothesis of substitutability between education and training. Supporting evidence is provided by Alba-Ramirez (1993) for Spain, Sloane *et al.* (1996) for the UK, and Büchel and Mertens (2004) for the German case.

The diffusion of undereducation is particularly high in the case of Spain where, according to Alba-Ramirez (1993), it affects 23% of employees[8]. The detection of a positive relationship between undereducation, experience, and training drives the Author to state that, under certain conditions, "undereducation is not a 'bad' job match" (Alba-Ramirez, 1993, p.265). Also Sloane *et al.* (1996) report a positive relationship between experience, tenure, competence, and undereducation in the UK. In particular, 10% of employees with less than two years of experience are undereducated, while for employees with over 20 years of experience the same figure reaches 24%. Vice versa, overeducation affects 43% of employees with less than two years of seniority in the labour market, and 25% of employees with over 20 years of experience. The effects of the employee's life cycle and of the technological and organisational change at the workplace on the dynamics of educational mismatch are still largely under-researched, also due to the scarce availability of suitable data. In general terms, several researchers report the higher incidence of overeducation at the beginning of the career (Dolton and Vignoles, 2000; Hartog, 2000). A temporary overeducation would fit with the HCT, which frames educational mismatch as a momentary unbalance between labour demand and offer, which solves when employers and employees acquire better information to optimise the matching. The theory of mobility career explains the higher incidence of overeducation at the entrance in the labour market by arguing that overqualified people will have more chances to climb up the firm hierarchy. The initial acceptance of a job which requires fewer qualifications than those attained would represent for the employee a sort of investment to secure higher future returns (Sicherman and Galor, 1990; Sicherman, 1991). However, empirical tests mostly confuted the theory of the mobility career (Robst, 1995; Büchel and Mertens, 2004) and the presence of overeducated and undereducated

[7] For the USA see Daly *et al.* (2000), McGoldrick and Robst (1996), Cohn and Kahn (1995), Robst (1995), Sicherman (1991), Tsang *et al.* (1991), Rumberger (1987), and Duncan e Hoffman (1981); for the UK, see Dolton and Siles (2003), Chevalier (2003), Battu *et al.* (2000), Dolton and Vignoles (2000), Green *et al.* (1999), and Sloane *et al.* (1999); for Germany, see Daly *et al.* (2000); for the Nederland, Allen and van der Velden (2001), Groot and Maassen van den Brink (2000b), and Hartog and Oosterbeek (1988).

[8] Even higher (33%) is the percentage of undereducated Spanish employees reported by a subsequent study on data from 1991 (García-Serrano e Malo, 1996).

people also among older employees support the hypothesis of either heterogeneity among individuals with the same educational qualification ((Green *et al.*, 2002), or bad functioning of the labour markets.

3. *The data*

The proposed empirical analysis bases on the information provided by the OAC database developed by Isfol (Tomassini, 2007). In 2004 Isfol promoted an inquiry among employees in the Italian private sector[9] in order to explore the relationship between labour organisation, education and training, and employees' skills. Data were collected between May and July 2004. Over 3,600 employees participated in approximately one-hour interviews held by trained personnel according to the Computer Assisted Personal Interviews methodology. The essential statistics for the examined sample are reported in Table 1.

The representativeness of the observed universe by the sample is assured by the adopted stratification strategy, which controls for gender of the interviewed workers, age class at the time of the interview, area of residence, professional qualification, and industrial sector. In addition, after data collection the stratification strategy allowed to assess the lack of self-selection biases among non-participants (Centra and Falorsi, 2007).

In line with the target of assessing how employees perceive their job and their workplace, the OAC inquiry privileged data collection via self-assessment, which guarantees access to information otherwise invisible to an external observer (Allen and van der Velden, 2005). Also the educational qualification required for the job, used for assessing educational mismatch, results from self-evaluation. The available measure of educational mismatch has consequently a subjective nature. In particular, interviewed employees were asked to answer to the following question: "What educational qualification should be required to someone applying for your same job?" [10].

The main problem posed by self-assessment consists in the risk of manipulation, be it deliberate or not. Following other large scale surveys (see, *e.g.*, Felstead *et al.*, 2002), Isfol reduced this risk by choosing appropriate questionnaire tools and interview techniques[11].

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[9] The investigation excluded mining, agriculture, and personal services.

[10] Answers included: (1) Primary school diploma; (2) Compulsory education; (3) Compulsory education + 1 year vocational school; (4) Compulsory education + 2 years vocational school; (5) Compulsory education + 3 years vocational school; (6) Secondary diploma from a technical institute; (7) Secondary diploma from a lyceum; (8) Bachelor or Master degree; (9) Bachelor or Master degree + 1 year specialisation; (10) Bachelor or Master degree + 2 years specialisation; (11) PhD.

