Overeducation -
New Evidence for 25 European Countries

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Abstract

This study investigates the incidence of overeducation among workers in the EU and its underlying factors based on the most recent wave of the European Labor Force Survey (EU-LFS 2013). Its main purpose is to shed light on the interplay of so far neglected explanatory factors such as household characteristics and field of study as well as to reveal country differences in the impact of these factors on vertical mismatch. Therefore, our innovative features are the large number of determinants as well as the considerable amount of European countries simultaneously analyzed. Moreover, we differentiate in our analysis between high- and medium-skilled workers. Our findings point to a considerable variation in the potential determinants of overeducation across countries as well as across skill levels. This variation is not restricted to job-related characteristics, but interestingly also concerns household variables. Among those determinants showing a largely uniform influence are nationality, job tenure, temporary employment and presence of unemployed household members.

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1 | Introduction

In general, the term overeducation refers to a job match in which the educational level of the worker clearly exceeds the educational requirements of the job. In the terminology of labour economics, this is often considered a vertical skill mismatch, as opposed to horizontal mismatches (workers choosing jobs with requirements outside the scope of their field of study/apprenticeship). A widespread occurrence of this phenomenon can seriously impair the competitiveness of an economy, both from a macro- and a microeconomic perspective. From a macroeconomic perspective, an overeducation status of qualified workers reflects a waste of scarce human capital. From a microeconomic perspective, the overeducation status can affect a worker's job satisfaction. In turn, a skill mismatch can reduce overall work motivation, expressing itself in more frequent absenteeism and higher turnover of the workforce (Tsang and Levin, 1985; Sicherman, 1991; Sloane et al., 1999). Moreover, overeducation is associated with earnings losses. Overeducated workers regularly earn more than their job colleagues but less than correctly matched workers with similar education (e.g. Daly et al., 2000; Bauer, 2002; Boll and Leppin, 2014a).

However, before being able to tackle the problem successfully, it is essential to understand the driving forces of overeducation at the individual level. Thus, the aim of this paper is to identify possible determinants of overeducation for EU-28 countries. We make use of the 2013 wave of the European Labour Force Survey (EU-LFS), a quarterly household sample survey that covers approximately 1.8 million individuals aged 15 years or older. This data set provides rich information on the respondent's demographic background, labour status, employment characteristics and educational attainment. It allows us to assess and compare the impact of a large variety of potential determinants, both separately for single countries and in a cross-country estimation. Furthermore, we carry out separate estimations for high- and medium-skilled workers to account for potential differences in the channels leading to overeducation.

In this way, we make several contributions to the existing empirical literature on the determinants of overeducation. First, we include a range of new candidates for explanatory factors into our framework, including a person's field of study and household characteristics such as the presence of inactive and unemployed household members. Moreover, the effect of having a second job is added as another potential job-related factor. Second, our results allow for the first time for a comprehensive country comparison of the associations between overeducation and distinct micro level characteristics within the EU area. This helps to identify differences in the seriousness of the phenomenon between countries and to develop tailor-made policy recipes. Finally, by undertaking estimations differentiated by skill level, we are able to analyze in how far certain channels affect the overeducation risk of workers at different educational levels differently.

This is of particular relevance for factors like field of study, whose interpretation is strongly related to educational status.

Our findings indeed point to a considerable variation in the potential determinants across countries as well as across skill levels. This variation is not restricted to job-related characteristics, but interestingly also concerns household variables. Among those determinants showing a largely uniform influence are nationality, job tenure, temporary employment and presence of unemployed household members. The outline of the paper is as follows. The next section provides a brief overview of the theories and empirical results regarding the determinants of overeducation. Section 3 describes measurement method, data and our model setup. The results are discussed in section 4 and section 5 concludes.

2 | Literature Findings

2.1 | Theories

In principle, a vertical skill mismatch can result from characteristics of the worker, characteristics of the job or characteristics of the worker-job matching procedure. The first case is emphasized by supply-side theories of labour productivity. According to the neoclassical *Human Capital Theory (HCT)*, a worker's productivity on-the-job is foremost determined by her past investments into human capital through formal education or training. These investments are under normal circumstances rewarded by the market, as workers get paid according to their marginal product. The HCT therefore regards job mismatch as a negligible and temporary phenomenon, which is naturally corrected by the market (Becker, 1964). This kind of reasoning rests on the assumption that skills gathered through schooling and skills gathered through practical experience (or inherited talents) are highly substitutable in shaping a worker's productivity. This clearly not fits reality for those occupations where a certain level of experience is indispensable for promotion. Against this backdrop, *the Career Mobility Theory* was developed as another attempt of a supply-side explanation (Sicherman and Galor, 1990; Sicherman, 1991). It views the entering of workers into a skill mismatch as a deliberate decision made to improve their long-term earnings prospects. By gathering experience at low entry levels, labour market entrants can enhance their skills and raise their chances of occupational upgrading. In contrast, the *Theory of Job Competition* first formulated by Thurow (1975) assumes that such an adaptation is at least in the short-run excluded, due to a rigidity of the wages paid for specific occupations. Workers therefore compete for jobs in certain occupations, not for wages. The set of jobs, in turn, is the result of firms' production

requirements. The higher an individual's formal level of education, the lower is its expected cost of training. As a consequence, more educated persons will have a higher chance of receiving a job in a certain occupation. Unsuccessful applicants will switch to less demanding jobs. If there is a shortage of jobs for professionals, some high-skilled workers will have to be satisfied with low-skill jobs.

The *Assignment Theory*, in turn, seeks to unify both supply- and demand-side explanations (Sattinger, 1993). Based on the Theory of Job Search (Jovanovic, 1979), it views overeducation as an inefficient outcome of a job matching procedure. Due to the existence of search costs, highly educated jobseekers might be satisfied with finding a position at a level below their formal qualification. At the same time, employers are happy to hire applicants whose skills exceed the current job requirements, as this could allow them to save training costs in the future. In this context, a special application of a job-search framework is the *Theory of Differential Overqualification* developed by Frank (1978). He attempts to explain the frequent occurrence of overeducation among women, particularly the married ones, based on matching problems. In traditional gender role model settings where the couple's priority is on the job match of the husband, the husband acts as a first-mover, i.e. he performs his job search first. After he has accepted a match, the wife will conduct her job search. However, due to the co-location restriction, she can do that merely within a much smaller market area. The likelihood of finding a job adequate to her qualification level is therefore much lower for her than for her husband, explaining a striking incidence of overeducation among married females.

2.2 | Empirical results

In the empirical testing of these alternative theories, the career mobility hypothesis has after its initial postulation received the least amount of confirmation. For instance, Battu et al. (2000), Büchel and Mertens (2000) as well as Baert et al. (2012) were unable to detect significant future wage growth for overeducated workers. This rejects the view of overeducation as the starting point for a promising career. Baert et al. (2012) even find evidence for the existence of an overeducation trap where workers systematically get stuck in low-paid jobs underutilizing their skills. Insufficient access of overeducated workers to training activities is identified as one channel through which such a trap can emerge.

On the other hand, the Human Capital Theory and the Job Competition Theory both receive some confirmation through the negative impact of work experience on overeducation risk estimated by most studies (e.g. Alba-Ramirez, 1993; Büchel and Battu, 2003; Nielsen, 2011; Boll et al. 2016b). The Human Capital Theory, however, is incompatible with the simultaneous observation of overeducation and an increase in the labour mar-

ket returns to skill. To be consistent with the view of overeducation as a short-term disequilibrium phenomenon, an opposite evolution should have been expected. The Job Competition Theory, in turn, is clearly at odds with the result of a positive return to surplus education for overeducated workers (e.g. Duncan and Hoffman, 1981): labour productivity is thus not purely job-related. Among all general frameworks, the Assignment Theory seems currently to be the empirically most well-founded. However, this is also the concept that allows for the fewest general conclusions. Finally, the Theory of Differential Overqualification is facing mixed empirical evidence. While McGoldrick and Robst (1996) reject the hypothesis that married women face a significantly higher probability to be overeducated, Büchel and Battu (2003) find some evidence for this fact after controlling for commuting distances.

Individual characteristics

Among the single determinants, the role of gender differences has received a large amount of attention in the recent literature. This interest primarily arises from the observation made in many countries that the share of overeducated workers among women is higher than among men. Despite the considerable amount of empirical work, no clear picture on direction and significance of this effect has yet emerged. A slight majority of the studies examined finds that the effect of gender on overeducation risk is insignificant in a multivariate setup (Büchel and Pollmann-Schult, 2001; Groot and van den Brink, 2003; Frenette, 2004; Green and McIntosh, 2007; Capsada-Munsech, 2015). Alba-Ramirez (1993), Groot (1996) and European Commission (2012) obtain the result that male employees face a slightly higher overeducation risk, an effect which is however in all cases merely weakly significant.

Moreover, one strand of literature focuses on the interaction of gender with marital status, mostly based on the Theory of Differential Overqualification outlined above (for the interaction with the number of children, see household characteristics). The tested hypothesis is that within the group of married workers women face a higher overeducation risk, as their job search is limited to a geographically smaller market area. The available evidence on this idea is rather weak. Frenette (2004) finds in his sample of university graduates neither two nor five years after graduation significant differences in overeducation risk for married females, neither in comparison to unmarried females nor to married males. Groot (1996) likewise detects no significant impact of marital status for women, but interestingly a risk-enhancing effect of marriage among men. In Sloane et al. (1999), interaction terms of gender and marital status are also found to be insignificant. Finally, Joona et al. (2012) in their estimation using Swedish register data even obtain the result that the fact of being married reduces overeducation risk for the subsample of women. However, this seemingly contrary evidence has to be interpreted cautiously, as it does not account for the impact on a woman's decision whether to work at all.

