THE OVER-EDUCATION WAGE PENALTY AMONG PHD HOLDERS: A EUROPEAN PERSPECTIVE

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The Over-education Wage Penalty Among PhD Holders: A European Perspective

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Abstract

While the literature on the incidence and wage effects of over-education is substantial, specific results for doctoral graduates are surprisingly scarce. This article aims to fill this gap, not only by measuring the prevalence of over-educated PhD holders in Europe (i.e. in EU Member States and the UK), but also by estimating their wage penalty relative to what they could have earned in a job corresponding to their level of education. Using a unique pan-European dataset, we rely on two alternative measures of over-education and control stepwise for four groups of covariates (i.e. socio-demographic characteristics, skills needed for the job, other job-specific characteristics and motivations for employment) in order to interpret the over-education wage penalty in light of theoretical models. Depending on the specification adopted, we find that over-educated PhD holders face a wage penalty ranging from 25 to 13.5% with respect to their well-matched counterparts. Our results also show that the over-education wage penalty is significantly higher for PhD holders who are both over-educated and over-skilled and especially for those who are both over-educated and dissatisfied with their jobs. Finally, unconditional quantile regressions highlight that the over-education wage penalty among PhD holders increases greatly along the wage distribution.

Keywords: PhD graduates, over-education, over-skilling, job satisfaction, wages, Europe.
JEL Codes: J21, J24.

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1. Introduction

Doctoral education is at the heart of the innovation process and a key driver of economic growth (Bansak et al., 2021; OECD, 2016). Through research, doctoral graduates produce the most advanced scientific knowledge, which is then used by firms to strengthen their productive capacity (Herrera et al., 2010). It is therefore recognised that PhD holders play a strategic role in the promotion of a learning society and the expansion of the so-called "knowledge economy" (Di Paolo and Mané, 2013; Ermini et al., 2017). In recognition of this crucial function, many countries have started to reform their PhD programs, resulting in a widespread increase in the number of PhD students, well above the demand for academic positions, with PhD supply exceeding demand, despite the growing demand for skilled workers (Stiglitz and Greenwald, 2014). Over the past 15 years, all European countries have seen a substantial increase in the number of doctorates awarded. In the European Union, the number of newly enrolled doctoral students aged 24-35 increased from around 71,000 in 2013 to almost 90,000 in 2018. The total number of doctoral students was estimated at around 660,000 in the European Union in 2018 (European Commission, 2020).

The increase in the number of doctoral degrees has raised concerns about the employability of new doctoral graduates and, in particular, about the availability of appropriate job opportunities that allow them to fully exploit their skills. The results of the survey on the Careers of Doctorate Holders (CDH) showed that a significant proportion of PhD recipients are employed in jobs unrelated to their doctorate or below their qualification level (Auriol, 2010; Auriol et al., 2013). In other words, the phenomenon of over-education among doctoral graduates, i.e. the situation where a doctorate holder has a higher level of education than that required for her/his job, has become widespread (Bender and Heywood, 2009, 2011; Boman et al., 2017; Ermini et al., 2017; Gaeta et al., 2022).

At the economy-wide level, this situation is worrying because it leads to the under-utilisation of the productive capacities of PhDs (Schwabe, 2011). Moreover, given the importance of doctoral graduates for economic development, but also the high cost of doctoral education and the large share of public funding that doctoral graduates receive, the efficiency loss due to mismatched PhD holders is probably higher than that for other educational groups (Gaeta, 2015).

From the individual's point of view, the doctorate is expected to generate significant private returns such as better career opportunities, increased work satisfaction and higher pay. However, for PhDs who end up in jobs for which they are over-educated, the disappointment

is likely to be considerable. A large literature indeed shows that over-educated workers earn overall significantly less than their former classmates employed in jobs matching their education (Bender and Roche, 2013, 2018; Dolton and Silles, 2008; Leuven and Oosterbeek, 2011; Jones et al., 2013). Yet, evidence on the specific wage penalty faced by over-educated PhDs is surprisingly scarce. In other words, little is known on the wage differential between over-educated PhD graduates and their well-matched counterparts (Bender and Heywood, 2009, 2011; Canal Domínguez and Rodríguez Gutiérrez, 2013; Caroleo and Pastore, 2018; Gaeta et al., 2017, 2022). This article aims to fill this gap. Specifically, we contribute to the existing literature, not only by measuring the incidence of over-educated PhD holders in the European Union, but also by estimating their wage penalty relative to what they could have earned in a job corresponding to their level of education. As far as we know, our study is one of the very few to address this issue in a cross-country perspective and the first to focus on all EU-27 Member States plus the UK.

To do this, we take advantage of access to a unique pan-European dataset, the European Skills and Jobs (ESJ) survey, a survey that was specifically conducted by CEDEFOP (2014) to collect detailed information on educational and skills mismatches in all EU-28 Member States (i.e. the current EU-27 countries plus the UK) and to enable a better understanding of the extent, determinants and consequences of these phenomena. In practice, we estimate wage equations according to the specification developed by Verdugo and Verdugo (1989), including a wide range of control variables (i.e. socio-demographic characteristics, skills needed for the job, other job-specific characteristics and motivations for employment) step by step in order to interpret the wage penalty associated with over-education in light of the underlying theoretical models. This approach, combined with our rich set of covariates – which, among other things, allows us to account for a potential ability bias that could arise from an unobserved ability factor that would be correlated with both over-education and earnings – is a significant improvement over previous studies. The robustness of our results is also assessed through the use of two alternative measures of over-education.

Furthermore, we add to the existing literature by examining the interaction effects between over-education and over-skilling on the one hand, and between over-education and job satisfaction on the other. Since over-educated workers or not necessarily over-skilled (and vice versa), we first investigate whether and how the over-education wage penalty depends on the interaction between these two variables. Second, we also examine the moderating role of job satisfaction. The intuition is that over-educated PhD holders might have chosen (or at least accepted) to be over-educated in order to improve other aspects of their job, such as

employment security, commuting time or work-life balance. Put differently, as Gaeta et al. (2022) point out, the interaction with job satisfaction provides information on whether or not holding a job that does not require the acquired level of education represents a 'voluntary' status.[1] We expect the wage penalty of over-education to be the greatest among over-educated PhD holders who are over-skilled and/or dissatisfied with their jobs. Finally, we rely on the unconditional quantile regression (UQR) method, developed by Firpo et al. (2009), to examine how the wage penalty evolves along the wage distribution. Put differently, we aim to assess whether the over-education wage penalty is more pronounced for low- or high-wage PhD graduates. To our knowledge, evidence on this issue is quite scarce for higher education graduates in general (Bender and Roche, 2018), and even more so for PhDs (Gaeta et al., 2017).

