Educational qualifications mismatch in Europe. Is it demand or supply driven?

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Abstract

Most papers dealing with individual overeducation risks focus on labour supply characteristics and workers behaviour. On the other hand, only few studies consider labour demand characteristics and technological change. In this paper we analyse the influence of both demand and supply factors on educational mismatch in a set of ten European countries. Our hypothesis, confirmed by results obtained using ordered probit model with sample selection, is that demand factors generally play major role in reducing educational mismatch in technologically more advanced countries, whereas supply factors are more important in countries that are lagging behind in the international division of labour. At the same time, important cross-country and gender differences have been identified in the way the demand/supply factors operate. All this calls for the fine-tuning of policies aimed to tackle the problem of educational mismatch. Apparently, EPL does not appear neither to hinder technological development, nor increase overeducation.

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Keywords: Educational mismatch; Overeducation; Undereducation; Demand; Supply; Ordered Probit.

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Introduction

The utmost utilization of human capital acquired by workers is a goal to be pursued by also removing the obstacles that hinder a proper match between educational qualifications obtained and job requirements.

One can identify three possible statuses for a person: under-/ properly and overeducated. Most of the papers dealing with educational mismatch concentrate on the issue of overeducation. The main reason is that it can be thought as a waste of resources, especially in the wake of a rapidly growing supply of graduates. In this paper we do not intend to question the validity of expansionary education policies, rather we aim to provide a broader framework to understanding the observed outcomes. The reality is such that there are many more people who end up being under- or overeducated for the type of job performed. Our enquiry is not only about why this happens, but also which can be the ways to correct for it. In this respect it is very important to understand the channels through which the demand and supply forces operate, and moreover which of the two may prevail in different contexts.

Our hypothesis is that countries which invest more in innovation and technologies should be able to make better use of the educated labour force. The demand factors aim to grasp this effect and are expected to play more important role in reducing the risk of overeducation in more technologically advanced countries. On the opposite, supply factors are expected to be the major cause for both under- and overeducation in countries lagging behind in terms of innovation and technologies.

Testing this hypothesis was implemented in two stages. Firstly, the principal components analysis was employed to cluster countries making part of the EU-LFS data set. We then choose to reduce their number to ten, so that to cover different patterns of labour market regulation, degrees of technological intensity and the incidence of educational mismatch[1]. On a country basis, we further investigate the impact of selected demand and supply factors[2] on the probability of being under-/properly or overeducated. For that purpose we estimate the ordered probit model with sample selection, separately for men and women.

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[1] In particular, *Italy*, *Greece*, *Portugal* and *Spain* are representative of low-to-middle technology and middle-to-high employment protection. *The Czech Republic* and *Hungary* have both relatively low technological level and employment protection. *France* and *Germany* appear as being in the middle, in terms of both technology and employment protection. *The UK* is known for low employment protection, coupled with high technological development. Finally, *Finland* leads the list for technology, despite middle employment protection.

[2] On the demand side we consider such characteristics as youth unemployment rate (in order to measure the difficulties at the entry into the labour market for the new graduates) or expenditure per worker in research and development sector (used as a proxy of technological development), all at regional level. On the supply side, participation into lifelong learning and the field of education obtained. For more details see section 3.

The paper is structured as follows. Section 1 provides a literature review and puts forward the hypothesis to be tested. Section 2 presents the criteria used in selecting the countries to analyze. Section 3 describes the data and methodology used for the analysis. Section 4 presents the empirical findings. Section 5 discusses the obtained results. The concluding remarks follow.

1. Literature review and hypotheses to be tested

The interest to the issue of educational mismatch is justified by the manifold negative consequences it may produce. Just to mention few of them, *at micro level* overeducation was found to produce the downward pressure on wages and productivity (see, amongst others, Bauer, 2002; Di Pietro and Cutillo, 2006a, 2006b; Lindley and McIntosh, 2010) as well as on individuals' job satisfaction (McGuinness and Sloane, 2009; Verhaest and Omey, 2008), *at macro level* it is associated to the waste of resources and the loss of efficiency (Budría and Moro-Egido, 2006)[3].

The growing number of studies which investigate the main causes of educational mismatch can broadly be divided in two groups, dealing with *labour supply (workers behaviour) or* otherwise *labour demand* characteristics (see Table 1).