Another potentially relevant individual characteristic is the worker's age. The European Commission (2012) finds a continuously shrinking overeducation probability for categories of workers of increasing age. Büchel and van Ham (2002) estimate a significant effect only after controlling for the selection effect of employment decisions. In this specification, the effect is generally positive, implying a higher overeducation risk for older workers. This result might partly be explained by the decision of old workers that suffer from a skill decline to leave the labour market prematurely. Their increased overeducation risk is only captured when controlling for sample selection. Ortiz and Kucel (2008) likewise estimate a significantly positive effect both for Spain and Germany, but again not for all specifications. In contrast, Groot and van den Brink (2003) detect no significant impact of age on the incidence of overeducation in any of their model types. Those papers focusing on the impact of work experience establish a more clear-cut picture. The by far dominating outcome is a highly significant negative impact of increased experience on the incidence of overeducation (Alba-Ramirez, 1993; Groot, 1996; Nielsen, 2011; Sloane et al., 1999). In Büchel and Pollmann-Schult (2001), the same effect is only weakly significant. In Boll et al. (2016b), the significance level varies between subsamples differing in region and educational attainment as well as between the chosen measures of overeducation. The most striking exception is McGoldrick and Robst (1996), where the effect is insignificant for all three measures of required schooling.

A seldom analyzed determinant is field of study, in some part due to data limitations. Green and McIntosh (2007) restrict their estimation for the United Kingdom to the subsample of university graduates and thus the tertiary level. They make a quite detailed distinction between 12 educational fields. Among those, degrees in Physical Sciences and in Computing are estimated to lower the overeducation probability significantly relative to the reference category Business and Management Studies. Moreover, signs of all field-related coefficients were negative, suggesting that the reference category Business and Management Studies is associated with the highest overeducation risk. In contrast, Ortiz and Kucel (2008) analyzed a mixed sample of workers differing in educational attainment. Estimations were separately conducted for Germany and Spain. As a reference category, a tertiary degree in Social Sciences, Businesses and law was chosen. This category was associated with the lowest overeducation risk both in Germany and Spain. The highest probability was estimated for tertiary graduates from the field Services, again in both countries. Moreover, both tertiary and non-tertiary graduates from Human Arts are exposed to a particularly high overeducation risk. In a further approach, Tarvid (2012) made use of the European Social Survey data and tested the field effect in a supranational sample comprising 30 countries, but only university graduates. Again, the most striking result is that graduates from Services exhibit a much higher overeducation probability than graduates from Business, Law and Economics. Probabilities higher than for the reference were also detected for the fields Education and Health. Berlingieri and Zierahn (2014) compare the overeducation risk of graduates from Humanities/Social Sciences,

Business/Law and Natural Sciences for highly educated German males. They find for most specifications that Business and Law graduates are at significantly higher risk than graduates from Natural Sciences. Finally, the most recent test was conducted by Capsada-Munsech (2015) for Italian university graduates. She found that graduates from Sociopolitics experience the highest overeducation probability, even significantly higher than the reference category Humanities. The lowest probability was estimated for Medicine. Overall, even though comparability is limited by the different field classifications, the literature results suggest some considerable degree of heterogeneity, with students of Social Sciences and Humanities being at higher risk than those in Natural and related Sciences.

Household characteristics

In addition to a worker's individual background, part of her overeducation risk can also be related to her living situation. The literature so far has focused on the presence of children as a determinant. Childcare requires a perpetual allocation of resources in the form of time and/or money. In this way, a job creates additional opportunity costs that can influence a parent's decision on which job match to accept. A high reservation wage due to high opportunity costs can induce a job applicant to turn down low-pay offers with low qualification requirements, thereby reducing the frequency of overeducation. On the other hand, some comparatively less demanding jobs especially in administration allow for more time flexibility than most high-level leadership positions. This fact raises the attractiveness of these jobs for parents, triggering an opposite effect of children on overeducation risk. In the same vein, the need to take care of children can limit the spatial mobility of parents and thus the number of appropriate job matches available within their restricted area of job search.In line with these thoughts, the existing evidence shows no uniform picture. The literature so far has set its focus on number of children as a household indicator, commonly including an interaction term with gender. Büchel and Pollman-Schult (2001) limit their measurement to pre-school children (< 7 years) and consider an interaction of the number of children with female sex. This does not deliver significant coefficients for any specification. In contrast, Büchel and van Ham (2002) include all children up to 16 years and also control for the selection effect of the employment decision. Without controlling for self-selection, they find for female workers a significant positive impact of the number of children on the risk of overeducation. Significance however disappears in the Heckman self-selection specification, indicating that the most relevant effect of kids already concerns the decision to enter the labour market. Green and McIntosh (2007) merely test for the impact of having children or not. It proves insignificant as long as job-related determinants are included in the model. When they are omitted, the children dummy significantly raises the overeducation probability, which signals a strong linkage between family situation and job type.

Several family-related aspects are yet only insufficiently explored. First, the role of a child's age deserves more attention. Sloane et al. (1999) provide at least some insights in this regard. They distinguish between children up to 2 years and children between 3 and 5 years in their model specification. While the number of kids younger than 2 years exerts a significant and positive impact on the overeducation risk of women, the effect for older children remains insignificant. This is in line with the idea that younger children impose tougher restrictions on the employment decisions of their parents. Furthermore, the impact of the presence of other household members is also worth investigating. For instance, living together with one or more elderly dependents could be expected to influence job search activity and thus also the overeducation probability.

Job characteristics

Previous studies demonstrate that the incidence of overeducation is strongly related both to job type and firm characteristics. Concerning the job type, one relevant distinction relates to contract length. Economic logic would suggest that people with fixed-term contracts are more likely to work in positions for which they are overeducated than people with permanent ones. Due to the transitory nature of fixed-term jobs, workers are less concerned about qualification levels, as they tend to view these matches as mere temporary solutions on their way to more favorable permanent positions. Green and McIntosh (2007) as well as Ortiz (2010) indeed find some evidence for a significantly lower overeducation risk among workers in permanent positions.

Less obvious from a theoretical point of view is the relation to the extent of work. Several arguments would suggest a lower overeducation risk for full-time workers. First, for people choosing to work part-time, their job-related activities make up a considerably smaller share of their entire daily activities than for full-time workers. Therefore, their willingness to execute job tasks that do not fully match their qualification levels can be expected to be greater. Moreover, jobs with longer working time can also create better opportunities for training participation and advancement, thereby improving the match quality over time. These arguments point to a negative correlation between hours of work and the overeducation probability. Green and McIntosh (2007) indeed document such a relationship for workers in Great Britain through a positively significant part-time dummy. Moreover, Groot and van den Brink (2003) come for the Netherlands to the same result when measuring work extent continuously (in hours of work). In contrast, the European Commission (2012) does not detect a significant association with the workload.

The empirically best-documented job-related determinant of overeducation risk is job tenure. A long tenure signals a high level of satisfaction with the match received. As job satisfaction is in turn linked to the incidence of overeducation (e.g. Allen and van der Velden, 2001), one would expect a long tenure to imply a low likelihood of overeducation. Another channel can emerge through internal mobility of workers within firms, as

suggested by the Career Mobility Theory. The longer a worker stays in a firm, the higher is the likelihood of advancement into better positions with higher skill requirements and thus lower overeducation risk. This is confirmed by the existing evidence. A wide range of papers detects a significant negative effect of job tenure on overeducation risk in a variety of datasets (Sloane et al., 1999; Büchel and Pollmann-Schult, 2001; Büchel and van Ham, 2002; Büchel and Battu, 2003; Groot and van den Brink, 2003; Ortiz, 2010; European Commission, 2012). An exception is Groot (1996), who measures the association to be significantly positive. He interprets this as an indication for a negative relationship between tenure and individual productivity. Low-productive workers receive less job offers and therefore tend to remain stuck in bad matches underutilizing their skills.

3 | Data and Measurement

We use data from the European Labour Force Survey (EU-LFS)[1] to identify possible determinants of overeducation. The EU-LFS covers approximately 1.8 Mio. individuals aged 15 years or older[2] and asks the respondents for their demographic background, labour status, employment characteristics and their previous employment experience/search for person not in employment. Our analysis is based on 2013 data and is restricted to the EU-28 countries. Respondents are assigned to countries based on their place of work. Malta, Poland and Slovenia are excluded from the analysis due to the lack of detailed information regarding occupation groups. Furthermore, the sample is restricted to respondents aged 15 to 74 years. Although we focus on highly-educated workers/graduates, we also estimate our models for medium-skilled workers and compare the results. Highly educated have completed tertiary education (5A, 6), and the medium educated persons have completed upper secondary or post-secondary education (ISCED 3-4, 5B). We use the EU-LFS weighting variable (COEFF) in order to calculate the modal qualification level of each occupation group.

We refer to the above mentioned overeducation as a vertical inadequacy. In the literature, different ways for measuring overeducation are followed, from expert statements and respondents' subjective assessments to statistical approaches (realized matches). For our purposes, we adopt the variant of the realized matches approach proposed by Kiker et al. (1997) and code a person as being overeducated if his or her highest educational attainment level is higher than the modal qualification level of her occupation group at the two-digit level. To investigate the causal factors of overeducation, we use a broad range of explanatory variables. In particular, we differentiate between three categories

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[1] For more detailed information on the European Labour Force Survey, see, for example, European Union (2014).