[11] Allen and van der Velden (2005) suggest some general rules to minimise the risk of answer manipulation. The Authors recommend to avoid "critical situations" such as questions which call for "socially de-

Table 1. The OAC archive: Descriptive statistics

Variable		N	%
Age class	15-29	691	19.17
	30-44	1,711	47.46
	45-64	1,203	33.37
Gender	Male	2,253	62.50
	Female	1,352	37.50
Qualification	Blue collars	1,534	42.55
	White collars	1,034	28.68
	Managers	1,307	28.77
Firm size [employees]	1-49	1,847	51.23
	50-99	268	7.43
	100-499	537	14.90
	≥ 500	751	20.83
	n.a.	202	5.60
Area of residence	North-West	956	26.52
	North-East	1,017	28.21
	Centre	798	22.14
	South	834	23.13
Total		3,605	100.00

Source: OAC, Isfol

4. *Educational mismatch in Italy*

In order to appraise educational mismatch in Italy, the employees interviewed in the OAC project have been classified as overeducated when their educational attainment along a 5 level scale[12] was higher than the required one, as undereducated if their educational attainment was lower, else matched. The main features of educational mismatch in Italy are presented in Table 2. Besides providing the estimates for the observed universe, Table 2 reports the mismatch by significant individual features (educational qualification, gender, age, job), industry, and area of residence.

In 68.8% of cases the interviews reveal a match between required and provided educational qualifications. Overeducation affects 14.1% of employees, while 17.1% recognise to be undereducated. While confirming that overeducation in Italy basically aligns with the figure for continental Europe[13], Isfol data show the prevalence of undereducation on overeducation. This pattern, which matches only with some studies from Spain (Alba-Ramirez, 1993; García-Serrano e Malo, 1996) and the Nederland (Hartog

sirable" answers, Likert scales missing a short explanation to clarify the meaning of their points, questions which target different issues/dimensions, or questions whose true answer makes the interviewee feel uneasy.

[12] The five educational attainments considered in this analysis include compulsory school diploma, vocational school diploma, secondary school diploma, degree, and post-degree. The scale was chosen to increase the international comparability of the proposed analysis.

[13] This result contrasts with the evidence reported by Istat (2005), whose definition of educational mismatch resorts anyway to an objective criterion which crosses the Isco-88 job classification with the Isced-97 classification of educational titles. According to this criterion, 16.5% of Italian workers (entrepreneurs, managers and military professionals excluded) result overeducated, and 9% undereducated.

and Oosterbeek, 1988), supports at least two contrasting scenarios. The fist one outlines problems in the governance mechanisms of the labour market: the higher weight of undereducation signals a shortage of adequate skills, but the contemporary presence of overeducation implies that skill shortage is not due to a lack of offer. In the second scenario, the prevalence of undereducation could correspond to job enlargement/enrichment or to career advancements gained thanks to the development of skills and competencies after leaving the education system. This second scenario confirms the importance of on-the-job training and outlines the need to assess the nature and the value of those skills, which strictly depend on the workplace where they develop. In mature and traditional industries (such as most "made in Italy" manufacturing), slow changes and comparatively low sophistication of technological systems support the hypothesis that experience can substitute for education. In those cases, investing in the experience of employees allows firms to exploit a potentially wider and less expensive labour force, yet at the cost of higher vulnerability in case of rapid changes. On the contrary, in high-tech industries the investment in training for undereducated employees leverages on their learning capabilities, which nevertheless require higher starting levels of formal education.

Some preliminary clues for understanding which scenario better fits with the Italian data come from the distribution of the educational mismatch across different groups of employees (Table 2). The mismatch by attained education displays a varied picture. Matching peaks for the lowest qualification (compulsory school diploma, 73.1%) and for secondary school diploma (74.1%). In this second case, the result confirms how the labour market still appreciates intermediate qualifications with marked vocational contents (high schools for accountants, qualified technicians, etc.). On the contrary, matching drops for post-graduate employees, among whom only one in three holds a job in line with the personal investment in education. As for undereducation, it concentrates at the lowest levels of education, with over 25% of employees who left school after the compulsory years or after a vocational diploma claiming to be undereducated.