Table 1. Selected studies addressing different aspects of educational mismatch

Labour Supply characteristics		**Labour Demand characteristics**	
Individual heterogeneity	Bauer, 2002; Chevalier, 2003; Frenette, 2004; McGuinness, 2003; McGuinness and Bennet, 2007; Green et al., 2002; McGuinness, 2006; Ghignoni, 2012; Quintini, 2011a.	*Labour markets rigidities and employment protection legislation*	Mendes de Oliveira et al., 2000; Di Pietro, 2002
Quality of education	Chevalier, 2003; Verhaest and Omey, 2004; Di Pietro and Cutillo, 2006a; Ordine and Rose, 2009; 2011.	*Skill Biased Technical Change*	Albrecht and Vroman, 2002; Gottschalk and Hansen 2003; Dolado, Jansen and Jimeno, 2009, Muysken and ter Weel, 1999; Malchow-Møller and Skaksen, 2004; Cuadras-Moratò and Mateos-Planas, 2006, 2011.
Spatial mobility	Büchel and Van Ham (2003), Croce and Ghignoni (2011) and Quinn and Rubb (2011)		

[3] There are contrasting views though. Büchel, de Grip and Mertens (2004) in particular state that *'Rather than an inefficiency, overeducation may even create a social benefit. If without this surplus education workers find it more difficult to find any employment and are more likely to be unemployed, overeducation may lead to savings in unemployment benefits and active labour market policies aimed at the insertion of workers in the labour market.'* We admit that some positive externalities may take place, but overall tend to see overeducation (and more generally educational mismatch) as a suboptimal outcome.

Labour supply characteristics. *Individual heterogeneity* is taken into account by assuming that two persons possessing the same years of education or similar credentials could have different skills and/or ability levels. In this framework, some studies use models that allow for variability in workers skills by controlling for unobserved effects, i.e. skill differences across individuals with similar levels of education (Bauer, 2002; Chevalier, 2003; Frenette, 2004). Other authors introduce into the analysis explicit (self-assessed) measures of skills related to job performance (McGuinness, 2003; McGuinness and Bennet, 2007)[4]. Green et al. (2002) concentrate on mismatches between required and acquired skills as opposed to years of education or credentials. The same study highlights the importance of cohort-related effects (also due to grade drift[5]), which can potentially result in significant differences in skills and competencies across individuals with similar levels of education. Moreover, skills of workers with the same educational degree could be very dissimilar depending on the different specific experience and /or the different training to which they were exposed (McGuinness, 2006). Along this theoretical line, Ghignoni (2012) proposed a method of measuring overeducation that, starting from the idea of "frontier of competencies" by occupation, links the concept of overeducation to *on-the-job experience*.

A different strand of literature highlighted the role of *educational quality* as a crucial element in determining overeducation. Chevalier (2003) argues that widening access to tertiary education has increased the heterogeneity of graduates through lower ability students accessing universities and an increase in student/teacher ratios. Verhaest and Omey (2004) tested the hypothesis that overeducation would compensate for a "bad" quality of education. Subsequently, Di Pietro and Cutillo (2006a) examined the effect of university quality on the early labour market outcomes of a cohort of recent Italian graduates. In a similar way, Ordine and Rose (2009; 2011), find a significant impact of educational quality on both overeducation risks and wage inequality among the college graduates. Regarding workers behaviour, Büchel and Van Ham (2003) see *spatial mobility* as a potential mean to avoid overeducation in German labour market. In the same line, Croce and Ghignoni (2011) and Quinn and Rubb (2011) developed the

[4] In this case McGuinness and Bennet (2007) utilised an explicit self-assessed subjective measure of skill based on the individual's average competency across 16 areas (word-processing, spreadsheets, data management, knowledge of ITC packages, Internet use, corporate finance, product/process management, quality assurance, customer awareness, human resource management, corporate statutory requirements, interpersonal skills, leadership skills, organisational skills, team building).

[5] The concept of *grade drift* describes a drop in educational standards implying that the level of human capital associated with various credentials has fallen over time and it will be evident if, ceteris paribus, employers are found to be increasing educational requirements for younger workers. Note, in this case a young worker possessing higher educational degree with respect to the one required to perform the job would not necessarily be overeducated. There is an evidence that a *grade drift* happened after the recent "3+2" University reform in Italy (see Bratti et al., 2007).

hypothesis that the risk of overeducation is highest for workers characterised by low migrating/commuting tolerance.

Only few papers analyzed individual's overeducation risks by focusing on **labour demand characteristics** and **technological change**. Most of them highlighted the role of institutional *labour markets rigidities* and *employment protection legislation* (EPL) (Mendes de Oliveira et al., 2000; Di Pietro, 2002). In particular, it is argued that the rapid pace of technological change may require school-provided skills higher than those possessed by currently employed workers. In less flexible labour market settings, firing restrictions may discourage firms to immediately upgrade the level of the "old" workforce in response to rapid changes in technologies (even in the presence of upward changes in skilled workforce availability). At the same time, firms upgrade their "new" hiring standards and recently hired employees, with higher educational qualifications than their older co-workers, *are perceived* (Mendes de Oliveira et al., 2000) or *perceive themselves* (Di Pietro, 2002) to be overeducated.