[2] Norway and Sweden only cover persons between 15 and 74 years and Iceland and Switzerland only provide data on people aged 15 and more.

of covariates, namely personal characteristics, household characteristics[3] and job characteristics. Moreover, we consider interaction terms between sex and different household characteristics.

Personal characteristics include gender, marital status and two dummy variables that are equal to one if the respondent is a foreigner from another EU country or a non-EU country, respectively. Furthermore, we use the following six age dummies: 15-24 years, 35-44 years, 45-54 years, 55-64 years and 65-74 years. Persons aged between 25 and 34 years belong to the reference group. Note that a person's age is only given in age groups comprising five years each (e.g. group "0-4 years") in the anonymized version of the EU-LFS. Since this study aims to identify the interplay between overeducation and field of highest level of educational attainment, our models also include a person's highest level of educational attainment. Therefore, we differentiate between eight broad fields of study: teacher, training and education science; humanities, languages and arts; social sciences, business and law (reference group); science, mathematics and computing; engineering, manufacturing and construction; agriculture and veterinary; health and welfare; and services. Respondents who classify themselves into "general programs" are excluded from the analysis, as these programs usually do not lead to a generally acknowledged degree.

Referring to household characteristics, we control for the number of unemployed and inactive adults, the number of persons aged 75 and over (eldercare) and the number of children (between 0 and 5 years, between 6 and 11 years and between 12 and 14 years) in the same household. Due to data restrictions these variables are not included in the models for the Scandinavian countries (Denmark, Finland and Sweden).

Job characteristics include, among others, usual working hours and tenure. Usual working hours are given as the number of hours that a respondent is usually working per week in his or her main job. Tenure is defined as the number of years since a person started to work for his/her current employer or as self-employed. Both variables are also included as quadratic terms in our models. Further job characteristics are considered by means of dummies that are equal to one if the respondent is usually working less than 15 hours per week (indicator for marginal employment), if he or she holds a temporary contract or if he or she has a second job, respectively. Firm size is controlled for by means of three dummy variables, namely 11 to 19 employees, 20 to 49 employees and more than 50 employees. Persons who work for firms whose number of employees varies between 1 and 10 belong to the reference group. Whether a respondent attended any courses, seminars, conferences or received private lessons or instructions outside the regular education system within the last 4 weeks prior to the interview is captured by a lifelong

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[3] Household characteristics are not available for the Nordic countries (see European Union, 2014).

learning dummy. The purpose of these most recent taught learning activities can be either job related or mostly personal.

As a variable reflecting the spatial dimension, the degree of urbanization is included. It varies from 1: densely populated area to 3: thinly populated area and is available for all countries. We also include economic sector and country dummies in our regressions. By including country dummies we control for different country sizes. Hence, the cross-section results may be interpreted as average effects of country specific regression results.

Finally, we include interaction terms between gender and age, field of study as well as a number of personal and household characteristics: marital status, the number of children, the number of persons aged 75 years and older and the degree of urbanization. We do this to account for likely discrepancies in the marginal effects of these variables between male and female workers, as suggested by theoretical reasoning (see Section 2).

In order to estimate the probability of being overeducated we make use of a Probit model (see Judge et al. (1988)). The target variable y_i classifies a respondent either to be overeducated ($y_i = 1$) or not ($y_i = 0$). In the Probit model, the probability of $y_i = 1$ is modelled as follows:

$$p = Pr(y_i = 1|X) = \Phi(X\beta)$$

where $\Phi(.)$ is the cumulative distribution function of the standard normal distribution and X is the set of covariates presented above. We estimate the model with the Maximum-Likelihood-Method, which yields consistent, asymptotically efficient and asymptotically normal distributed estimates. Due to the nonlinearity of the model, marginal effects are not simply given by the estimated coefficients $\widehat{\beta}$, but depend on the level of the covariates. In the results section, we report the marginal effects measured at the means of the covariates.

4 | Results

4.1 | Descriptive results on overeducation

Figure 1 depicts the incidence of overeducation for medium-skilled workers in 2013. While about half of the medium-skilled workers are overeducated in Spain (ES) and Portugal (PT), this holds for only 3 % in the Czech Republic (CZ) and Slovakia (SK). Concerning the geographical distribution, it is a striking pattern that the four Southern European countries most severely affected by the current sovereign debt crisis (Greece, Italy, Portugal, Spain) all exhibit rates well above the EU average of 19 %. Apparently, one reflection of the crisis in these countries is also a high risk of skill mismatches for

medium-skilled workers. Potentially, this is an outcome of the general downturn of local labour demand, forcing workers to accept inadequate positions to avoid unemployment. At the same time, overeducation rates for medium-skilled in the Middle and East European countries that joined the EU in 2004 all rank clearly below EU average. This regional particularity is confirmed by a previous report (European Commission, 2012), albeit not differentiating by educational level. The result could be related to the ongoing wave of labour migration from the Eastern to the Western part of the EU. Workers facing a scarcity of job offers adequate to their qualifications on their national labour markets prefer to migrate abroad instead of working in low-qualified jobs at home. This gains support by the fact that overeducation is observed to be especially rare in those countries exhibiting a common border with Germany and/or Austria.

Figure 1: Percentage of overeducated on all medium-skilled employees, 2013
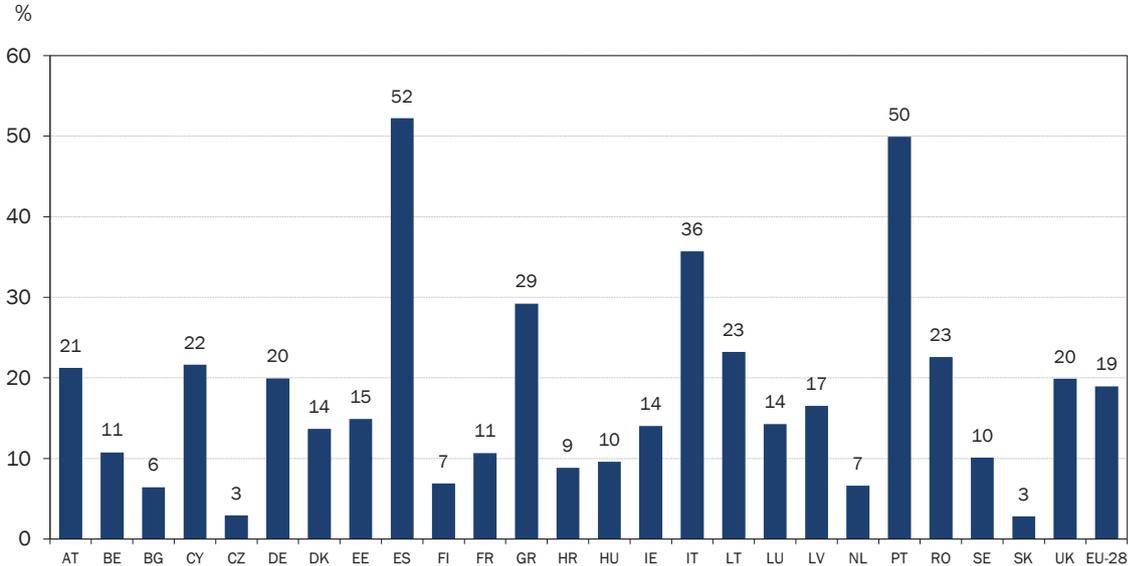
EU-28: without Malta, Poland and Slovenia
Sources: EU-LFS (2013), Boll et al. (2016a).

Considering high-skilled workers, the picture looks quite different (see Figure 2). The overall incidence of overeducation is considerably more widespread in the majority of countries. The only exceptions to this are Spain, Greece, Ireland, Lithuania, Latvia, Portugal and Romania, where the overeducation risk of the medium skilled is still higher. The average percentage of overeducated workers on all the highly-skilled is 27 %. The geographical pattern also differs decisively. The Southern countries do not stand out with particularly high rates. The rate in Greece is with 9 % (together with Ireland) even measured to be the lowest. Again, a combination of migration and unemployment could serve as an explanation for these numbers. The exodus of well-trained young graduates from the crisis countries (Verwiebe et al., 2014) has created a scenario where the remaining population of high-skilled is either well matched (and therefore has no emigration incentive) or unemployed, generating the statistical result of a seemingly high matching

efficiency. For example, 52 % of migrants with Spanish, Italian or Greek nationality who have moved within the last three years before 2011 were highly skilled, compared to 28 % of nationals of the NMS-8, where by contrast 49 % of migrants were medium educated (Boll et al., 2014b). Nevertheless, it is astonishing that in economically successful countries like Germany and the UK educational mismatches among university graduates are apparently a much more frequent phenomenon. In all, the EU-internal country differences in educational mismatch show that the European community is still far away from reaping the full benefits from cross-border labour migration created by the common market legislation.