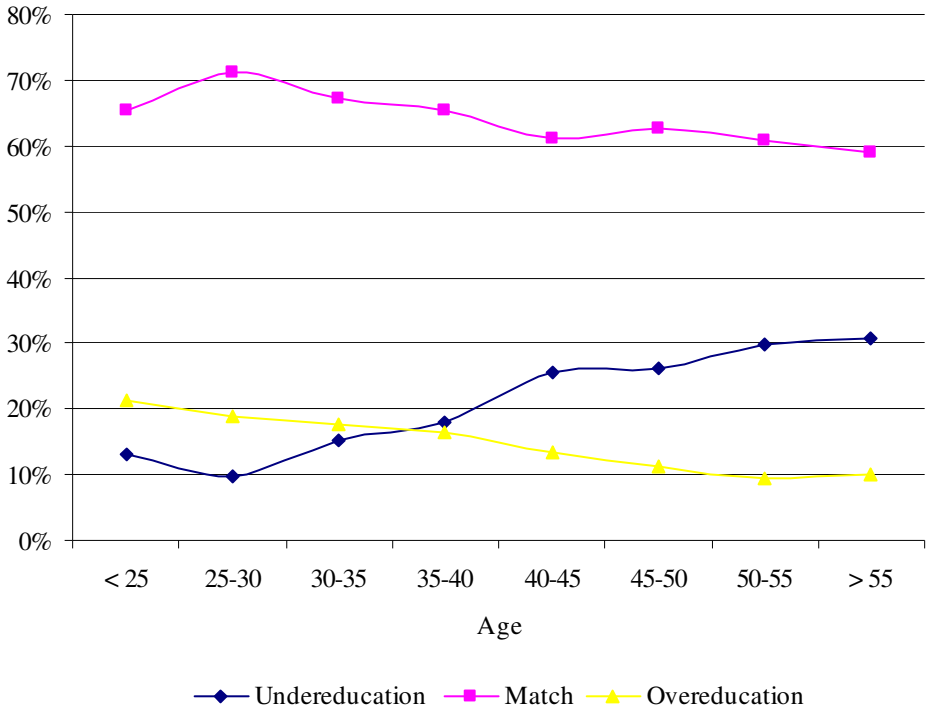
At first sight, it seems that most sophisticated educational qualifications are not fully exploited by the Italian labour market, while undereducation does not obstacle success. The whole picture fits with the scenario of a national industry focused on traditional and scarcely dynamic activities, where skills are accumulated in time via learning-by-doing processes. On the side of labour demand, this scenario justifies the preference for recruiting employees with low-to-medium qualifications, instead of higher ones.

Table 2 - Educational mismatch in Italy

Mismatch	*Undereducation* (a) %	*Match* (b) %	*Overeducation* (c) %	*Educational mismatch* (d) μ	σ
Total (e)	17.12	68.80	14.08	-0.030	0.558
By educational qualification					
Compulsory school	26.94	73.06	0.00	-0.269	0.444
Vocational school	26.65	55.68	17.67	-0.090	0.660
Secondary school	7.70	74.10	18.20	0.105	0.498
Degree	7.32	55.11	37.57	0.302	0.598
Post-degree	0.00	34.24	65.76	0.658	0.475
By gender					
Males	17.67	67.43	14.90	-0.028	0.570
Females	16.25	70.99	12.76	-0.035	0.537
By age class					
15-29 years old	11.66	69.31	19.03	0.074	0.549
30-44 years old	17.40	68.66	13.94	-0.035	0.559
45-64 years old	22.08	68.57	9.35	-0.127	0.546
By occupation					
Managers and Administrators	31.40	59.00	9.60	-0.218	0.602
Professional occupations	23.86	71.42	4.72	-0.191	0.499
Associate Professional and Technical Occupations	32.59	59.92	7.48	-0.251	0.581
Administrative and Secretarial Occupations	18.07	73.10	8.83	-0.092	0.510
Craft and Related Occupations	19.00	68.53	12.47	-0.065	0.557
Personal Service Occupations	1.52	89.84	8.64	0.071	0.311
Sales Occupations	16.42	62.56	21.02	0.046	0.610
Plant and Machine Operatives	14.84	67.16	18.00	0.032	0.572
Elementary Occupations	10.57	67.28	22.15	0.116	0.560
By industry					
Manufacturing: traditional	16.84	66.97	16.19	-0.006	0.575
Manufacturing: scale intensive	13.34	73.42	13.25	-0.001	0.516
Manufacturing: science based	22.60	66.27	11.14	-0.115	0.569
Wholesale and retail trade	17.91	65.45	16.64	-0.013	0.588
Hotels and restaurants	13.47	65.73	20.80	0.073	0.581
Transportation and warehousing	12.61	72.62	14.77	0.022	0.523
Communications and ICT	20.83	64.82	14.36	-0.065	0.590
Finance and insurance	23.41	65.85	10.74	-0.127	0.571
Professional, scientific and technical services, Real estates, rental and leasing	14.68	77.92	7.41	-0.073	0.464
By area of residence					
North-West	17.69	71.22	11.10	-0.066	0.532
North-East	19.74	63.30	16.96	-0.028	0.605
Centre	13.56	68.49	17.95	0.044	0.560
South	16.50	71.47	12.03	-0.045	0.532

(a) Attained education (AE) < Required education (RE)
(b) Attained education = Required education
(c) Attained education > Required education
(d) Educational mismatch = 1 if AE > RE, 0 if AE = RE, -1 if AE < RE.
(e) Weighted data to the observed universe (9.182.953 employees).

Figure 1. Educational mismatch and age



Likewise the results of the survey proposed by Sloane (2002), the analysis by gender does not reveal important differences in the educational mismatch for men and women. Much wider are the contrasts by age class[14]: matching always rounds 69%[15], but undereducation dramatically peaks with age, and overeducation drops (Figure 1). Contrary to the overall evidence, the break down of the analysis by the employees' age reveals that undereducation only prevails among workers over 35. However, for every age group reported in Table 2, the outlined figures are about half of the values calculated by Dekker *et al.* (2002) for the Nederland, based on a subjective criterion.