Moreover, firing restrictions may discourage firms from adopting new technologies and from undertaking R&D, thus reducing the number of vacancies that can be filled with highly skilled workers in the medium/long run (Di Pietro, 2002).

Neither of these papers provides strong direct evidence about the relation between EPL, technological change and overeducation.

Mendes de Oliveira et al. (2000) tested the hypothesis that (young) overeducated workers undergo more firm-specific training than (old) non-overeducated ones, and this allows meeting the needs of employer willing to upgrade the production technology. Unfortunately, their analysis is limited to Portugal and failed to compare countries with different levels of EPL.

On the other hand, Di Pietro (2002) compares 11 countries (with different degrees of labour market flexibility) and shows that strict rules against collective dismissals increase the incidence of overeducation. Nevertheless the analysis does not include any technological variable.

We here identify 3 critical points in this theoretical framework:

1. If newly hired workers have been chosen on the basis of a higher educational level due to jobs technological upgrade, they can perceive themselves as overeducated, but probably they are not "genuine" overeducated (Chevalier and Lindley, 2009). In this case it would be important to verify whether the higher educational level of newly hired workers has been driven by the necessity that workers could manage technological and organizational changes ("demand effect"), or if it is the result of a simple "supply effect" and labour demand is just drawing newly hired workers from a population where high educated individuals are becoming more numerous.

2. A large number of economic models in the literature provides a foundation for Skill Biased Technical Change (SBTC) (see e.g. Acemoglu, 2002; Aghion, 2002; Hornstein et al.,

2005). In particular, they contend that more educated, able or experienced workers deal better with technological change. Skilled workers are less adversely affected by the turmoil created by major technological transformations, since it is less costly for them to learn the additional knowledge needed to adopt a new technology (Nelson and Phelps, 1966). Then, in the early adoption phase of a new technology those who adapt more quickly can reap some benefits. As time goes by, there will be enough workers learning how to work with the new technology to offset the wage differential. In countries characterized by higher aggregate human capital in the (old and young) labour force and by a higher level of lifelong learning (LLL) (especially among the older population) firms would not have to lay off older people to implement technological innovations, and the diffusion of technological changes should be fairly independent from the strictness of EPL.

3. According to Endogenous SBTC (Acemoglu, 1998), the expansion of educated labour over the post-war period made it profitable to develop machines complementary to skilled workers. If supply creates its own demand, firms may have incentives to undertake R&D and to adopt new technologies in countries characterised by higher aggregate human capital and LLL. In this case even high levels of EPL would not prevent intensifying R&D and, from this point of view, it should not be thought as a factor that may increase overeducation.

A more promising strand of literature which analyses the impact of *labour demand characteristics* and *technological change* on overeducation just focuses on the role of SBTC.

Some of the recent studies claim that SBTC might work in the direction of reducing overeducation (Albrecht and Vroman, 2002; Gottschalk and Hansen 2003; Dolado, Jansen and Jimeno, 2009), others instead claim that it would increase overeducation (see e.g. Muysken and ter Weel, 1999; Malchow-Møller and Skaksen, 2004; Cuadras-Moratò and Mateos-Planas, 2006, 2011).

- In particular, Cuadras-Moratò and Mateos-Planas (2011) state that "following a SBTC, firms searching for educated workers become more selective in their hiring policies, rejecting candidates who, in spite of their credentials, turn out to be poorly skilled. Low ability educated workers will then seek employment in jobs that do not require a qualification and become overeducated". In the same line, Muysken and ter Weel (1999), point out that in the presence of SBTC low educated workers will be crowded out of the labour market (thus explaining the rise in unemployment among low educated workers in most European countries), while the bumping down of high educated workers would explain overeducation. Both papers are better fit to explain the effects of the increasing supply of educated workers than the effects of the increasing demand for educated workers and/or the "qualitative change in the composition of jobs" entrained by the SBTC (Acemoglu, 1999).