Our findings first show that while the share of over-educated PhD holders is around 75%, 'only' 42% of PhDs actually appear to be over-skilled. Moreover, we find that 36% of doctoral graduates are both over-educated and over-skilled, and 18% over-educated and dissatisfied with their jobs. OLS estimates further indicate that the gross hourly wage penalty associated with over-education amounts to 25%, but decreases to 13.5% after including all covariates. All else being equal, the penalty increases slightly above 15% for genuinely over-educated workers (i.e. PhD holders that are both over-educated and over-skilled) and is even estimated at about 28% for over-educated PhDs who are dissatisfied with their jobs. Turning to the results along the earnings distribution, we find that the penalty for over-educated PhDs is not statistically significant in the bottom quartile but rises steadily to more than 15% at the median and at almost 30% at the 85th percentile.

The remainder of this paper is organised as follows. Section 2 describes the wage consequences of over-education according to the main theoretical models and reviews the empirical results on the wage penalty of over-education among doctoral graduates. Our methodology, data set and descriptive statistics are described in sections 3 and 4. Econometric results are presented in section 5. The last section concludes.

[1] The term 'voluntary' should be interpreted with caution as it may obviously be a constrained choice.

2. Literature review

2.1 Theoretical background

In Becker's (1962) human capital theory, over-education is interpreted as a temporary mismatch between the human capital of workers and the technology of firms (Leuven and Oosterbeek, 2011). In the longer term, over-education is seen as a statistical artefact consequent to omitted variable problems when the measurement of earnings and human capital accumulation is imperfect (McGuinness, 2006). Put differently, the wage penalty associated with over-education would simply result from the fact that workers with higher degrees than those required for their jobs have less human capital overall (e.g. less work experience) than their properly matched counterparts. According to Becker's theory, obtaining a doctorate is therefore a rational investment to acquire additional skills and ultimately a higher salary.

Thurow's (1979) job competition theory sees over-education as a permanent phenomenon in the economy where there is over-investment in education and individuals have to defend their position in the job distribution queue. In the case of demand rigidity and poor job prospects for highly educated individuals, they are more likely to accept jobs for which they are over-skilled and to over-invest in education in order to strengthen their position in the labour market. According to this model, only job characteristics influence earnings.

Sattinger's (1993) assignment theory can be described as an intermediate explanation between the human capital and job competition theories, in which the characteristics of workers and the characteristics of the jobs available in the economy can explain labour mismatch. In the job allocation process, workers prefer some jobs to others when they maximise their utility, while wages are determined by a hedonic price equation that takes into account both job and worker characteristics.

Sicherman and Galor's (1990) occupational mobility theory argues that workers end up being over-educated because they try to acquire the right amount of work experience and skills in order to improve future levels of mobility and income (Mavromaras et al., 2013). In other words, over-education is supposed to be a short-term phenomenon for the individual but a constant feature of the economy (Rubb, 2003).

Finally, Jovanovic (1979), in his job search theory, describes the phenomenon of over-education as a consequence of the individual's lack of information and her/his need for time to find the right job. In addition, mismatch can also be voluntary (Mavromaras et al., 2013) and result from workers choosing to compensate for lower pay with other intrinsic aspects of the

job that increase satisfaction, for example job security or work-life balance (McGuinness and Sloane, 2013).

2.2. Empirical findings

While the literature on the incidence and wage effects of over-education is substantial (Bender and Roche, 2013, 2018; Leuven and Oosterbeek, 2012; Maida and Tealdi, 2021, Tani, 2021; Verhaest and van der Velden, 2013), specific results for doctoral graduates are surprisingly scarce. The main reason for this is probably that it is often quite difficult to obtain sufficiently comprehensive databases to study this issue in depth for doctoral graduates. As a result, only a limited number of studies provide empirical results on this issue, most often with data for a single country.

Bender and Heywood (2009) analysed the impact of over-education on wages of doctorates in science using US cross-sectional data. They estimated earnings equations and found that mismatch is associated with lower wages, decreased job satisfaction and a higher rate of turnover. Specifically, they found that doctoral graduates having a job not related to their PhD suffer a wage penalty of between 7 and 14%, depending on the sector in which they are employed, compared to their well-matched counterparts. In terms of incidence, their estimates show that about 15% of academics and almost 50% of non-academics with a PhD report some degree of mismatch. In a more recent study, Bender and Heywood (2011) used a panel dataset of scientists in the US to provide estimates of the over-education wage penalty by field of study and at different career stages. Their fixed effects estimates show that the penalty is more pronounced for PhD holder workers in the hard and social sciences, as well as for those in the later stages of their careers.

The results of Canal Dominguez and Rodriguez Gutierrez (2013) confirm that being over-educated leads to a wage penalty for Spanish PhDs. They estimated wage differentials by field of study and occupation using Heckman's (1979) correction method for self-selection problems alongside the Oaxaca (1973) and Blinder (1973) decomposition technique. Overall, they found that doctoral graduates in non-academic jobs requiring doctoral or post-doctoral training earned more than doctoral graduates in non-academic jobs requiring only professional training. Specifically, their results suggest that, all other things being equal, doctorate holders suffer a wage penalty of between 18 and 25% compared to matched doctorate holders. Di Paolo and Mané (2016) examined the situation of doctoral graduates in Catalonia, considering not only over-education but also over-skilling as measures of mismatch. They estimated an

extended wage equation according to a labour market view based on assignment theory, in which both the human capital of workers and the characteristics of jobs determine pay. Applying a bivariate probit estimator to seemingly unrelated regressions (SUR), they find a wage penalty that peaks at about 12% when PhD holders are both over-educated and over-skilled.

Gaeta, Lavadera and Pastore (2017) studied the wage penalty associated with over-education among doctoral graduates in Italy using cross-sectional data for 2009. In essence, the authors show that the wage penalty incurred by over-educated PhD holders is around 11% but that this penalty is significantly higher among doctoral graduates who are genuinely over-educated (i.e. either over-educated and over-skilled or over-educated and dissatisfied with their job). In a more recent paper, Gaeta, Pastore and Lavadera (2022) used Italian cross-sectional data for 2009 to measure, through a recentered influence function (RIF), the effect of over-education at different points of the conditional wage distribution, as well as by field of study and sector of employment of doctorate holders. Overall, their results show that over-education penalises the wages of PhD holders who are employed in the academic sector and in non-R&D jobs outside universities. In contrast, no penalty is obtained for those who perform R&D outside academia. Finally, the authors find that the over-education wage gap is very heterogeneous along the wage distribution and particularly high in the middle and upper part of the wage distribution, which seems to be consistent with the glass ceiling hypothesis.