The progressive shift from overeducation to matching, and from matching to undereducation, suggest that labour demand and offer adjust in time and that job enlargement and job enrichment build up over training and experience. However, the non negligible percentage of overeducated people also among older employees suggests that at least a share of overeducation has permanent rather than temporary nature.

[14] The adoption of three age classes (15-29 years old, 30-44 years old, and 45-64 years old when interviewed) follows the stratification method used by Isfol. However, no significant difference arises when using a less aggregated classification (Figure 1).

[15] The substitution between overeducation and undereducation with age is well documented in literature. However, Italy stands out for the high matching at all age levels. Alba-Ramirez (1993) reports for Spain steady growing match values, from 45% for the youngest employees to over 75% for employees over 60.

Undereducation by professional occupation is higher for qualified jobs: it affects 31.4% of managers, almost 24% of professionals, and over 32% of technicians. On the contrary, overeducation concentrates in occupations where lower educational requirements are expected: overeducated employees are over 20% in the case of non-qualified blue collars ("Elementary occupations"), but also for sales occupations. While the pattern observed for qualified occupations supports the hypothesis of progressive on-the-job accumulation of skills, the overeducation among less qualified employees is hardly explained as the search for redundant competencies by employers, or as an investment to enter a promising career by employees. In accordance with Robs (1995) and Büchel and Martens (2002), the OAC data deny the hypothesis of career mobility argued by Sicherman and Galor (1990) and Sicherman (1991) also in the case of Italy.

Coherently with the above results, matching by industry revolves around average values, while educational mismatch is higher where formal education is expected to play a more important role. Knowledge-based industries such as science-based manufacturing, ICT, finance and insurance and professional services display reduced values of overeducation, always lower than undereducation. Once more, this evidence does not support the vision of overeducation as a source of redundant knowledge to face unexpected change and casts doubts upon the actual need for highly educated human resources by Italian firms. In summary, the analysis by occupation and by industry confirms the tendency to develop specialised skills at the workplace, rather than in the education system.

5. *The economic return to educational mismatch*

The assessment of an educational mismatch in Italy outlines the need for understanding the economic implications of the misalignment between provided and required education. Following literature, in all the estimated models the dependent variable is represented by the natural logarithm of net hourly wage[16]. Besides avoiding biases due to the different length of the working day or the working week, this choice also increases the international comparability of the obtained results.

The detailed list of the regressors used to estimate the wage Equation (1) (Section 2.2) is reported in Table 3, with a brief description. Explanatory variables can be classified in five groups, namely human capital, individual characteristics, job characteristics, occupation, and industry. Besides the "classical" dimension of required education, overeducation, undereducation and experience, variables on human capital also include the training provided to interviewed employees, defined as the overall length of training pe-

[16] The OAC archive records the net monthly wage perceived by interviewed workers and their weekly work time. 3.081 employees (86% of the sample) completed the question about their monthly earnings.

riods after the entrance in the labour market. A positive estimated coefficient for Training and a negative coefficient for Undereducation would support the hypothesis that education matters, but training can substitute for the missed years of schooling.

Table 3. The variables used in the econometric estimates

	Description	μ	σ
Ln_w	Natural log of net hourly wage in € Dependent variable	1.967	0.360
Explanatory variables			
Human capital			
Required_Edu	Required years of education	12.296	3.480
Overeducation	Years of education exceeding the required level	0.547	1.469
Undereducation	Years of education below the required level	0.799	1.773
Experience	Years in the labour market	17.195	10.478
Training	Years of training after leaving education	0.289	0.602
Employee			
Age_1	= 1 for employees between 15 and 29 years old	0.192	0.394
Age_2	= 1 for employees between 30 and 44 years old	0.475	0.499
Gender	= 1 for females	0.375	0.484
Job			
Part_time	= 1 for part-time contracts	0.068	0.251
Temp	= 1 for temporary contracts	0.108	0.311
LnSize	Natural log of firm employees	4.176	2.582
North_East	= 1 if area = North-East	0.282	0.450
Centre	= 1 if area = Centre	0.221	0.415
South	= 1 if area = South	0.231	0.422
Occupation	*Baseline: Administrative and Secretarial*		
Managers	= 1 for Managers and Administrators	0.173	0.379
Professionals	= 1 for Professional occupations	0.031	0.174
Technicians	= 1 for Associate Professional and Technical Occupations	0.083	0.276
Skilled_trades	= 1 for Craft and Related Occupations	0.124	0.330
Personal_serv	= 1 for Personal Service Occupations	0.007	0.085
Sales	= 1 for Sales Occupations	0.071	0.256
Plant_machines	= 1 for Plant and Machine Operatives	0.143	0.350
Elementary	= 1 for Other Occupations	0.099	0.299
Industry	*Baseline: Wholesale and retail trade*		
Mfg_traditional	= 1 for Manufacturing: traditional	0.167	0.373
Mfg_scale intensive	= 1 for Manufacturing: scale intensive	0.139	0.347
Mfg_science based	= 1 for Manufacturing: science based	0.116	0.320
Hotel_Rest	= 1 for Hotels and restaurants	0.046	0.209
Trasport	= 1 for Transportation and warehousing	0.081	0.273
ICT	= 1 for Communications and ICT	0.080	0.272
Finance	= 1 for Finance and insurance	0.088	0.284
Other_serv	= 1 for Professional, scientific and technical services, Real estates, rental and leasing	0.106	0.308

