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**Young graduate employees between educational mismatch and skill mismatch:
An empirical analysis based on REFLEX data**

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Abstract

By examining the determinants of different measures of mismatch for a sample of Italian younger university graduates, this paper provides additional evidence on the enabling factors and the obstacles to early matching in the labour market. After building up different education-based and skill-based indexes of alignment between required and provided skills, the paper explores the determinants of matching conditions. The proposed empirical analysis takes advantage of the Italian section of REFLEX, a dataset providing rich information on the education and the early careers of a sample of 1999-2000 young university graduates from 13 European countries and Japan. The results of the empirical analysis confirm the distinct information contents provided by measures of educational mismatch and skill mismatch and their differentiated impact on the earnings of university graduates. The analysis of the determinants of mismatch shows that the aggregate categories of overeducation and undereducation mask differentiated combinations of educational and skill mismatch, often affected by distinct drivers. This finding holds significant implications for policy tools aimed at mitigating mismatch in the labour market and, above all, its negative consequences for employers and employees. Attention should focus on segmented, multi-dimensional measures rather than on aggregate measures of overeducation, undereducation and matching.

1. Introduction

The match between required and provided skills plays a crucial role for economic growth. The alignment between skill demand and supply in the labour market supports firms in filling up vacant positions and cuts the costs of process re-engineering. Matched employees benefit from higher returns to their investment in education and training and enjoy higher satisfaction levels. In addition, matching in the labour market signals the success of public policies in support of education and vocational systems. The above advantages make the alignment between required and provided skills a desirable target and justify the large body of literature on this topic.

Probably due to the easier measurability, the larger availability of internationally comparable data and the relevance for policy makers, the majority of available studies resort on measures of educational mismatch to apprise the degree of alignment between required and supplied skills (Kiker *et al.*, 1997; Hartog, 2000). Nevertheless, a growing amount of evidence has been stressing the significant methodological and empirical problems posed by this proxy (Allen and van der Velden, 2005; Robst, 2007; Sgobbi and Suleman, 2011). First, no agreement so far has been reached on the best measure of educational mismatch. If some authors stress the superiority of objective criteria against subjective ones due to the lower risk of manipulation (Hartog, 2000), others underline that subjective criteria often allow to collect at lower cost information otherwise invisible to an external observer (Allen and van der Velden, 2005). Second, the measures of educational mismatch provided by different criteria are positively but only partially correlated (McGuinness, 2006). In addition, when measured as the correspondence between the duration of required and provided educational path the mono-dimensional nature of educational match does not account for the differentiated distribution of skills or preferences among individuals with the same educational qualification (Bauer, 2002; Robst, 2008; Lopes and Teixeira, 2009; McGuinness and Wooden, 2009; Cainarca and Sgobbi, 2011), the different contents of educational paths with similar duration (García-Aracil and van der Velden, 2008; Robst, 2007; Robst, 2008) or the difference between standard and actual time spent in the education system (Brynin and Longhi, 2009). In addition, a largely time-invariant measure such as educational qualification after entry in the labour market can hardly capture the dynamic nature of skills, for which accumulation, modification and obsolescence processes continue well beyond the exit from the education system (de Grip *et al.*, 2002; de Grip *et al.*, 2008; Crifo, 2008) and significantly affect labour mobility (Elliott and Lindley, 2006; McGuinness and Wooden, 2009; Mavromaras *et al.*, 2010).

The above limitations to the effectiveness of educational mismatch as a proxy for skill mismatch have triggered an increasing number of attempts to gauge the gap between required and provided skills based on more direct assessment of employee capabilities (see, e.g., Allen and van der Velden, 2001; Chevalier, 2003; Green and McIntosh, 2007; Chevalier and Lindley, 2009; Green and Zhu, 2010; McGuinness and Sloane, 2011; Sgobbi and Suleman, 2011). Skill-based measures of skill mismatch share several limitations with education-based assessments, including lack of agreement on measurement standards and possible biases due to the large use of self-assessment in empirical analyses.

Nevertheless, existing studies suggest that measures of skill mismatch could usefully complement educational mismatch by adding significantly different information (Allen and van der Velden, 2001; Green and McIntosh, 2007; McGuinness and Wooden, 2009; McGuinness and Sloane, 2011; Cainarca and Sgobbi, 2011; Sgobbi and Suleman, 2011).

Mainly focused on the implications of skill mismatch for employees, the existing analyses show that skill mismatch is a significant determinant of employee earnings (Green and Zhu, 2010; McGuinness and Sloane, 2011; Cainarca and Sgobbi, 2011; Sgobbi and Suleman, 2011) and employee satisfaction (Green and Zhu, 2010; McGuinness and Sloane, 2011). In addition, skill mismatch significantly conditions employee mobility paths (Groot and Maassen van den Brink, 2003; McGuinness and Wooden, 2009) and participation in training programmes (Verhaest and Omeij, 2006).

Provided that the benefits of an alignment between required and supplied skills extend well beyond employees to include employers and institutional actors, the analysis of the determinants of educational and skill match is expected to offer additional insight to improve quantitative and qualitative adjustment in labour markets. The studies of the determinants of educational mismatch were first stimulated by the theory of career mobility (Sicherman and Galor, 1990), which justifies increased rates of overeducation at the beginning of career as a temporary disadvantage targeted at faster subsequent career steps. The empirical findings that, contrary to the predictions, overeducation persists in the later stages of career for a declining but not negligible share of employees and that overeducation is not associated with more intense search for better employment stimulated further research on the determinants of employee overeducation (Tur-Sinai *et al.*, 2009). Past empirical studies have shown that the probability of overeducation decreases with experience in the labour market (Groot and Maassen van den Brink, 2003), with the quality of the attended educational institutions (Robst, 1995) and with a favourable family background (Verhaest and Omeij, 2010). Female employees and individuals subject to mobility constraints display higher probability of being overeducated (Büchel and van Ham, 2003). In addition, the contents of educational paths significantly affect the probability of educational mismatch (Robst, 2007).

The brief review provided above suggests that the probability of educational mismatch is path dependent (Dolton and Silles, 2008). Choices at the very beginning of career or even educational choices significantly affect the probability of future matching. Past literature also suggests that the outcomes of existing empirical analyses display sensitivity to the operative solution adopted for measuring mismatch in the labour market (Battu *et al.*, 2000; McGoldrick and Robst, 1996; Giret and Hatot, 2001; Verhaest and Omeij, 2010).

By examining the determinants of different measures of mismatch for a sample of Italian younger university graduates, this paper provides additional evidence on the enabling factors and the obstacles to early matching in the labour market. After building up different education-based and skill-based indexes of alignment between required and provided skills, this paper explores the determinants of matching conditions. The focus on higher education graduates, who represent a minor share of the overall labour force, is

justified by the higher costs absorbed by their education and their crucial role in shaping innovation trajectories within economic systems (see, e.g., Di Pietro and Urwin, 2006; García-Aracil and van der Velden, 2008; Chevalier and Lindley, 2009; McGuinness and Sloane, 2011). In addition, the growing differentiation of the jobs and tasks performed by higher education graduates in recent years (Ransom and Phipps, 2010) is often associated with task mismatch, which in turn increases the probability of overqualification (Rochery, 2011).

