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Drivers of skill mismatch among Italian graduates: The role of personality traits

Piero Esposito[a] *and Sergio Scicchitano*[b]

Abstract

It is now well accepted that human capital is a heterogeneous aggregate and that non-cognitive skills are at least as relevant as cognitive abilities. In spite of this growing interest in the labour market consequences of personality traits, the relationship between these and educational and skill mismatch is scant. In this paper, we investigate the impact of the five main personality traits (Big 5) on educational and skill mismatch in Italian graduates. To this aim, we use the 2018 wave of the INAPP-PLUS survey, which contains information on skill mismatch, on the Big 5 personality traits, and on a large number of other individual and job-specific characteristics. The empirical analysis takes into account both demand and supply variables mediating the effect of personality on skill mismatch and controls for non-random selection into employment and tertiary education. We find that some personality traits reduce the probability of overeducation, suggesting complementarity between cognitive and non-cognitive skills. In addition, we find a positive effect of conscientiousness on both overeducation and overqualification. The evidence regarding job satisfaction suggests that individuals with high scores for conscientiousness voluntarily decide to be mismatched when this entails higher satisfaction in other dimensions of the job.

JEL codes: C25, J24, J31, J82,

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1. Introduction

Human capital is the key element in all analyses of economic growth (Barro, 2001). Technological development is transforming the labour market, and the number of jobs associated with monotonous and uncreative activities is decreasing. There is a growing need for workers with advanced cognitive and non-cognitive characteristics who are able to combine professional expertise and the ability to effectively communicate with colleagues and clients (Deming, 2017). In a world characterized by pervasive technological change and global uncertainty, the nature of jobs and demand for skills change continuously and workers need to update their own human capital. Failure to adapt to these changes may result in loss of competitiveness, underemployment and low wage growth. Therefore, investigating the determinants and effects of skill mismatch is extremely important for the implementation of economic policies tailored to technological transition.

It is now well accepted that human capital is a heterogeneous aggregate and that non-cognitive skills are at least as relevant as cognitive abilities. Heckman et al. (2006) report that 'personality, persistence, motivation, and charm matter for success in life'. In fact, there is now considerable evidence that these traits—in addition to cognitive ability and academic achievement—are relevant determinants of economic success. This represents an important shift in the modern conception of human capital, moving beyond brains and brawn to incorporate a broad set of psychosocial traits (Lundberg, 2019). This change in perspective has stimulated a large body of literature investigating the effect of personality on labour market outcomes. The inclusion of non-cognitive skills in the assessment of labour market outcomes also allows minimizing the set of omitted variables, thus reducing the unobserved heterogeneity among individuals with the same level of skills (Blazquez and Budría, 2012).

Most research has focused on educational choices (Koch et al., 2015) with respect to specific traits such as motivation, self-esteem, the tendency to avoid competitive environments and the so-called 'present bias' (Steel, 2007). Some personality traits are found to be important predictors of educational outcomes and human capital accumulation (Flippin and Paccagnella, 2012; Lindahl et al., 2014). Other studies have found significant effects on job performance, wages (Nyhus and Pons, 2005; Cobb-Clark and Tan, 2011; Wells et al., 2016) and unemployment risk (Caliendo, 2015; Blásquez and Budría, 2017; Egan et. al., 2017). In spite of this growing interest in the labour market consequences of personality traits, the

relationship between these and educational and skill mismatch is scant and focused on the educational component of such mismatch (Sohn, 2010; Blázquez and Budría, 2012; Palzckinska, 2019a).

The aim of this paper is to contribute to this literature by investigating the impact of the five main personality traits (Big 5) on educational and skill mismatch among Italian graduates. Two questions are relevant here. To what extent do personality traits affect mismatch among highly educated Italian workers? Are there significant differences between educational and skill mismatch?

The Italian case is peculiar since the country is characterized by high degrees of both educational and skill mismatch (Cedefop, 2020) and appears to lag behind other countries in the digitalization process. The Programme for the International Assessment of Adult Competencies (PIAAC) survey carried out by the OECD has shown that Italy is one of the countries with the highest rates of both overqualification and underqualification (OECD, 2016). The OECD (2017) highlights that skill mismatch is so pervasive as to prevent Italy from leaving its 'low-skills low-quality trap'. Thus, promoting skills assessment and anticipation to reduce skill mismatch is reported as one of the main challenges for the country. Italy also lags behind in terms of technological change. The latest data from the Digital Economy and Society Index (DESI) confirm this, as the country ranks 21st among the 28 considered,[1] with a particularly disappointing score for human capital (European Commission, 2021).

The high level of skill mismatch in Italy is the result of both supply-side and demand-side factors (Esposito and Scicchitano, 2020). Specialization in low-tech sectors (Basso et al., 2019), entailing a high share of routine-intensive jobs, as well as the large-scale use of low-cost and temporary labour contracts among Italian firms (Cetrulo et al., 2019) has led to substantial overeducation, especially among tertiary-educated workers (Marcolin et al., 2018). As for supply-side determinants, alongside academic performance and cognitive skills, the choice of fields of education characterized by a high degree of mismatch is a major cause (Caroleo and Pastore, 2018).

In this paper, we provide micro-level evidence on the relationship between personality and skill mismatch by taking into account the main demand and supply factors affecting this relationship. To this aim, we use the National Institute for Public Policy Analysis' (INAPP) Participation, Labour and Unemployment Survey (PLUS) for the year 2018. PLUS contains information on several characteristics of the labour force and allows us to build different measures of educational and skill mismatch using self-reported

[1] DESI is a composite index that measures the digital performance of countries in Europe on the basis of 5 areas: connectivity, human capital, use of internet, integration of digital technology and digital public services.

information or revealed matches. In addition, the survey further allows building measures of personality traits matching the Big 5 classification using the Ten Item Personality Inventory (TIPI; see Costa and McCrae, 1992).

The paper contributes to the existing literature in three ways. To begin with, this is the first study on the relationship between personality traits and qualification mismatch among the highly educated in Italy. Second, we take into account a large number of demand-side factors obtained through worker reports of job and firm characteristics. The role of these factors has been left largely unexplored by the previous literature on skill mismatch. Third, we analyse the role of personality in overqualification defined broadly, thus providing additional insight with respect to the previous literature focused on overeducation only.

The remainder of the paper is structured as follows. In Section 2, we review the main literature on labour market outcomes, overeducation and personality traits. In Section 3, we provide descriptive evidence on the distribution of personality traits for well-matched and mismatched workers classified according to a broad range of characteristics. Section 4 describes the econometric strategy, discusses the results of the empirical model and presents robustness checks. Section 5 provides summary conclusions and policy implications.

2. Big 5 personality traits, educational choices and labour market outcomes: a survey

Recently, the economics literature has started to focus on the importance of non-cognitive skills in determining educational (Koch et al., 2015) and labour market outcomes (Heckman et al., 2006; Carneiro et al., 2007; Borghans et al., 2008; Heckman and Kautz, 2012; Burks et al., 2015, Cobb-Clark, 2015; Caliendo et al., 2019; Golsteyn and Magnée, 2020; Glewwe et al., 2022). It is indeed well recognized that personality traits are strong predictors of socioeconomic success (Borghans et al., 2008; Almlund et al., 2011; Palczyńska, 2020). Among others, Heckman et al. (2006) find that non-cognitive skills are at least as relevant as cognitive abilities in determining a number of adult outcomes. Lindqvist and Vestman (2011) use data based on personal interviews conducted by a psychologist during the Swedish military enlistment exam and find that low levels of non-cognitive abilities are more associated with unemployment or low earnings, while cognitive ability is highly correlated with wages for skilled workers. Segal (2013) uses data on young men from the US National Education Longitudinal Survey and finds that eighth-grade misbehaviour is relevant for earnings, over and above eighth-grade test scores.

Looking at child socio-emotional traits, Conti et al. (2010) show that children's cognitive traits are stronger predictors of employment and wages than socio-emotional traits or early health.[2]

The analysis of the Big 5 personality traits was introduced by Costa and McCrae (1992). Since then, it has been widely applied—along with measures of knowledge and intelligence—to investigating academic achievements and job performance. The emerging evidence is that conscientiousness is by far the best personality predictor of grades, years of education, leadership ratings and job performance, especially for semi-skilled and unskilled workers (Schmidt and Hunter, 2004), who rely less on cognitive skills. Self-control, perseverance and other aspects of conscientiousness such as risk aversion are found to be major contributors to success in school and in life (Steel, 2007; Lindahl et al., 2014). The positive effect of conscientiousness is confirmed by studies on job performance and wages (Hogan and Holland, 2003; Nyhus and Pons, 2005; Cobb-Clark and Tan, 2011; Wells et al., 2016), as well as research on unemployment determinants (Caliendo, 2015; Blázquez and Budría, 2017; Egan et. al., 2017) and female labour market participation (Wichert and Pohlmeier, 2010).

Other studies have found that neuroticism as defined in the Big 5 (which is negatively related to emotional stability) is another important trait. Nyhus and Pons (2005) have shown that emotional stability predicts higher wages, for example. Hogan and Holland (2003) have also shown measures of emotional stability to be potent and general predictors of job performance (inversely). Finally, Big 5 extraversion is found to significantly increase employment probability (Wichert and Pohlmeier, 2010; Blázquez and Budría, 2017; Egan et. al., 2017), whereas the evidence on agreeableness shows opposite results. A recent study (Gensowski et al., 2021) found that personality affects the gender wage gap because of the higher prevalence of neuroticism among women in early life, when life-changing decisions have to be made.

Few studies have focused on the Italian case. Corazzini et al. (2021) analyse the university performance of Italian students and find that high levels of conscientiousness and openness to experience lead to better performance. Topino et al. (2021) find a moderately positive effect of conscientiousness on job satisfaction. Bonacini et al. (2021a) use PLUS data and find that openness and conscientiousness improve educational and occupational skills, whereas agreeableness acts in the opposite way. The authors also find substantial heterogeneity in the effect of Big 5 personality traits among Italian macro-regions.

Moving to the relationship between personality traits and skill mismatch, the main reason for the emergence of such a relationship lies in employer evaluations of non-cognitive skills. If cognitive and

[2] It has been shown that socio-emotional skills are significant predictors of health and health behaviours (Attanasio et al., 2020).

non-cognitive skills are complements, the lack of some specific personality traits might lead to overeducation. In other words, workers whose educational attainment is above the level predicted by their cognitive skills might struggle to find jobs in line with their cognitive skills. Alternatively, the failure of employers to recognize positive non-cognitive skills might lead to overqualification and a lack of proper career development. These two effects have different policy implications: in the case of overeducation, efforts should be directed at improving non-cognitive skills before entering the labour market; in the case of overqualification, labour market policies aimed at improving the quality of worker–job matches would be required.

The literature on the subject is still scant. Few studies have focused on overeducation (Sohn, 2010; Blásquez and Budría, 2017; Palczyńska, 2021), and no studies exist on the other dimensions of skill mismatch. Sohn (2010) analysed the relationship between overeducation and internal locus of control in the United States. Internal locus of control is defined as the degree of control individuals have over their own lives. It is a predictor of labour market success and is also highly correlated to all Big 5 traits.[3] The main finding is a significant effect of locus of control on future earnings, but not on the probability of being overeducated. Blázquez and Budría (2012) used longitudinal data on German households to analyse the effect of the Big 5 traits and external locus of control on overeducation. The authors found that conscientiousness, extraversion and having an external locus of control decrease the probability of being overeducated, while openness increases it. However, all these effects decline with an increase in the level of schooling, which is in line with the evidence on the greater importance of non-cognitive skills for individuals with low educational attainment. Palczyńska (2021) estimates the wage penalty due to overeducation in Poland and uses Big 5 personality traits as determinants of selection into overeducation. The results show that personality traits cause overeducation, but only among workers up to 28 years of age. In particular, agreeableness is found to significantly increase the probability of overeducation, whereas conscientiousness reduces it.