3. Methodology

3.1. Measuring over-education and its impact on wages

Over-education is typically measured by comparing the level of education attained by workers with the level of education required for the job they hold. Three methods co-exist in the literature to measure the level of required education for a job (Hartog, 2000; Verhaest and Omey, 2010). These are respectively the job analysis (JA), the realized matches (RM) and the worker self-assessment (WA) methods.

The JA method is based on the evaluation by professional analysts of the level of education required by occupation. The American DOT (Dictionary of Occupation Titles) is an example of this objective assessment method. It was used by Rumberger (1987), among others. This method may seem very attractive because it is based on explicit and objective definitions and measures. However, carrying it out on a large scale requires careful and time-consuming

work (Hartog, 2000). Moreover, it is criticized by Verdugo and Verdugo (1992), who state that the DOT is sometimes based on a single job analyst discussing requirements with the employer, leading to some doubts over the reliability and the validity of this measurement.

The RM method is based on the educational attainment of workers in each range of occupation. Two alternative measurements can be used. On the one hand, the mean level of education across a range of occupations is calculated, and workers whose educational attainment is greater than one standard deviation above the mean value for their occupation are considered as over-educated (Verdugo and Verdugo, 1989). On the other hand, the mode of years of education in each worker's occupation is calculated, and workers whose educational attainment is greater than the mode are considered as over-educated (Kampelmann and Rycx, 2012). However, the main shortcoming of this realized matches method is that it does not measure the real requirements for a job, but rather the actual assignment practice as determined by hiring standards and labour market conditions (Hartog, 2000).

Survey techniques can also be used whereby respondents are directly asked to specify the minimum level of education they consider to be needed to get their job. This WA method has been used, for example, by Duncan and Hoffman (1981) and Allen and van der Velden (2001). It is of particular interest because it allows to gather up-to-date information, and the obtained required level of education corresponds precisely to the respondent's job rather than to an aggregate measurement. However, this method does not rely on rigorous measurement as respondents can overstate the requirements of their own jobs. They can also reproduce hiring standards over the years, leading to major issues in case of a constant increase in the effective workers' level of education over time (Verhaest and Omey, 2010).

So far, there has not been any single perfect indicator, as each measurement method has its advantages and shortcomings (Leuven and Oosterbeek, 2012). The choice of one method over another is therefore mainly driven by data availability. Given the feature of ours, we use the WA method in this paper. The workers in our dataset were asked to self-assess the level of education needed *to do* as well as *to get* their job.[2] By comparing these levels of education with the highest level of education attained by each worker, we can then determine (based on each

[2] By relying on the WA method, over-education is constructed with replies from questions concerning the usefulness of the PhD. In this regards, it has been underlined how the exact phrasing varies substantially across studies: some interviews refer to recruiting standards (Duncan and Hoffman, 1981), while others to the education needed to perform the job (Hartog and Oosterbeek, 1988). Evidence also shows that the same person responds differently to similar questions, and it is not clear whether and to what extent these variations in framing and phrasing cause differences in the measured levels of required education (Green et al, 1999). For these reasons, we calculated the over-education variable in two alternative ways, namely on the basis of the usefulness of the PhD title *to do* and *to get* the current job position respectively.

criteria separately, i.e. either the educational level *to do* or *to get* the job) whether respondents are working above their own level of education (see section 4.1 for more details).[3]

To estimate the effect of over-education on the wages of doctorate holders in Europe, we rely on the dummy specification (or VV specification) developed by Verdugo and Verdugo (1989) which improves the traditional Mincer wage equation by distinguishing between the educational level of workers and the educational requirements of the job. Accordingly, our benchmark equation is formulated as follows:

$$lnW_i = \gamma_0 + \gamma_1 S_i^a + \gamma_2 OE_i + \gamma_3 UE_i + \gamma_4 X_i + u_i \quad (1)$$

where :

- lnW_i denotes the logarithm of the gross hourly wage of worker i;
- S_i^a is the number of years of education (i.e. the attained level of education) of worker *i*;
- OE_i is a dummy variable taking the value 1 if the worker is over-educated, and 0 otherwise;
- UE_i[4] is a dummy variable taking the value 1 if the worker is under-educated, and 0 otherwise;
- X_i is a vector containing a set of detailed covariates that have been divided in four groups:

  (i) Socio-demographic characteristics, which aim to take into account human capital theory arguments (Becker, 1962). These characteristics include dummies regarding the PhD field of study (teacher training and education sciences; humanities, languages and arts; economics, business, law and finance; other social sciences; natural sciences; mathematics and statistics; computing sciences; engineering sciences; agriculture and veterinary sciences; medicine and health-

[3] The over-education variable computed on the basis of the educational level *to get* the job is used as a robustness test. Estimates based on this alternative measure are very similar to those based on the educational level required *to do* the job. Therefore, the latter are only reported for the stepwise OLS analysis (without interaction effects). The results of other specifications, which corroborate our findings, are available on request.

[4] A worker is considered as under-educated if her/his level of education is lower than that required for her/his job.

related sciences; security, transport or personal services); worker's age (in level and squared); worker's years of tenure (in level and squared); dummies defining the previous labour market status of the worker (i.e. in education or training, employed, unemployed, other e.g. child care, disability); dummies for participation in training courses in the last 12 months (i.e. courses attended during working hours, outside working hours, while performing the regular job); a dummy variable for gender (1 for men, 0 otherwise); and dummies specifying the living conditions of the individual (i.e. living alone, with parents, with partner, with children).

(ii) & (iii) Skills needed to do the job and other job-specific characteristics, which are intended to take account of arguments relating to the job competition model (Thurow, 1979) and the assignment theory (Sattinger, 1993). The characteristics of the skills needed to do the job include 5 dummy variables identifying whether the level of literacy, numeracy and ICT skills required for doing the job are basic, moderate or advanced respectively.[5] The job-specific characteristics comprise dummies for the type of employment contract (i.e. temporary/fixed-term, indefinite/permanent, no formal contract); dummies for the characteristics that the job involves, i.e. learning new things during daily work, choosing the way in which to do the work (autonomy), team working and responding to non-routine situations in daily work; a dummy equal to one if the individual has been promoted to a higher position since working for the current employer; dummies for the sectors of activity (i.e. science and engineering; health; teaching; business and administration; ICT; legal, social and cultural industries); a dummy equal to one if the employee works in the private sector; a dummy equal to one if the company has more than one workplace; and dummies for the size of the firm (i.e. number of full-time equivalent employees being 1-9, 10-49, 50–99, 100-249, 250-499, 500 and more).