The proposed empirical analysis takes advantage of the Italian section of REFLEX, a dataset providing rich information on the education and the early careers of a sample of 1999-2000 young university graduates from 13 European countries and Japan. The results of the empirical analysis confirm the distinct information contents provided by measures of educational mismatch and skill mismatch and their differentiated impact on the earnings of university graduates. In addition, the empirical analysis supports the use of multi-dimensional measures by identifying significantly different drivers behind different combinations of educational and skill mismatch.

The rest of this paper is organised as follows. Section 2 reviews the empirical strategies proposed by literature to assess educational mismatch and skill mismatch. Section 3 calculates six different measures of mismatch for the sample of Italian university graduates included in the REFLEX database and compares the outcomes with the existing literature. After providing estimates of the return to educational mismatch and skill mismatch, Section 4 presents and discusses the determinants of educational and skill mismatch. Section 5 concludes the paper by outlining the main results and the future research lines.

2. Measuring mismatch in the labour market

Operative solution for the empirical assessment of mismatch in the labour market abound in literature. For our purposes, those methods can be conveniently grouped in three main categories, respectively including measures of educational mismatch, measures of skill mismatch and multi-dimensional approaches. According to the first category, by large the most popular one in labour economics, individuals are overeducated if their educational qualification is higher than required to do or to get their current job, undereducated if their educational qualification is lower than required and matched otherwise¹. Measures of educational mismatch are based on objective criteria when the quality of the match is judged by independent external experts or according to the requirements stated by job directories. Measures of educational mismatch are based on subjective criteria when overeducation, undereducation or matching are self-assessed by workers or by their supervisors.

Measures of skill mismatch signal underskilling when a worker does not own all the skills he or she needs to provide an effective performance, overskilling when not all skills are properly exploited in current job and matching otherwise. Also skill mismatch can be measured according to objective criteria, e.g. by performing standardised tests, or

¹ For a more extended discussion on the pros and cons of different approaches, see Hartog (2000). Allen and van den Velden (2005) and McGuinness (2006).

to subjective criteria, mainly involving self-assessment by workers. In addition, skill mismatch assessment can target either the whole set of required/provided capabilities or focus on specific knowledge domains.

The category of multi-dimensional methods includes a set of recently suggested empirical approaches that, acknowledging the only partial overlap between the information conveyed by education-based and skill-based measures, aim at assessing matching in the labour market by crossing different dimensions. For example, by crossing underskilling as a proxy for skill deficit with overskilling as a proxy for skill under-utilisation Allen and van den Velden (2005) identify four different types of skill mismatch, respectively named as wrong skills (characterised by the simultaneous presence of skill deficit and overskilling). skill shortage (skill deficit and no overskilling). skill match (no skill deficit and no skill underutilisation) and skill surplus (no skill deficit and overskilling)². Chevalier (2003) suggests to discriminate between ‘genuine’ and ‘apparent’ overeducation by crossing a measure of overeducation based on objective criteria with the satisfaction level expressed by workers. The underlying hypothesis is that, when coupled with high satisfaction, overeducation is not genuine and rather reflects a convenient arrangement for employees who may be endowed with lower skills compared to properly matched individuals with the same educational title or may prefer to focus their effort outside work. An additional multi-dimensional index is proposed by Green and Zhu (2010). who discriminate between ‘real’ and ‘formal’ overqualification by crossing an objective measure of overeducation with self-assessed overskilling. In case of adequate utilisation of skills and capabilities objective overeducation does not involve a bad match and the resulting situation had better be labelled as formal rather than real mismatch. The suitability of Green and Zhu’s approach is indirectly supported by Tur-Sinai *et al.* (2009) who, based on a sample of Israelite first-level graduates, show that individual cognitive abilities and quantitative reasoning skills negatively affect the likelihood of becoming overeducated.

Multi-dimensional methods represent a very promising development in the literature on mismatch in the labour market. However, those approaches often suffer from significant shortcomings. First, most of proposed approaches replicate the traditional bias of literature towards overeducation compared to undereducation (McGuinness, 2006, Tur-Sinai *et al.*, 2009). Given the risks posed to globalised economic systems by skill shortage in the labour force, undereducation and underskilling deserve as much attention as the more explored concepts of overeducation and overskilling. Second, the variables entering multi-dimensional indexes should be carefully checked for avoiding risks of endogeneity. For example, satisfaction may be endogenous with educational mismatch in Chevalier’s index of genuine and apparent overeducation. Third, indexes calculated by crossing variables originated by the same source are highly exposed to risks of common bias method. In addition, the richer information they require compared to mono-dimensional approaches obstacles the wide diffusion of those measures.

² For similar approaches, see also Green and McIntosh (2007) and Badillo Amador *et al.* (2008).

3. Educational mismatch and skill mismatch among Italian young graduates

A suitable database for calculating and comparing indexes of mismatch in all the three categories mentioned above is provided by REFLEX. The EU-funded REFLEX project (acronym for ‘Research into Employment and professional FLEXibility’) was carried out in 16 countries between 2005 and 2007 and aimed at assessing whether higher education graduates could meet the flexibility and competence challenges posed by the development of the knowledge society. As a part of the REFLEX project, over 34,000 graduates who completed a tertiary education study programme between 1999 and 2000 were interviewed in 2005³. The survey provides information on young graduates’ study programme, employment history (first job after graduation, job at the time of the interview and intermediate experiences), individual assessment of required and provided skills, individual and family background and study programme evaluation.

Thanks to the richness of the available information, the REFLEX database is particularly suited for calculating different indexes of mismatch in the labour market and for testing possible differences in the determinants of educational and skill mismatch. The REFLEX database includes 3,093 interviews to young Italian university graduates⁴ (see Table 1 for some descriptive statistics). Based on those interviews, this section calculates and discusses six indexes of mismatch in the labour market, including:

- a) educational mismatch based on an objective criterion;
- b) educational mismatch based on a subjective criterion;
- c) overskilling and underskilling;
- d) skill deficit vs. skill underutilisation;
- e) skill deficit by knowledge domain;
- f) apparent vs. genuine educational mismatch;
- g) real versus formal educational mismatch.

An index of objective educational mismatch was calculated by comparing the educational qualification declared by sampled graduates in employment⁵ with the ISCED-97⁶ educational level required by OECD (2007) for each occupation identified by the 1-digit International Standard Classification of Occupations (ISCO-88). An index of subjective educational mismatch is provided by the REFLEX questionnaire, which asks interviewees to identify the most appropriate type of education required by the positions they held immediately after graduating and at the time of the survey. The comparison between those measures of objective and subjective educational mismatch (Figure 1) shows that they provide virtually identical results in the assessment of overeducation (slightly above

³ Interviews were carried out in Austria, Belgium, Czech Republic, Estonia, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain and the United Kingdom. For additional information, see www.reflexproject.org.