In this paper, we provide the first empirical evidence on the relation between personality traits and skill mismatch in Italy. By using a worker-level database containing self-assessed information on the Big 5 personality traits for a large number of workers in 2018, we are able to substantially increase the sample size compared to most existing studies. In addition, the database is extremely rich in terms of

[3] An external locus of control is positively correlated with openness, conscientiousness, extraversion and agreeableness, whereas is it negatively correlated with neuroticism.

socioeconomic characteristics, thus allowing us to control for competing explanations of overeducation and overqualification. Finally, to our knowledge, this is the first study focusing on overqualification.

3. Data and descriptive evidence

The data used in this article come from the eighth Labour Participation and Unemployment Survey (PLUS), a sample survey of the Italian labour supply developed and administered by the National Institute for Public Policy Analysis (INAPP).[4] The primary objective of PLUS is to provide reliable statistical estimates of phenomena that are rare or marginally explored by other surveys on the Italian labour market. The eighth wave of the survey was carried out in 2018 on a sample of about 45,000 individuals. In our analysis, we restrict the sample to 8145 graduates between 20 and 65 years of age.[5]

For our purposes, PLUS is particularly useful as it provides information on measures of educational and skill mismatch as well as on Big 5 personality traits. Skill mismatch, and more specifically overqualification (OQ), is self-assessed through the following question: To what extent are your skills suitable for the job you perform? Individuals are classified as overqualified if their answer is either 'slightly above' or 'well above' and are classified as well-matched otherwise. Self-assessed measures of skill mismatch have been widely used in recent years (Boll et al., 2016; Munoz-de Bustillo-Lorente, 2018) as worker perceptions can include information that is not captured by other measures, in particular with regards to a more precise understanding of work requirements. The disadvantage is that self-assessed measures are subject to so-called self-reporting bias due to the fact that individuals might misestimate the requirements of a job or their own skill (McGuinness, 2006).

To analyse the effect of personality on the different dimensions of overqualification, we complement overqualification with a measure of overeducation (OE) calculated using the standard revealed-match approach.[6] More precisely, we calculate the number of years of education for each individual and compare this to the median years of education for workers belonging to each occupation calculated at the 2-digit International Standard Classification of Occupations (ISCO) level. Workers are classified as overeducated if their years of education exceed the occupation-specific median by more than one

[4] The INAPP-PLUS data are available by accessing https://inapp.org/it/dati/plus.
[5] For further details on the survey, see Filippetti et al. (2019), Meliciani and Radicchia (2016) and Bonacini et al. (2021).
[6] See, for example, Caroleo and Pastore (2018)

standard deviation. Revealed-match measures of educational mismatch have the advantage of being easily implemented, as data on educational attainments by profession are widely available.

Personality traits are measured by using self-assessed information from the Ten Item Personality Inventory (TIPI) measure of the Big 5 framework, which currently receives considerable support and has become the most accepted and widely used model of personality (John and Srivastava, 1999). The TIPI, originally introduced by Gosling et al. (2003) and adapted for Italy by Chiorri et al. (2015), is one of the simplest multi-item instruments to include in a socioeconomic survey. It assumes that individual differences in adult personality characteristics can be described in terms of five broad trait domains: extraversion, agreeableness, conscientiousness, neuroticism and openness to experience.[7] Gosling et al. (2003) demonstrate that the TIPI reaches adequate levels in terms of (i) convergence with widely used Big 5 measures in self-, observer, and peer reports, (ii) test–retest reliability, (iii) patterns of predicted external correlates and (iv) convergence between self- and observer ratings. The TIPI includes two questions for each Big 5 category, assessing the positive and negative aspects of each trait. Individuals are asked to rate their perceived level on a scale from 1 to 7. We aggregate the two measures into a single trait by inverting the negative component (1=7; 2=6; …; 7=1) and adding it to the positive component. Each trait ranges from a minimum of 2 to a maximum of 14. The list of all traits and facets is reported in Table 1.

Table 1 Definition of personality traits

Big 5	Positive	Negative
Openness (OP)	Open to experience (OX)	Conservative (CN)
Agreeableness (AG)	Loving/altruistic (LA)	Litigious (LI)
Conscientiousness (CO)	Self-disciplined (SD)	Careless/disorderly (CD)
Extraversion (EX)	Exuberant (ET)	Quiet/private (PV)
Neuroticism (NE)	Anxious (AN)	Emotionally stable (ES)

Source: own elaboration on PLUS 2018 data.

In Figure 2, we report the differences in Big 5 personality traits for the two measures of skill mismatch and for the main socioeconomic groups identified in the literature as showing important differences in personality. Considering the two measures of skill mismatch, we can see that overqualified workers show higher scores on all traits except neuroticism, with particularly strong differences for openness and

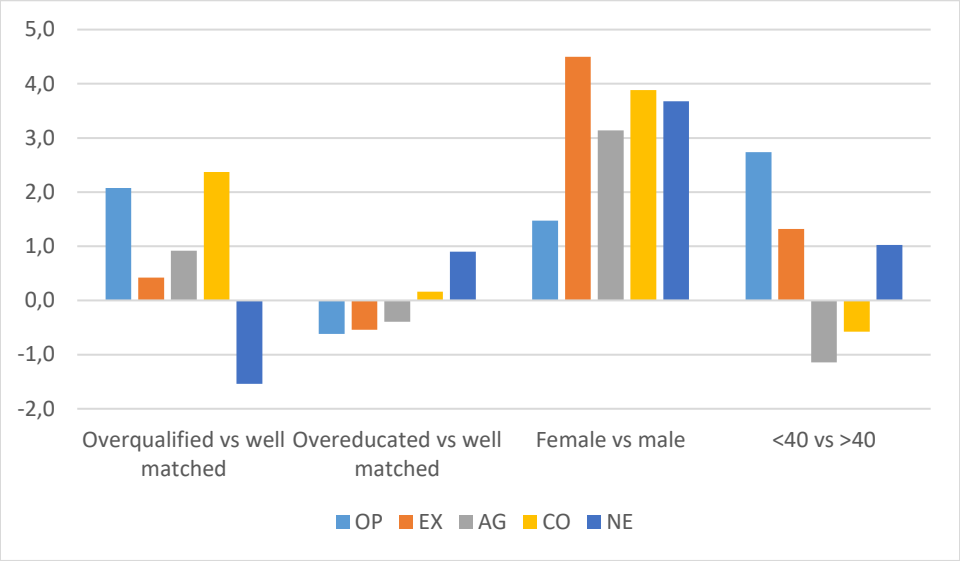
[7] A number of rating instruments have been produced to measure the Big 5 dimensions. The most comprehensive is the 240-item structure proposed by Costa and McCrae (1992), but the 100-item inventory (Goldberg 1992), the 60-item inventory (Costa and McCrae 1992), and the 44-item Big 5 inventory (John and Srivastava 1999) have also been investigated.

conscientiousness when compared to well-matched workers. The picture is completely inverted when looking at overeducation: overeducated workers show lower scores on openness, extraversion and agreeableness, whereas higher scores are reported for neuroticism.

These differences can be explained by looking at the information content of the two measures. Overeducation is typically considered a signal of low skills (Baert et al., 2013; Baert and Verhaest, 2019) compared to educational attainment. Thus, in the case of complementarity between cognitive and non-cognitive skills, low scores in desirable traits lead to overeducation. Overqualification signals that workers do not use their endowment of cognitive and non-cognitive skills—not only those acquired during tertiary education. A demand-side explanation for overqualification is, therefore, that non-cognitive skills might not be valued by employers, especially for high-skill occupations. In addition, some personality traits may lead to voluntary overqualification. For example, individuals with high scores in openness might be inclined to acquire new knowledge and experiences not related to a specific job. This means that they might not seek a perfect match between occupation and skill endowment. By the same token, high scores in conscientiousness might be associated with risk aversion and occupational choices that, while in line with educational attainment, might be driven by the search for other characteristics such as stability and work–life balance.

Moving to the analysis of different groups, female workers show higher scores on all traits, in line with the findings of Gensowski et al. (2021), while workers in Mezzogiorno, where lagging areas are located, are less open and neurotic but more agreeable and conscientious. As for age groups, workers below 40 years of age are more open and extraverted than older workers, and they also show higher levels of neuroticism.

Figure 2 Differences in Big 5 scores by main category

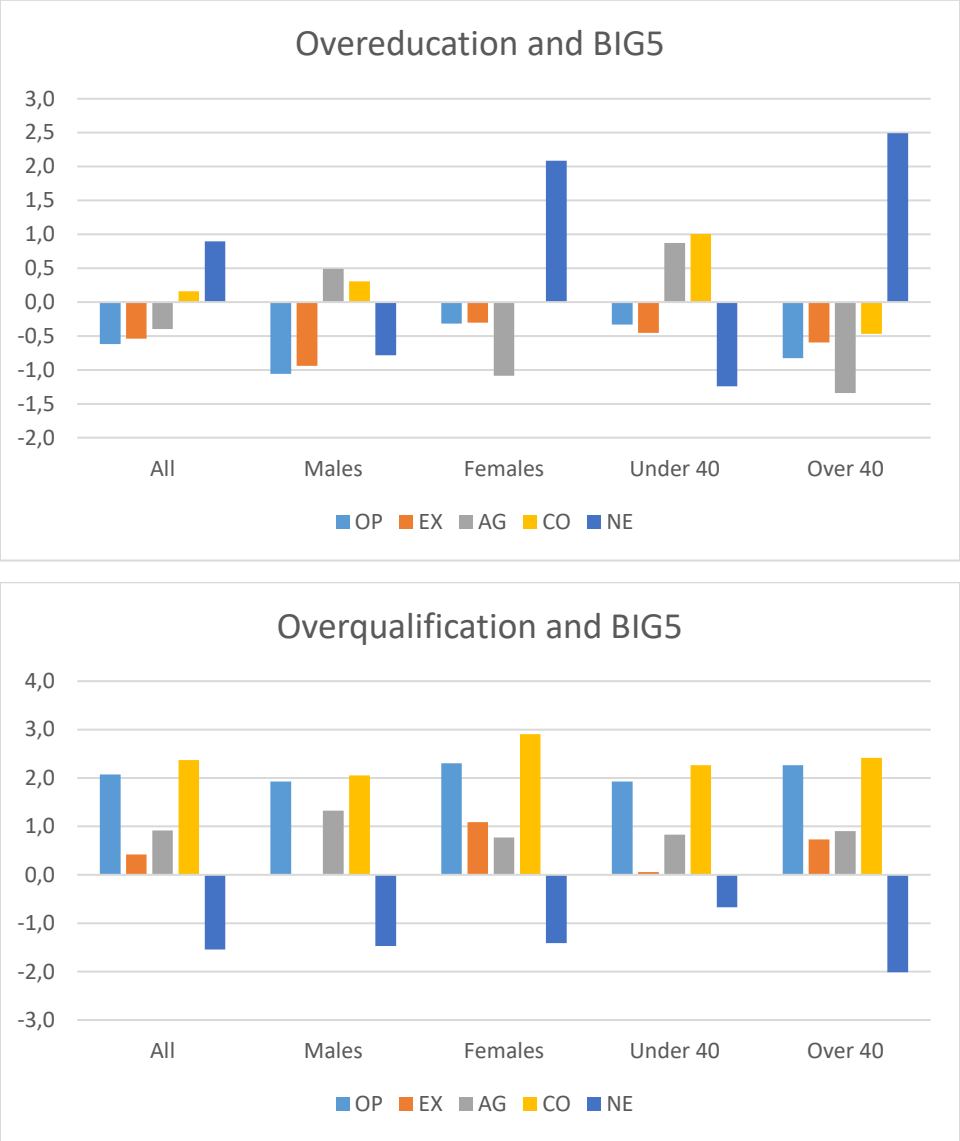


Source: own elaboration on PLUS 2018 data.

In Figure 3 (upper panel), we focus on overeducated and overqualified workers and show differences with well-matched workers according to the above-defined social groups. Starting with overeducation, we find that overeducated female workers show higher scores for neuroticism and lower scores for openness, agreeableness and extraversion. Overeducated male workers, instead, show lower scores for neuroticism compared to well-matched peers, whereas they have similar results for the other traits. Lower extraversion is found for overeducated workers in the Centre-North, whereas in Mezzogiorno overeducation is associated with lower openness, higher extraversion and higher neuroticism. Looking at the two age groups, overeducated workers below 40 years of age show a lower degree of neuroticism and both higher agreeableness and higher conscientiousness, whereas among older workers overeducation is associated with lower scores in all desirable characteristics, including emotional stability (the inverse of neuroticism). While for older workers the association between overeducation and a lack of positive personality traits is clear, this evidence is less clear-cut among young workers due to the fact that overeducation in the early stages of one's career is, in many cases, temporary and related to a lack of labour market experience.