The employee features include age (with employees over 45 as the baseline) and gender. In order to capture possible gender-related wage penalties depending on working time (Manning and Petrongolo, 2005), Gender also interacts with part-time. Additional variables to characterise the job and the workplace include the length of the labour contract (temporary or not), the size of the firm and the area of residence and work.

In order to take into account the impact of professional occupations, the proposed models also control for the employee's occupational group[17]. Due to their quantitative importance, Administrative and Secretarial Occupations were chosen as the reference category. Eventually, control variables include 8 industry dummies, always jointly significant. Besides made compulsory by the stratification strategy adopted to build up the OAC sample, those variables allow to verify how strongly wages depend on industry-specific features. Significant inter-industry differences would support the JCT, which claims the prominent impact of workplace conditions on the individual productivity.

Also when significant, correlation coefficients among explanatory variables are always low enough to exclude the risk of biases due to multicollinearity. This risk is also denied by the value calculated for Variance Inflation Factors.

5.1. *The returns to educational mismatch for the whole sample*

The results of the OLS regression estimated for the whole sample are reported in Table 4. Included independent variables explain over 53% of the observed variance. As expected, the estimate of the determinants of the hourly wage for Italian employees confirms the general findings of the international literature about the significance and sign of the coefficients which measure the return to human capital. The negative coefficient of Undereducation proves the penalisation suffered by employees with a lower than required educational level, while the positive value of Overeducation signals the wage premium attached to the skills and capabilities provided by each additional year of schooling. However, the value recognised to excess education is only partially acknowledged by employers: the coefficient of Overeducation is hardly a quarter of that of Required_Edu.

The impact of required education, overeducation and undereducation on the overall wage is small in comparison with the results of similar studies in other industrialised countries. Based on the OAC archive, the wage premium for an additional year of required education amounts to 3.2% of the hourly wage, while for subjective methods literature reports values between 4.8% in the USA (Sicherman, 1991) and 9.2% in Spain (Alba-Ramirez, 1993). Equally small, and lower than the estimates for other countries,

[17] Jobs reported in the OAC archive were codified according to the UK Standard Occupational Classification.

are the returns to a year of overeducation (0.8%, against the average 4.9% reported by Groot and Maassen den Brink, 2000a) and undereducation (-1,7% against -3.5%). These results suggest that in Italy, to a larger extent than in other countries, wage bargaining is constrained by social, contractual and institutional factors. Coherent with this finding is the much higher impact of age, rather than education, on wage. In comparison with older colleagues, an employee between 15 and 29 years old suffers an average wage cut of 9.8%, which drops to 3% for individuals aged between 30 and 44.

The estimated model does not support the predictions of the Human Capital Theory and the Job Competition Model. The test on the restriction $\beta_1 = \beta_2 = -\beta_3$ for Equation (1) allows to reject at the 99% level the null hypothesis that wages reword in the same way all the components of the human capital as measured by attained education ($F(3, 2842) = 27.253$). In a similar way, the irrelevance of overeducation and undereducation argued by the JCM is rejected by testing the restriction $\beta_2 = \beta_3 = 0$ ($F(2, 2842) = 22.017$). Nonetheless, the diversified significance and value assumed by the coefficients of the industry dummies support the existence of sector-specific differences which could drive the employees' preferences and job search strategies. In general terms, the proposed evidence supports the Assign models, which includes among the determinants of wage both employee-specific and workplace-specific variables.

The return to wage of accumulated experience is positive and significant, yet once more comparatively small: on average, an additional year on the labour market confers a wage premium of 0.7%. The significance of this variable and the important cumulative effects for older workers support the hypothesis of substitutability between on-the-job experience and formal education. As experience cumulates, modest saturation effects take place, signalled by the negative coefficient of Experience^2. On the contrary, no significant impact was detected for Training: in the observed sample, training experience after leaving the education system does not involve detectable wage effects.

The variable Gender shows that female employees suffer on average a consistent penalisation, about 8.8% of their net hourly wage. However, contrary to most countries, this penalisation shrinks to 4.2% in the case of part-time female employees[18]. If, independently from gender, part-time contracts do not involve lower hourly wages, quite different is the impact of temporary contracts. For a male employee in a clerical occupation, Isfol data signal an average penalisation of 8.7% of wage. As a matter of fact, temporary work not only limits the time span of individual life projects, but also involves an objective penalisation of rewards.