- Other studies suggest that the SBTC should cause overeducation to reduce. The main idea is that educated/skilled workers become more likely to refuse low quality jobs and wait until they find a better one. In particular, according to Albrecht and Vroman (2002), if the relative demand shift due to SBTC is large enough, it can trigger a switch to an "ex-post segmentation equilibrium" in which high-skilled workers only take up high-skill jobs. More recently, Dolado et al. (2009) enlarge Albrecht and Vroman's model by allowing mismatched workers to keep the option of moving to better jobs through on-the-job search. The introduction of this option reduces the opportunity cost of mismatch for the highly-educated workers and, under the hypothesis of relative labour demand shift, leads to job-to-job transitions. Finally, Gottschalk and Hansen (2003), state that college-educated workers will flow out of non-college jobs as they are attracted by the increased wages in college jobs caused by the SBTC.

In this theoretical framework, we formulate the following *hypotheses to be tested*:

1. In countries characterised by high aggregate human capital, firms have an incentive to undertake R&D and to adopt new technologies. In such context EPL would not play a critical role.

2. *The adoption of new technologies produces a relative demand shift which favours highly educated workers* [6] *and reduces overeducation.*

3. *Supply side factors are instead more efficient in balancing the educational mismatch in countries with lower levels of technological development.*

The first hypothesis is verified by a principal components analysis reported in section 2, which is also used to choose countries representative of different patterns of labour market regulation/ technological development. In order to test the hypotheses 2 and 3, which are central to the paper, we then estimate the effects of demand and supply factors on the individual risks of educational mismatch as will be explained in section 3.

2. The choice of countries

The choice of countries was made on the basis of a clustering exercise, bases on principal components analysis, which takes into account some indicators of technology, aggregate human capital and employment protection, as presented in Figure 1.

[6] This hypothesis is not fully shared in the economic literature. Indeed, Weiss (2008) presents a model in which SBTC does not always lead to increasing demand for skilled labour and to increasing wage inequality. According to this author, if there are complementarities between goods that do not benefit greatly from technological innovations and goods whose production costs fall in the course of technical progress, the relative price of these "low-tech" goods rises. If the production of "low-tech" goods is intensive in the use of unskilled labour, unskilled workers benefit from this increase in the relative goods price. Nevertheless, most of the literature agrees with Funk and Vogel (2004) who assume that (for the production technologies known at any given point in time) physical capital is a closer substitute for unskilled labor than for skilled labour, and show that technical change is rarely biased in favor of the unskilled and often against them.

- For *Technology* and *Aggregate Human Capital* dimensions we rely on statistics available from the Eurostat online database (at country level), including: the number of high-tech patents applications to the EPO[7] (Pat), Expenditure per worker in R&D sector (R&D), the share of ISCED 5 and 6 graduates among the working age population (HC), and the share of population participating in lifelong learning activities (LLL).

- For *Employment Protection* we rely on the summary indicator of the Strictness of employment protection legislation (henceforth EPL) calculated by OECD and available (at country level) for the year 2003[8] (OECD 2004: Tab. 2.A.2.4, p. 117).

In addition to that we consider the Share of temporary workers (Temp) among the employed population as well as the indicator of State intervention in the labour market, such as expenditure on labour market policies in percentage of GDP (LMP_GDP) (Eurostat online database).

The first factorial axis in Figure 1 shows, on its positive side, a high correlation with a strong labour market regulation (EPL) and the percentage of temporary contracts[9]. The second factorial axis shows, on the positive semi-axis, a strong correlation with technology and human capital indicators. There appears to be no clear relation between employment protection and technological development. Countries are distributed between the four quadrants, and technology variables (Pat and R&D) seem to be more tied to aggregate human capital (HC) and LLL than to EPL and labour market flexibility. In particular, in Mediterranean countries high EPL is coupled with low "technology", whereas Scandinavian countries are characterized by medium levels of employment protection and yet high levels of technology development. In the same way, the UK and Ireland have a very low level of employment protection but they are characterized by a significantly lower technological dimension than Scandinavian countries (in particular, Finland).

Note also that the high R&D spending (per worker) does not necessarily imply the high number of patents applications to the EPO. R&D expenditure per worker in Finland is lower than in Italy and in Portugal (Table A.1). Nevertheless, Finland enjoys the highest number of EPO patents, whereas Italy and Portugal lag far behind. This could be a sign of the lack of efficiency of R&D spending. In fact, there is much cross-country variation in this respect (Conte, 2009).