Moving to overqualification (Figure 3, lower panel), overqualified workers show higher scores in all positive traits, and differences with well-matched workers are rather uniform across groups. Differences are particularly marked with respect to openness and conscientiousness among female workers and workers in Mezzogiorno.

Figure 3 Differences in Big 5 scores between well-matched and overqualified/overeducated workers by main category



Source: own elaboration on PLUS 2018 data.

To sum up, the descriptive evidence seems to confirm the role of personality traits in determining overeducation and overqualification. More specifically, overqualified workers tend to have high scores for all positive traits, whereas overeducated workers show a higher presence of negative traits, in particular among female workers, workers in southern regions and workers above 40 years of age. Hence, this preliminary evidence is in line with the assumption that non-cognitive skills are important for labour market outcomes. However, the prevalence among the overqualified of traits typically associated with

success in career and life is somehow unexpected. The empirical analysis in the next section will allow us to further investigate these results.

4. Econometric analysis

In the empirical analysis, we assess the impact of personality traits on the probability of being overeducated or overqualified. To this aim, we begin by estimating a standard probit model where the probability of being mismatched is estimated as a function of personality traits, alongside individual characteristics chosen according to the main empirical literature on the determinants of mismatch. The estimated equation is the following:

$$PM_i = \sum \beta_k PT_i^k + \sum \gamma_h X_i^h + \varepsilon_i, \qquad (1)$$

where *PM* is the dummy for skill mismatch (alternatively, overqualification and overeducation), *PT* are the Big 5 personality traits (OP, AG, CO, EX, NE) and X^h is a vector of h individual-specific characteristics. These include birth sex (female), age, macro-region (four categories), field of education (13 categories) and two measures of academic performance given by one's graduation mark and a dummy equal to 1 for late graduation (Aina and Pastore, 2020). The latter represents individuals belonging to the last tertile of the distribution of the number of years to graduation for each degree. To control for socioeconomic background as a determinant of educational choices and occupational outcomes (Caroleo and Pastore, 2018), we introduce information on parents' educational attainments (primary, secondary, tertiary) and father's occupation (low-, medium- or high-skill, according to the ISCO classification).

In a second step, we take into account the mediating effect of job characteristics and other variables related to the demand side, the exclusion of which might bias the results. Alongside standard determinants such as the type of contract and job tenure, which account for career development and the acquisition of on-the-job skills, overeducation might be the result of skill obsolescence due to technical change, in particular among routine jobs. In Italy, routine-intensive jobs are widespread and an important share of graduates are employed in these occupations, most of whom end up being overeducated (Marcolin et al., 2016; Esposito and Scicchitano, 2020). Firm hiring and firing dynamics might also affect the probability of both overeducation and overqualification. Hiring and firing behaviour reflects firms' growth strategies and causes a change in the internal organization of a firm. In addition, it can reflect a strategy of cost minimization though the use of temporary contracts to fill low-quality jobs, which are

usually highly routine (Cirillo et al., 2017; Cetrulo et al., 2019). Both lead to a higher probability of overeducation.

To take into account the above-mentioned characteristics of labour demand and other potential sources of demand-side heterogeneity, we augment the previous models with the following variables: type of contract (open-ended, fixed-term, self-employed, other), tenure, sector of activity (10 categories), firm size (micro, small, medium, large and public), whether the firm hired or fired workers in the two years before the survey (2016–2018), a measure of routine intensity of the occupation,[8] and whether the firm introduced any innovation in the last two years. The formal specification is the following:

$$PM_i = \sum \beta_k PT_i^k + \sum \gamma_h X_i^h + \sum \theta_n Y_i^n + \varepsilon_i, \qquad (2)$$

where the vector *Y i*ncludes the above-defined job and labour-demand characteristics.

In a third step, we look at the interaction between cognitive and non-cognitive skills in determining skill mismatch. Interaction effects allow understanding whether the effect of personality traits is non-linear with respect to cognitive skills. For example, similarly to the results of Schmidt and Hunter (2004), (cognitively) low-skilled graduates might benefit more from non-cognitive skills than high-skilled ones. To measure cognitive skills, we use a dummy variable equal to one if the graduation mark is below 100/110, corresponding to percentage scores of 90% and below,[9] and interact it with the Big 5 personality traits.

$$PM_i = \sum \beta_k PT_i^k \cdot (Mark_i > 100) + \sum \gamma_h X_i^h + \varepsilon_i \qquad (3)$$

$$PM_i = \sum \beta_k PT_i^k \cdot (Mark_i > 100) + \sum \gamma_h X_i^h + \sum \theta_n Y_i^n + \varepsilon_i \qquad (4)$$

A number of elements might bias the estimates from equation (1). The main concerns refer to the non-random selection of individuals into employment and tertiary education. Overeducation is often the result of a lack of skills, but for the same reasons individuals might face a lower degree of employability. To

[8] The measure is calculated by aggregating scores for 18 job requirements divided into cognitive, routine, and manual tasks. Perceived routine intensity is calculated as the share of routine tasks on total tasks.
[9] This threshold includes less than 30% of graduates.

overcome this issue, we estimate a Heck-probit (Heckit henceforth) model whereby equation (1) is estimated jointly with a selection equation assessing the probability of being employed. In order to obtain reliable results, suitable exclusion restrictions, i.e. variables affecting the probability of being employed but not exerting any direct effect on the probability of mismatch, are required. Therefore, we rely on two instruments: first, a self-assessed measure of health status, since health problems might lead to discontinuous employment or inactivity; second, we use marital status and add a dummy for married individuals, both alone and interacted with gender. This takes into account the different employment incentives of married people and the constraints faced by married females (Michaud and Tatsiramos, 2005). The selection equation takes the following form:

$$EMP_i = \sum \beta_k PT_i^k + \sum \gamma_h X_i^h + \sum \theta_n Y_i^n + \varphi_1 health_i + \varphi_2 Married_i + \varphi_3 Married_i x Female_i + e_i, \quad (5)$$

where *EMP* is the dummy for employed individuals. The right-hand side (RHS) includes all regressors of equation (1) and the three exclusion restrictions. The validity of the selection model is based on the correlation between the residuals of equations (1) and (5).

A second potential source of bias comes from the non-random selection of individuals into tertiary education. While personality traits and socioeconomic status are important determinants of educational choices (Koch et al., 2015), other unobserved factors affecting these choices might be correlated with unobserved factors determining overeducation and overqualification.

To take into account this issue, we estimate a Heckit model where the determinants of overeducation are estimated jointly with the determinants of tertiary education. Exclusion restrictions for the selection equation should affect overeducation and overqualification only though educational choices. Plausible choices, given the availability of information in PLUS, are health status—similar to the selection into employment—and a measure of time preferences. Health status might affect educational choices by constraining the time and effort allocated to education. Time preference is an important determinant of educational choice since it affects the motivation to work for long-term results (Koch et al., 2015). Individuals with a strong time preference are expected to be less likely to enrol in tertiary education, instead preferring to join the labour force. Since the selection procedure requires all regressors in the main equation to be included in the selection equation, we exclude from the *j* original regressors in equation (1) the variables related to academic career, namely, mark, late graduation and field of education. The resulting system of equations is the following:

$$PM_i = \sum \beta_k PT_i^k + \sum \gamma_h X_i^{h\prime} + \sum \theta_n Y_i^n + \varepsilon_i; \qquad (6)$$

$$Ter_i = \sum \beta_k PT_i^k + \sum \gamma_h X_i^{h\prime} + \sum \theta_n Y_i^n + \psi_1 health_i + \psi_2 TimePref_i + \upsilon_i, \qquad (7)$$

where *Ter* is a dummy equal to 1 if a worker holds a tertiary degree. All estimates are performed on the total sample of tertiary-educated workers. However, to take into account potential sources of heterogeneity, we also run the estimates separately for young graduates (below 40 years of age) and for male and female workers. Standard errors are clustered according to sector of activity and geographical region.

4.1 Results

In this section, we discuss the results of probit estimates of equations (1) to (4).[10] In Table 3, we report the results of the basic specification with individual characteristics only. For each of the two measures of mismatch, we show results for the whole sample, for the two groups of workers below and above 40 years, as well as for males and females.

Starting with the effects of the Big 5, the probability of being overqualified is positively affected by openness and conscientiousness, whereas it is negatively affected by neuroticism. Conscientiousness is also the only trait significantly affecting overeducation. A worker with the maximum score for conscientiousness (i.e. 14) faces an increase of 3 percentage points (0.005x6) in the probability of being overeducated with respect to an individual with a median score (i.e. 8). Regarding overqualification, this gap increases to 9 percentage points. A similar difference in openness increases the probability of being overqualified by 6 percentage points, while neuroticism reduces it by 2.4 percentage points. The results for overqualification are consistent across groups, although we detect a greater impact of conscientiousness for female workers. The effect of neuroticism is concentrated among workers above 40 years of age. As for overeducation, the positive effect of conscientiousness is driven by workers above 40 and women. For these same groups, we also find a negative effect of agreeableness.

Socioeconomic background seems to play a significant role only for overqualification. More precisely, low-skilled parents are associated with a higher probability of being overqualified, while no significant

[10] Table A1 in the Appendix reports estimates using the Ten Item Personality Inventory.

effect is found for overeducation. As for the other controls, age is positively related to overqualification and negatively to overeducation. The former can be explained by the acquisition of additional skills during one's working life as result of training, experience and the accumulation of job-specific human capital. The latter is a standard result in career mobility theory (Sichermann and Galor, 1990; Baert and Verhaest, 2019; Esposito and Scicchitano, 2020) as young overeducated workers, in general, tend to improve the quality of the match over time. Female workers tend to be less overqualified, while the propensity to be overeducated depends on age: young women are more likely to be overeducated, whereas women above 40 are less likely to be overeducated. Finally, there is a clear negative relationship between academic performance, on the one hand, and overeducation and overqualification on the other. This is shown by the positive impact of the late graduation dummy and the negative impact of the graduation mark.

Table 3 Determinants of overqualification and overeducation

	Overqualification					Overeducation				
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.010***	0.010*	0.011**	0.012**	0.009**	0.001	-0.001	0.003	-0.001	0.002
	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
EX	0.001	0.000	0.001	-0.003	0.003	-0.003	-0.005	-0.002	-0.004	-0.003
	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]
AG	-0.001	0.001	-0.003	-0.001	-0.002	-0.002	0.005	-0.007**	0.006	-0.009**
	[0.003]	[0.004]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
CO	0.014***	0.013**	0.015***	0.009*	0.019***	0.005*	0.000	0.009**	0.002	0.007**
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
NE	-0.004*	0.000	-0.007*	-0.006	-0.003	0.001	-0.003	0.002	-0.004	0.003
	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
Father LS	-0.003	-0.038	0.031	0.047	-0.04	0.034	0.038	0.030	0.047	0.02
	[0.023]	[0.033]	[0.032]	[0.037]	[0.030]	[0.021]	[0.032]	[0.029]	[0.035]	[0.027]
Father MS	-0.026	-0.056*	0.005	-0.010	-0.041	0.03	0.013	0.039	0.015	0.039
	[0.020]	[0.029]	[0.028]	[0.032]	[0.026]	[0.018]	[0.028]	[0.024]	[0.029]	[0.024]
Mother LS	0.005	0.084**	-0.063*	-0.014	0.014	-0.036*	-0.028	-0.043	-0.084**	-0.001
	[0.023]	[0.032]	[0.033]	[0.038]	[0.030]	[0.021]	[0.031]	[0.029]	[0.035]	[0.027]
Mother MS	0.035*	0.091***	-0.017	0.034	0.033	-0.014	0.010	-0.036	-0.023	0.001
	[0.020]	[0.028]	[0.030]	[0.032]	[0.026]	[0.019]	[0.027]	[0.026]	[0.030]	[0.024]
Father med.	0.03	-0.01	0.055**	0.027	0.034	0.014	0.008	0.019	0.007	0.021
	[0.019]	[0.029]	[0.024]	[0.030]	[0.024]	[0.017]	[0.028]	[0.021]	[0.028]	[0.021]
Father high	0.001	-0.036	0.030	0.01	-0.004	-0.013	-0.04	0.007	-0.047	0.013
	[0.024]	[0.035]	[0.032]	[0.038]	[0.030]	[0.022]	[0.035]	[0.028]	[0.036]	[0.027]
Age	0.003***	0.007***	0.004**	0.002**	0.003***	-0.007***	-0.008***	-0.006***	-0.005***	-0.008***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.000]	[0.002]	[0.001]	[0.001]	[0.001]
Female	-0.024*	-0.018	-0.031*			-0.002	0.045**	-0.027*		
	[0.014]	[0.021]	[0.018]			[0.013]	[0.020]	[0.016]		
Late grad.	0.055***	0.055*	0.050**	0.061**	0.044*	0.078***	0.092***	0.067***	0.094***	0.063***
	[0.013]	[0.024]	[0.017]	[0.020]	[0.018]	[0.013]	[0.025]	[0.015]	[0.019]	[0.017]
Mark	-0.001	0.000	-0.002	0.000	-0.002*	-0.003***	-0.005***	-0.001	-0.002	-0.004***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
N	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122

Marginal impacts. Standard errors in brackets. * p<0.10 **, p<0.05, *** p<0.01.