⁴ The original REFLEX database includes 3,139 interviews to Italian higher education graduates. However, 46 interviewees declared they completed a higher education study programme either before January 1999 or after December 2000.

⁵ By 2005 a non negligible share of interviewees (21%, see Table 1) had achieved additional qualifications after completing a higher education study programme in 1999/2000. Actual educational qualifications have been updated accordingly.

⁶ ISCED is the acronym for International Standard Classification of Education.

27.5%). whereas the sampled graduates perceive much higher undereducation levels than those resulting from the 'objective' assessment of the educational needs of their roles (14.1% against 4.2%). This outcome, which may depend on the low self-confidence of individuals with still short experience in the labour market, highlights the need for a careful use of subjective measures with samples whose characteristics strongly deviate from the universe of the whole labour force. In line with other surveys on the Italian labour market (see, e.g., Cainarca and Sgobbi, 2009). the REFLEX data on younger graduates show matching levels much higher than those displayed for other industrialised countries (McGuinness, 2006; McGuinness and Sloane, 2011).

The REFLEX questionnaire asked higher education graduates to rate along a 1-5 point Likert scale the extent to which they made use of their knowledge and skills both in their first job and in their job at the time of the interview. In a similar way, graduates were asked to rate to what extent their work demanded more knowledge and skills than they could actually offer. Following past literature (Allen and van den Velden, 2001; Green and McIntosh, 2007). overskilling was recognised when workers declared low or very low use of their knowledge and skills, whereas underskilling corresponds to high or very high request for additional capabilities. The resulting indexes of underskilling and overskilling (Figure 2) suggest that skill mismatch is a more pervasive phenomenon than educational mismatch.

The analysis of skill mismatch types confirms that, contrary to most of their EU colleagues (Allen and van den Velden, 2001; McGuinness and Sloane, 2011). young Italian graduates recognise higher levels of skill shortage, but also significantly higher levels of matching. When crossing the dimensions of underskilling (skill deficit) with overskilling (skill under-utilisation). the Italian higher education graduates listed in the REFLEX dataset reproduce all the four categories of skill mismatch identified by Allen and van den Velden (2001). With 67.6% of interviewees, skill match represents the largest group (Figure 3). Skill shortage (high underskilling but no severe overskilling) affects 22.5% of interviewees, whereas skill surplus (no underskilling and high overskilling) is recognised by 8.8% of the sample. Eventually, a residual percentage of young graduates declare to be endowed with wrong skills for their job, due to a combination of both underskilling and overskilling.

Thanks to interviewee self-assessment of the importance played by 19 competences in their current job and of their own level of competence on a 1-7 point Likert scale, the REFLEX database allows exploring skill deficit by knowledge domain. More in detail, a factor analysis on the importance given to the 19 listed competences identified three factors corresponding to the knowledge domains of managerial skills, professional skills in own field and communication skills. Domain-specific indexes of skill deficit were calculated as the average difference between the importance and the individual proficiency scored by competences in each area (Figure 4). The analysis of skill deficit by competence area allows to detail the perception of overskilling and underskilling among the sampled graduates. Figure 4 displays a modest skill deficit in the domains of managerial and professional skills. In contrast, communication skills display an equally modest surplus. In

all identified knowledge domains skill deficit displays a negative significant correlation with overskilling and a positive significant correlation with underskilling. Anyway, correlation coefficients are always low (absolute values lower than 0.170).

Figure 5 reports the outcomes of applying Chevalier's (2003) approach to discriminate between genuine and apparent educational mismatch among young Italian graduates. Contrary to the original formulation, 'genuine' or 'apparent' membership is extended to the categories of matched and undereducated workers. By crossing objective educational mismatch in current employment with a dummy variable indicating high or very high satisfaction with the current job, the index reveals nuances in educational mismatch also in the case of Italian higher education graduates. Genuine undereducation is a marginal phenomenon, involving only 0.3% of interviewed workers. Virtually all undereducated individuals are satisfied with their job. Provided that almost all undereducated workers (103 out of 109 observations) graduated in the first stage of tertiary education (ISCED5), and that ISCED5 graduates still represented a marginal novelty in the Italian labour market when the REFLEX survey was carried out in 2005, this finding may result from an insufficient perceived differentiation in the professional profiles corresponding to ISCED5 and ISCED6 educational levels in similar knowledge domains. Apparent mismatch dominates over genuine mismatch also in the case of overeducation. Nevertheless, genuinely overeducated people represent almost 20% of sampled individuals affected by overeducation. In addition, both genuine and apparently overeducated workers include both ISCED5 and ISCED6 graduates. Figure 5 also highlights that not all workers whose educational attainment corresponds to the qualification required according to the OECD objective classification are happy with their matching: apparent matching affects 8.4% of sampled individuals.

An additional multi-dimensional measure of mismatch calculated for the REFLEX Italian sub-sample extends the concept of real and formal overqualification proposed by Green and Zhu (2010) to all types of educational mismatch, undereducation included. Accordingly, Figure 6 discriminates between real and formal overqualification, real and formal underqualification, real matching, matching with underskilling and matching with overskilling. Figures are reported for interviewees' first job (first column in Figure 6) and for the job held at the time of the interview (second column). This index clearly highlights the different information conveyed by direct measures of educational mismatch and skill mismatch and the value-added of mixed indicators. Formal overqualification and underqualification (i.e., educational mismatch not accompanied by claims of skill mismatch) largely prevail over real overqualification and underqualification and this trend accentuates between the first and the last job held after entry in the labour market. In addition, also individuals matched according to objective criteria often declare excess or, more frequently, insufficient skills compared to the needs of their organisational role. The comparison between the first and the second column in Figure 6 suggests that significant adjustments take place also in the early steps of the careers of higher education graduates. The area of real matching displays a substantial increase. However, this increase does not reflect a generalised decline of mismatch in all areas. Whereas real overqualification and

match with overskilling suffer a sizable reduction, the area of undereducation/underskilling is not affected.

A similar pattern can be observed when restricting the analysis of transitions between first and current job to objective educational mismatch. Table 2 shows a significant decline of overeducation (from 31% to 27.6% of sampled graduates) that mirrors a similar growth in matching (from 64.3% to 68%) and leaves the share of undereducation substantially unchanged, around 4.5%. Contrary to this pattern, the analysis of mismatch transitions as resulting from interviewee self-assessment (Table 3) reveals higher volatility, with the driving trend represented by the increasing inadequacy of educational attainments perceived by the sampled graduates. The higher volatility of subjective assessment compared to objective criteria is confirmed by the transition matrix for skill mismatch reported in Table 4. Only 57.3% of graduates in employment at the time of the interview declare the same type of skill (mis)match in their first and their current job. In addition, the overall increase of skill matching (from 57.6% to 67.4%) at the expenses of skill surplus (17.8% to 8.2%) results from the composition of multiple inter-category shifts.