Figure 2: Percentage of overeducated on all high-skilled employees, 2013
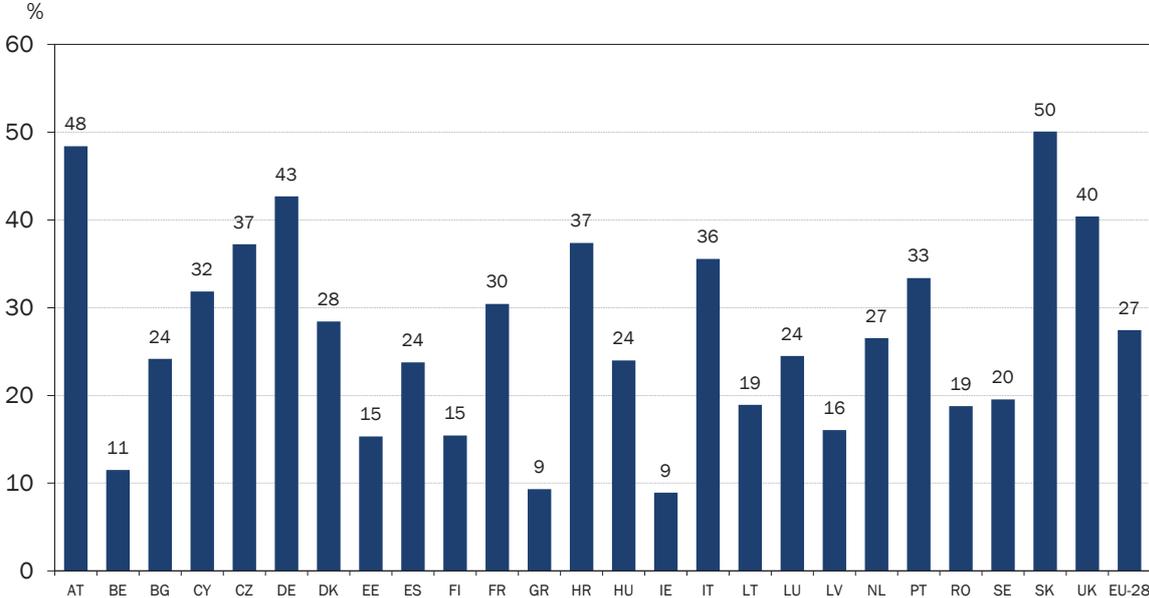
EU-28: without Malta, Poland and Slovenia
Sources: EU-LFS (2013), Boll et al. (2016a).

In addition to the distribution by countries, the distribution by worker characteristics offers additional insights. Table 1 provides information on the percentage of overeducated and not overeducated high- and medium-skilled workers by sex, age, and field of study in the aggregate cross-country sample (for more comprehensive descriptive statistics see Tables A1 and A2 in the Appendix). As can be seen, highly-skilled men are slightly more frequently overeducated (29.3 %) than women (25.7 %) at this level of education. In the group of medium skilled-workers, the frequency of being overeducated hardly differs by gender. This does not need to imply that differences in match quality among skill groups are lower for women. It can also hint at gender differences in worker characteristics and the decision to work at all, channels whose roles will be investigated later on.

Table 1: Percentage of overeducated (yes) and not overeducated (no) persons by sex, age, and educational attainment

Skill level	High-skilled		Medium-skilled	
Overeducation status	Yes	No	Yes	No
Sex (in % on all employees)				
- Male	29.3	70.7	13.2	86.8
- Female	25.7	74.3	13.1	86.9
Age (in % on all employees)				
- 15-24	42.8	57.2	15.7	84.3
- 25-34	28.6	71.4	16.1	83.9
- 35-44	26.9	73.1	13.9	86.1
- 45-54	26.5	73.5	11.6	88.4
- 55-64	25.1	74.9	10.2	89.8
- 65-74	32.4	67.6	15.3	84.7
Field of study (in % on all employees)				
- Teaching, Education	15.4	82.4	20.5	79.5
- Humanities, Languages, Arts	27.2	72.8	11.7	88.3
- Social Sciences, Business and Law	28.7	71.3	12.3	87.7
- Science, Mathematics, Computing	27.3	72.7	14.3	85.7
- Engineering, Manufacturing, Construction	31.2	68.8	12.2	87.8
- Agriculture, Veterinary	46.5	53.5	19.3	80.7
- Health, Welfare	21.4	78.6	8.3	91.7
- Services	40.9	59.1	14	86

Sources: EU-LFS (2013), Boll et al. (2016a).

Moreover, among high-skilled workers the youngest (15-24 years) and the oldest group of (65-74 years) high-skilled workers are more frequently overeducated than workers from other age groups. A lack of actual work experience and a missing occupational focus of study programs are potential factors to explain why young high-skilled workers are at a particular risk. For old high-skilled workers, other influences should dominate, potentially related to formally low-ranked but yet redeeming consulting activities executed in retirement. Given the voluntary nature of those activities, a welfare judgement of overeducation patterns should always discriminate carefully between age groups. Nevertheless, it has to be stressed that both age groups lie outside the core segment of high-skilled workers and are therefore rather thinly populated in our sample, limiting their usefulness for general conclusions. Again, the picture looks quite different if we look at medium-skilled workers. This group of workers is not only less likely to be over-educated in general, but the difference between different age groups is also less marked. Intuitively, this could both be ascribed to a stronger occupational focus of educational programs at the medium level, facilitating young workers' access to adequate positions,

and to a high relevance of practical work experience, helping older workers to maintain qualified jobs. Again, this result requires a more thorough analysis in the following section.

The comparison by field of study shows that high-skilled workers from the fields Agriculture, Veterinary and Services are much more frequently overeducated than high-skilled workers from the fields Teaching, Education and Health, Welfare. This becomes intuitive by considering the narrow occupational focus of the latter fields, thoroughly preparing graduates to become teaching and health professionals, respectively. Indeed, in our sample, 69 % of all high-skilled graduates from Teaching, Education worked as teaching professionals, while 67 % of high-skilled graduates from Health, Welfare worked as health (or health associate) professionals. Graduation has the role of an entry ticket into these occupations. The result is a high degree of internal educational homogeneity (Abraham et al., 2011). Existing research on social closure shows that this restriction practice is associated with positive wage effects, further stabilizing the field-occupation linkages (Weeden, 2002). On the other hand, in study programs in the field of services, the occupational focus tends to be much wider. This is reflected by a high variation in the occupations chosen by graduates from services in our sample. As a consequence, entry barriers into service-related occupations are largely weak, implying insufficient protection from falling back to low-qualified jobs. Consequently, high-skilled graduates from Services rank second-highest in terms of overeducation frequency. However, among medium-skilled workers, the picture looks a little different. Here, the field Teaching, Education is associated with the highest overeducation share. To some extent, such shifts could be attributed to the skill-dependency of occupational profiles associated with formally the same field, limiting comparability of fields across skill levels. For instance, medium-skilled graduates from Teaching, Education only work to 48 % as teaching professionals, while another significant share of 15 % sorts into the occupational group of legal, cultural and social associated professionals.

4.2 | Determinants of overeducation

Table 2: Estimation results (cross-country estimation)

	High-skilled		Medium-skilled	
	Coeff	*SE*	*Coeff*	*SE*
Personal characteristics				
Female	-0.008	*0.013*	-0.004	*0.008*
Age groups (reference: 25-34 years):				
- 15-24 years	0.140***	*0.022*	-0.008	*0.007*
- 35-44 years	0.011	*0.009*	-0.009**	*0.004*
- 45-54 years	-0.006	*0.009*	-0.029***	*0.004*
- 55-64 years	-0.007	*0.010*	-0.026***	*0.005*
- 65-74 years	0.060**	*0.024*	-0.010	*0.012*
Married	-0.029***	*0.007*	-0.004	*0.003*
Foreigner: EU countries	0.078***	*0.014*	0.112***	*0.010*
Foreigner: non EU countries	0.167***	*0.016*	0.085***	*0.008*
Field of study (reference: Social Sciences, Business and Law):				
- Teaching, education	-0.102***	*0.010*	0.089***	*0.019*

- Humanities, languages, arts	0.012	0.012	-0.018*	0.009
- Science, mathematics, computing	-0.008	0.010	-0.017**	0.008
- Engineering, manufacturing, construction	-0.011	0.007	-0.058***	0.004
- Agriculture, veterinary	0.094***	0.017	-0.024***	0.006
- Health, welfare	-0.096***	0.010	0.038***	0.009
- Services	0.108***	0.015	-0.041***	0.005
Household characteristics				
Number of unemployed adults[1]	0.048***	0.007	0.017***	0.004
Number of inactive persons[1]	0.013***	0.003	0.001	0.002
Persons aged 75 or older[1]	0.057	0.118	-0.036	0.049
Number of children between 0 and 5 years[1]	-0.006	0.005	0.002	0.003
Number of children between 6 and 11 years[1]	-0.008	0.005	0.000	0.003
Number of children between 12 and 14 years[1]	-0.001	0.008	0.001	0.004
Job characteristics				
Firm size (reference: < 10 persons):				
- 11-19 persons	-0.014**	0.007	0.005	0.004
- 20-49 persons	-0.054***	0.006	-0.005	0.003
- 50 and more persons	-0.053***	0.006	0.015***	0.003
Marginal employment[2]	-0.019	0.015	-0.014*	0.007
Temporary contract	0.038***	0.007	0.027***	0.004
Usual working hours	-0.058***	0.010	-0.001	0.006
Usual working hours squared	0.001	0.001	0.000	0.001
Tenure	-0.002	0.006	-0.006**	0.003
Tenure squared	-0.006***	0.002	-0.004***	0.001
Participation in LLL	-0.036***	0.006	0.021***	0.004
Second job	0.007	0.008	0.013**	0.006
Degree of urbanization	0.009***	0.003	-0.005***	0.002
Interaction terms:				
Sex and married	0.021**	0.009	-0.009*	0.005
Sex and urbanization	0.014***	0.005	-0.002	0.003
Sex and elder household members	0.036	0.131	-0.035	0.061
Sex and children:				
- number of children (0-5 years)	-0.030***	0.007	-0.009**	0.005
- number of children (6-11 years)	0.005	0.007	0.000	0.004
- number of children (12-14 years)	0.010	0.011	0.003	0.006
Sex and age groups (references: 25-34 years):				
- 15-24 years	-0.013	0.024	-0.023***	0.009
- 35-44 years	-0.013	0.011	-0.011*	0.006
- 45-54 years	0.009	0.011	-0.012**	0.006
- 55-64 years	0.018	0.013	-0.024***	0.007
- 65-74 years	-0.008	0.034	-0.049***	0.014
Sex and field of study (reference: Social Sciences, Business and Law):				
- Teaching, education	0.017	0.013	0.044**	0.018
- Humanities, languages, arts	-0.021	0.015	0.017	0.013
- Science, mathematics, computing	-0.014	0.015	0.023	0.015
- Engineering, manufacturing, construction	-0.026**	0.011	0.017***	0.006
- Agriculture, veterinary	-0.036	0.022	0.043***	0.013
- Health, welfare	0.014	0.012	0.012	0.008
- Services	0.010	0.021	0.013*	0.008
Observations	248,230		431,542	

Sources: EU-LFS (2013), Boll et al. (2016a).