In Table 4, we show the results of the specification with demand-side controls. The main differences in the effects of personality traits are, first, the insignificant impact of conscientiousness on the probability of women being overeducated and, second, the changes in the effect of extraversion. The latter is no longer significant for women and older workers, but it becomes positive and significant for workers below 40 years of age and for males. This last result is particularly interesting at it shows that net of demand-side factors such as sector of performance, contractual arrangement and tasks characteristics, agreeableness tends to penalize young workers.

As for socioeconomic background, we find that having a father with a low or medium educational attainment increases the probability of being overeducated. The difference with regard to the previous results suggests that socioeconomic background matters not so much in the choice of a specific career but, rather, in selecting better jobs within occupations (Goldthorpe and Jackson, 2008). The effects of the other regressors remain broadly unchanged when adding demand-side controls. The latter show effects in line with expectations, in most cases, especially with respect to the effect of technology-related regressors. The introduction of innovation reduces the risk of overeducation, whereas routine intensity increases it. Interestingly enough, working for a firm that fired workers in the two years prior increases both forms of mismatch, especially for young workers and women, whereas hiring new workers does not show a significant impact on the two forms of mismatch.

In Table 5, we show the results of the specifications with interactions between personality traits and cognitive skills, the latter being measured by the dummy for marks below 100/110. For the sake of space, we only show marginal impacts of personality traits. In the specification without demand-side controls (upper panel), the effect of openness on overqualification is uniform across categories; the higher significance for high-mark students is likely to be due to the higher number of observations in this category (70%). The effect of conscientiousness on overqualification is stronger for high-mark graduates, although the differences are not highly significant. Furthermore, we find that workers above 40 years of age and women with high scores in neuroticism are less likely to be overqualified if their graduation mark is high.

As for overeducation, the positive effect of conscientiousness, for the whole sample and for women, is significant among low-mark graduates only. This means that low-skilled graduates scoring high in

conscientiousness are more likely to be overeducated. In addition, the negative effect of agreeableness on women's risk of overeducation is stronger for low-mark workers.

Moving to the specification with demand-side controls (lower panel), the previous results are broadly confirmed and further show that the negative effect of extraversion on the overeducation risk of young workers is concentrated among those with low graduation marks. The same applies for the positive effect of agreeableness on workers below 40 years of age and on males.

Summing up, the results are in line with the assumption that non-cognitive skills, as measured through personality traits, matter for the skill-mismatch problem. Extraversion among young workers is an important trait to reduce the risk of overeducation of graduates, and low-skilled ones in particular. An opposite effect is exerted by agreeableness, and this is in line with the main findings in the literature (Blázquez and Budría, 2017; Egan et. al., 2017). A possible explanation for this result is that specific dimensions of agreeableness, such as modesty, compliance and tender-mindedness might result in a less career-oriented attitude, especially in highly competitive environments. Agreeableness, however, is associated with a lower probability of overeducation for females and older workers when demand-side controls are excluded. This suggests that individuals within these categories with high scores in agreeableness tend to choose jobs characterized by low levels of overeducation.

We also find that high scores in conscientiousness are associated with a higher risk of overeducation among workers with a low graduation mark. This result is puzzling and goes against the main evidence (Blásquez and Budría, 2012; Palczyńska, 2021). A possible explanation might be that individuals with high levels of conscientiousness do not look exclusively at the match with formal education when choosing a job and also look at other desirable characteristics. To find evidence for this argument, Figure A1 in the Appendix shows self-assessed scores for different dimensions of job satisfaction for overeducated and well-matched workers, further divided according to their scores for conscientiousness (>11 vs all others). The evidence is straightforward and shows that overeducated workers with high scores in conscientiousness are more satisfied than other overeducated workers across all dimensions. In addition, in most cases their satisfaction is similar or higher than that of well-matched peers, especially in terms of working time, workload, safety and work–life balance. This suggests that overeducation might be a voluntary choice by conscientious workers when it comes with higher job satisfaction, and in particular for low-mark graduates, who are less likely to successfully compete for the most wanted jobs.

The same explanation can be applied to overqualification. As shown in Figure A2, there is evidence—although less marked—of higher job satisfaction for overqualified workers scoring high in conscientiousness. Thus, it is possible that the search for stability and other desirable chrematistics leads to voluntary overqualification.

The effect of openness on overqualification cannot be explained by the same argument. As shown in Figure A3, high scores for openness are not associated with higher levels of job satisfaction among overqualified workers. In this case, the explanation might be that openness is not rewarded by employers in terms of career development, as it may be associated with lower attachment to the job and, thus, lower effort.

Table 4 Determinants of overqualification and overeducation: specification with demand-side controls

	Overqualification					Overeducation				
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.011***	0.012**	0.011**	0.013**	0.010**	0.002	0.001	0.002	0.000	0.002
	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
EX	0.001	-0.001	0.002	-0.003	0.004	-0.003	-0.007**	0.000	-0.003	-0.003
	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]
AG	0.000	0.003	-0.003	0.001	-0.001	0.001	0.008**	-0.004	0.007*	-0.003
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
CO	0.014***	0.014**	0.014***	0.008*	0.019***	0.004*	0.000	0.008**	0.000	0.004
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
NE	-0.005*	0.000	-0.009**	-0.007*	-0.005*	0.000	-0.003	0.002	-0.006*	0.004
	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]
Father LS	0.000	-0.038	0.035	0.052	-0.037	0.045**	0.032	0.051*	0.059*	0.035
	[0.024]	[0.034]	[0.032]	[0.038]	[0.030]	[0.020]	[0.030]	[0.026]	[0.033]	[0.024]
Father MS	-0.022	-0.051*	0.010	-0.002	-0.04	0.042**	0.017	0.056**	0.033	0.051**
	[0.020]	[0.029]	[0.028]	[0.032]	[0.026]	[0.017]	[0.026]	[0.022]	[0.028]	[0.021]
Mother LS	-0.005	0.070**	-0.068**	-0.016	-0.001	-0.041**	-0.047	-0.035	-0.066**	-0.028
	[0.024]	[0.033]	[0.033]	[0.038]	[0.030]	[0.019]	[0.029]	[0.026]	[0.032]	[0.023]
Mother MS	0.029	0.080**	-0.021	0.029	0.025	-0.017	-0.004	-0.028	-0.015	-0.016
	[0.021]	[0.028]	[0.030]	[0.032]	[0.027]	[0.017]	[0.025]	[0.024]	[0.027]	[0.021]
Father med.	0.029	-0.005	0.052**	0.029	0.032	0.009	0.009	0.009	0.011	0.003
	[0.019]	[0.030]	[0.025]	[0.031]	[0.024]	[0.016]	[0.027]	[0.020]	[0.028]	[0.019]
Father high	0.006	-0.028	0.034	0.024	-0.006	-0.008	-0.024	0.006	-0.020	-0.005
	[0.024]	[0.036]	[0.032]	[0.039]	[0.030]	[0.021]	[0.033]	[0.026]	[0.036]	[0.024]
Age	0.003***	0.007**	0.004**	0.002*	0.004**	-0.002**	-0.004	-0.001	-0.004**	-0.001
	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Female	-0.039**	-0.029	-0.050**			-0.001	0.036*	-0.019		
	[0.014]	[0.021]	[0.019]			[0.012]	[0.020]	[0.015]		
Self-empl.	-0.045*	-0.056*	0.024	-0.058	-0.042	-0.067**	-0.058*	-0.094*	-0.070*	-0.072**
	[0.027]	[0.031]	[0.057]	[0.044]	[0.033]	[0.021]	[0.027]	[0.045]	[0.036]	[0.025]
Other	-0.095***	-0.127***	-0.048	-0.090*	-0.103**	-0.200***	-0.198***	-0.197***	-0.163***	-0.218***
	[0.025]	[0.034]	[0.038]	[0.039]	[0.034]	[0.020]	[0.030]	[0.029]	[0.032]	[0.026]
Fixed term	-0.044*	-0.024	-0.078*	-0.059	-0.032	-0.044*	-0.036	-0.069*	-0.085**	-0.02
	[0.022]	[0.027]	[0.043]	[0.038]	[0.027]	[0.018]	[0.024]	[0.034]	[0.033]	[0.019]
Tenure	0.000	0.001	0.000	0.001	0.000	-0.001	0.002	-0.001*	0.001	-0.002*
	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]

Part-time	0.074***	0.064*	0.096**	0.125**	0.060**	0.059***	0.042*	0.069**	0.003	0.066***
	[0.020]	[0.027]	[0.030]	[0.044]	[0.023]	[0.016]	[0.023]	[0.023]	[0.038]	[0.017]
Hired	-0.024	-0.006	-0.023	-0.042	-0.006	0.014	0.02	0.006	0.007	0.011
	[0.022]	[0.028]	[0.035]	[0.034]	[0.028]	[0.018]	[0.025]	[0.026]	[0.029]	[0.022]
Fired	0.072***	0.085***	0.051	0.082**	0.055*	0.024	0.036*	0.013	0.001	0.046*
	[0.021]	[0.025]	[0.035]	[0.031]	[0.027]	[0.017]	[0.022]	[0.027]	[0.027]	[0.021]
Firm innov.	-0.001	-0.01	0.007	-0.004	0.001	-0.057***	-0.061***	-0.055***	-0.052**	-0.054***
	[0.013]	[0.020]	[0.017]	[0.020]	[0.017]	[0.011]	[0.018]	[0.014]	[0.018]	[0.014]
Routine int.	0.035	0.022	0.031	0.102	-0.006	0.278***	0.306***	0.272***	0.223***	0.287***
	[0.040]	[0.056]	[0.056]	[0.067]	[0.049]	[0.033]	[0.051]	[0.044]	[0.056]	[0.041]
Late grad.	0.057***	0.056*	0.055**	0.062**	0.046*	0.073***	0.091***	0.063***	0.091***	0.058***
	[0.014]	[0.025]	[0.017]	[0.021]	[0.018]	[0.012]	[0.024]	[0.014]	[0.018]	[0.015]
Mark	-0.001	0.001	-0.002	0	-0.001	-0.001*	-0.003*	0	-0.001	-0.001
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
N	7145	3146	3999	3070	4075	6923	3046	3877	2951	3972

Marginal impacts. Standard errors in brackets. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 5 Determinants of overeducation and overqualification: interaction between cognitive and non-cognitive skills