(iv) Variables related to job motives (i.e. the reasons why a worker chose his/her job), which aim to capture the importance of the arguments put forward by theories of

[5] Given the distribution of these variables, we have chosen to include 2 dummies for ICT skills (i.e. for moderate and advanced levels) and only 1 for numeracy and literacy skills respectively (i.e. for the advanced level).

occupational mobility (Sicherman and Galor, 1990) and job search (Jovanovic, 1979). These variables include dummies that are respectively equal to one when the job matches the individual's qualifications and skills; when the job offers the possibility of gaining work experience; when it provides security; when it offers the possibility of career progression; when the company's reputation is good; when it offers benefits such as health insurance, bonuses, a company car; when the workplace is close to home; when the nature of the job is interesting for the worker; and when the job provides a good work-life balance.

– u_i is the error term.

In equation (1), γ_1 measures the return to an additional year of attained education, while γ_2 and γ_3 measure the returns of being over- and under-educated respectively. The level of attained education is controlled for in equation (1), so that mismatched workers are compared directly to workers with the same level of attained education but in a job for which they are adequately educated. The existing literature suggests that γ_2 should take a negative value, over-educated workers being subject to a penalty compared to their former classmates employed in jobs that match their level of education, meaning that over-educated individuals earn less than their comparably educated counterparts who are well matched (McGuinness, 2006).

3.3 Estimation techniques

Equation (1) has been estimated with two different methods: (i) ordinary least squares (OLS), and (ii) the unconditional quantile regression (UQR) approach. The OLS estimator, with heteroscedasticity-consistent standard errors, is based on the cross-section variability between workers in our sample. OLS estimates are likely to suffer from two main biases: endogeneity (i.e. unobserved ability) and measurement error (Mavromaras et al., 2013).

The unobserved ability bias could arise in the presence of an unobserved ability factor that is correlated with both over-education and earnings. In other words, the omission of unobserved ability overstates the pay penalty for the over-educated status (Verhaest and Omey, 2010). Authors have attempted different strategies in order to tackle this issue. The inclusion of more precise control variables of the quality of workers' human capital is a first possible approach (Kleibrink, 2016). A second possibility is to rely on instrumental variables. However,

finding instruments that are both relevant and exogeneous remains difficult (Kampelmann et al., 2020). Finally, when appropriate longitudinal data are available, a fixed-effect estimator can also be used. In this paper, we rely on the first strategy, i.e. we include a large set of covariates that capture the heterogeneity of workers' abilities and motivations (cf. groups 1 and 4 of the control variables discussed above). We expect the OLS regression coefficient associated with the over-education dummy variable to decrease (in absolute value) when these covariates are included (Gaeta et al., 2017).

Second, since we rely on the worker self-assessment (WA) approach to measure over-education, and workers tend to overestimate their likelihood of being over-educated, our estimates may suffer from a measurement error bias. Evidence suggests that this bias generally under-estimates the true wage penalty associated with over-education (Dolton and Silles, 2008). Indeed, the wage penalty associated with over-education is expected to decrease (in absolute value) as more individuals believe to be over-educated when they are not (Caroleo and Pastore, 2018). Therefore, the results presented in this paper should be interpreted with caution, bearing in mind that they are likely to be lower bound estimates, i.e. the true wage penalty for over-education is likely to be higher (Verhaest and Omey, 2010).

Another limitation of the OLS estimator is that it only estimates the over-education wage penalty at the mean value of the dependent variable. However, the penalty is likely to be heterogeneous and to vary along the wage distribution (Bender and Roche, 2018). To examine this issue, we re-estimated equation (1) using the unconditional quantile regression (UQR) approach developed by Fortin et al. (2009).

4. Data set and computation of mismatch variables

In spring 2014, the European Center for the Development of Vocational Training (CEDEFOP), commissioned Ipsos to carry out the first pan-European survey on skills mismatch. This European Skills and Jobs (ESJ) survey, at the basis of our analysis, was conducted by telephone and online on 48,676 employees aged between 24 and 65 in the 27 European Union Member States and the UK. It aims at assessing the extent to which respondents' qualifications and skills correspond to the level required to do their job. The survey has the advantage of providing a large number of educational and skill mismatch indicators. Another distinctive feature is the variety of moderating and/or control variables that can be included, thus improving the relevance and accuracy of the analysis.

Concerning the level of education of respondents, the International Standard Classification of Education (ISCED 2011) was applied. As this analysis focuses on European doctorate holders, only individuals with an educational level corresponding to ISCED 2011 level 8 were considered. Furthermore, in order to analyse the relation between over-education and workers' wages, jobless individuals, consisting in a small portion of the sample (1.2%), were dropped. The wage variable has been constructed from the following question: "On average, how much is your gross monthly earnings from your job (before deductions or credits of tax and national insurance)?". A significant portion of answers was missing (27.2%) because some individuals (i.e. 768 workers) either did not know their wage or refused to communicate it, and were therefore dropped from the sample. Our final sample is therefore made of 2,053 workers holding a PhD. Table A-2 in the Appendix presents the descriptive statistics of our main regressors and moderating variables before and after restricting our sample to only those workers for whom wage information is available. It is interesting to note that the descriptive statistics remain largely unchanged after applying this restriction.

4.1 Computing the main variables of interest

In order to measure over-education, two questions in our data set have been compared, namely: "What are the educational qualifications, if any, that someone actually needs *to do* your job today?" and "What is the highest level of education or training that you have completed?". A worker was then classified as over-educated for her/his job if her/his level of education was higher than that required *to do* the job. In the context of this research, and given the fact that all workers in the data hold a PhD degree, a worker was automatically considered over-educated (dummy variable equal to one) if her/his job did not require a doctorate qualification. According to this approach, 79% of the workers in our sample declared to be over-educated.

As mentioned earlier, the WA method of measuring over-education is subjective and may therefore lead to over-estimation by respondents, which is possibly to be the case here as the portion of over-educated workers in our sample is quite large. Therefore, as a robustness test, an alternative measure of over-education has been used, namely over-education in order *to get* the job the individual currently holds. Specifically, to classify a worker as over-educated or not, we compared the following questions: "What are the educational qualifications, if any, that someone actually needs *to get* your job today?" and "What is the highest level of education or training that you have completed?". A worker is then classified as over-educated for her/his job if her/his level of education is higher than that required *to get* the job. Following this

alternative approach, 76% of workers in our sample stated that the doctorate was not useful for obtaining their current job.

As over-education usually comes with over-skilling, another measure of mismatch has been considered, namely the situation in which a worker feels that she/he makes little use of her/his past experience, skills and abilities in her/his current job (Chevalier, 2003). In this paper, the measure of over-skilling is based on individuals' responses to the following question: "Overall, how would you best describe your skills in relation to what is required to do your job?", with possible answers being "My skills are higher than required by my job", "My skills are matched to what is required by my job", and "Some of my skills are lower than what is required by my job and need to be further developed". Based on the answers to this question, it appears that 42.5% of the workers in the sample are over-skilled.