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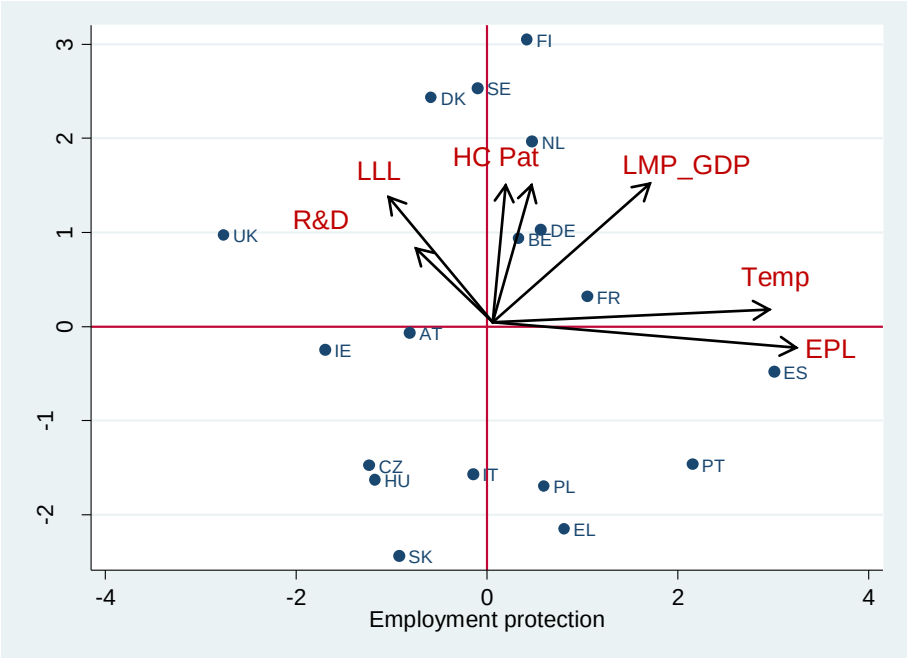
[7] EPO - European Patent Office.

[8] We take the version of this indicator which accounts for Regular employment, Temporary employment and Collective dismissals.

[9] Note that EPL and the share of temporary contracts could be correlated. Indeed, according to Engellandt and Riphahn (2005), countries characterised by limited employment protection (for permanent and temporary workers) would use temporary contract mainly as a screening device. By contrast, countries characterised by stronger protection would need to use temporary contract also as a cyclical buffer. Eurostat data seem to confirm this intuition. In 2003 EPL for permanent and temporary contracts in Spain was, respectively, 2.6 and 3.5. The same index for UK was 1.1 and 0.4. At the same time, the percentage of temporary contracts in Spain reached 31.7% of population aged 15 or more, whereas in the UK the share of temps was only 6.1%.

Since we assume that technological development goes in the direction of reducing overeducation, our preliminary findings are not supportive to those reported by Di Pietro (2002), who sustains that imposing rules against collective dismissals discourages firms from undertaking R&D/adopting new technologies and increases the incidence of overeducation.

Figure 1. Principal components analysis: Technology and Employment protection



Note: the arrows indicate the direction in which the variables affect the positioning of the country on the graph.
Source: own calculation on Eurostat online database and OECD indicators, as described above.

The data used for the principal components analysis, together with the percentages of overeducated by country, are reported in Table A.1 of the Appendix and provide further insight on this issue. Apparently, the incidence of overeducation is as high in Greece, Spain and Italy (high EPL), as in Ireland, the UK and Hungary (low EPL). On the other side, overeducation is very low in Denmark (low EPL), Austria, Sweden, the Netherlands and Germany (medium-high EPL) and in Portugal (very high EPL).

In what follows we choose to concentrate on the following countries: Italy, Greece, Portugal, Spain, the Czech Republic, Hungary, France, Germany, Finland, and the UK, representing a different mixture of Technology/EPL as in Figure 1[10].

[10] The choice of countries was also driven by data availability, e.g. Finland is the only Scandinavian country for which regional data was available at NUTS 2 level.

3. Data and methodology used for the analysis

The analysis is based on the EU Labour Force Survey 2003 and an ad hoc module on lifelong learning for the same year. The definition of key variables is provided in Table A.2 of the Appendix, followed by descriptive statistics (Table A.3).

Dependent variable and modeling strategy

In this paper we concentrate on educational qualifications mismatch only[11] and consider three possible statuses for a person: under-/properly and overeducated. This way we do not only look at what explains the very fact of being under-/overeducated or not, but allow for the co-existence of cases with proper match.

Three main alternatives are known in economic literature to measure the minimum requested education and under-/overeducation.