		Individual controls only									
		All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	Mark<100	0.010*	0.013	0.009	0.006	0.013*	0.005	0.003	0.007	0.004	0.008
		[0.006]	[0.008]	[0.008]	[0.008]	[0.008]	[0.005]	[0.008]	[0.007]	[0.007]	[0.007]
	Mark>=100	0.011***	0.009*	0.012**	0.014**	0.009*	0.000	-0.002	0.002	-0.003	0.000
		[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
EX	Mark<100	0.000	-0.004	0.003	-0.001	-0.003	-0.005	-0.013*	0.001	-0.004	-0.008
		[0.005]	[0.006]	[0.007]	[0.007]	[0.007]	[0.004]	[0.006]	[0.006]	[0.006]	[0.006]
	Mark>=100	0.001	0.001	0.001	-0.003	0.005	-0.003	-0.002	-0.003	-0.003	-0.002
		[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
AG	Mark<100	-0.006	-0.014	-0.001	-0.006	-0.010	0.000	0.013*	-0.01	0.011	-0.017**
		[0.006]	[0.009]	[0.009]	[0.008]	[0.009]	[0.005]	[0.008]	[0.007]	[0.008]	[0.008]
	Mark>=100	0.000	0.007	-0.004	0.002	0.000	-0.003	0.002	-0.006	0.003	-0.007*
		[0.003]	[0.005]	[0.004]	[0.006]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
CO	Mark<100	0.012*	0.008	0.016*	0.007	0.014	0.010*	-0.001	0.019**	0.006	0.011
		[0.006]	[0.009]	[0.009]	[0.009]	[0.009]	[0.006]	[0.008]	[0.008]	[0.008]	[0.008]
	Mark>=100	0.015***	0.014**	0.015**	0.009*	0.020***	0.004	0.001	0.006	0.000	0.006
		[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
NE	Mark<100	0.003	0.006	0.003	-0.009	0.013*	-0.003	-0.002	-0.004	-0.007	-0.001
		[0.005]	[0.007]	[0.007]	[0.007]	[0.007]	[0.005]	[0.007]	[0.006]	[0.007]	[0.006]
	Mark>=100	-0.006*	-0.002	-0.010**	-0.005	-0.007*	0.002	-0.003	0.005	-0.003	0.004
		[0.003]	[0.004]	[0.004]	[0.005]	[0.003]	[0.003]	[0.004]	[0.003]	[0.005]	[0.003]
	N	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122
		Individual and demand controls									
		All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	Mark<100	0.011*	0.013	0.01	0.008	0.015*	0.004	0.002	0.007	0.004	0.007
		[0.006]	[0.008]	[0.008]	[0.008]	[0.008]	[0.005]	[0.007]	[0.006]	[0.006]	[0.006]
	Mark>=100	0.011***	0.012*	0.011**	0.014**	0.009*	0.001	0.001	0.001	-0.001	0.001
		[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.003]	[0.005]	[0.003]
EX	Mark<100	0.000	-0.004	0.004	-0.002	-0.002	-0.005	-0.016**	0.003	-0.004	-0.005
		[0.005]	[0.006]	[0.007]	[0.007]	[0.007]	[0.004]	[0.005]	[0.006]	[0.006]	[0.005]
	Mark>=100	0.001	-0.001	0.002	-0.003	0.005	-0.002	-0.004	-0.001	-0.002	-0.002
		[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]	[0.003]	[0.003]	[0.004]	[0.002]
AG	Mark<100	-0.005	-0.012	-0.001	-0.004	-0.008	0.005	0.017**	-0.007	0.014*	-0.010

		[0.006]	[0.009]	[0.009]	[0.008]	[0.009]	[0.005]	[0.007]	[0.007]	[0.007]	[0.007]
	Mark>=100	0.001	0.008	-0.004	0.003	0.000	0.000	0.004	-0.003	0.004	-0.002
		[0.003]	[0.005]	[0.004]	[0.006]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
CO	Mark<100	0.012*	0.01	0.015*	0.006	0.015	0.013**	0.006	0.019**	0.010	0.014*
		[0.006]	[0.009]	[0.009]	[0.009]	[0.009]	[0.005]	[0.008]	[0.007]	[0.007]	[0.007]
	Mark>=100	0.015***	0.015**	0.014**	0.009*	0.020***	0.002	-0.003	0.004	-0.004	0.002
		[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.003]
NE	Mark<100	0.003	0.006	0.001	-0.009	0.013*	-0.003	0.000	-0.007	-0.009	0.003
		[0.005]	[0.007]	[0.007]	[0.007]	[0.007]	[0.004]	[0.007]	[0.006]	[0.006]	[0.006]
	Mark>=100	-0.008**	-0.002	-0.011**	-0.006	-0.009**	0.001	-0.003	0.004	-0.005	0.004
		[0.003]	[0.004]	[0.004]	[0.005]	[0.003]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
	N	7145	3146	3999	3070	4075	6923	3046	3877	2951	3972

Marginal impacts. Standard errors in brackets. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level. Other controls: firm size, public/private firm, field of education, sector of activity.

4.2 Selection issues: employability and educational choices

In this section, we look at the estimates of equations (1)–(5) and (6)–(7), whereby the former account for non-random selection into employment and the latter for selection into tertiary education. Table 6 reports the determinants of overeducation taking into account employment self-selection. The correction for self-selection is significant in the case of overeducation; however, the results of all specifications are broadly in line with the estimates in Table 3. The estimates of the employment equation are shown in Table A2 in the Appendix. Among the Big 5, a positive effect on employment probability is exerted by extraversion, especially among young workers and women. Conscientiousness increases the employment probability of males and workers above 40 years of age. The effect of openness is mixed, being positive for older workers but negative for young ones. This last result is coherent with the low market reward for this trait. Neuroticism exerts a negative effect on employment probability, driven by female workers and workers above 40 years of age. Finally, even though the selection is not always significant, the three exclusion restrictions are significant and show the expected sign. The low significance of residual correlation (Athanrho) might be due to the role of personality traits that account for a large fraction of unobserved heterogeneity (Blàzquez and Budrìa, 2012), thus reducing the probability of non-random selection.

We now move to the estimates of equation (6), which applies a correction for selection into tertiary education. As shown in Table 7, the results for the five personality traits indicate that the positive effect of conscientiousness on both overeducation and overqualification remains significant, and so does the effect of openness on overqualification. The magnitudes of marginal impacts are broadly in line with the previous estimates. The effect of neuroticism on overqualification, instead, becomes insignificant. This

suggests that the effect of neuroticism is mainly due to the effects of time preference and health status on the decision to complete tertiary education. Moving to the estimates by main group, the result worth noticing is that the positive effect of conscientiousness on the overeducation risk of females becomes insignificant. This means, again, that the result is driven by an effect of time preference on the propensity to pursue tertiary education. As for the other regressors, the results are broadly in line with the previous estimates, the only exception being the negative relationship between maternal educational attainment and the probability of overqualification, as shown by the positive and significant impacts of medium- and low-skilled mothers on overqualification.

In Table 8, we add demand-side controls and job characteristics to the Heckit model and compare the results with the equivalent probit estimates (Table 4). The result are, again, largely unchanged and coherent with the previous specification, in particular with respect to the insignificance of conscientiousness on women's overeducation risk. The positive effect of extraversion is maintained but both the size and significance are reduced, suggesting that part of the effect is mediated by educational choices. Interestingly enough, by controlling for selection into tertiary education all controls for socioeconomic background become insignificant. This means that family background affects overeducation risk mostly by influencing the decision to pursue tertiary education.

The results of the selection equation (Table A3) confirm this interpretation, as socioeconomic background is highly significant in explaining the decision to pursue tertiary education. Among personality traits, openness and conscientiousness increase this probability whereas agreeableness reduces it. The effect of neuroticism, instead, is related to gender and increases the probability of tertiary education for men but reduces it for women. Finally, even though residual correlation (Athanrho) does not always point to a significant selection bias, the two exclusion restrictions are significant: a preference for present outcomes and a poor health status both reduce the probability of pursuing tertiary education.

Table 6 Heckit model with selection into employment

	Overqualification					Overeducation				
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.010***	0.010*	0.011***	0.012**	0.009**	0.001	-0.001	0.011	-0.001	0.002
	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.010]	[0.004]	[0.003]
EX	0.001	0.000	0.005	-0.002	0.003	-0.003	-0.005	-0.006	-0.004	-0.003
	[0.002]	[0.003]	[0.008]	[0.004]	[0.003]	[0.002]	[0.003]	[0.009]	[0.003]	[0.003]
AG	-0.001	0.002	-0.009	0.000	-0.001	-0.002	0.006	-0.005**	0.006	-0.008*
	[0.003]	[0.004]	[0.010]	[0.005]	[0.004]	[0.003]	[0.004]	[0.002]	[0.004]	[0.004]
CO	0.015***	0.013**	0.017***	0.009*	0.019***	0.005*	0.000	0.007**	0.002	0.006*
	[0.003]	[0.005]	[0.010]	[0.005]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.004]
NE	-0.004*	0.000	-0.008*	-0.007	-0.004	0.000	-0.003	0.003	-0.004	0.003

	[0.002]	[0.004]	[0.004]	[0.004]	[0.003]	[0.002]	[0.004]	[0.005]	[0.004]	[0.003]
Father LS	-0.003	-0.038	0.101	0.049	-0.036	0.036*	0.039	0.119	0.047	0.022
	[0.023]	[0.033]	[0.079]	[0.037]	[0.030]	[0.022]	[0.033]	[0.090]	[0.035]	[0.027]
Father MS	-0.025	-0.056*	0.025	-0.010	-0.037	0.031	0.014	0.130*	0.015	0.040*
	[0.020]	[0.029]	[0.068]	[0.032]	[0.026]	[0.019]	[0.028]	[0.077]	[0.030]	[0.024]
Mother LS	0.005	0.083*	-0.055*	-0.012	0.011	-0.035	-0.029	-0.162*	-0.085**	0.000
	[0.023]	[0.032]	[0.032]	[0.038]	[0.030]	[0.022]	[0.032]	[0.093]	[0.035]	[0.027]
Mother MS	0.033	0.090**	-0.064	0.031	0.031	-0.015	0.010	-0.013*	-0.023	0.000
	[0.020]	[0.028]	[0.074]	[0.032]	[0.027]	[0.019]	[0.027]	[0.007]	[0.030]	[0.024]
Father med.	0.031*	-0.010	0.045*	0.030	0.036	0.016	0.008	0.074	0.007	0.022
	[0.019]	[0.029]	[0.025]	[0.030]	[0.024]	[0.017]	[0.028]	[0.067]	[0.029]	[0.022]
Father high	0.002	-0.036	0.066	0.012	-0.004	-0.012	-0.040	0.016	-0.048	0.013
	[0.024]	[0.035]	[0.077]	[0.039]	[0.030]	[0.022]	[0.035]	[0.087]	[0.037]	[0.027]
Age	0.003***	0.007**	0.007*	0.003***	0.003***	-0.007***	-0.008***	-0.006***	-0.006***	-0.008***
	[0.001]	[0.002]	[0.003]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]
Female	-0.032*	-0.023	-0.025***	-0.036*	-0.026	-0.006	0.042**	-0.174***	0.006	-0.027
	[0.014]	[0.022]	[0.025]	[0.018]	[0.026]	[0.013]	[0.021]	[0.051]	[0.016]	[0.023]
Late grad.	0.056***	0.057*	0.090*	0.063**	0.046*	0.080***	0.094***	0.174***	0.094***	0.064***
	[0.014]	[0.024]	[0.042]	[0.020]	[0.018]	[0.013]	[0.025]	[0.048]	[0.020]	[0.017]
Mark	-0.001	0.000	0.000	0.000	-0.002*	-0.003***	-0.005***	-0.001	-0.002	-0.004***
	[0.001]	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]	[0.001]	[0.001]
Athanrho	0.501	0.370	1.436	0.955	1.489	0.937***	0.291	1.300*	-0.023	0.874***
	[0.343]	[0.362]	[0.978]	[0.623]	[1.007]	[0.266]	[0.560]	[0.684]	[1.140]	[0.262]
Obs.	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122
Censored	2173	1342	831	678	1495	2173	1342	831	678	1495

Standard errors in brackets. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 7 Heckit model with selection into tertiary education