[1]: in same household

[2]: usually working less than 15 hours per week

Notes: Malta, Poland and Slovenia are excluded due to data restrictions. *, **, *** statistically significant at the 10-percent, the 5-percent, the 1-percent level. Robust standard errors. Dummies for industry and country included. LLL: Life Long Learning. Coeff: coefficients, SE: robust standard errors.

Table 2 presents estimated coefficients of the aggregate cross-country model for high-skilled and medium-skilled workers separately.[4] The following discussion focuses on results from the cross-country model. Results for single countries are only reported if they clearly deviate from the aggregate ones.

In the cross-country perspective, the base level of gender proves to be insignificant for both medium and high-skilled workers, in line with a large part of the preceding literature (Büchel and Pollmann-Schult, 2001; Groot and van den Brink, 2003; Frenette, 2004; Green and McIntosh, 2007; Capsada-Munsech, 2015). However, this does not imply the general absence of a gender effect on overeducation. This is shown by the interaction

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[4] Regression tables for the single country regressions are provided upon request.

terms of gender with other covariates, precisely with household composition variables and degree of agglomeration. The insignificant base term of gender solely implies that there exists no significant gender difference in overeducation risk for the subgroup of unmarried workers living in urban areas in households with neither persons older than 75 nor children younger than 15. The partial significance of the interaction terms shows that this is different for other subgroups. For instance, the interaction of gender with marital status is significant for members of both skill groups, albeit with opposite sign. Additionally, the base level of marital status is significantly negative for high-skilled workers and insignificant for medium-skilled workers. Figure 3 displays the composed marginal effects of being member of a certain subgroup.

Figure 3: Marginal effects (%) of the interaction of gender and marital status (reference: unmarried men)
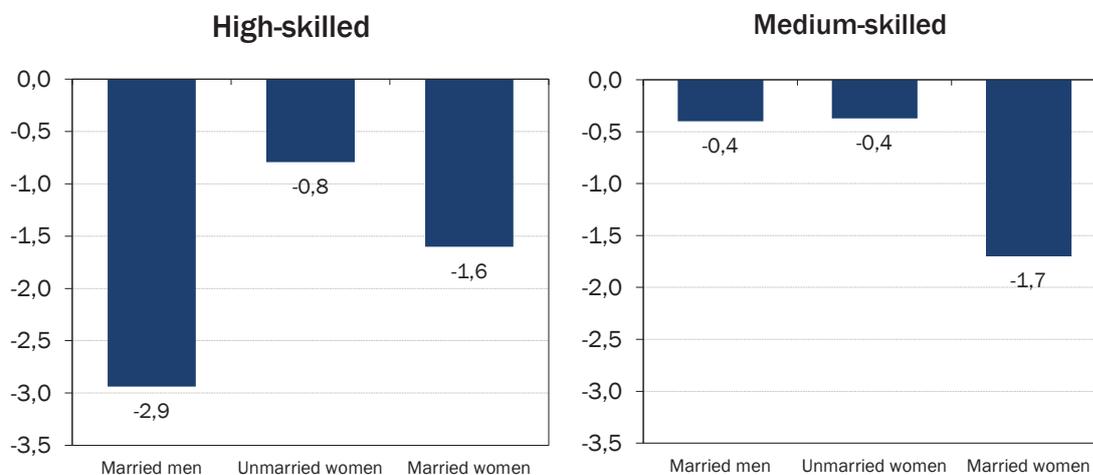
Sources: EU-LFS, Boll et al. (2016a).

Hence, among high-skilled workers, married men face a significantly lower overeducation probability (about 2.9 % at the means) than unmarried men. At the same time, the probability for married men is also clearly lower than for married women, which is in line with Frank's Theory of Differential Overqualification (1978), but contrasts results of Frenette (2004) and Sloane et al. (1999), who find interaction terms to be insignificant. The pattern is also opposed to the estimates of Groot (1996), who predicts a risk-enhancing effect of marriage for men. At the same time, results are consistent with Joane et al. (2012) in the sense that being married is associated with a lower risk of overeducation for women. Among medium-skilled workers, married and unmarried men do not exhibit significantly different probabilities, but they are significantly higher than those for married women. The Frank theory thus does not find confirmation for the aggregate sample of medium-skilled workers. Again, however, the result of Joane et al. (2012) is supported.

With regard to the interplay of gender and urbanization, results likewise tend to differ between high-skilled and medium-skilled workers. Among high-skilled workers, women living in rural areas face a higher overeducation risk than women in urban areas in the cross-country estimations, an outcome again coinciding with the views of Frank. Another interpretation is that in rural areas women are significantly more at risk than men. For medium-skilled workers, this interaction term is insignificant, thus not pointing at a spatial dimension of the gender effect. At first glance, this outcome seems surprising, as high-skilled workers are commonly observed to be more mobile than workers with lower qualification levels (Greenwood, 1975). Therefore, one could expect their job quality to be less affected by conditions in their area of living. At the same time, however, theories of knowledge spillovers suggest that high-skilled workers benefit to the largest extent from working in urban areas (Duranton and Puga, 2004).

In the single-country estimations, the significance of the interaction of urbanization and gender in the high-skilled segment is not observed for all large countries, for instance not for France and the UK. For these two countries, no rural-urban gap in the overeducation probability of women can be proved. This could hint at a higher degree of worker mobility and/or at a stronger influence of the female partner on a couple's co-location decision in these countries. Furthermore, the insignificance of the same term for medium-skilled workers in the aggregate estimation is revealed to be the outcome of contrary effects at country level. In countries like Hungary and Romania, medium educated women are at a significantly higher risk in rural than in urban areas, while the opposite holds in countries like Greece and Sweden. The interplay of space and gender in determining the probability of overeducation thus sketches a more clear-cut pattern for the highly educated than for the medium educated.

Moreover, our results for the impact of field of study deserve some attention. In this regard, the comparison to Ortiz and Kucel (2008) is most informative, as they apply the same categorization of fields and discriminate between tertiary and non-tertiary graduates in their estimation. However, in contrast to them, we added a differentiation of effects by gender, which proves revealing. First, among male high-skilled workers, the cross-country estimation yields the highest overeducation risk for graduates from the field Services, which is consistent with the results of Ortiz and Kucel (2008). The difference in risk to the reference group Social Sciences, Businesses and Law is highly significant (see Figure 4). The same holds for the group with the second largest risk in our data, students of Agriculture and Veterinary Medicine. A deviation from Ortiz and Kucel (2008) emerges with respect to students of Humanities. In contrast to their results, this group does in our estimation not exhibit a significantly higher risk than the reference group. Another difference concerns students of Teaching and Education, which in our approach enjoy the smallest overeducation probability, also significantly smaller than the reference group. As explained in the previous section, this can be rationalized by the

phenomenon of social closure. Graduates from teaching have overcome the hurdle for working as a teaching professional. They therefore enjoy access to a number of adequate positions with limited competition. Due to the wider occupational focus of their studies, graduates from many other fields are much less protected, therefore facing a higher risk of ending up in mismatches.

Figure 4: Marginal effects (%) of field of study for male workers (cross-country estimation), 2013
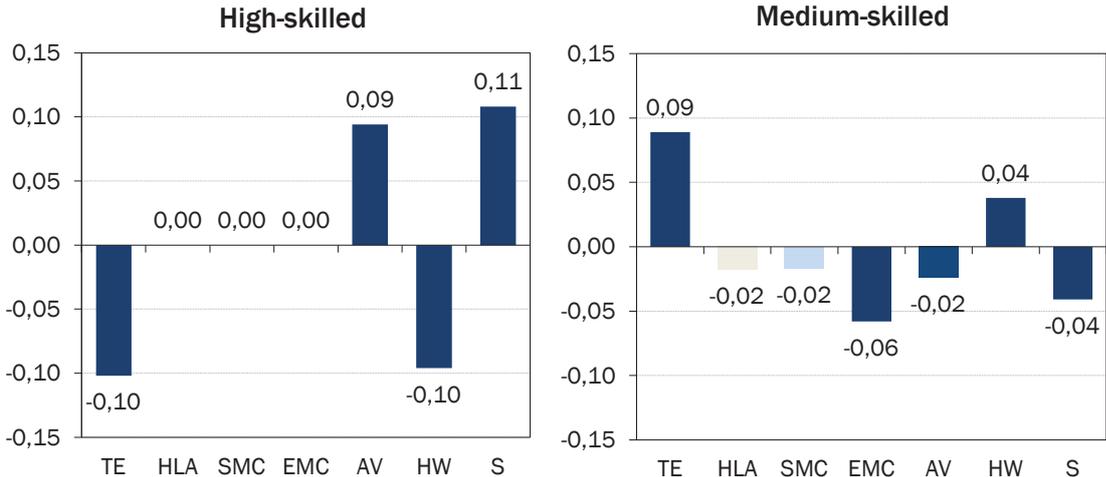
Sources: EU-LFS (2013), Boll et al. (2016a).
TE: Teaching, Education. HLA: Humanities, Languages, Arts SMC: Science, Mathematics, Computing. EMC: Engineering, Manufacturing, Construction. AV: Agriculture, Veterinary. HW: Health, Welfare. S: Services. Reference group: Social Sciences, Business and Law.