1. The *objective* measure. Professional job analysts identify the required level and type of education in a particular occupation and this way place an occupation into a requirement ranking. For example, the US Employment Service compiles the Dictionary of Occupation Titles (DOT), similar to the Standard Occupational Classification System (SOCS) in the UK. These classifications are then converted into years of requested schooling or schooling dummies which can be compared with the acquired schooling of the individuals in the study (Rumberger, 1987).
2. The *subjective* measure: This approach relies on worker's self-assessment. It resorts to a survey asking which level of education is required to get (Duncan and Hoffman, 1981) or to do (Hartog and Oosterbeek, 1988) their job. Once again this (classified) information can be compared with the actual schooling of the individual.
3. The *empirical* measure: This approach uses the distribution of schooling years in a given occupation or a group of occupations. Most commonly, individuals are defined to be overeducated if their schooling level is more than one standard deviation above the mean (Verdugo and Verdugo, 1988) or mode (Kiker et al., 1997) of all individuals in that occupation.

We here rely on the empirical measure[12]. The dependent variable takes value '1', which corresponds to undereducation, if the highest level of education achieved (measured in full years)

[11] Some of the most recent papers moreover consider the join problem of educational qualifications and skill mismatch (see for instance Quintini 2011a). We do admit the importance of this comprehensive approach, but at the same time understand the related risks. In particular, the subjective (worker's) evaluation data which is generally used to identify the discrepancy between the possessed and required skills can be subject to an error. Thus adhering to educational qualifications can be rewarding.

[12] The choice of empirical as opposed to normative or self-assessed measures proposed in the literature (for a recent survey see Quintini 2011b) was dictated by data availability.

is lower than the mode[13] for the occupation (at ISCO 2-digit). Value '2' stands for a proper match, i.e. when the years of education are exactly the same as the mode. '3' stands for overeducation, when the years of education are higher than the mode for the occupation. For descriptive statistics by country see Table A.2 in the Appendix.

The type of the dependent variable used for the analysis justifies the choice of an ordered probit setting. Assume the following model, where y_i^* is a latent variable, unobserved measure of educational (mis)match.

$$y_i^* = x_i\beta + \varepsilon_i, \qquad \varepsilon_i \mid x_i \sim^{iid} N(0,1)$$

$$y_i = \begin{cases} 1, \text{ if } y_i^* \leq \alpha_1 \\ 2, \text{ if } \alpha_1 < y_i^* \leq \alpha_2 \\ 3, \text{ if } y_i^* > \alpha_2 \end{cases}$$

The set of explanatory variables x_i includes both demand and supply factors, as described below. The estimated coefficients should be interpreted as increasing the risk of overeducation/reducing the probability of undereducation if they are positive, and the other way around. Note that the marginal effects do not always coincide with the sign of the estimated coefficients. The marginal effects for the three outcomes of interest will thus be reported alongside to the estimated coefficients (Tables A.4.1-A.4.10).

Demand and supply factors

The *demand factors* are drawn primarily from the Eurostat online database and are defined at the regional level (NUTS 2). These include: 1) patents applications to the EPO; 2) expenditure per worker in research and development sector; 3) gross fixed capital formation per person[14]; 4) youth unemployment rate. In addition to that we calculate 5) the share of ISCO 1, 2 and 3 among the working population, by region, using EU-LFS 2003 data. For the first three indicators we used the average value over the years 2000-2003 in order to account for lagged effects.

The *supply factors* are represented by individual characteristics, such as age, marital status, level of the highest education obtained, the field of education, working conditions (type of

[13] We used a mode-based criterion since, as argued by Mendes de Oliveira et al. (2000), it is "less sensitive to the presence of outliers in the data and provides a more accurate measure of the extent of surplus or deficit schooling than can be garnered from the mean".

[14] The final choice of demand factors was made after careful examination of other pieces of data that can be informative about the way local labour markets operate, including e.g.: human resources in science and technology as percentage of the working population, long-term unemployment rate, the share of highly educated among the employed/active population (for other viable alternatives see Science and Technology report by the Eurostat 2011). Eventually we had to restrict the number of explanatory variables in order to avoid strong correlation between them. Some of them are used interchangeably in the output tables (A.4.1-A.4.10).

contract, firm size), occupation, the index of participation into LLL[15], and a spatial mobility indicator.

Note that the combined use of data at regional and individual levels may be a reason of biased standard errors as illustrated by Moulton (1990). In what follows we thus report cluster adjusted standard errors.

The issue of sample selection bias

Since educational (mis)match can only be observed for working population, there is an issue of sample selection bias (Heckman, 1979). We account for it by implementing sample selection correction procedure[16]. Moreover we perform estimates separately for men and women in order to account for differences in their labour force participation.