4. Mismatch drivers

The measures of educational and skill mismatch reported in the above section witness a significant mismatch between demand and supply in the labour market of younger Italian graduates from tertiary education. Table 5 highlights the non negligible consequences of this mismatch on earnings by reporting the coefficients estimated for different measures of educational and skill mismatch in OLS wage regressions⁷. The regressions, estimated for the whole sample and separately for male and female workers, show general significance of mismatch coefficients, with the noticeable exception of direct appraisal of high overskilling and underskilling levels⁸.

The significant impact of mismatching on the wage of younger graduates confirms the lower value that firms recognise to their effort and justifies the exploration of the determinants of the observed mismatch. More in detail, the proposed analysis aims at understanding whether the segmentation of overeducation and undereducation in additional classes through multi-dimensional measures provides additional significant information on the determinants of educational mismatch and, in turn, on the viable solutions to control and limit this phenomenon. In order to achieve the above target, the REFLEX database has been used to estimate the determinants of mismatch in current job for a 'traditional' measure such as objective educational mismatch and for two multi-dimensional indexes, namely genuine vs. apparent educational mismatch and formal vs. real qualification mismatch. In line with the empirical literature on the determinants of educational mismatch

⁷ Higher education graduates not in employment at the time of the interview are obviously excluded from the analysis. A 2-step Heckman procedure where the probability of non employment was proxied for by a binary variable for children and by university final grade revealed no difference between employed and non employed individuals due to self-selection.

⁸ When mismatch is measured by a binary variable, estimated coefficients signal the relative advantage compared to a matched individual with the same educational level (McGuinness, 2006). Existing studies on the whole labour force usually report negative values for the coefficients of the variables measuring overeducation/overskilling and positive coefficients for the variables that assess undereducation/underskilling.

(see, e.g., Robst, 1995; Groot and Maassen van den Brink, 2003; Sohn, 2010; Verhaest and Omey, 2010). the proposed empirical estimates are based on multinomial models, with match as the reference category. Results are reported in Table 6 (objective educational mismatch). Table 7 (genuine vs. apparent educational mismatch) and Table 8 (formal vs. real qualification mismatch).

All the estimated models include three binary variables aimed at capturing the auto-regressive nature of mismatch, i.e. educational mismatch in first job after graduation, high underskilling in first job and high overskilling in first job. The coefficient of the dummy variable for educational mismatch in the first work experience after graduation is always highly significant and by large the most important determinant of mismatch in current position. Despite a significant share of higher education graduates initially mismatched managed to improve their matching five years after the graduation, the large majority of those still experiencing some type of mismatch were already suffering from educational mismatch at the very beginning of their career. This outcome highlights the crucial role of a careful choice of the initial position in order to improve matching along working life. The coefficients of the binary variables assessing initial skill mismatch (overskilling and underskilling) display lower significance and lower absolute values than educational mismatch. Contrary to expectations, unskilling in the first job increases the odds of objective overeducation in the current job, but also the probability of apparent overeducation against matching, as well as the probability of real and formal overqualification. The low and non significant correlation between initial underskilling and further investment in education allows to exclude that underskilled graduates enrol in additional educational programmes to fill up their knowledge gaps. A possible explanation is that university graduates who experience underskilling at their entry in the labour market tend to look for less demanding jobs possibly characterised by lower educational requirements and turn into overeducation. As expected, initial overskilling reduces the odds of future underskilling. However, it has to be noted that initial overskilling almost triples the odds of future overskilling coupled with objective overeducation (positive and strongly significant coefficient of initial overskilling for real overqualification in Table 8).

The estimated regressions include two different measures of professional competence at the early stages of career. The final grade obtained at university provides an objective measure of the capabilities acquired in higher education, whereas *Field_competence* is a self-assessment of the interviewee mastery of his or her field or discipline along a 1-7 point Likert scale. Both variables reduce the odds of overeducation/overqualification compared to matching. Nevertheless, high final grades at university reduce the probability of apparent overeducation and formal overqualification, while strong professional competences impacts on genuine overeducation and real overqualification.

The multinomial models account for the development of additional competences after entry in the labour market by introducing two binary variables that signal, respectively, formal vocational training in the 12 months before the interview and the acquisition

of additional educational titles⁹. The provision of recent training significantly increases the odds of undereducation. However, multi-dimensional indexes of mismatch (models in Tables 6 and 7) show that training programmes affect apparent rather than genuine undereducation and formal rather than real underqualification. In other words, in line with literature, vocational training substitutes for insufficient educational qualification and positively impacts on satisfaction levels and self-perceived effectiveness of undereducated individuals. In general terms, the attainment of additional educational qualifications after entry in the labour market significantly increases the odds of matching compared to both overeducation and undereducation (Table 6). Nevertheless, the analysis of segmented qualification mismatch (Table 8) shows more substantial and more significant effects in reducing the odds of severe skill mismatch.

Recent empirical studies have suggested that labour market conditions may influence the initial choices of new entrants and condition the subsequent evolution of their careers. Based on a sample of French, Italian and Spanish employees, Ortiz (2007) suggests that uncertainty in the labour market may induce employees to prefer permanent positions over temporary ones, also when higher employment security is associated with overeducation. To test the impact of initial labour contracts on the probability of subsequent mismatch, the estimated multinomial models include two dummy variables for temporary contract and part time contract at entry in the labour market¹⁰. Initial employment with a temporary contract is only weakly associated with genuine overeducation (Table 7), whereas a part-time job soon after university significantly increases the odds of real overqualification compared to matching (Table 8).

Existing empirical studies report consistent rates of overeducation among new entrants in the labour market, also in the case of graduates from higher education studies (Sloane *et al.*, 1999; Dolton and Vignoles, 2000; Allen and van den Velden, 2001; Di Pietro and Urwin, 2006). However, significant adjustments take place after entry also due to the higher propensity of overeducated employees to search for other work (Groot and Maassen van den Brink, 2003). Controls for industry change, firm change and tasks change between first and current job are consequently expected to reveal the drivers of early adjustment of educational and skill mismatch. Nevertheless, a move to another job may also increase mismatch in case of limited skill transferability across workplaces (Robst, 2007). The coefficients of the variables *Industry_change*, *Firm_change* and *Task_change* reveal a significant impact only on the odds of undereducation (Table 6). Inter-industry work change supports matching: a move to a different sector squeezes to almost one third the odds of undereducation compared to matching. On the contrary, competence disruption seems to prevail over mismatch adjustment effects in the case of firm and task change, which are positively and significantly associated with an increased probability of undereducation. The regressors qualifying work changes between first and cur-

⁹ Due to the lack of additional qualifications among individuals affected by genuine undereducation in current job, the regressor *Further_qualification* has been excluded from the estimate reported in Table 7.