	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.011***	0.011**	0.013***	0.011*	0.012***	-0.001	-0.002	0.000	-0.004	0.000
	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.005]	[0.004]	[0.004]	[0.004]
EX	0.000	0.000	0.000	-0.002	0.001	-0.004	-0.004	-0.003	-0.006	-0.002
	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
AG	-0.002	-0.003	-0.003	0.000	-0.004	-0.003	0.000	-0.005	0.006	-0.010**
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
CO	0.013***	0.013**	0.013**	0.008*	0.018***	0.006**	0.001	0.008**	0.004	0.006
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
NE	-0.004	0.000	-0.006*	-0.006	-0.002	0.001	-0.002	0.003	-0.004	0.004
	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
Father LS	0.019	-0.039	0.056	0.07	-0.036	0.043	0.063	0.025	0.052	0.04
	[0.026]	[0.036]	[0.042]	[0.043]	[0.034]	[0.026]	[0.039]	[0.035]	[0.041]	[0.039]
Father MS	-0.008	-0.051	0.016	0.021	-0.047	0.039*	0.047	0.029	0.03	0.049
	[0.023]	[0.031]	[0.037]	[0.039]	[0.030]	[0.023]	[0.034]	[0.030]	[0.036]	[0.036]
Mother LS	0.028	0.094**	-0.039	0.016	0.017	-0.019	-0.021	-0.023	-0.054	0.011
	[0.027]	[0.034]	[0.054]	[0.044]	[0.034]	[0.026]	[0.036]	[0.041]	[0.040]	[0.037]
Mother MS	0.044*	0.087**	-0.003	0.044	0.027	0.001	0.009	-0.012	0.008	0.003
	[0.023]	[0.029]	[0.047]	[0.037]	[0.031]	[0.022]	[0.031]	[0.036]	[0.034]	[0.033]
Father med.	0.033*	-0.012	0.057*	0.039	0.029	0.03	0.042	0.022	0.041	0.021
	[0.019]	[0.030]	[0.025]	[0.031]	[0.024]	[0.019]	[0.031]	[0.024]	[0.031]	[0.023]
Father high	0.008	-0.032	0.035	0.037	-0.010	-0.005	-0.018	0.008	-0.02	0.008
	[0.024]	[0.036]	[0.032]	[0.039]	[0.030]	[0.024]	[0.038]	[0.031]	[0.040]	[0.029]
Age	0.002***	0.009***	0.003*	0.002*	0.003***	-0.008***	-0.005*	-0.009***	-0.007***	-0.009***
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Female	-0.039**	-0.034	-0.042*			-0.044**	-0.026	-0.057**		
	[0.014]	[0.021]	[0.020]			[0.014]	[0.022]	[0.017]		
Athanrho	0.489**	0.147	0.406	0.555	0.071	0.268	0.245	0.147	0.065	0.474

	[0.250]	[0.295]	[0.665]	[0.569]	[0.342]	[0.275]	[0.305]	[0.400]	[0.907]	[0.510]
Obs.	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122
Censored	9488	3037	6451	5117	4371	9495	3040	6455	5119	4376

Standard errors in brackets. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 8 Heckit model with selection into tertiary education and demand-side controls

	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.012***	0.013**	0.012**	0.012**	0.012**	-0.001	-0.002	0.000	-0.002	-0.002
	[0.003]	[0.004]	[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
EX	0.000	-0.003	0.001	-0.002	0.001	-0.003	-0.006*	0.000	-0.004	-0.002
	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]	[0.002]	[0.003]	[0.003]	[0.004]	[0.003]
AG	-0.001	-0.001	-0.003	0.000	-0.003	0.003	0.006	0.000	0.009*	-0.002
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
CO	0.014***	0.014**	0.012**	0.009*	0.019***	0.004	0.000	0.007*	0.003	0.003
	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]	[0.004]	[0.004]	[0.004]	[0.003]
NE	-0.005*	-0.001	-0.007*	-0.007	-0.003	0.000	-0.003	0.002	-0.008*	0.005
	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]	[0.002]	[0.004]	[0.003]	[0.004]	[0.003]
Father LS	0.013	-0.038	0.048	0.058	-0.031	0.061**	0.052	0.064*	0.084*	0.068*
	[0.026]	[0.037]	[0.036]	[0.041]	[0.033]	[0.023]	[0.032]	[0.032]	[0.038]	[0.029]
Father MS	-0.014	-0.048	0.012	0.01	-0.043	0.056**	0.042	0.064*	0.067*	0.067**
	[0.022]	[0.032]	[0.030]	[0.035]	[0.028]	[0.020]	[0.027]	[0.028]	[0.032]	[0.025]
Mother LS	0.006	0.085*	-0.074*	-0.012	0.004	-0.027	-0.041	-0.016	-0.046	-0.006
	[0.026]	[0.036]	[0.040]	[0.040]	[0.034]	[0.022]	[0.031]	[0.034]	[0.036]	[0.027]
Mother MS	0.029	0.082**	-0.032	0.025	0.022	-0.003	-0.004	0.000	0.010	-0.004
	[0.022]	[0.030]	[0.036]	[0.033]	[0.030]	[0.019]	[0.026]	[0.030]	[0.030]	[0.024]
Father med.	0.029	-0.020	0.054*	0.043	0.023	0.015	0.028	0.010	0.036	-0.003
	[0.020]	[0.031]	[0.025]	[0.031]	[0.025]	[0.019]	[0.029]	[0.024]	[0.031]	[0.022]
Father high	0.014	-0.031	0.045	0.065	-0.017	-0.012	-0.021	0.005	-0.004	-0.018
	[0.025]	[0.038]	[0.033]	[0.040]	[0.031]	[0.023]	[0.034]	[0.031]	[0.039]	[0.027]
Age	0.003***	0.009**	0.004**	0.003*	0.004***	-0.002*	-0.001	-0.003*	-0.004**	0.000
	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]
Female	-0.044**	-0.038	-0.053**			-0.014	0.007	-0.028		
	[0.014]	[0.023]	[0.018]			[0.013]	[0.019]	[0.017]		
Tenure	0.000	0.002	0.000	0.000	-0.001	-0.001	0.002	-0.002*	0.001	-0.003*
	[0.001]	[0.003]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Hired	-0.033	-0.026	-0.016	-0.043	-0.022	0.005	0.02	-0.004	-0.005	0.006
	[0.022]	[0.029]	[0.035]	[0.035]	[0.028]	[0.019]	[0.025]	[0.030]	[0.031]	[0.023]
Fired	0.076***	0.098***	0.039	0.082**	0.064*	0.023	0.026	0.015	-0.002	0.046*
	[0.021]	[0.026]	[0.035]	[0.032]	[0.028]	[0.018]	[0.022]	[0.031]	[0.029]	[0.022]
Routine int.	0.076*	0.094*	0.049	0.193**	-0.025	0.362***	0.365***	0.363***	0.305***	0.361***
	[0.041]	[0.057]	[0.057]	[0.066]	[0.050]	[0.035]	[0.052]	[0.049]	[0.058]	[0.044]
Firm innov.	-0.008	-0.011	-0.011	0.014	-0.022	-0.062***	-0.062**	-0.063***	-0.055*	-0.059***
	[0.015]	[0.023]	[0.021]	[0.025]	[0.018]	[0.013]	[0.020]	[0.018]	[0.023]	[0.016]
Self-empl.	-0.047*	-0.055*	0.022	-0.062	-0.043	-0.076**	-0.061*	-0.089*	-0.077*	-0.076**
	[0.027]	[0.032]	[0.056]	[0.044]	[0.034]	[0.023]	[0.028]	[0.051]	[0.039]	[0.028]
Other	-0.100***	-0.145***	-0.037	-0.102*	-0.101**	-0.249***	-0.237***	-0.252***	-0.220***	-0.269***
	[0.026]	[0.036]	[0.038]	[0.040]	[0.034]	[0.022]	[0.030]	[0.032]	[0.036]	[0.028]
Fixed term	-0.033	-0.013	-0.056	-0.053	-0.021	-0.041*	-0.016	-0.070*	-0.080*	-0.01
	[0.023]	[0.028]	[0.043]	[0.038]	[0.027]	[0.020]	[0.025]	[0.040]	[0.036]	[0.022]
Part-time	0.078***	0.060*	0.101***	0.144**	0.056*	0.072***	0.052*	0.090***	0.035	0.068***
	[0.021]	[0.028]	[0.030]	[0.045]	[0.023]	[0.018]	[0.024]	[0.027]	[0.040]	[0.019]
Athanrho	0.153	0.188	-0.02	-0.149	0.068	0.339**	0.311	0.256	0.458**	0.540***
	[0.358]	[0.274]	[0.943]	[0.354]	[0.750]	[0.019]	[0.209]	[0.197]	[0.228]	[0.178]

Obs.	7145	3146	3999	3070	4075	6923	3046	3877	2951	3972
Censored	8394	2734	5660	4635	3759	8401	2737	5664	4637	3764

Standard errors in brackets. *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

5. Conclusions

Economists are increasingly investigating the relevance of so-called 'soft skills' for labour market success. The evidence is clear that these skills—also called 'non-cognitive skills'—are important drivers of success in school and in adult life (Deming, 2017) and are related to personality traits. Yet the very term 'soft skills' reveals our lack of knowledge of what these skills are, how to evaluate them, and the consequences they can have in the labour market, for example, in terms of skill mismatch.

In this paper, we contribute to the knowledge in the field by investigating the relationship between personality traits and skill mismatch in Italy in terms of overeducation and overqualification. To this aim, we use the 2018 wave of the INAPP-PLUS, a survey that allows building a self-assessed measure of overqualification to be used alongside the standard revealed-match measure of overeducation. In addition, the survey includes information on Big 5 personality traits through self-assessed questions on the Ten Item Personality Inventory (Gosling et al., 2003), one of the most reliable classifications among those using a reduced number of items. This is the first analysis of the relationship between personality traits and overeducation in Italy. Compared to other studies, the innovation lies also in the large number of controls available, in terms of socioeconomic background, academic performance and labour-demand characteristics.

The results indicate that the most significant trait is conscientiousness, which exerts a positive and significant effect on both overeducation and overqualification. For the former, the effect is driven by women, who also account for the majority of the effect on overqualification. The positive effect of conscientiousness on skill mismatch seems to be related to job satisfaction. Mismatched individuals scoring high in conscientiousness also report higher scores for job satisfaction such as stability, work–life balance, workload and career opportunities. This suggests that these workers attach less importance to the match with their own education and skills and greater importance to the characteristics of the job. The implication is that conscientiousness among tertiary-educated workers might lead to voluntary overeducation and overqualification.

As for the other traits, openness is a positive determinant of overqualification, especially among male workers. Neuroticism is negatively related to overqualification, but the effect seems to be driven by (negative) self-selection into tertiary education. Moreover, we find that after controlling for demand-side characteristics, extraversion reduces the overeducation risk of young workers while agreeableness increases it, especially for the male component. Finally, the results hold after controlling for the self-selection of workers into employment and tertiary education and after including job-specific and labour-demand characteristics.

Policy

All in all, our results confirm that non-cognitive skills measured through personality traits are important determinants of skill mismatch. The positive relationship between cognitive skills and overqualification implies that workers are underused, due to a lack of recognition of these skills by employers or as a result of the search for other desirable characteristics in a job. The negative relationship between some traits and overeducation, instead, suggests that efforts to advance cognitive skills may not avoid mismatch if individuals lack some crucial non-cognitive skills. In terms of policy implications, our findings indicate that tackling mismatch involves a reconsideration of both supply-side and demand-side policies. The former should orient towards the expansion of education to allow for a proper development of both cognitive and non-cognitive skills and reduce the overeducation risk of poor-performing students. In this respect, information on the personality traits of students can be an important tool to make counselling more affective and more tailored to individual specificities. Demand-side policies should focus on improving the quality of the jobs offered to tertiary-educated workers, not only in terms of wages but looking at all dimensions of job satisfaction, thus avoiding any trade-off between mismatch and job satisfaction.

This study is not without limitations, as the data did not allow us to rule out endogeneity concerns. Nonetheless, we believe that exploratory studies such as this one extend our knowledge on the psychological determinants of mismatch and can thus be helpful in designing further research on the topic. Future studies could concentrate on the role of intergenerational transmission of personality traits, self-selection into occupations and tasks, and engagement in training. More research on these topics, including research that uses experimental methods, would be desirable.