The instrumental variable used is 'Live_alone'[17] or, in alternative, 'Young_children' (for definition see Table A.2). We assume that the person who declares to be living alone would most probably have to rely on incomes from paid work and this should increase the probability for him/her to be employed. At the same time, there are no evident reasons for why the educational match of a person living alone should be different from a person living in a numerous household. In turn, since the presence of children negatively affects female participation in the labour market (Dolton and Vignoles, 2000), whereas it provides incentives for male participation (Di Pietro and Cutillo, 2006b), this variable is a suitable selection variable when the analysis is disaggregated by gender. The quality and the validity of the instruments have been ascertained (for details see Appendix B).

4. Empirical findings

We first calculate the incidence of educational mismatch by country, differently for men and women, as reported in Table 2.

[15] The construction of this index is based on (on-line and off-line) self-studying activities and on libraries and learning centers visiting. These activities appear to be primarily related to an individual choice. For this reason we interpret the LLL index as a measure of individual heterogeneity (such as ability, talent, and, in particular, aspirations and motivations).

[16] We first estimate the participation equation (where the dependent variable is a dummy for working/not working) and then use the obtained inverse Mills ratio as an entry into the main equation (where the dependent variable is defined as educational (mis)match).

[17] This variable could not be constructed in the case of Finland since information about family relations had been suppressed in the available release of data.

Table 2. The incidence of over-/undereducation, by country

Country	Undereducated		Overeducated		Total educational mismatch	
	Men	Women	Men	Women	Men	Women
	1	2	3	4	1+3	2+4
Italy	24.7	32.8	21.3	18.4	46	51.2
Greece	21.8	25.6	26.8	15.0	48.6	40.6
Portugal	16.6	18.9	16.11	14.8	32.71	33.7
Spain	33.3	27.8	23.2	24.0	56.5	51.8
Czech Republic	17.8	25.6	17.4	12.7	35.2	38.3
Hungary	19.9	24.9	23.6	19.8	43.5	44.7
France	44.9	41.4	11.2	17.6	56.1	59
Germany	18.8	21.5	15.6	11.8	34.4	33.3
Finland	39.4	37.9	10.3	14.5	49.7	52.4
United Kingdom	40.6	43.7	19.1	20.5	59.7	64.2

Source: own calculation on EU-LFS 2003.

Finland, France and the United Kingdom show the highest rates of undereducation coupled with relatively low overeducation rates – something to be expected in the context of technologically advanced and fast developing economies. The Mediterranean countries instead are characterized by higher than average both under- and overeducation rates revealing the inefficacy of the educational systems therein not able to meet the needs of the economies.

The two East European countries considered, the Czech Republic and Hungary, both show asymmetry in the rates of under-/overeducation by gender: male overeducation rates are higher than female rates, while undereducation on the opposite hits more women. This pattern is also confirmed for Mediterranean countries, except for Spain, suggesting that the gender breakdown is particularly important for these two groups of economies.

Germany and Portugal have the lowest rates of overeducation (and total educational mismatch), for different reasons though. Germany is characterized by high average educational attainments, with 29% of the sample considered possessing high level of education and 58% - medium (see Table A.3 in the Appendix). The good match can thus be a sign of a well functioning educational system adapted to the needs of the national labour market. Portugal instead is characterized by very low educational attainments with 89% of the sample considered reporting low levels of education. High education there remains a kind of luxury, and the few ones who manage to get access to it fit well into the labour market after the completion of studies. Those who possess low degree also seem to be placed well. The framework is thus completely different: the economy seems to not create enough incentives but also opportunities for people to invest into education, whereby low educational mismatch can be explained by low educational production.

The above results are consistent with those obtained in a recent study by Croce and Ghignoni (2012)[18] who analyze the evolution of the incidence of overeducation in 26 European

[18] This study uses both mean and modal measures of overeducation, focusing on university graduates only.

countries over an extended period of time (1998-2006) relying on the same EU-LFS data. According to this study, Mediterranean countries not only are characterized by high incidence of overeducation (except for Portugal), but also exhibit an increasing trend during the time span considered (including Portugal). France, Germany, Finland and UK are characterized by a low incidence of overeducation, but the trends for them differ: increasing for France and Finland, and declining for Germany and the UK. Even the Czech Republic and Hungary would be characterized by a high level of (modal-based)[19] overeducation and by a slightly increasing trend over the period.

Further analysis aims to explore more in detail what is behind these cross-country differences in educational mismatch. We thus proceed by estimating the ordered probit model, as explained in the previous section, taking into account the issue of sample selection bias. Tables A.4.1-A.4.10 in the Appendix report the estimates by country.