[18] Based on the European Community Household Panel Survey, Manning and Swaffield (2005) generally report significant penalisations for the gross hourly wage of part-time women in comparison with full-timers. However, three countries – Italy, Germany and Greece – depart from this pattern.

Table 4 – The determinants of wage for the whole OAC sample

Regressors	*β*	*Standard error*	
Constant	1.4113	0,0402	***
Required_Edu	0.0317	0,0020	***
Overeducation	0.0079	0,0032	**
Undereducation	-0.0171	0,0028	***
Experience	0.0117	0,0017	***
Experience^2	-0.0001	0,0000	***
Training	0.0096	0,0079	
Age_1	-0.1037	0,0200	***
Age_2	-0.0300	0,0132	**
Gender	-0.0924	0,0108	***
Part-time	-0.0491	0,0384	
Part-time*Gender	0.0988	0,0415	**
Temp	-0.0915	0,0186	***
LnSize	0.0129	0,0019	***
North_East	0.0188	0,0119	*
Centre	-0.0088	0,0129	
South	-0.0754	0,0127	***
Managers °	0.2363	0,0145	***
Professionals °	0.1312	0,0281	***
Technicians °	0.0832	0,0181	***
Skilled_trades °	-0.0475	0,0169	**
Personal_serv °	-0.0452	0,0536	
Sales °	-0.0515	0,0204	***
Plant_machines °	-0.0402	0,0168	**
Elementary °	-0.0582	0,0182	
Mfg_traditional °°	0.0152	0,0164	
Mfg_scale intensive °°	0.0105	0,0174	
Mfg_science based °°	0.0163	0,0182	
Hotel_Rest °°	-0.0399	0,0243	
Transport °°	0.0688	0,0203	***
ICT °°	-0.0154	0,0201	
Finance °°	0.1592	0,0202	***
Other_serv °°	0.0234	0,0184	
Adjusted R^2	0.537		
ANOVA F-test	105.073 ***		

*Dependent variable: Ln_w; OLS regression; 2.875 observations; *** p < 1%, ** p < 5%, * p < 10%*
° Baseline: Clerical and Secretarial Occupations
°° Baseline: Wholesale and retail trade

The variables concerning firm size and area of residence contribute to increase the explanatory power of the model and basically confirm previous findings from literature: working in a large firm involves a (small) wage premium, while people in Southern regions of Italy suffer from a wage penalty.

The estimated model also outlines the important return attached to individual occupations, which can be roughly arranged into three wage groups. Everything else equal, the rewards of people providing personal services are not significantly different from those of administrative employees, the estimate baseline. Significant and more and more

important advantages accrue to technicians, professionals and managers. Eventually, blue collars and people in sales occupations share an average penalisation against the above groups.

5.1. *The returns to educational mismatch by age class*

The model in Table 4 estimates the wage determinants for the whole sample. However, the statistical analysis on the distribution of educational mismatch by age class provided in Section 4 outlined significantly different patterns (Table 2 and Figure 1). Moreover, also the estimate of Equation (1) for the whole OAC sample outlines the high economic return to age.

In order to appreciate possible differences by age class in the return to education and to other wage determinants, the OLS estimate of the wage equation has been replicated for employees aged between 15 and 29, between 30 and 44, and between 45 and 64 (Table 5).

First of all, the comparison between Table 4 and Table 5 shows that the returns to overeducation and undereducation for the whole sample do not equally replay for each age group. In particular, overeducation and undereducation do not impact on the wage of younger employees, while older ones are only affected by undereducation. The statistical tests of the HCT and the JCM for the three sub-samples show that the HCT is never supported, while the JCM is confirmed in the case of younger workers: only the education level required by the employer drives rewards in the latter case (Table 6). In other words, school leavers have an actual incentive to enter the labour market with the highest possible education level. By giving access to the "right" queue (McGuinness, 2006; Thurow, 1973), which in time leads to the adjustment between required and provided skills, the educational qualification could make the difference between a successful and a plain career. The fit between the JCM and the labour market for new entrants explains how an employee could fall in the "overeducation trap": an individual who at the beginning of the career enters more or less by chance a job for which s/he is overqualified risks to stay in similar roles along the whole career, suffering a wage penalisation in the future. For employees aged between 30 and 44 this penalisation consists in the lower return of overeducation against required education. For people over 45, the wage premium to overeducation disappears and the employees still positioned below their qualification are simply equalled to their colleagues with lower educational attainments. For people over 30, every year of undereducation on average involves a 2% penalisation of their reward, and this result at least partially denies the full substitutability between learning on-the-job and formal education