In analyzing the interaction with gender, the insignificance of most interaction terms suggests that the relationship between overeducation risk and field choice is qualitatively very similar for male and female graduates from tertiary education. The prime difference concerns the field Health and Welfare, where the risk-reducing effect compared to the reference group of Social Sciences, Businesses and Law is estimated to be even more pronounced for women. This could be due to gender differences in field selection within the rather broad reference group. For instance, a higher popularity of Social Sciences with their rather vague job profiles among female students could raise the overall risk of the reference group. However, the significance of this effect remains weak.

For medium-skilled workers, results of our estimation are almost turned upside down: male graduates from Teaching and Education are at the highest risk, graduates from Services at the second lowest (after Engineering and Construction). As explained above, the discrepancy most likely results from differences in the matching of educational fields and occupational groups across educational levels. These limit comparability across skill groups. Here, the interaction with gender reveals a particularly high risk for female medium-skilled workers in the field of Health and Welfare. It is likely that occupational segregation plays a major role in this, given the female image of low-qualified jobs in the

area of caretaking and medical assistance. Segregation could also help to explain the observed gender difference in Teaching and Education, where again the high relative risk of medium-skilled men is even exceeded by that of women. In contrast to results for the high-skilled, the gender bias in field-specific risks is estimated to be highly significant. Hence, among medium-skilled workers, the sorting into certain fields of study seems to have a stronger impact on overeducation risk for women than for men.

At the country level, the single estimations show the highest degree of conformity with respect to the situation of high-skilled graduates from Services. Among the larger countries, only in Greece and Italy do these graduates not show a significantly higher overeducation probability than the reference category. The low probability for high-skilled graduates from Teaching is also remarkably widespread. In the high-skill segment, the strongest diversity of coefficients across countries can be observed for the fields Humanities and Engineering. Regarding Humanities, for instance in Italy and Portugal a significantly positive coefficient for the base term is estimated (again implying a higher overeducation risk than for the reference group), while it is negative in Germany. Results for Engineering are even more equally divided. Comparing field effects for medium-skilled workers, it is again Humanities where results are particularly mixed. The same can be said about medium-skilled graduates from Services. The overall picture can thus be described as follows: While some combinations of field and skill level are systematically associated with higher or lower overeducation probabilities throughout Europe, the role of others is highly country-specific.

Of less complex nature is apparently the link to nationality. For both high- and medium-skilled workers, the overeducation risk is measurably higher for foreigners.[5] To the extent that we can equate foreigners with immigrants, this is in line with general economic reasoning. It would predict a higher risk for immigrants due to the non-transferability of human capital accumulated abroad and the role of cultural and language barriers. Some interesting discrepancy however emerges in the comparison of EU- and non-EU foreigners. Among high-skilled workers, the overeducation probability is clearly lower for EU- than for non-EU-foreigners, which seems consistent with a notion of cultural distance. Among medium-skilled workers, however, this is not observed. Again, this is a slightly surprising result. One could expect that for high-skilled workers distance matters less, as they should be better trained in aligning their skills with changing local conditions. Thinking in another direction, an explanation might be the existence of general legal or social barriers non-Europeans face in accessing high-skilled jobs in the EU. This fact would obviously be of less relevance for the overeducation risk of medium-skilled workers. Results at country level mostly fit this overall picture, apart from a few outliers. For instance, no significant differences between native and foreign medium educated

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[5] We also tested an alternative model in which nationality is also interacted with gender. However, results proved insignificant for both skill levels, suggesting that the impact of nationality is similar for male and female workers.

workers are identified in the Netherlands. Among the highly educated, EU-foreigners are even predicted to be less exposed to the risk of overeducation than Dutch workers. Part of these country differences could be related to cultural ties, to the existence of migrant networks as well as to the particularities of local labour markets.

For high-skilled workers, cross-country results on the role of worker's age seem to support the U-shaped relationship found by Green and McIntosh (2007) as well as Joona et al. (2012). Compared to the reference category 25-34 years, both the youngest group of 15-24 years old and the oldest group of 65-74 years old workers are predicted to be at a significantly higher risk. As the interaction terms of gender and age remain insignificant, this pattern holds for male and female high-skilled workers alike. Given that we control for marginal employment, it cannot simply be dismissed as reflecting age-specific spare-time work like student jobs or jobs for retirees. Rather, two conclusions seem to emerge. First, the high risk faced by the youngest group points at the existence of significant entry barriers that young high-skilled workers face when accessing the labour market immediately after graduation. Given the increasing supply of young graduates from university bachelor programmes as part of the Bologna process, the outcome is worrying in its potential implications for the future career paths of these cohorts. Second, it is interesting to see that the category of 56-64 years old workers, which in many countries represents the group immediately before the regular retirement age, is not yet affected by the U-shaped turn. Skill depreciation thus does not seem to be a general concern for high-skilled workers, at least not with respect to the adequacy of jobs.

In contrast, cross-country results for medium-skilled workers reveal a startlingly different picture, both concerning the overall distribution among age groups and the nature of gender differences. Concerning male workers, it is the reference group of 25-34 years old that is measured to exhibit the highest probability of overeducation, with probabilities for all other age groups being significantly lower. Hence, among male workers with medium education the youngest group is not exposed to a particular high risk, which might be explained by the shorter training period and the stronger occupational focus compared to higher educational levels. At the same time, results for the oldest cohorts point at a beneficial role of work experience. Coefficients for the three oldest age groups are clearly smaller than for the two younger groups, indicating a reduced overeducation risk for male workers older than 34. For medium-skilled workers, this beneficial role seems to be of even higher importance than for high-skilled workers, possibly due to the lower requirements concerning formal education. However, at least for the group of 55-64 years old the statistical effect of non-random labour market exit (outselection) has to be kept in mind: workers trapped in bad matches (especially those with physically demanding work) have higher incentives to retire prematurely. Coefficients of the interaction terms of age and gender are throughout negative and significant. This implies that the risk-reducing effect of age (starting from the group of 35-44 years old) is not only

maintained for women, its magnitude is even larger than in case of men. As for male workers, this result should be interpreted against the background of selection effects in the context of labour market exit, which are likely to be stronger and to occur earlier in life for female workers.

As to be expected, results at country level show some degree of heterogeneity. The European-wide patterns of age coefficients are for both high- and medium-skilled workers nevertheless largely confirmed at country level. For the high-skilled workers, Italy constitutes an outlier among the large countries. Here, overeducation risk is continuously declining with increasing age for the high-skilled. Among medium-skilled workers, Greece is a special case with a particularly high overeducation probability for the youngest group of 15-24 years old workers.

Household characteristics

A salient feature of our estimates for the household-specific determinants is the gender dichotomy. Starting with the role of children in the household, the coefficients of the base terms are generally insignificant. This means in our setup that the overeducation risk of male workers is not affected by children of any number and age composition. For female workers, the interaction terms with gender are relevant. Here, the result seems to hinge upon the age of children as well as the worker's educational level. For high-skilled female workers, having an additional child below the age of six is predicted to reduce the overeducation probability significantly. This is at oods with Sloane et al. (1999), who detect a risk-enhancing effect of small children. However, it matches our reservation wage argument from above: the reward should be high enough to cover the (monetary and emotional) costs of giving the child into external care. In turn, high rewards are typically associated with high skill requirements. For older children, the association remains insignificant, which is also in line with intuition, given that school-age children require less intensive care.

For medium-skilled workers, the risk-reducing effect of small children is of lower magnitude and only weakly significant. This does not need to imply that medium-skilled females face lower costs of childcare. It could also result from the generally lower overeducation risk for medium-skilled workers. Another reason might be that medium-skilled workers are on average expected to be less wealthy than the high-skilled, which could force them to accept also barely adequate jobs when living with children. In the estimations undertaken at country level, having children below the age of six cannot be proven to raise the overeducation risk of high-skilled workers for the majority of countries. Nevertheless, we observe a serious degree of heterogeneity also among large countries (see Figure 5).