Another interesting variable is job satisfaction. Indeed, as suggested by Gaeta et al. (2017), the interaction between over-education and job satisfaction makes it possible to distinguish between people who have voluntarily chosen to work in a job for which they are over-educated (or at least are satisfied with it) and those for whom this situation is clearly undesirable and unsatisfying. Therefore, a variable measuring the worker's satisfaction with her/his current job (which we will later interact with over-education) was constructed by considering the answer to the following question: "On a scale from 0 to 10, where 0 means very dissatisfied, 5 means neither satisfied nor dissatisfied and 10 means very satisfied, how satisfied are you with your job?". The satisfaction variable consists of a dummy that takes the value of 1 when the individual is satisfied with her/his job, 0 otherwise, and the individual is considered satisfied when her/his response takes values from 6 to 10. Based on this definition, 21% of the individuals in our sample are dissatisfied with their current job.

4.2 Interaction effects

An important part of our empirical analysis focuses on interaction effects. More specifically, we first considered the interaction between over-education and over-skilling. Following Mavromaras et al. (2013), Pecoraro (2014) and Di Paolo and Mané (2016), four alternative situations have been considered: (1.i) genuine matching, which occurs when respondents report being neither over-educated nor over-skilled, (1.ii) apparent matching, which occurs when respondents report being over-skilled but not over-educated, (1.iii) apparent over-education, which occurs when respondents report being over-educated but not over-skilled, and (1.iv) genuine over-education, which occurs when respondents report being both over-educated and

over-skilled. Looking at the data, it appears that 43% of PhD holders are over-educated but not over-skilled (i.e. apparently over-educated), while 36% declared to be both over-educated and over-skilled (i.e. genuinely over-educated). Only 7% of those who are not over-educated are over-skilled (i.e. apparently matched).

We also examined the interaction between over-education and workers' job satisfaction. Following Chevalier (2003), four alternative situations can be considered: (2.i) genuine matching, which occurs when the doctorate holder is not over-educated and satisfied with her/his current job, (2.ii) apparent matching, which occurs when the PhD holder is not over-educated but dissatisfied with her/his job, (2.iii) apparent over-education, which occurs when the PhD holder is over-educated but satisfied with her/his job, and finally (2.iv) genuine over-education, which occurs when the PhD holder is both over-educated and unsatisfied with her/his job. In our sample, we find that 61% of PhD holders are overeducated but satisfied with their current job (i.e. apparently overeducated), while 18% report being both overeducated and dissatisfied with their current job (i.e. genuinely overeducated).[6]

5. Econometric results

5.1 Stepwise OLS analysis

In order to analyse the relationship between over-education and wages, we first estimated equation (1) by OLS. The dependent variable is the natural logarithm of the gross hourly wage. The over-education variable (OE_i) is a dummy that equals 1 when the individual is considered to be over-educated and its coefficient (γ_1) will be interpreted as a *ceteris paribus* correlation. Therefore, a negative relationship between the dependent variable and the variable of interest is expected, which means that being over-educated should be correlated with lower wages. To strengthen the robustness of our results, all regressions were run with two alternative definitions of over-education: one considering the educational qualification needed *to do* the job, the other based on the educational qualification needed *to get* the job (see section 4.1 for more details). Following McGuinness and Pouliakas (2017), four groups of covariates were included step-by-step in order determine how and to what extent the over-education wage penalty can be attributed to either human capital (i.e. socio-demographic) characteristics, specific skills needed to do the job, other job characteristics, and compensating job attributes.

[6] Complementary descriptive statistics is given in Appendix Table A-1.

[Insert Table 1 about here]

The OLS estimates, with heteroscedasticity-consistent standard errors, are presented in Table 1. The results in columns (1) and (1') show the effects of over-education on workers' wages using either measure of over-education while controlling only for country fixed effects.[7] As expected, regardless of the indicator of over-education used, we find that the regression coefficient associated with over-education is significant and negative. Specifically, in both cases, estimates indicate that the wage penalty for over-educated PhD holders is about 25% compared to their well-matched former classmates. Our results therefore suggest that over-educated PhDs could earn about a quarter more if they worked in jobs where their doctoral degree was required.

Columns (2) and (2') of Table 1 show how differences in socio-demographic characteristics (e.g. PhD field of study, age, tenure, labour market status before the current job, participation in training courses in last 12 months)[8] contribute to the explanation of this wage penalty. For both over-education indicators, we find that the over-education wage penalty is reduced by almost one-third, from about 25% to slightly less than 17% after the inclusion of these covariates. Therefore, a significant fraction of the gross wage penalty of over-educated PhD holders appears to derive from their less favourable (i.e. rewarding) human capital attributes. That said, in light of the large residual wage penalty, other explanations deserve to be explored. In line with previous studies (e.g. Di Paolo and Mané (2014) and Gaeta et al. (2017, 2022)), our results indeed suggest that arguments put forward by human capital theory (Becker, 1962) only partially explain the wage gap between over-educated and well-matched PhDs.

Columns (3) and (3') of Table 1 include additional controls respectively for the level of numeracy, literacy and ICT skills needed to do the job. In doing so, we test the hypothesis that part of the over-education wage penalty results from the fact that over-educated PhDs hold jobs with lower average requirements than those associated with jobs held by well-matched PhDs. Following the inclusion of these covariates, we find that the over-education wage penalty decreases by approximately 1.5% points to around 15% percent. Our results thus confirm the hypothesis under investigation. However, differences in the ICT, numeracy and literacy skills

[7] The complete set of regression results, not reported here due to space constraints, is available on request.
[8] See Section 3.1 and Appendix Table A-1 for a detailed description of these characteristics.

required for the jobs held by the over-educated and well-matched PhDs respectively appear to contribute rather modestly to the overall wage gap between them.

To further test the relevance of the arguments put forward by the job competition (Thurow, 1979) and assignment (Sattinger, 1993) models, we added various other controls for job-specific characteristics (e.g. type of contract, sector of activity, size of the workplace, job complexity, autonomy to do the work, ability to learn new things during daily work, working as part of a team). The results, presented in columns (4) and (4') of Table 1, show that these characteristics also contribute to explaining the over-education wage penalty. However, their contribution is again relatively limited, as the penalty does not decrease by more than 1% point, to about 14%. Overall, our estimates in columns (3), (3'), (4) and (4') support the theoretical arguments of the models that attribute a role to job characteristics that would limit the ability of over-educated PhDs to fully exploit their skills, reduce their productivity and thus also their wages. That said, in quantitative terms, our results suggest that the contribution of these arguments amounts to less than 10% of the gross wage penalty associated with over-education (i.e. contributes less than 3 percentage points).