¹⁰ Due to the absence of initial part-timers among individuals affected by genuine undereducation in current job, the regressor *Part-time_first* has been excluded from the estimate reported in Table 7.

rent job have a similar impact also on the odds of real underqualification compared to matching (Table 8).

Younger Italian university graduates working for the public sector experience higher probability of undereducation and lower probability of overeducation compared to their colleagues in private companies. This outcome, confirmed across the three estimates, may reflect the bureaucratic selection systems adopted by Italian public administrations, which limit the possibility of undereducation, and the concentration of high skilled jobs in specific areas of the public sector (e.g., education or health services). which reduces the odds of self-perceived overeducation and overskilling.

The last set of independent variables control for some individual characteristics of the sampled university graduates. The higher probability of overeducation experienced by female workers (Table 6) does not impact on their satisfaction levels (increased odds of apparent but not genuine overeducation in Table 7). However, female gender is positively associated with real besides formal overqualification (Table 8). In labour economics literature parents' education level is usually regarded as a proxy for slack resources that allow rejecting immediately available but inadequate work offers and waiting for better match opportunities. Experience as a part-time student is similarly regarded as a signal of lack of spare resources that may induce the acceptance of a sub-optimal matching after leaving the education system. The REFLEX data for Italian graduates substantially confirm past findings. The odds of undereducation significantly decrease when at least on parent has achieved a medium qualification (ISCED3 or ISCED4) or, to a larger extent, a high qualification (ISCED5 or ISCED6). The same impact is observed on the odds of real underqualification, suggesting that a favourable family background helps avoiding undereducation accompanied by perceived skill mismatch rather than generic undereducation. Experience as a part-time student confirms to increase the probability of overeducation, in particular when accompanied by low satisfaction levels (Table 7).

5. Concluding remarks

In line with past studies, the proposed analysis has confirmed the importance of educational mismatch among Italian young university graduates, despite the high share of matched individuals (67.9% five years after entry in the labour market) differentiates the figures for Italy from those of international literature. The high rates of overskilling and underskilling declared by interviewed workers (9.8% and 24.3%, respectively). only partially overlapped with over- and undereducation, make the Italian graduates of the REFLEX database a suitable case for testing differences in the information contents provided by complementary measures of educational mismatch, skill mismatch and mixed multi-dimensional indexes. The estimate of wage equations with different specification of mismatch confirmed the differentiated impact of educational and skill mismatch on the earnings of university graduates.

The analysis of the determinants of mismatch has highlighted that the aggregate categories of overeducation and undereducation mask differentiated combinations of educational and skill mismatch, often affected by distinct drivers. For example, the provided

estimate of the determinants of educational mismatch shows that final university grade is associated with lower odds of overeducation. However, when discriminating between real and formal overeducation according to the approach proposed by Green and Zhu (2010) a higher university grade predicts lower probability of overeducation only when overeducation is not accompanied by significant overskilling. In a similar way, task change increases the odds of undereducation at the aggregate level. Nevertheless, the separate exam of the impact on real and formal undereducation shows that a change in performed tasks increases the odds of undereducation only when actually involving skill disruption.

This finding holds significant implications for policy tools aimed at mitigating mismatch in the labour market and, above all, its negative consequences for employers and employees. Attention should focus on segmented, multi-dimensional measures rather than on aggregate measures of overeducation, undereducation and matching. The exploration of new indexes able to account for both educational and skill mismatch represent a promising area for future research.

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Table 1. Descriptive statistics

	N	Min	Max	μ	σ
ISCED5 diploma	3093	0	1	0.08	0.27
ISCED6 diploma	3093	0	1	0.92	0.27
Further qualification	3093	0	1	0.21	0.41
University grade/110	3052	0	110	103.11	7.18
High school grade/60	3017	36	60	49.56	7.36
Part-time student at university	3086	0	1	0.24	0.43
Graduates after 30 years of age	2802	0	1	0.10	0.30
Currently in employment	3086	0	1	0.86	0.35
Never in paid employment	3086	0	1	0.06	0.24
Experience [months]	1526	-1	422	60.25	34.48
Multiple employers after graduation	3093	0	1	0.50	0.50
Task change between first and current job	3093	0	1	0.43	0.49
Part time contract, last job	2527	0	1	0.06	0.24
Temporary contract, last job	2500	0	1	0.22	0.41
Last job = Manager	2803	0	1	0.01	0.12
Last job = Professional	2803	0	1	0.60	0.49
Last job = Technician	2803	0	1	0.20	0.40
Last job = Clerk	2803	0	1	0.16	0.37
Last job = Blue collar	2803	0	1	0.02	0.15
Firm size last job = 1-9	2264	0	1	0.26	0.44
Firm size last job = 10-49	2264	0	1	0.16	0.37
Firm size last job = 50-99	2264	0	1	0.09	0.29
Firm size last job = 100-249	2264	0	1	0.10	0.31
Firm size last job = 250-999	2264	0	1	0.11	0.31
Firm size last job = 1000 and over	2264	0	1	0.27	0.44
Female	2959	0	1	0.57	0.50
Age in 2005	2802	28	44	32.03	2.79
Children	2952	0	1	0.19	0.39
Highest parents qualification = ISCED 1+2	2903	0	1	0.37	0.48
Highest parents qualification = ISCED 3+4	2903	0	1	0.40	0.49
Highest parents qualification = ISCED 5+6	2903	0	1	0.23	0.42

Source: Italian 1999-2000 higher education graduates from the REFLEX database

**Table 2. Objective educational mismatch.
Transitions between first and current job**

		Objective educational msm, Current job				
		Undereducation	Match	Overeducation	Total	
Objective educational msm, First job	Undereducation	Count	100	11	1	112
		% of total	4.08	0.45	0.04	4.58
	Match	Count	2	1,493	80	1575
		% of total	0.08	60.99	3.27	64.34
	Overeducation	Count	6	161	594	761
		% of total	0.25	6.58	24.26	31.09
Total	Count	108	1,665	675	2,448	
	% of total	4.41	68.01	27.57	100.00	

**Table 3. Subjective educational mismatch.
Transitions between first and current job**

		Subjective educational msm, Current job				
		Undereducation	Match	Overeducation	Total	
Subjective educational msm, First job	Undereducation	Count	97	95	55	247
		% of total	3.98	3.89	2.25	10.12
	Match	Count	175	929	314	1418
		% of total	7.17	38.07	12.87	58.11
	Overeducation	Count	67	395	313	775
		% of total	2.75	16.19	12.83	31.76
Total	Count	339	1,419	682	2,440	
	% of total	13.89	58.16	27.95	100.00	

**Table 4. Skill mismatch.
Transitions between first and current job**

		Type of skill msm, Current job					
		Wrong skills	Skill shortage	Skill match	Skill surplus	Total	
Type of skill msm, First job	Wrong skills	Count	7	27	42	6	82
		% of total	0.29	1.10	1.71	0.24	3.34
	Skill shortage	Count	4	206	282	30	522
		% of total	0.16	8.39	11.49	1.22	21.27
	Skill match	Count	25	251	1,083	55	1,414
		% of total	1.02	10.23	44.13	2.24	57.62
Skill surplus	Count	6	73	246	111	436	
	% of total	0.24	2.97	10.02	4.52	17.77	
Total	Count	42	557	1,653	202	2,454	
	% of total	1.71	22.70	67.36	8.23	100.00	