Figure 5: Marginal effects (%) of no. of children for female workers in five West European countries, 2013

High-skilled

Medium-skilled

■ 12-14 years ■ 6-11 years ■ 0-5 years
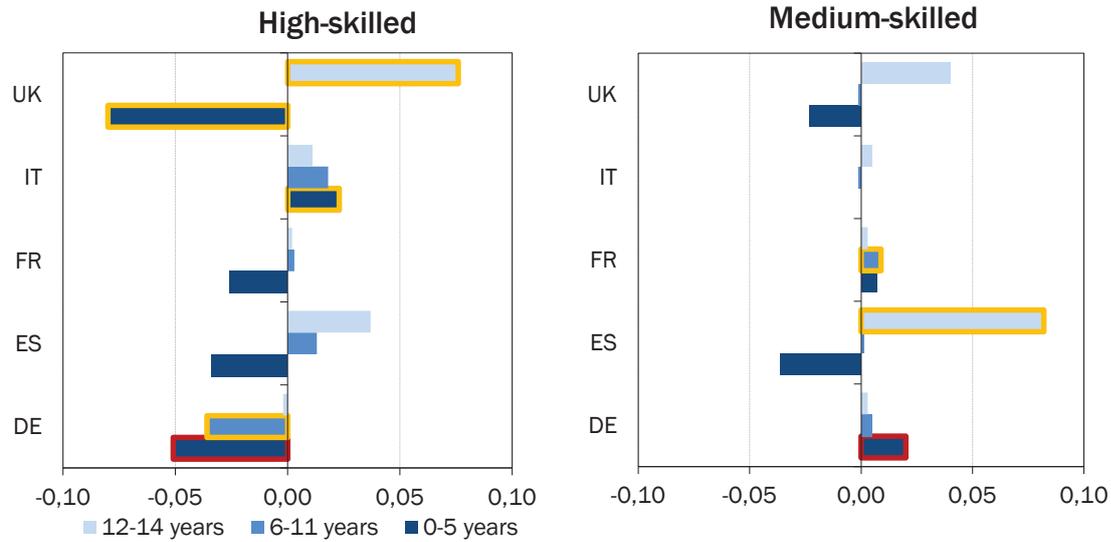
Sources: EU-LFS (2013), Boll et al. (2016a).
Yellow frame: significant at the 5 % level. Red frame: significant at the
1 % level.

Furthermore, the presence of unemployed persons in the same household is estimated to increase the likelihood of overeducation for both skill classes. This is interesting, not least because it is a so far a new result in the overeducation literature. One interpretation could be that the need to financially support unemployed household members induces workers to avoid own unemployment by accepting even comparatively bad matches. This result is confirmed for many, if not for all countries in the separate estimations. Exceptions for which the coefficients show a reverse sign are only found at the medium-skill level and comprise two countries, Germany and Lithuania.

When comparing the role of unemployed with those of inactive household members, the influence of the inactive is measurably smaller in the cross-country estimations, as expected. For medium-skilled workers, the influence is insignificant. This seems to point at a linkage between household composition and job-related productivity: workers living together with unemployed might themselves be less productive on average, a fact that reduces their chances to find a match adequate to their formal education. In other words, for the medium educated the correlation points rather to selection than to causality. At the country level, this distinction is largely confirmed. In a clear majority of countries, the effect of unemployed household members exceeds the effect of the inactive. A notable exception is marked by high-skilled workers in Italy, for whom only inactive household members significantly contribute to a higher overeducation risk. Again, Germany represents an outlier for medium-skilled workers: just like in case of unemployed household members, inactive members are predicted to reduce the overeducation probability, even though to a lower degree.

By contrast, the presence of persons in the household at the age of 75 and above is not estimated to change the risk of overeducation in the cross-country analysis. Among the few countries for which sufficient data are available, one exception marks again Germany, where the presence of elderly is at least for high-skilled workers associated with a higher overeducation probability. The other exception is Hungary, in the sense that the association is measured to be significantly negative for medium-skilled workers.

Job-related characteristics

Concerning job characteristics, results are partially surprising. Foremost, this concerns the role of marginal employment. While being insignificant for high-skilled workers, the coefficient is weakly significant and negative for medium-skilled workers. This means that marginally employed workers are at a lower risk of becoming overeducated, which contradicts the intuition outlined above. Even more surprising, in the estimations at country level, this result is confirmed for a clear majority of countries both in the segments of high- and medium-skilled workers. Descriptive analysis reveals that this difference results from the fact that marginally employed workers tend to select into different occupational groups in these countries. For instance, Managers and Professionals make up a considerably larger share among marginally employed workers in the UK (48.4 %) than in Germany (39.3 %). This might reflect country differences in the social perception of certain jobs. However, we need to be cautious with our interpretation, given that we only define marginal employment based on information on working hours.

In contrast, the coefficients for working in a temporary position are clearly positive for high- and medium-skilled workers, which is both in line with expectation and the results of Green and McIntosh (2007) and Ortiz (2010). Again, one explanation could be that the transitory nature of fixed-time jobs could convince people to accept less ideal matches. The role of training activities exhibits contrary signs for the high- and the medium-skilled in the cross-country estimations. For high-skilled workers, recent participation in LLL is associated with significantly lower overeducation risk for high-skilled, but significantly higher overeducation risk for medium-skilled workers. The risk-reduction for high-skilled workers is also observed for almost all countries in the country-specific measurement. This indicates that the starting points for participating in training activities tend to be different ones for high- than for medium-skilled workers. Among the highly educated, training foremost takes place within already favorable matches. Here, the view seems to dominate that only adequate jobs offer promising opportunities for career advancement through training. By contrast, training incentives for the medium educated are predicted to be higher under unfavorable matches. Here, the upgrading argument seems to apply, i.e. workers seek to escape inadequate positions by improving their human capital through training. While the negative coefficient of LLL participation for the highly skilled proves to be negative for the majority of countries, there exists

considerable country variation in the coefficients for the medium-skilled. For instance, in Greece and Italy it is positive and thus opposed to the aggregate effect. In all, the outcome documents the ambiguous relationship between training participation and the incidence of skill mismatches outlined above.

Results for the remaining job-related characteristics show a slightly more uniform picture. Longer job tenure is associated with a shrinking risk of overeducation for members of both skill segments, which is consistent with the general literature (Sloane et al., 1999; Büchel and van Ham, 2002). Workers in a skill mismatch are unlikely to achieve high levels of job satisfaction and are therefore not expected to remain in the current match for a long time. As the quadratic term is negative and highly significant, the risk reduction associated with any additional year is predicted to become even stronger with increasing tenure. For very long tenure, an overeducation status is thus especially rare. Moreover, while the negative association with overeducation risk cannot be statistically proven for all single countries, it is nowhere estimated to be positive except for medium-skilled workers in Romania. This can be interpreted as a high degree of stability, especially compared to the outcomes for other covariates. Less straightforward are the results for hours of work. In the aggregate approach, the expected negative coefficient can only be confirmed for the high-skilled. This might have something to do with better promotion opportunities for high-skilled workers. These could create incentives to show high levels of engagement, i.e. to spend much time at the workplace, which is in turn rewarded through advancement into better positions. For medium-skilled workers, the corresponding incentives are lower, diluting a relationship between hours of work and overeducation risk. Moreover, the quadratic terms remain insignificant for both skill classes. Variation of the estimates among countries mostly concerns the quadratic term, reaching from a clearly positive to a clearly negative influence. This suggests an overlapping of several contrary influences, which are hard to disentangle in the individual case.

In addition, the estimated coefficients for firm size also show conflicting patterns. For the high-skilled, the overeducation risk is predicted to decline with increasing firm size. This result seems to fit the notion that larger firms can achieve a more precise matching of applicants and positions. Moreover, they offer more internal opportunities for advancement. For the medium-skilled, however, this is not observed. Workers in firms with more than 50 employees are here even at a significantly higher risk than those in very small firms. This observation is presumably technology-related, in the sense that it reflects a relationship between occupation and firm organization: manual jobs in industrial mass production are typically executed within large organizations. For instance, for medium-skilled workers within the occupational group of plant and machine operators and assemblers, the share of workers employed in firms which are measured to have more

than 50 employers is equal to 49.6 % in our dataset, which clearly exceeds their share across occupations of 34.7 %.

Finally, we also undertook additional estimations including further explanatory factors at the regional level (NUTS 2), such as the regional unemployment rate and employment-to-population ratio. However, due to the large share of missing values, models including this regional information did not yield reliable results for the population as a whole.

5 | Conclusion

The purpose of this paper was to conduct a comprehensive econometric analysis of potential determinants of overeducation for the EU-28 countries in a unified framework. Based on data from the European Labour Force Survey (EU-LFS), a series of individual, household, job-related and regional characteristics were used as explanatory factors in a Probit model explaining the probability that a worker can be considered overeducated. Estimations were undertaken both for a cross-country sample and a set of 25 EU countries, selected based upon data availability. At each regional level, the sample was further split into two subsamples of high- and medium-skilled workers.

For most potential determinants, sign and magnitude of the estimated impact exhibits considerable variation both among countries and skill segments, justifying our disaggregated analysis. Results that are less scenario-sensitive are the higher overeducation risk of foreigners compared to native workers, the lower risk for persons with longer job tenure, the higher risk for persons in temporary compared to persons in permanent positions and the risk-increasing effect of the presence of unemployed and inactive household members. Others apparently specific to high-skilled workers are a U-shaped relationship between age and overeducation risk and the significant risk increase for female workers arising from a child below the age of six. Moreover, the risk was shown to vary significantly with the chosen field of study even when controlling for all other measurable characteristics. Among high-skilled workers, graduates from the field of Services exhibit the highest, teaching graduates the lowest EU-wide probability of overeducation. For medium-skilled workers, almost the inverse outcome was obtained, with graduates from Teaching facing the highest and graduates from Engineering facing the lowest overeducation probability. Concerning the more controversial results, of course, all of our results need to be interpreted against the background of potential distortions like omitted variable bias and two-sided causality, dangers that can within a cross-sectional analysis even in a data-rich setting like ours hardly be avoided.