Finally, we added several control variables related to job motives. These variables reflect, among other things, the importance that the worker places on the fact that the job suits his level of qualifications and skills, offers a good career progression and development, provides a good security, is interesting, is close to home, is well paid or allows a good work-life balance. Estimates, presented in columns (5) and (5') of Table 1, show that job motives matter as the over-education wage penalty decreases further to about 13.5%. However, given that this decrease is less than 1% point, our results suggest that the argument of compensatory job attributes, put forward by career mobility (Sicherman and Galor, 1990) and job search (Jovanovic, 1979) theories, plays a rather limited role in explaining the over-education wage penalty among PhDs.

In sum, our stepwise OLS analysis reveals that, compared to their well-matched counterparts, over-educated PhDs in European countries suffer a wage penalty of between 25 and 13.5% depending on the specification adopted. This range for our results is in line with the few existing studies on the US, Spain and Italy (see e.g. Bender and Heywood, 2009; Canal Dominguez and Gutierrez; Di Paolo and Mané; Gaeta et al., 2022). Moreover, consistent with these studies, we find that characteristics explain less than half of the unadjusted wage penalty associated with over-education among Ph.D. holders. This result also corroborates the estimates of other studies of all higher education graduates, including Bender and Roche (2018) for the US in 2015.

5.2 The moderating role of over-skilling and job satisfaction

Next, following Mavromaras et al. (2013), we tested the role of two moderating variables, namely over-skilling and job satisfaction, in the relationship between over-education and earnings of PhD holders.

Therefore, we have first re-estimated equation (1) by distinguishing the following four situations in which PhD holders may find themselves, namely being: (1.i) genuinely matched (i.e. neither over-educated nor over-skilled), (1.ii) apparently matched (i.e. not over-educated but over-skilled), (1.iii) apparently over-educated (i.e. over-educated but not over-skilled), and (1.iv) genuinely over-educated (i.e. over-educated and over-skilled).

[Insert Table 2 about here]

The OLS regression using these interaction terms was carried out following the same approach as for the regressions presented so far. For the sake of simplicity and clarity, Table 2 presents only the coefficients for these interaction variables. However, we controlled for exactly the same set of covariates as in Table 1. The regression coefficients for the apparently matched, apparently over-educated and genuinely over-educated are interpreted as the wage penalty faced by these different groups of PhD holders with respect to their genuinely matched counterparts (i.e. the reference category).

Our results first show, in line with earlier results obtained for Italy by Gaeta et al. (2022), that the regression coefficients for apparently matched and apparently over-educated PhD holders are not statistically significant. Therefore, we cannot reject the hypothesis that these two categories of PhD holders earn similar wages to their genuinely matched counterparts. If we consider PhD holders who are both over-educated and over-skilled, results are very different. Indeed, they show a significant wage penalty of 15,3% compared to genuinely matched PhD holders. As expected, this penalty is higher than the one estimated for over-educated PhDs, using our model *without* interaction effects (see Table 1). However, the differential wage gap does not exceed 2% points (15,3 vs 13,5%).

Next, we examined the moderating role of job satisfaction. To do so, as highlighted in Section 4.2, the four following situations in which PhD holders may find themselves have been considered, namely being: (2.i) genuinely matched (i.e. neither over-educated nor dissatisfied), (2.ii) apparently matched (i.e. not over-educated but dissatisfied), (2.iii) apparently over-educated (i.e. over-educated but not dissatisfied), and (2.iv) genuinely over-educated (i.e. over-

educated and dissatisfied). These interaction effects provide some information on the potential voluntary status of over-education. More precisely, these interactions allow us to distinguish between people who have 'voluntarily' chosen to work in a job for which they are over-educated[9] (or at least are satisfied with it) and those for whom this is clearly an undesirable and unsatisfactory situation. Indeed, while some workers may give up a job corresponding to their level education and thus a higher wage in favour of other job characteristics (e.g. greater job security, shorter commuting time or a better work-life balance), for others, holding a job for which they are over-educated is by no means the result of a compensatory strategy that satisfies them (Jovanovic, 1979).

[Insert Table 3 about here]

The OLS regression results with the interaction variables between over-education and job satisfaction are presented in Table 3. They first show that PhD holders that are apparently matched or apparently over-educated do not experience a wage penalty compared to their genuinely matched counterparts. In contrast, genuinely over-educated PhDs are found to earn 28,1% less than the reference category. Doctoral graduates who are both over-educated and dissatisfied with their jobs therefore earn more than a quarter less than if they were in a job that matches their education and satisfies them. Moreover, we find that the over-education wage penalty (estimated at 13.5% in our specification *without* interaction effects, see Table 1), more than doubles when focusing on those who report being dissatisfied with their jobs.

5.3 Analysis along the wage distribution

Finally, we analysed the heterogeneity of the over-education wage penalty and in particular its evolution along the wage distribution. To do so, we relied on the unconditional quantile regression approach, developed by Firpo et al. (2009), using the same control variables as in equation (1).

[Insert Figure 1 about here]

[9] See footnote 1.

Figure 1 displays the estimates obtained for the over-education variable through a graphical representation where the horizontal axis represents the quantiles of the wage distribution, and the vertical axis represents the estimated over-education wage penalty.[10] Overall, we find that the detrimental effect of over-education on wages is highly heterogeneous throughout the wage distribution. More precisely, in the bottom part of the wage distribution, results show that the coefficient of over-education is small, close to zero and statistically non-significant. This suggests that, for low levels of wages, there is no correlation, *ceteris paribus,* between the over-education status of PhD holders and their earnings. The over-education coefficient becomes statistically significant starting from the 35th percentile, with a wage penalty of 4.2%. The coefficient then increases along the wage distribution and reaches the highest value at the 85th percentile. At that level, the over-education wage penalty for a doctorate holder is 29.5%.

To sum up, our results suggest that over-educated PhD graduates face a substantial wage penalty, especially when they are located in the middle-top of the earnings distribution. A similar outcome has been reported by Gaeta et al. (2022) in the Italian context. The absence of a significant wage penalty at the bottom of the wage distribution can be interpreted in the light of the various labour market institutions in Europe (e.g. minimum wages, trade unions, unemployment benefits) that raise and compress the earnings of low-paid workers. As for the higher wage penalty at the middle-top of the distribution, it seems to be consistent with the existence of a glass ceiling, i.e. the fact that over-educated PhDs face invisible but real barriers preventing them from obtaining higher level positions.