Table 5. The return to education and skill mismatch

	All		Men		Women	
	β	Std. error	β	Std. error	β	Std. error
Objective educational mismatch (reference category: educational match)						
Overeducation dummy	-0.071	0.036	-0.063	0.056	-0.076	0.047
Undereducation dummy	-0.030	0.073	-0.216	0.112	-0.119	0.096
# obs.	1,097		526		571	
adj R2	0.294		0.235		0.303	
Subjective educational mismatch (reference category: educational match)						
Overeducation dummy	-0.075	0.026	-0.065	0.040	-0.080	0.035
Undereducation dummy	-0.004	0.037	-0.004	0.057	0.013	0.048
# obs.	1,076		521		555	
adj R2	0.298		0.235		0.302	
Overskilling/Underskilling (reference category: skill match)						
Overskilling	-0.061	0.038	-0.053	0.057	-0.058	0.052
Underskilling	0.003	0.028	-0.012	0.044	0.008	0.038
# obs.	1,088		525		563	
adj R2	0.293		0.231		0.294	
Skill mismatch (reference category: skill match)						
Skill surplus	-0.075	0.040	-0.070	0.061	-0.073	0.053
Skill shortage	-0.005	0.029	-0.022	0.045	0.000	0.038
Wrong skills	0.070	0.115	0.029	0.142	0.226	0.213
# obs.	1,088		525		563	
adj R2	0.293		0.230		0.295	
Skill deficit						
Managerial_deficit	0.035	0.015	0.028	0.022	0.030	0.021
Professional_deficit	-0.031	0.017	-0.033	0.026	-0.030	0.022
Communication_deficit	0.012	0.015	0.004	0.023	0.029	0.019
# obs.	1,060		518		542	
adj R2	0.302		0.225		0.325	
Apparent/Genuine objective educational mismatch (reference category: educational match)						
Genuine overeducation	-0.179	0.053	-0.134	0.083	-0.224	0.071
Apparent overeducation	-0.042	0.038	-0.039	0.062	-0.043	0.050
Genuine undereducation	0.095	0.173	0.341	0.239	-0.111	0.256
Apparent undereducation	0.034	0.075	0.209	0.115	-0.099	0.099
# obs.	1,084		521		563	
adj R2	0.303		0.244		0.308	
Formal/Real overqualification/underqualification (reference category: real match)						
Real overqualification	-0.168	0.058	-0.229	0.094	-0.133	0.074
Formal overqualification	-0.065	0.039	-0.030	0.061	-0.087	0.052
Qual. match with skill underutilisation	-0.025	0.054	0.042	0.074	-0.078	0.080
Qual. match with skill deficit	-0.036	0.033	-0.057	0.050	-0.027	0.045
Formal underqualification	0.073	0.082	0.223	0.121	-0.057	0.115
Real underqualification	-0.094	0.104	0.100	0.168	-0.221	0.130
	1,083		521		562	
	0.297		0.244		0.297	

Statistically significant coefficients in bold. OLS regressions. Dependent variable: $\ln(\text{gross monthly wage})$. Additional regressors account for type of higher education (ISCED5 or ISCED6), experience in the labour market (months), gender (all sample only), temporary contract in current job, weekly hours worked in current job, a subjective self-assessment of horizontal mismatch in current job, at least one parent holding a ISCED5/6 diploma, type of current job (5 binary variables), discipline field (9 binary variables) and firm size by class (6 binary variables).

Table 6. The drivers of objective educational mismatch

		β	Std. Error		Exp(β)
Overeducation	Intercept	2.944	1.447	**	
	edu_msm_first	4.374	0.181	***	79.395
	Underskilling_FirstJ	0.406	0.192	**	1.501
	Overskilling_FirstJ	-0.220	0.184		0.803
	Uni_grade	-0.020	0.012	*	0.980
	Field_competence	-0.004	0.067		0.996
	Recent_training	-0.146	0.160		0.864
	Further_qualification	-0.527	0.215	**	0.590
	Temporary_first	0.238	0.166		1.269
	Part_time_first	-0.018	0.427		0.982
	Industry_change	-0.112	0.220		0.894
	Firm_change	-0.253	0.192		0.777
	Task_change	0.154	0.205		1.167
	Public	-0.697	0.194	***	0.498
	Female_worker	0.359	0.165	**	1.432
	EduParent_Medium	-0.005	0.176		0.995
EduParent_High	0.170	0.219		1.185	
Ptime_student	0.315	0.182	*	1.370	
Undereducation	Intercept	-4.156	2.615		
	edu_msm_first	6.535	0.736	***	688.582
	Underskilling_FirstJ	0.402	0.323		1.494
	Overskilling_FirstJ	-1.065	0.378	***	0.345
	Uni_grade	0.012	0.021		1.013
	Field_competence	-0.090	0.113		0.914
	Recent_training	0.770	0.283	***	2.160
	Further_qualification	-1.665	0.535	***	0.189
	Temporary_first	-0.175	0.280		0.840
	Part_time_first	0.501	0.688		1.650
	Industry_change	-0.987	0.422	**	0.373
	Firm_change	0.770	0.327	**	2.159
	Task_change	0.944	0.338	***	2.570
	Public	0.486	0.298	*	1.626
	Female_worker	-0.194	0.281		0.824
	EduParent_Medium	-0.608	0.293	**	0.545
EduParent_High	-1.062	0.432	**	0.346	
Ptime_student	-0.786	0.340	**	0.455	

*Multinomial logit estimate. Dependent variable: objective educational mismatch in current employment (reference category = match). 2,039 observations. -2LogLikelihood = 1,592.362. Nagelkerke Pseudo R² = 0.666. ***=p<0.001; **=p<0.05; *=p<0.10.*