Table 5 – The determinants of wage by class age

Regressors	Age = 15-29 *565 observations*			Age = 30-44 *1,361 observations*			Age = 45-64 *939 observations*		
Constant	1.3719	0.070	***	1.363	0.056	***	1.547	0.073	***
Required_Edu	0.0142	0.004	***	0.034	0.003	***	0.036	0.003	***
Overeducation	-0.0029	0.006		0.011	0.005	**	0.002	0.007	
Undereducation	-0.0094	0.009		-0.021	0.004	***	-0.021	0.004	***
Experience	0.0143	0.009		0.013	0.003	***	0.000	0.004	
Experience^2	0.0000	0.001		0.000	0.000	***	0.000	0.000	
Training	-0.0159	0.025		0.006	0.012		0.025	0.013	*
Gender	-0.0346	0.021		-0.118	0.016	***	-0.082	0.020	***
Part-time	-0.0472	0.054		-0.021	0.057		-0.290	0.124	**
Part-time*Gender	0.1243	0.064	*	0.092	0.061		0.282	0.127	**
Temp	-0.1005	0.025	***	-0.043	0.030		-0.088	0.051	*
LnSize	0.0284	0.005	***	0.013	0.003	***	0.006	0.003	*
North_East	0.0290	0.025		0.024	0.018		0.008	0.022	
Centre	-0.0055	0.026		0.009	0.019		-0.041	0.023	*
South	-0.0831	0.025	***	-0.077	0.019	***	-0.078	0.023	***
Managers °	0.2482	0.044	***	0.230	0.022	***	0.223	0.024	***
Professionals °	0.2072	0.051	***	0.052	0.041		0.306	0.056	***
Technicians °	0.1534	0.038	***	0.058	0.027	**	0.093	0.032	***
Skilled_trades °	-0.0460	0.033		-0.036	0.026		-0.057	0.032	*
Personal_serv °	0.0208	0.084		-0.121	0.095		-0.009	0.102	
Sales °	0.0050	0.038		-0.065	0.030	**	-0.098	0.041	**
Plant_machines °	-0.0047	0.033		-0.032	0.025		-0.077	0.032	**
Elementary °	-0.0054	0.036		-0.054	0.028	*	-0.083	0.033	**
Mfg_traditional °°	0.0170	0.031		0.015	0.025		-0.019	0.030	
Mfg_scale intensive °°	0.0186	0.032		0.018	0.027		-0.017	0.032	
Mfg_science based °°	0.0122	0.0347		0.008	0.028		-0.016	0.032	
Hotel_Rest °°	0.0572	0.054		-0.064	0.034	*	-0.099	0.047	**
Transport °°	0.0866	0.046	*	0.045	0.032		0,069	0,034	**
ICT °°	0.0337	0.040		-0.016	0.030		-0,034	0,038	
Finance °°	0.1957	0.050	***	0.121	0.031	***	0,181	0,034	***
Other_serv °°	0.0862	0.039	**	0.004	0.026		0,049	0,036	
Adjusted R^2		0.352			0.440			0.557	
ANOVA F-test		11.216	***		36.652	***		40.308	***

*Dependent variable: Ln_w; OLS regressions; *** p < 1%, ** p < 5%, * p < 10%*

° Baseline: Clerical and Secretarial Occupations

°° Baseline: Wholesale and retail trade

Required education is always a significant determinant of reward and its return increases with age. Every additional year of study required by the employer rewards younger employees with a 1.4% premium, which rises to 3.5% for the intermediate group and to 3.7% for older workers. However, the cross-sectional nature of the OAC database does not allow to discriminate between the effects of augmented productivity achieved thanks to on-the-job training and experience and the results of grade drift or credentialism (Green *et al.*, 2002).

As expected, saturation effects do not manifest for the (short) experience accumulated by younger workers. Also training has no significant impact on their reward. This result is explained by the low percentage of employees below 30 who reported training experiences (36.8% of the sub-sample, compared with 50.6% and 51.9% for the two subsequent age groups), as well as by the shorter length of the reported cumulative experience (respectively, 0.14 years of training for the first age group, o.29 years for the second, and 0.33 for the third one).

In the case of older employees, the coefficients of the variables which reflect the cumulative development of skills sketch a multifaceted picture. The lack of significant returns to experience signal that firms recognise the disruptive effects of skill obsolescence. Training mitigates this phenomenon, as signalled by the positive coefficient of the associated variable, which is significant only for this age group. However, it should be reminded that only half of employees between 45 and 64 reports training experiences. When present, the return to a year of training amounts to 2.5% of wage, while the penalisation for a year of education is 2%. This finding supports the hypothesis that training could substitute for education. However, since undereducated employees on average receive 0.12 years of training for each years of undereducation, compensation effects are at best partial.

Part-timing does not generally involve penalisations of the hourly wage, apart for male employees above 45. The heavy penalisation they suffer (over 29% of pay, the highest of the estimated effects) could signal the prevalence of involuntary part-time for this category of employees. If part-timing among older male workers is mostly involuntary, the observed wage penalty could correspond to organisational roles which do not fully value the employee's skills and are only accepted to continue in the labour market.