6. Conclusion

Over the past 15 years, the number of doctoral degrees awarded in European countries has increased very significantly. This has led to growing concerns about the career prospects of doctoral graduates (Gaeta et al., 2022). The growth in the number of PhDs raises challenges when looking for a job in the labour market, especially outside academic institutions (Canal Dominguez and Rodriguez, 2013). Despite research demonstrating the costs associated with excess human capital (i.e. over-education and over-skilling), policies to address the problem are rarely visible, either at national or European level. McGuinness and Pouliakas (2016)

[10] Detailed regression results, not reported here due to space constraints, are available on request.

suspect that policymakers do not see over-education as highly problematic, but simply as a short-term phenomenon.

While the literature on the incidence and wage effects of over-education is substantial (Bender and Roche, 2009, 2013, 2018; Leuven and Oosterbeek, 2012; Jones et al., 2013;Maida and Tealdi, 2021, Tani, 2021), specific results for doctoral graduates are surprisingly scarce. This paper aims to fill this gap, not only by measuring the prevalence of over-education among PhD holders in Europe (i.e. in EU Member States and the UK), but also by estimating their wage penalty relative to what they could have earned in a job corresponding to their level of education. Using a unique pan-European dataset (CEDEFOP, 2014), we rely on two alternative measures of over-education and control stepwise for four groups of covariates (i.e. socio-demographic characteristics, skills needed to do the job, other job-specific characteristics and motivations for employment) in order to interpret the over-education wage penalty in light of theoretical models.

Our descriptive statistics first show that while the share of over-educated PhD holders is around 75%, 'only' 42% of PhDs actually appear to be over-skilled. Moreover, we find that 36% of doctoral graduates are both over-educated and over-skilled, and 18% over-educated and dissatisfied with their jobs. Depending on the specification adopted, OLS estimates further indicate that the gross hourly wage penalty associated with over-education amounts to 25%, but decreases to 13.5% after including all covariates. As expected, *ceteris paribus*, our results also show that the wage penalty associated with over-education is higher (at around 15%) for doctoral graduates who are both over-educated and over-skilled, and particularly severe (at around 28%) for those who are both over-educated and dissatisfied with their jobs. Finally, unconditional quantile regressions suggest that over-educated PhD graduates face a substantial wage penalty, specifically when they are located in the middle-top of the earnings distribution. While the absence of a significant wage penalty at the bottom of the wage distribution can be interpreted in the light of the various labour market regulations in Europe that raise and compress the wages of low-paid workers, the higher penalty at the median (around 15%) and especially at the top of the distribution (around 30%) seems consistent with the existence of a glass ceiling.

In summary, the analysis carried out in this article leads to a double conclusion. On the one hand, it appears that a significant fraction (i.e. between 1/5 and 1/3) of PhD holders in Europe are genuinely over-educated (i.e. they are either over-educated and over-skilled, or over-educated and dissatisfied with their jobs). On the other hand, these genuinely over-

educated PhD holders are found to face a substantial wage penalty (ranging from 15 to almost 30%).

In many ways, these results are worrying. Firstly, given the extent of the phenomenon of over-education and its socio-economic consequences (Bender and Heywood, 2017; Bender and Roche, 2013; Leuven and Oosterbeek, 2011), the incentive for individuals to undertake a PhD is likely to be dampened. Indeed, individuals may reconsider their investment in education, fearing that the time and effort spent on obtaining a PhD is not sufficiently rewarded (Gaeta et al., 2022). This is a key issue as PhD holders are generally considered to play a strategic role in the expansion of the so-called 'knowledge economy' (Bansak et al., 2021; Ermini et al., 2017). Moreover, from a public finance perspective, the fact that many doctorate holders end up in jobs for which they are genuinely over-educated means that significant resources are wasted, especially as the cost of doctoral training is high and the share of public funding spent on doctorate holders is large (Caroleo and Pastore, 2018). Finally, given that doctoral education is often described as central to the innovation process and a key driver of productivity growth (OECD, 2016), the economic gains from improving the matching of PhD holders are likely to be very large. Overall, this suggests that the problem of over-education of doctoral graduates should not be taken lightly and requires further attention from scientists (to better understand the phenomenon) and policy makers (to take appropriate action).

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Table 1: Stepwise OLS estimates

Dependant variable: log of hourly wage	(1)	(1')	(2)	(2')	(3)	(3')	(4)	(4')	(5)	(5')
Over-education *to do* the job	-0.249***		-0.167***		-0.152**		-0.142**		-0.135**	
	(-4.21)		(0.06)		(0.06)		(0.06)		(0.06)	
Over-education *to get* the job		-0.246***		-0.165***		-0.150**		-0.139**		-0.131**
		(-4.16)		(0.06)		(0.06)		(0.06)		(0.06)
Control variables:[1]										
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Socio-demographic characteristics	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Skills needed to do the job	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Other job-specific characteristics	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Motivations for employment	No	No	No	No	No	No	No	No	Yes	Yes
Number of observations	2,053	2,053	2,053	2,053	2,053	2,053	2,053	2,053	2,053	2,053
R^2	0.163	0.163	0.112	0.112	0.117	0.117	0.159	0.159	0.163	0.163

Notes: [1] The precise description of the control variables is provided in Section 3.1 and in Appendix A-1.
Robust standard errors are reported between parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 2: Interaction effects between over-education and over-skilling (to do the job), OLS estimates

Dependant variable: log of hourly wage	(1)
Genuinely matched (i.e. neither over-educated nor over-skilled)	Reference category
Apparently matched (i.e. not over-educated but over-skilled)	0.17 (0.09)
Apparently over-educated (i.e. over-educated but not over-skilled)	-0.0019 (0.04)
Genuinely over-educated (i.e. over-educated and over-skilled)	-0.153*** (0.06)
Control variables:[1]	
Country fixed effects	Yes
Socio-demographic characteristics	Yes
Skills needed to do the job	Yes
Other job-specific characteristics	Yes
Motivations for employment	Yes
Number of observations	2,053