Table 7. The drivers of apparent/genuine mismatch

	β	Std. Error		Exp(β)	β	Std. Error		Exp(β)
	Genuine overeducation				Apparent overeducation			
Intercept	2.722	2.000			2.941	1.435	**	
edu_msm_first	3.863	0.295	***	47.586	4.484	0.198	***	88.627
Underskilling_FirstJ	-0.045	0.302		0.956	0.528	0.198	***	1.696
Overskilling_FirstJ	0.078	0.254		1.081	-0.275	0.191		0.760
Uni_grade	-0.017	0.017		0.983	-0.022	0.012	**	0.978
Field_competence	-0.175	0.094	*	0.840	0.031	0.070		1.031
Recent_training	-0.576	0.242	**	0.562	-0.075	0.166		0.927
Temporary_first	0.400	0.245	*	1.492	0.183	0.172		1.201
Industry_change	0.188	0.322		1.207	-0.248	0.228		0.780
Firm_change	-0.348	0.285		0.706	-0.186	0.199		0.830
Task_change	0.282	0.305		1.326	0.066	0.211		1.069
Public	-0.464	0.280	*	0.628	-0.824	0.201	***	0.439
Female_worker	0.181	0.240		1.198	0.438	0.171	***	1.550
EduParent_Medium	0.118	0.259		1.125	-0.093	0.182		0.911
EduParent_High	0.392	0.317		1.480	0.070	0.227		1.073
Ptime_student	0.525	0.256	**	1.690	0.284	0.189		1.328
	Genuine undereducation				Apparent undereducation			
Intercept	-1.318	6.698			-3.477	2.537		
edu_msm_first	4.250	1.127	***	70.123	5.715	0.536	***	303.420
Underskilling_FirstJ	0.635	0.900		1.886	0.368	0.322		1.445
Overskilling_FirstJ	-0.982	1.149		0.374	-1.031	0.386	***	0.357
Uni_grade	-0.040	0.054		0.961	0.012	0.022		1.012
Field_competence	-0.370	0.328		0.691	-0.073	0.112		0.929
Recent_training	0.379	0.849		1.460	0.746	0.284	***	2.108
Temporary_first	-0.090	0.839		0.914	-0.253	0.279		0.776
Industry_change	-1.317	1.197		0.268	-1.124	0.431	***	0.325
Firm_change	0.585	0.995		1.796	0.866	0.323	***	2.377
Task_change	-0.314	0.976		0.731	0.917	0.337	***	2.501
Public	1.385	0.829	*	3.997	0.269	0.295		1.309
Female_worker	-1.419	0.914		0.242	-0.084	0.281		0.919
EduParent_Medium	-1.765	1.129		0.171	-0.582	0.292	**	0.559
EduParent_High	-0.911	1.145		0.402	-1.069	0.436	**	0.343
Ptime_student	-1.129	1.137		0.324	-0.684	0.341	**	0.504

*Multinomial logit estimate. Dependent variable: Apparent/Genuine mismatch in current employment (reference category = match). 2,039 observations. -2LogLikelihood = 2,203.994. Nagelkerke Pseudo R² = 0.616. ***=p<0.001; **=p<0.05; *=p<0.10.*

Table 8. The drivers of real/formal mismatch

	β	Std. Error		Exp(β)	β	Std. Error		Exp(β)
	Real overqualification				Formal overqualification			
Intercept	4.295	2.270	*		1.864	1.532		
edu_msm_first	3.987	0.348	***	53.888	4.441	0.193	***	84.818
Underskilling_FirstJ	0.550	0.306	*	1.734	0.346	0.198	*	1.413
Overskilling_FirstJ	0.997	0.269	***	2.711	-0.532	0.194	***	0.588
Uni_grade	-0.023	0.019		0.977	-0.023	0.012	**	0.977
Field_competence	-0.323	0.102	***	0.724	0.076	0.070		1.079
Recent_training	-0.348	0.263		0.706	-0.129	0.165		0.879
Further_qualification	-1.157	0.441	***	0.314	-0.421	0.221	*	0.656
Temporary_first	0.182	0.268		1.199	0.263	0.172		1.301
Part_time_first	1.290	0.528	**	3.633	-0.756	0.528		0.470
Industry_change	-0.058	0.344		0.944	-0.170	0.228		0.844
Firm_change	-0.179	0.316		0.836	-0.228	0.198		0.796
Task_change	0.166	0.332		1.180	0.114	0.211		1.121
Public	-0.733	0.330	**	0.481	-0.648	0.201	***	0.523
Female_worker	0.668	0.270	**	1.950	0.337	0.170	**	1.400
EduParent_Medium	-0.083	0.275		0.921	-0.012	0.182		0.988
EduParent_High	-0.071	0.365		0.931	0.281	0.226		1.324
Ptime_student	0.262	0.286		1.300	0.310	0.188	*	1.364
	Real underqualification				Formal underqualification			
Intercept	-6.833	2.958	**		1.485	4.303		
edu_msm_first	5.734	0.616	***	309.083	5.133	0.766	***	169.594
Underskilling_FirstJ	-0.104	0.380		0.901	1.265	0.458	***	3.541
Overskilling_FirstJ	-1.223	0.448	***	0.294	-0.565	0.614		0.569
Uni_grade	0.021	0.024		1.022	-0.035	0.035		0.966
Field_competence	-0.058	0.125		0.944	-0.147	0.183		0.864
Recent_training	0.479	0.309		1.614	1.488	0.529	***	4.429
Further_qualification	-1.699	0.646	***	0.183	-1.610	0.846	*	0.200
Temporary_first	0.233	0.311		1.262	-1.297	0.477	***	0.273
Part_time_first	0.112	0.842		1.118	0.532	0.926		1.702
Industry_change	-1.058	0.498	**	0.347	-0.827	0.657		0.437
Firm_change	0.676	0.354	**	1.966	1.267	0.566	**	3.549
Task_change	1.062	0.379	***	2.893	0.486	0.519		1.627
Public	0.274	0.335		1.315	1.281	0.460	***	3.601
Female_worker	-0.341	0.310		0.711	0.412	0.469		1.509
EduParent_Medium	-0.927	0.336	***	0.396	0.097	0.452		1.102
EduParent_High	-0.925	0.460	**	0.397	-1.097	0.822		0.334
Ptime_student	-0.782	0.391	**	0.457	-0.750	0.531		0.473

*Multinomial logit estimate. Dependent variable: Real/Formal mismatch in current employment (reference category = match). 2,039 observations. -2LogLikelihood = 2,139.361. Nagelkerke Pseudo R² = 0.643. ***=p<0.001; **=p<0.05; *=p<0.10.*

Figure 1. Objective and subjective educational mismatch
(current job)

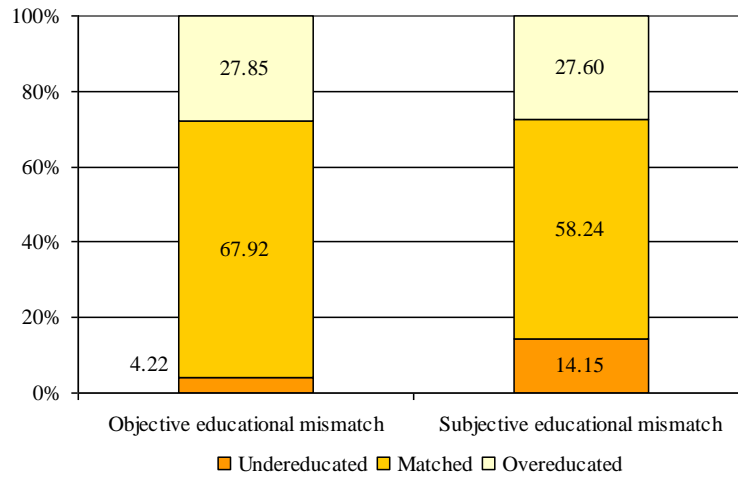


Figure 2. Overskilling and underskilling
(current job)