Our results provide a stimulus for future research with respect to several aspects. First, the striking discrepancies observed in the role of many determinants between highly

and medium educated workers clearly deserve some attention. It would be interesting to know to which extent these results reflect a genuine treatment of persons at certain educational levels and to which extent they merely disguise the selection effect of educational programs. Second, concerning the effects of household composition, a further differentiation could yield additional insights. For instance, among the inactive household members, it would be beneficial to distinguish between permanently inactive ones (e.g. due to physical disability) and those who would be willing to work under changed conditions (hidden reserve). Under the assumption of rational behavior, the search pressure imposed by inactive household members on their active housemates can be expected to be lower in the case of voluntary inactivity, implying a different relation to overeducation. Third, our cross-sectional setup could be extended to a Panel dataset in order to study the dynamics of overeducation. This would allow us to analyze the impact of previous employment histories, thereby gaining insights into the persistence of the phenomenon over the lifecycle. Fourth, an investigation of the interplay of the roles of gender and selection into educational fields would contribute to our understanding of the gender discrepancies. Finally, in order to stress the policy relevance of these results, empirical analysis should link the overeducation phenomenon to individual welfare. Foremost, this concerns the association with the wage level.

6 | References

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Appendix

Table A 1: Descriptive statistics: high-skilled workers, EU-28

Variable	obs.	mean	std.	min.	max.
Overeducation	415197	0.3212	0.4669	0	1
Personal characteristics					
Female	416275	0.4985	0.5000	0	1
Age Group:					
- 15-24 years	416275	0.0325	0.1773	0	1
- 25-34 years	416275	0.2657	0.4417	0	1
- 35-44 years	416275	0.2983	0.4575	0	1
- 45-54 years	416275	0.2450	0.4301	0	1
- 55-64 years	416275	0.1400	0.3469	0	1
- 65-74 years	416275	0.0185	0.1348	0	1
Married	416275	0.5706	0.4950	0	1
Foreigner EU countries	416195	0.0366	0.1879	0	1
Foreigner non EU countries	416195	0.0307	0.1725	0	1
Field of study:					
- Teaching, education	407486	0.0927	0.2900	0	1
- Humanities, languages, arts	407486	0.1003	0.3004	0	1

- Social sciences, business and law	407486	0.3112	0.4630	0	1
- Science, mathematics, computing	407486	0.0939	0.2917	0	1
- Engineering, manufacturing, construction	407486	0.1917	0.3937	0	1
- Agriculture, veterinary	407486	0.0215	0.1451	0	1
- Health, welfare	407486	0.1455	0.3526	0	1
- Services	407486	0.0431	0.2031	0	1

Household characteristics

Number of unemployed adults in same household	337097	0.0563	0.2467	0	4
Number of inactive adults in same household	337097	0.2103	0.4907	0	6
Persons aged 75 or older in same household	416275	0.0006	0.0236	0	1
Number of children between 0 and 5 years in same household	337097	0.2579	0.5598	0	4
Number of children between 6 and 11 years in same household	337097	0.2316	0.5413	0	5
Number of children between 12 and 14 years in same household	337097	0.1053	0.3365	0	4

Job characteristics

Firm size:

- 0-10 persons	356010	0.2065	0.4048	0	1
- 11-19 persons	356010	0.0973	0.2964	0	1
- 20-49 persons	356010	0.1654	0.3715	0	1
- 50 and more persons	356010	0.5309	0.499	0	1

Industry:

- Agriculture, forestry and fishing	414990	0.0118	0.1078	0	1
- Mining and quarrying	414990	0.0022	0.0469	0	1
- Manufacturing	414990	0.1050	0.3065	0	1
- Electricity, gas, steam and air conditioning supply	414990	0.0095	0.0968	0	1
- Water supply, sewerage, waste management and remediation activities	414990	0.0043	0.0654	0	1
- Construction	414990	0.0372	0.1892	0	1
- Wholesale and retail trade; repair of motor vehicles and motorcycles	414990	0.0885	0.2840	0	1
- Transportation and storage	414990	0.0255	0.1578	0	1
- Accommodation and food service activities	414990	0.0196	0.1386	0	1
- Information and communication	414990	0.0547	0.2274	0	1
- Financial and insurance activities	414990	0.0468	0.2112	0	1
- Real estate activities	414990	0.0093	0.0958	0	1
- Professional, scientific and technical activities	414990	0.1093	0.3120	0	1
- Administrative and support service activities	414990	0.0278	0.1643	0	1
- Public administration and defence; compulsory social security	414990	0.0899	0.2860	0	1
- Education	414990	0.1556	0.3625	0	1
- Human health and social work activities	414990	0.1540	0.3610	0	1
- Arts, entertainment and recreation	414990	0.0206	0.1421	0	1
- Other service activities	414990	0.0225	0.1483	0	1
- Activities of households as employers; undifferentiated goods- and service-producing activities of households for own use	414990	0.0041	0.0642	0	1
- Activities of extraterritorial organizations and bodies	414990	0.0019	0.0432	0	1

Variable	obs.	mean	std.	min.	max.
Marginal employment	406910	0.0303	0.1713	0	1
Temporary contract	351643	0.0971	0.2961	0	1
Usual working hours (in 10h)	406910	3.8347	1.0890	0.1	8
Usual working hours squared (in 10h)	406910	15.891	8.4739	0.01	64
Tenure (in 10y)	412751	1.0440	0.9634	0	6
Tenure squared (in 10 y)	412751	2.0182	3.2534	0	32
Participation in lifelong learning	415687	0.1612	0.3677	0	1
Second job	416237	0.0484	0.2146	0	1
Degree of urbanization	416275	1.6792	0.7756	1	3

Sources: EU-LFS (2013), Boll et al. (2016a).

Table A 2: Descriptive statistics: medium-skilled workers, EU-28

Variable	obs.	mean	std.	min.	max.
Overeducation	691106	0.1893	0.3918	0	1
Personal characteristics					
Female	693017	0.4468	0.4972	0	1
Age Group:					
- 15-24 years	693017	0.0705	0.2561	0	1
- 25-34 years	693017	0.2157	0.4113	0	1
- 35-44 years	693017	0.2683	0.4431	0	1
- 45-54 years	693017	0.2836	0.4507	0	1
- 55-64 years	693017	0.1468	0.3539	0	1
- 65-74 years	693017	0.0151	0.1220	0	1
Married	693017	0.5576	0.4967	0	1
Foreigner EU countries	692888	0.0301	0.1707	0	1
Foreigner non EU countries	692888	0.0250	0.1562	0	1
Field of study:					
- Teaching, education	666137	0.0218	0.146	0	1
- Humanities, languages, arts	666137	0.0321	0.1761	0	1
- Social sciences, business and law	666137	0.2651	0.4414	0	1
- Science, mathematics, computing	666137	0.0275	0.1636	0	1
- Engineering, manufacturing, construction	666137	0.3910	0.488	0	1
- Agriculture, veterinary	666137	0.0397	0.1953	0	1
- Health, welfare	666137	0.0999	0.2999	0	1
- Services	666137	0.1229	0.3283	0	1
Household characteristics					
Number of unemployed adults in same household	583596	0.0666	0.2708	0	5
Number of inactive adults in same household	583596	0.2541	0.5371	0	7
Persons aged 75 or older in same household	693017	0.0006	0.0246	0	1
Number of children between 0 and 5 years in same household	583596	0.1999	0.4919	0	5
Number of children between 6 and 11 years in same household	583596	0.2145	0.5086	0	5
Number of children between 12 and 14 years in same household	583596	0.1151	0.3448	0	4
Job characteristics					
Firm size:					
- 0-10 persons	595038	0.2713	0.4446	0	1
- 11-19 persons	595038	0.1193	0.3241	0	1
- 20-49 persons	595038	0.1647	0.3709	0	1

- 50 and more persons	595038	0.4448	0.4969	0	1
Industry:					
- Agriculture, forestry and fishing	691513	0.0345	0.1825	0	1
- Mining and quarrying	691513	0.0034	0.0585	0	1
- Manufacturing	691513	0.1802	0.3844	0	1
- Electricity, gas, steam and air conditioning supply	691513	0.0096	0.0974	0	1
- Water supply, sewerage, waste management and remediation activities	691513	0.0078	0.0878	0	1
- Construction	691513	0.0834	0.2764	0	1
- Wholesale and retail trade; repair of motor vehicles and motorcycles	691513	0.1541	0.361	0	1
- Transportation and storage	691513	0.0579	0.2335	0	1
- Accommodation and food service activities	691513	0.0420	0.2006	0	1
- Information and communication	691513	0.0227	0.1488	0	1
- Financial and insurance activities	691513	0.0305	0.172	0	1
- Real estate activities	691513	0.0093	0.0958	0	1
- Professional, scientific and technical activities	691513	0.0400	0.1959	0	1
- Administrative and support service activities	691513	0.0395	0.1948	0	1
- Public administration and defence; compulsory social security	691513	0.0714	0.2575	0	1
- Education	691513	0.0429	0.2025	0	1
- Human health and social work activities	691513	0.1199	0.3249	0	1
- Arts, entertainment and recreation	691513	0.0137	0.1163	0	1
- Other service activities	691513	0.0288	0.1674	0	1
- Activities of households as employers; undif-ferentiated goods- and service-producing activ-ities of households for own use	691513	0.0078	0.0879	0	1
- Activities of extraterritorial organizations and bodies	691513	0.0007	0.0258	0	1
Marginal employment	675874	0.0395	0.1949	0	1
Temporary contract	589890	0.0862	0.2806	0	1
Usual working hours (in 10h)	675874	3.7331	1.0988	0.1	8
Usual working hours squared (in 10h)	675874	15.1433	8.3185	0.01	64
Tenure (in 10y)	682450	1.0949	1.005	0	6
Tenure squared (in 10 y)	682450	2.2088	3.4956	0	32
Participation in lifelong learning	692262	0.0956	0.294	0	1
Second job	692971	0.0371	0.1891	0	1
Degree of urbanization	693017	1.9497	0.8032	1	3

Sources: EU-LFS (2013), Boll et al. 2016a.

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