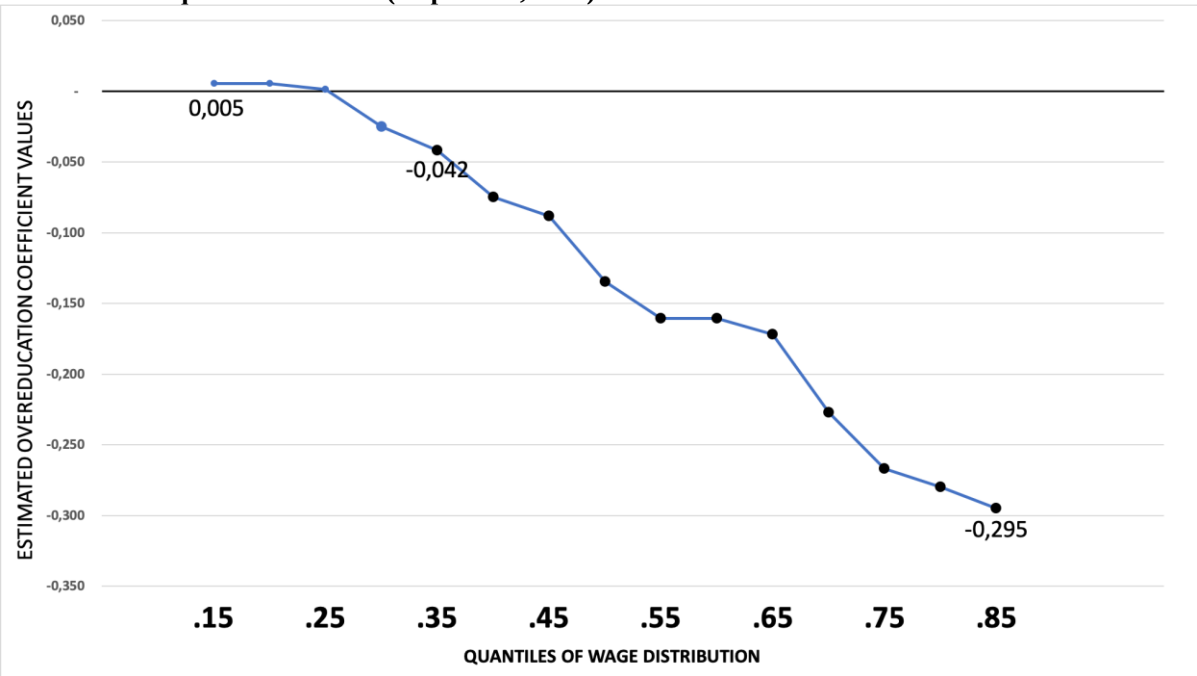
Notes: [1]The precise description of the control variables is provided in Section 3.1 and in Appendix A-1. Over-education and over-skilling refer to over-education and over-skilling *to do* the job. Robust standard errors are reported between parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Interaction effects between over-education and job satisfaction, OLS estimates

Dependant variable: log of hourly wage	(1)
Genuinely matched (i.e. neither over-educated nor dissatisfied)	Reference category
Apparent matching (i.e. not over-educated but dissatisfied)	0.160 (0.10)
Apparent over-education (i.e. over-educated but not dissatisfied)	0.183 (0.14)
Genuine over-education (i.e. over-educated and dissatisfied)	-0.281*** (0.06)
Control variables:[1]	
Country fixed effects	Yes
Socio-demographic characteristics	Yes
Skills needed to do the job	Yes
Other job-specific characteristics	Yes
Motivations for employment	Yes
Number of observations	2,053

Notes: [1] The precise description of the control variables is provided in Section 3.1 and in Appendix A-1. Over-education refers to over-education *to do* the job. Robust standard errors are reported between parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: The over-education wage penalty along wage distribution, unconditionnel quantile estimates (Firpo et al., 2009)



Notes: The blue (black) dots on the graph correspond to statistically non-significant (significant) regression coefficients at the 10% probability level. Detailed regression results, not reported here due to space constraints, are available on request.

Appendix Table A-1. Descriptive statistics, overall sample

Variables	Share of sample (%)
Main explanatory variables and moderators:	
Over-educated (to do the job)	79.5
Over-skilled (to do the job)	42.5
Unsatisfied with the job	21.0
Over-educated and over-skilled (to do the job)	35.8
Over-educated (to do the job) and unsatisfied with the job	18.3
Control variables:	
a) Socio-demographic characteristics	
PhD field of study:	
Teacher training and education sciences	11.1
Humanities, languages and arts	14.0
Economics, business, law and finance	18.6
Other social sciences	6.7
Natural sciences	15.0
Mathematics and statistics	4.7
Computing sciences	9.4
Engineering sciences	15.0
Agriculture and veterinary sciences	1.9
Medicine and health-related sciences	7.7
Security, transport or personal services	2.1
Age categories:	
24-35	33.0
36-45	37.0
46-55	22.0
56-64	8.0
Tenure > 10 years	36.7
Status before current job:	
Education or training	28.9
Employed	55.0
Unemployed	10.8
Other (not working, e.g. child care, disability)	2.0
Training courses attended in the last 12 months:	
Courses attended during working hours	49.3
Courses attended outside working hours	25.0
Courses attended while performing regular job	3.9
Men	55.6
Living conditions:	
Alone	19.1
With parents	3.2
With partner	68.6
With children	43.6
With friends	1.7
b) Skills needed to do the job	
Level of ICT skills to do the job: advanced	25.0
Level of ICT skills to do the job: moderate	62.1
Level of ICT skills to do the job: basic	8.6
Level of literacy skills to do the job: advanced	78.8
Level of numeracy skills to do the job: advanced	46.12
c) Other job-specific characteristics	
Type of contract:	
Indefinite	12.2

Temporary	84.6
No formal work contract	1.2
Characteristics that the job involves:	
Responding to non-routine situations during the course of the daily work	97.5
Choosing the way in which to do the work	96.8
Learning new things during daily work	98.7
Working as part of a team	97.8
Individual has been promoted to a higher position since working for the current employer	39.1
Sector of activity:	
Science and engineering	19.5
Health	8.5
Teaching	19.3
Business and administration	11.0
ICT	7.6
Legal, social and cultural	5.1
Company with more than 1 workplace	68.8
Size of the workplace (FTE number of employees):	
1-9	11.8
10-49	22.6
50-99	14.3
100-249	15.3
250-499	8.1
>500	26.0
d) Motivations for employment	
Job suits qualifications and skills	98.3
Willingness to gain work experience	96.2
Good job security	98.2
Good career progression and development	97.1
Company well known in the field	97.3
Good pay and package of fringe benefits	95.3
Close to home	90.7
Interested in nature of the job itself	98.6
Good work-life balance	97.3
Number of observations	2,053

Appendix Table A-2: Sample before and after excluding individuals with no information on wages

% of sample	Sample including all workers (also those for whom there is no information on their wages (1)	Sample comprising only workers for whom wage information is available (2)
Over-educated (to do the job)	79.1	79.5
Over-skilled (to do the job)	42.1	42.5
Unsatisfied with the job	21.2	21.0
Over-educated (to do the job) and over-skilled	34.7	35.8
Over-educated (to do the job) and unsatisfied with the job	18.1	18.3
Share of sample (%)	100.0	100.0
Number of observations	2,821	2,053

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