Table 6. Tests for Human Capital Theory and the Job Competition Model by age class

	Human Capital Theory H_o: $\beta_1 = \beta_2 = -\beta_3$	**Job Competition Model** H_o: $\beta_2 = \beta_3 = 0$
Age = 15-29	F (3, 537) = 70.691 $F_{1\%}(3, 537) = 5.500$	F (2, 537) = 0.607 $F_{10\%}(2, 537) = 4.645$
	H_o rejected ($p < 1\%$)	*H_o accepted*
Age = 30-44	F (3, 1.335) = 110.022 $F_{1\%}(3, 1.335) = 5.433$	F (2, 1.335) = 15.651 $F_{1\%}(2, 1.335) = 6.944$
	H_o rejected ($p < 1\%$)	*H_o rejected ($p < 1\%$)*
Age = 45-64	F (3, 911) = 49.994 $F_{1\%}(3, 911) = 5.468$	F (2, 911) = 11.861 $F_{1\%}(2, 911) = 6.960$
	H_o rejected ($p < 1\%$)	*H_o rejected ($p < 1\%$)*

Differently from the other sub-samples, gender is not a significant determinant of wage for younger workers. This results matches with the findings of Manning and Swaffield (2005) for the UK. Similarly to the Italian case, the Author underline that, despite insignificant wage gaps between men and women at the beginning of the career, after 10 years the average penalisation is over 20% of the hourly wage. Moreover, despite reduced the difference persists also after controlling for family responsibilities and contract.

Temporary contracts are particularly penalising for younger workers, with a reduction of 8.1% in comparison with 3.2% and 5.9% for the other two age groups, for which the coefficient is also less significant. The wage discrimination of temporary contracts already outlined for the whole sample becomes consequently even larger for younger employees. It has to be noted that temporary contracts involve 17% of the labour spells for sampled employees below 30, against 5% for those aged between 30 and 44 and 3% for over-45.

Firm size always has a significant and positive impact, but a contract with a large firm is particularly convenient at the beginning of the career. Among younger workers the traditional separation between blue collars and white collars has no more consequences on wage, substituted by the more dramatic polarisation between high-profile occupations (managers, professionals and technicians) and low-profile ones (all the remaining occupations). On the contrary, the return to occupation is still marked and varied for older employees.

In summary, the OLS estimates by age class confirm that the different distribution of the educational mismatch by age (Figure 1) goes along with significant differences in the determinants of wage.

Besides the results of the econometric estimates, also the parameters to appraise the model fit and explanatory power deserve a remark. All models in Table 5 present a high overall fit with data. The explained variance is always high, but the adjusted R^2 grows up from 0.352 (15-29 years), to 0.440 (30-44 years), to 0. 557 (45-64 years). In other words, the Mincerian model, also in the extended form, explains particularly well the wage determinants for employees in traditional labour contracts. On the contrary, the employment solutions entered by young workers, often based on innovative contents besides new contractual forms, apparently also call for new interpretive models.

6. *Concluding remarks*

The proposed analysis has shown the non negligible weight of educational mismatch in the Italian labour market, even if the percentage of workers claiming their job to be in line with their educational attainments is higher than in other developed countries. The

educational mismatch significantly affects the wage of employees. However, while the signs of those effects reflect the conclusions already proposed by other international studies, their much more limited amount witnesses the lower sensitivity of the Italian labour market to the role of the education system as a source of skills and capabilities. The OAC archive points out a further peculiarity of the Italian case, *i.e.* the dominance of undereducation against overeducation. Both the limited return to education and the wide diffusion of undereducation point at an economic system focused on traditional and scarcely dynamic industries, where learning-by-doing is often the main source of competence. Most sophisticated skills are hardly exploited, while career paths based on learning on-the-job are not penalised against formal education.

However, the overall picture results from significantly different sketches, as witnessed by the analysis of wage determinants by age class. In particular, the evidence on the pay penalty suffered by younger employees with temporary jobs contributes to the current debate about the relationship between fixed-term contracts and the development of professional careers. Data from the OAC archive point out that pay penalty is an additional disadvantage besides the lack of job security.

As in international literature, undereducation increases with age, while overeducation displays an opposite dynamics. Nonetheless, the 9.3% of overeducated employees in the 45-64 age group signals that at least a share of overeducation may represent a structural phenomenon, perhaps due to the bad functioning of the labour market for new entrants, which "locks" some individuals into less qualified positions along their whole career. Indeed, the estimate of the wage equation for younger workers shows the independence of rewards from educational mismatch, hence supporting the Job competition Model. At the same time, the analysis of wage determinants for older employees denies the substitutability of experience for education, while training as a remedy for undereducation is at least partially confirmed.

In summary, the proposed results confirm the limited openness to innovation by Italian firms. A relationship exists between the vocation of some firms to privilege traditional forms of labour organisation in traditional industries and the features of educational mismatch in Italy. In a traditional environment firms optimise their usage of human capital by recruiting employees with low-to-medium educational profile, who will resort to learning-by-doing in order to progressively develop the required skills. The policy measures to contrast the existing educational mismatch should take into account the national or local specificities of the phenomenon and take steps on both the demand and the offer side of the labour market. Policy measures to increase the offer of qualified labour by younger employees would simply amplify mismatch levels, if not accompanied by a proper evolution of manufacturing and industrial sectors.

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