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Appendix

Table A1 Probit model with the Ten Item Personality Inventory

	Probit									
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
Open to experience	0.014**	0.009	0.021**	0.013	0.015*	0.001	-0.002	0.003	0.012	-0.008
	[0.005]	[0.008]	[0.007]	[0.008]	[0.007]	[0.005]	[0.008]	[0.006]	[0.008]	[0.006]
Conservative	-0.007*	-0.010*	-0.006	-0.009	-0.006	-0.001	0.001	-0.002	0.007	-0.005
	[0.004]	[0.005]	[0.005]	[0.006]	[0.005]	[0.003]	[0.005]	[0.004]	[0.005]	[0.004]
Extraverted	0.003	0.007	0.000	0.005	0.002	0.000	-0.005	0.001	-0.005	0.003
	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]	[0.004]	[0.006]	[0.004]	[0.006]	[0.004]
Shy/private	0.003	0.007	-0.001	0.012*	-0.003	0.006*	0.006	0.005	0.004	0.008*
	[0.004]	[0.005]	[0.005]	[0.006]	[0.004]	[0.003]	[0.005]	[0.004]	[0.006]	[0.004]
Polemical	0.003	0.001	0.005	0.002	0.004	0.001	-0.009*	0.007	-0.005	0.005
	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]	[0.003]	[0.005]	[0.004]	[0.006]	[0.004]
Caring	0.003	0.007	0.000	0.003	0.003	-0.004	0.000	-0.006	0.006	-0.013*
	[0.006]	[0.009]	[0.008]	[0.009]	[0.008]	[0.005]	[0.009]	[0.007]	[0.008]	[0.007]
Trustworthy	0.018*	0.031**	0.011	0.019*	0.016*	0.003	0.011	-0.001	-0.011	0.013*
	[0.007]	[0.011]	[0.009]	[0.011]	[0.009]	[0.006]	[0.010]	[0.008]	[0.010]	[0.008]
Unorganized	-0.012**	-0.005	-0.015**	-0.003	-0.019***	-0.007*	0.004	-0.013**	-0.006	-0.006
	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]	[0.004]	[0.006]	[0.005]	[0.006]	[0.004]
Anxious	-0.009*	-0.007	-0.009*	-0.013*	-0.006	-0.003	-0.008*	0.001	-0.002	-0.003
	[0.004]	[0.005]	[0.005]	[0.006]	[0.004]	[0.003]	[0.005]	[0.004]	[0.006]	[0.004]
Emotionally stable	-0.003	-0.011	0.003	-0.005	-0.001	-0.006	-0.007	-0.005	0.006	-0.013*
	[0.005]	[0.007]	[0.006]	[0.008]	[0.006]	[0.004]	[0.007]	[0.006]	[0.008]	[0.005]
Obs.	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122
	Heckit selection into tertiary education and demand-side controls									
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
Open to experience	0.017**	0.008	0.023**	0.012	0.019*	0.002	-0.001	0.005	0.017*	-0.011*
	[0.006]	[0.009]	[0.008]	[0.009]	[0.008]	[0.005]	[0.007]	[0.007]	[0.008]	[0.006]
Conservative	-0.011**	-0.016**	-0.007	-0.009	-0.010*	0.003	0.002	0.003	0.011*	-0.002

	[0.004]	[0.006]	[0.006]	[0.006]	[0.005]	[0.003]	[0.005]	[0.005]	[0.006]	[0.004]
Extraverted	0.001	0.002	0.002	0.003	0.001	-0.001	-0.005	0.001	-0.005	0.002
	[0.004]	[0.006]	[0.005]	[0.007]	[0.005]	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]
Shy/private	0.004	0.010*	0.000	0.006	0.001	0.004	0.008	0.001	0.005	0.004
	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]	[0.003]	[0.005]	[0.005]	[0.006]	[0.004]
Polemical	0.005	0.008	0.003	0.004	0.004	-0.003	-0.010*	0.001	-0.007	-0.001
	[0.004]	[0.006]	[0.005]	[0.006]	[0.005]	[0.004]	[0.005]	[0.005]	[0.006]	[0.004]
Caring	0.003	0.014	-0.004	0.011	-0.001	0.002	0.001	0.001	0.012	-0.004
	[0.006]	[0.009]	[0.008]	[0.009]	[0.008]	[0.005]	[0.008]	[0.007]	[0.009]	[0.007]
Trustworthy	0.022**	0.036**	0.013	0.022*	0.022*	-0.004	0.001	-0.006	-0.016	0.003
	[0.007]	[0.012]	[0.009]	[0.011]	[0.009]	[0.006]	[0.010]	[0.008]	[0.010]	[0.008]
Unorganized	-0.010*	-0.005	-0.011*	-0.001	-0.017**	-0.007*	0.000	-0.012**	-0.009	-0.004
	[0.004]	[0.007]	[0.005]	[0.006]	[0.005]	[0.004]	[0.006]	[0.005]	[0.006]	[0.004]
Anxious	-0.008*	-0.009	-0.008*	-0.014*	-0.005	-0.001	-0.004	0.002	-0.005	0.002
	[0.004]	[0.005]	[0.005]	[0.006]	[0.005]	[0.003]	[0.005]	[0.005]	[0.006]	[0.004]
Emotionally stable	-0.001	-0.01	0.005	-0.002	0.000	-0.002	0.000	-0.003	0.010	-0.008
	[0.005]	[0.008]	[0.007]	[0.008]	[0.006]	[0.005]	[0.007]	[0.006]	[0.008]	[0.005]
Obs.	7145	3146	3999	3070	4075	6923	3046	3877	2951	3972
Censored	8394	2734	5660	4635	3759	8401	2737	5664	4637	3764

Table A2 Selection into employment equation

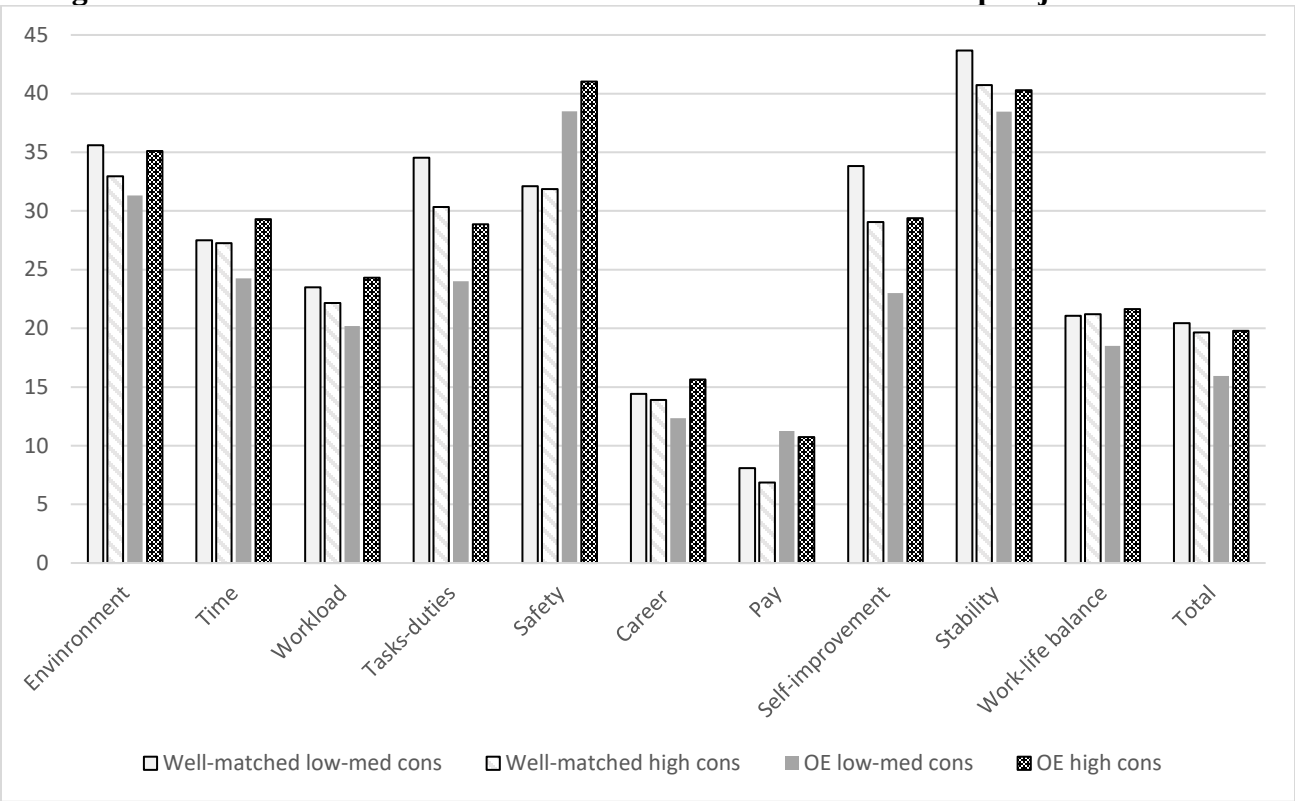
	Overequalification					Overeducation				
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	-0.001	-0.005*	0.031***	-0.002	0.000	-0.002	-0.006*	0.011	-0.002	-0.001
	[0.002]	[0.002]	[0.009]	[0.002]	[0.002]	[0.002]	[0.003]	[0.010]	[0.002]	[0.002]
EX	0.002*	0.005*	0.005	0.001	0.003*	0.002*	0.005*	-0.006	0.001	0.003
	[0.001]	[0.002]	[0.008]	[0.002]	[0.002]	[0.001]	[0.002]	[0.009]	[0.002]	[0.002]
AG	-0.001	-0.004	-0.009	0.000	-0.003	-0.002	-0.004	-0.025*	0.000	-0.003
	[0.002]	[0.003]	[0.010]	[0.002]	[0.002]	[0.002]	[0.003]	[0.011]	[0.002]	[0.003]
CO	0.003	0.004	0.037***	0.003	0.002	0.003*	0.004	0.027*	0.004*	0.004
	[0.002]	[0.003]	[0.010]	[0.002]	[0.003]	[0.002]	[0.003]	[0.011]	[0.002]	[0.003]
NE	-0.002*	0.000	-0.021*	0.001	-0.005*	-0.003*	0.000	0.003	0.001	-0.005*
	[0.001]	[0.002]	[0.008]	[0.002]	[0.002]	[0.001]	[0.002]	[0.009]	[0.002]	[0.002]
Father LS	0.011	-0.02	0.101	-0.011	0.021	0.011	-0.023	0.119	-0.012	0.026
	[0.013]	[0.021]	[0.079]	[0.016]	[0.019]	[0.013]	[0.021]	[0.090]	[0.017]	[0.020]
Father MS	0.000	-0.012	0.025	0.003	-0.007	0.000	-0.014	0.130*	0.005	-0.005
	[0.011]	[0.017]	[0.068]	[0.013]	[0.017]	[0.011]	[0.018]	[0.077]	[0.014]	[0.017]
Mother LS	0.004	0.032*	-0.175*	0.022	-0.01	0.001	0.028	-0.162*	0.023	-0.014
	[0.013]	[0.019]	[0.082]	[0.015]	[0.019]	[0.013]	[0.021]	[0.093]	[0.016]	[0.019]
Mother MS	0.011	0.051**	-0.064	0.030*	-0.005	0.01	0.052**	-0.137*	0.030*	-0.006
	[0.011]	[0.016]	[0.074]	[0.013]	[0.017]	[0.011]	[0.017]	[0.083]	[0.014]	[0.017]
Father med.	-0.004	-0.027	0.151*	-0.002	-0.007	-0.003	-0.027	0.074	-0.001	-0.008
	[0.011]	[0.018]	[0.060]	[0.014]	[0.015]	[0.011]	[0.018]	[0.067]	[0.014]	[0.016]
Father high	-0.008	-0.006	0.066	-0.008	-0.012	-0.009	-0.008	0.016	-0.009	-0.012
	[0.013]	[0.022]	[0.077]	[0.017]	[0.019]	[0.014]	[0.022]	[0.087]	[0.018]	[0.020]
Age	0.004***	0.018***	0.007*	0.003***	0.004***	0.004***	0.018***	-0.020***	0.003***	0.004***
	[0.000]	[0.001]	[0.003]	[0.000]	[0.001]	[0.000]	[0.001]	[0.003]	[0.001]	[0.001]
Female	-0.060***	-0.063***	-0.185***			-0.067***	-0.064***	-0.174***		
	[0.009]	[0.013]	[0.045]			[0.010]	[0.014]	[0.051]		
Late title	-0.021**	-0.085***	0.090*	-0.01	-0.032**	-0.028***	-0.100***	0.174***	-0.020*	-0.040***
	[0.008]	[0.014]	[0.042]	[0.009]	[0.011]	[0.008]	[0.015]	[0.048]	[0.010]	[0.011]
Mark	0.004***	0.004***	0	0.002***	0.005***	0.004***	0.004***	-0.001	0.002**	0.005***
	[0.000]	[0.001]	[0.003]	[0.001]	[0.001]	[0.000]	[0.001]	[0.003]	[0.001]	[0.001]
Married	0.118***	0.238***	0.088**	0.086***	0.020*	0.110***	0.228***	0.088**	0.090***	0.019*
	[0.013]	[0.036]	[0.022]	[0.010]	[0.010]	[0.014]	[0.042]	[0.022]	[0.011]	[0.011]
Married female	-0.100***	-0.243***	-0.070**			-0.091***	-0.235***	-0.077**		