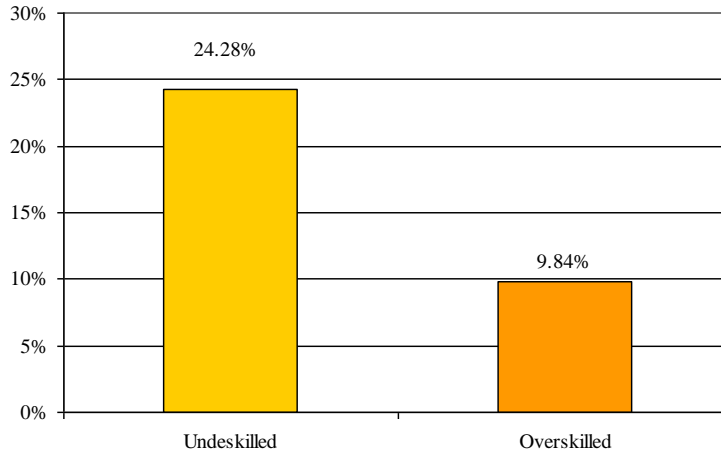


Figure 3. Skill deficit vs. skill underutilisation
(current job)

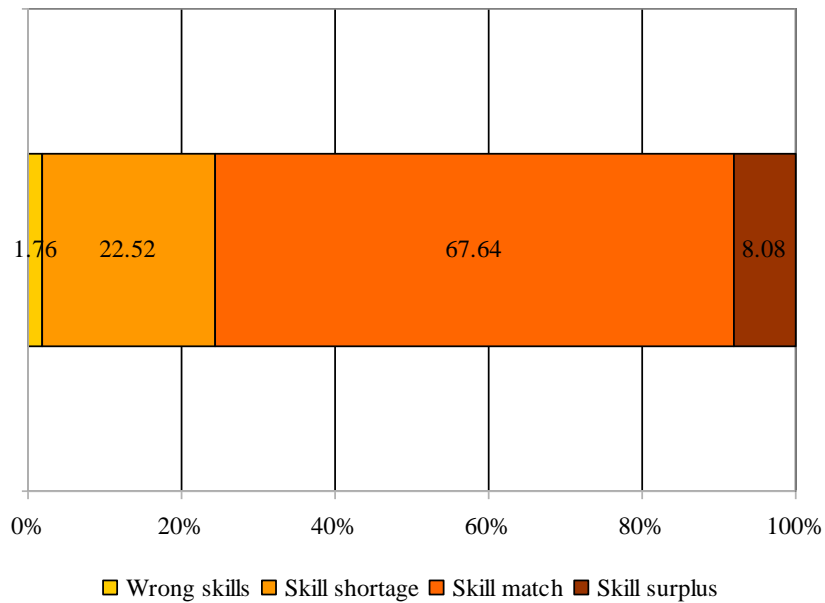
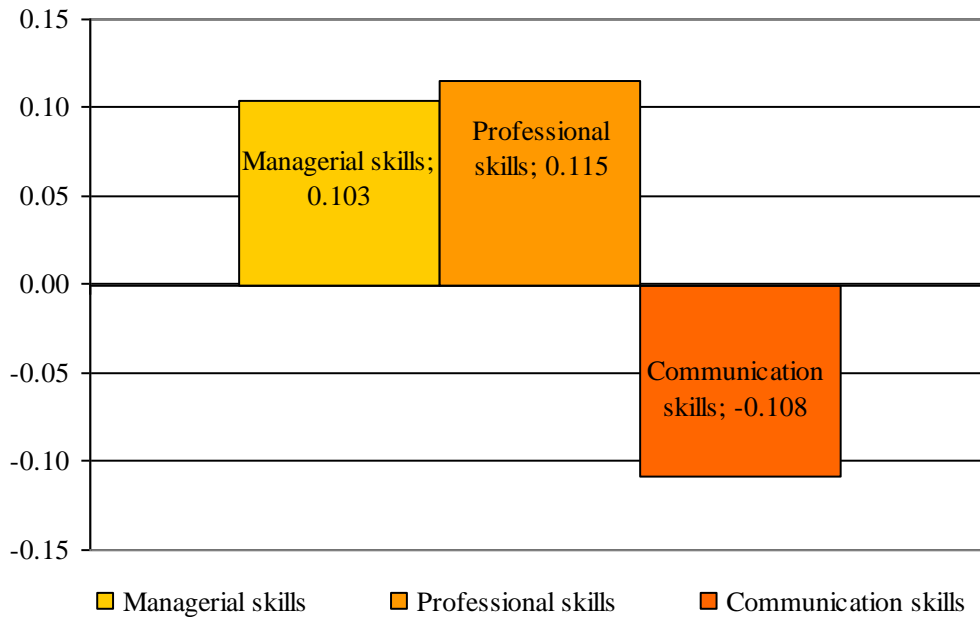
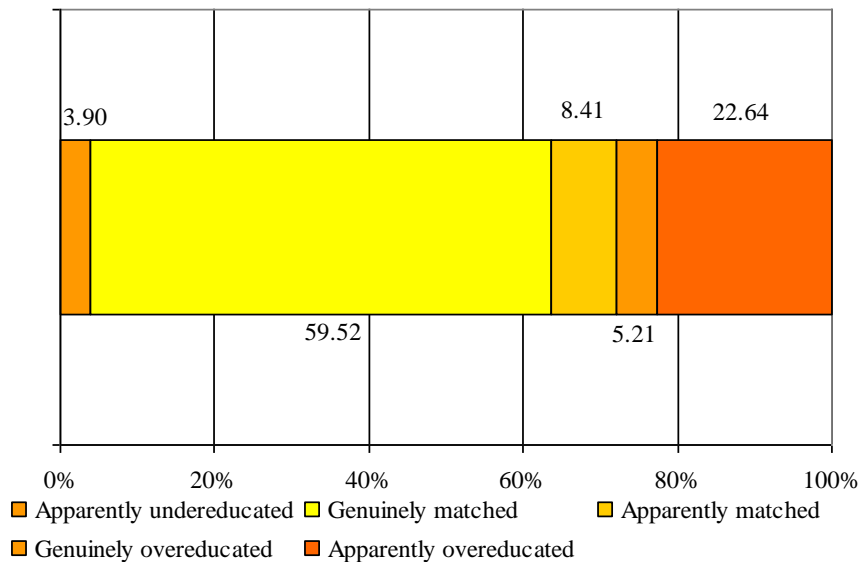


Figure 4. Skill deficit by knowledge domain
(current job)



Difference between skill importance in employee job (1-7 scale) and employee proficiency (1-7 scale)

Figure 5. Apparent and genuine educational mismatch
(current job)



Residual category of genuinely undereducated graduates (0.33% of sample) omitted

Figure 6. Real and formal overqualification
(current job)