	[0.015]	[0.039]	[0.025]			[0.016]	[0.047]	[0.030]		
Health	-0.033***	-0.036*	0.033***	-0.031**	-0.034**	-0.037***	-0.036*	0.037***	-0.028*	-0.040***
	[0.008]	[0.015]	[0.011]	[0.011]	[0.011]	[0.008]	[0.016]	[0.010]	[0.015]	[0.012]
Obs.	9566	4623	4943	3845	5721	9341	4522	4819	3724	5617

Table A3 Selection into tertiary education equation

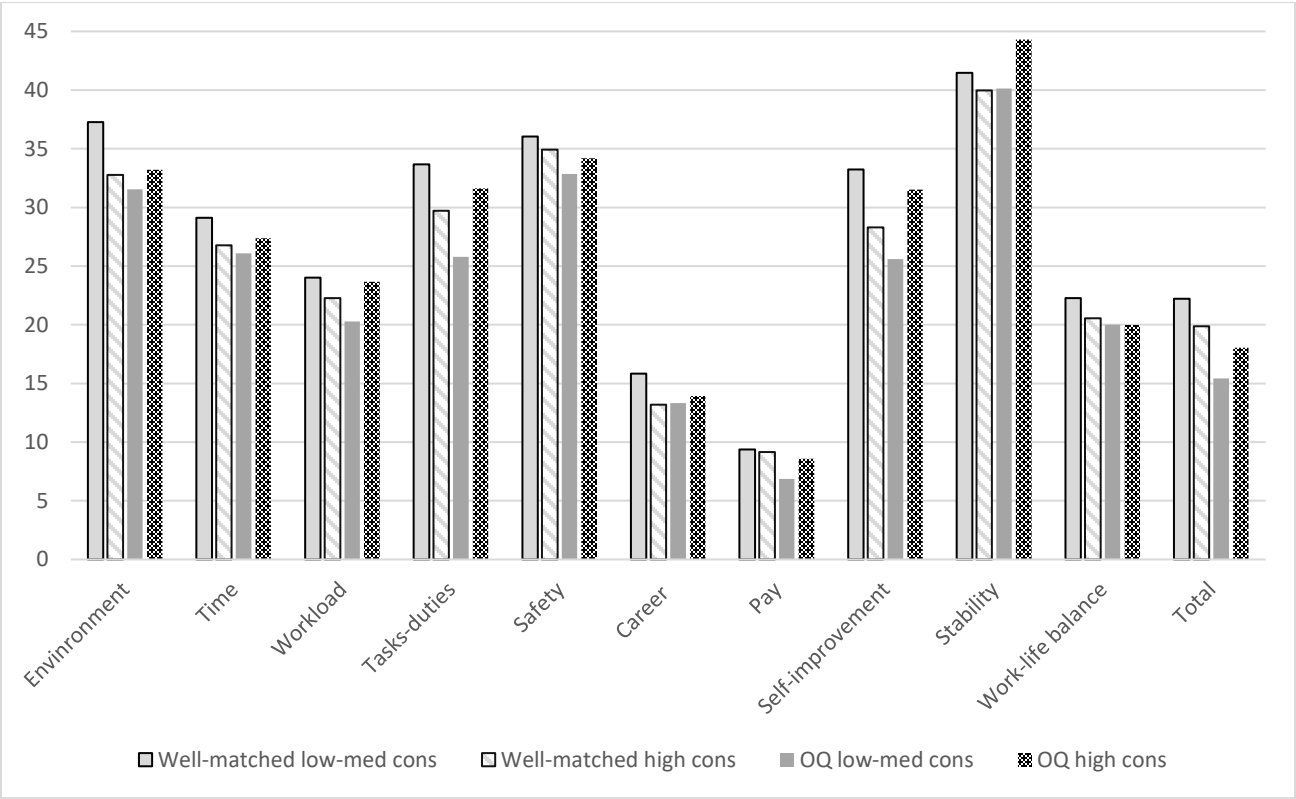
	Overqualification					Overeducation				
	All	Under 40	Over 40	Male	Female	All	Under 40	Over 40	Male	Female
OP	0.015***	0.009***	0.018***	0.011***	0.019***	0.014***	0.008***	0.017***	0.010***	0.019***
	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]	[0.001]	[0.002]	[0.001]	[0.002]	[0.002]
EX	-0.002	-0.002	-0.001	-0.003*	0.000	-0.002	-0.002	-0.001	-0.003*	0.000
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]
AG	-0.006***	-0.005*	-0.006***	-0.005**	-0.007***	-0.006***	-0.005*	-0.006***	-0.004**	-0.007***
	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
CO	0.005***	0.007**	0.002	0.004*	0.005*	0.005***	0.007**	0.003	0.004**	0.006*
	[0.001]	[0.003]	[0.002]	[0.002]	[0.002]	[0.001]	[0.003]	[0.002]	[0.002]	[0.002]
NE	0.000	0.001	0.000	0.004**	-0.005**	0.000	0.000	0.000	0.004**	-0.005**
	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]	[0.001]	[0.002]
Father LS	-0.225***	-0.246***	-0.199***	-0.190***	-0.275***	-0.217***	-0.241***	-0.191***	-0.180***	-0.271***
	[0.014]	[0.023]	[0.018]	[0.018]	[0.023]	[0.014]	[0.023]	[0.018]	[0.017]	[0.023]
Father MS	-0.119***	-0.143***	-0.094***	-0.102***	-0.144***	-0.115***	-0.140***	-0.091***	-0.096***	-0.143***
	[0.014]	[0.022]	[0.017]	[0.017]	[0.022]	[0.014]	[0.022]	[0.017]	[0.017]	[0.022]
Mother LS	-0.200***	-0.189***	-0.233***	-0.169***	-0.246***	-0.198***	-0.186***	-0.232***	-0.166***	-0.244***
	[0.015]	[0.021]	[0.022]	[0.018]	[0.025]	[0.014]	[0.021]	[0.021]	[0.018]	[0.025]
Mother MS	-0.097***	-0.068***	-0.141***	-0.075***	-0.134***	-0.095***	-0.063**	-0.141***	-0.072***	-0.131***
	[0.014]	[0.020]	[0.022]	[0.017]	[0.024]	[0.014]	[0.020]	[0.021]	[0.017]	[0.024]
Father med.	0.066***	0.066***	0.066***	0.054***	0.080***	0.065***	0.066***	0.065***	0.055***	0.079***
	[0.007]	[0.013]	[0.008]	[0.009]	[0.011]	[0.007]	[0.013]	[0.008]	[0.009]	[0.011]
Father high	0.098***	0.094***	0.103***	0.089***	0.110***	0.097***	0.092***	0.103***	0.089***	0.107***
	[0.011]	[0.019]	[0.013]	[0.014]	[0.017]	[0.011]	[0.019]	[0.013]	[0.014]	[0.017]
Age	0.002***	0.013***	0.001**	0.003***	0.001	0.002***	0.012***	0.002***	0.003***	0.001
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]
Female	0.117***	0.169***	0.085***			0.118***	0.171***	0.085***		
	[0.005]	[0.009]	[0.007]			[0.005]	[0.009]	[0.007]		
Time pref.	-0.016**	-0.026*	-0.011	-0.017*	-0.011	-0.017**	-0.024*	-0.012*	-0.018*	-0.015*
	[0.006]	[0.012]	[0.007]	[0.010]	[0.009]	[0.006]	[0.012]	[0.007]	[0.009]	[0.009]
Health	-0.038***	-0.066***	-0.029***	-0.029***	-0.048***	-0.037***	-0.062***	-0.029***	-0.027**	-0.048***
	[0.006]	[0.014]	[0.007]	[0.008]	[0.010]	[0.006]	[0.013]	[0.007]	[0.008]	[0.010]
Obs.	7393	3281	4112	3167	4226	7168	3180	3988	3046	4122
Censored	9488	3037	6451	5117	4371	9495	3040	6455	5119	4376

Figure A1 – Overeducation and conscientiousness scores: relationship to job satisfaction



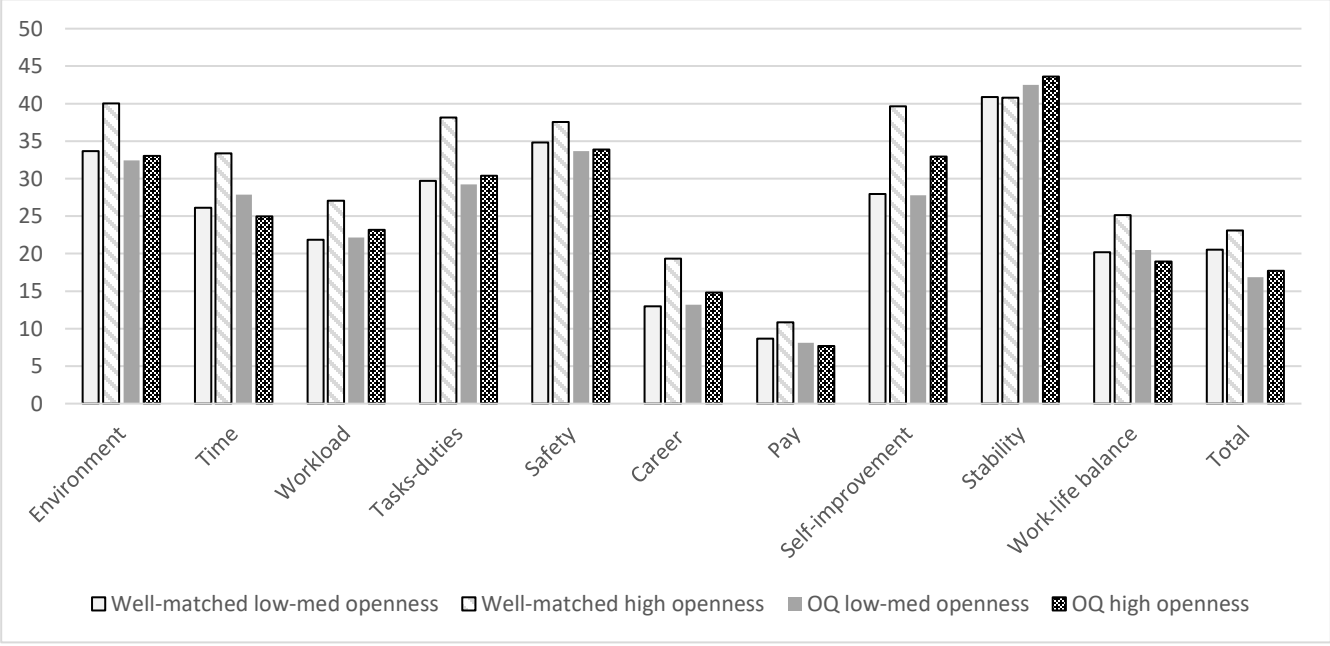
Source: own elaboration on PLUS data.

Figure A2 – Overqualification and conscientiousness scores: relationship to job satisfaction



Source: own elaboration on PLUS data.

Figure A3 – Overqualification and openness scores: relationship to job satisfaction



Source: own elaboration on PLUS data.