The first thing to note is that the joint effect of demand factors does not exceed the joint effect of supply factors. Nevertheless, the significance of these effects varies. For Italy and Greece the demand side counts very little in reducing educational mismatch, while it is more influential in countries like Germany and Finland. This is in line with the hypothesis we put forward at the beginning of the paper, namely that demand is more effective in technologically advanced countries. Note, moreover, that in some countries, in particular Portugal, men are more responsive to the demand factors, while in others, apparently the United Kingdom, the same holds true for women.

There is no single factor on the demand side which would appear to be significant throughout the countries, suggesting that there may be no universal cure for the educational mismatch. Patents applications (used here as a proxy for the efficiency of R&D sector), cause overeducation to reduce in Portugal, Spain (only for women) and Germany (for both men and women). If moreover we look at the marginal effects, it tends to increase the probability of being properly matched (as in Finland).

The interpretation of the coefficient for the youth unemployment rate is not straightforward. In some cases it tends to decrease the probability of overeducation. This is possible in case, rather than accepting the job which does not correspond to the level of education achieved, a young person prefers to be unemployed (this holds true for men in Spain and women in the UK). But there are also cases when it has positive and significant coefficient, meaning that higher youth unemployment rates are associated with higher educational mismatch. This is revealing of the pressure that is often felt in the labour market, pushing young people to

[19] In the case of the Czech Republic and Hungary the average and the modal measures of overeducation provide significantly different results. For the other countries the two measures provide much more similar results.

accept any type of job, even if not appropriate to the level of his/her education (this holds true for men in Portugal, France and Hungary, less so for both men and women in Germany)[20]. The positive effect nevertheless prevails, which highlights the need to facilitate school-to-work transitions in most European countries.

The gross fixed capital formation has the expected negative and significant coefficients for Spain, France and the Czech Republic. In most of the other countries, albeit negative, it does not appear to be significant. This may be a sign of inefficient investments into fixed capital, which gets even worse in case of Portugal, where the coefficient is positive and significant. It has nevertheless positive effect on labour market participation in both of the Eastern European countries considered, as well as in France and Finland.

We also found that increasing expenditure in R&D sector does not help overcoming the problem of educational mismatch. At best it allows reducing undereducation, as in Finland. In Hungary and Portugal it works in the direction of reducing overeducation but only partially, for women, while increasing undereducation. In no other country it appears to be statistically significant. Probably, this can be taken as a sign of lack of efficiency of spending in R&D.

The variable ISCO123 was used to check the relevance of the SBTC hypothesis. In particular, the higher percentage of top occupations among the working population means higher needs for educated labour force. In case it associates to lower/higher rates of educational mismatch, SBTC causes educational mismatch to reduce/increase. The empirical findings are partly supportive to this hypothesis. In most of the countries for which the variable appears to be significant (including Germany, Hungary, Finland, the UK and Portugal for men only) the marginal effects are positive for undereducation and negative for overeducation, suggesting that SBTC tends to increase the risk of undereducation while reducing the risk of overeducation.

On the supply side, age counts. In about half of the countries considered the risk of overeducation tends to increase with age, while undereducation tends to reduce. This is true for Germany, Spain and men in the Czech Republic, Hungary and the UK. In Italy and Greece, on the opposite, the risk of overeducation is higher for younger workers, while undereducation is lower for them. This identifies the young cohorts as being most exposed to the waste of human capital in the Italian and Greek contexts.

The counterbalancing factor appears to be individual participation into LLL. It tends to reduce, in a statistically significant way, the risk of overeducation in all of the countries

[20] In this framework, some authors (Rice, 1999, for the UK, and Giannelli and Monfardini, 2003, for Italy) argue that unemployment reduces the opportunity cost of education and therefore increases the probability that a young person is studying, rather than searching for a job (or accepting a job below his/her expectations). By contrast, Pastore (2005), focusing on a sample of young Poles, finds that high unemployment regions provide a disincentive to further education, and an incentive for job search for young people in Central and Eastern European countries.

considered for which the index of participation into LLL could be constructed[21]. It may thus be an important complement to formal education and an indicator of individual motivation. The latter is an important characteristic of individual heterogeneity. In fact, not that the type of skills acquired by means of LLL are 'sold' at the market (components of LLL index are described in Tab.A2), rather they enhance the employability of a person as well as the chances to be properly matched. Our results also show that participation into LLL is associated to higher risk of undereducation. All together this would suggest that individual motivation to invest in informal training after leaving formal education can help people with a low level of schooling to stay in employment, whereas it can favour movements along career paths for those possessing a high level of education[22].

The choice of education field appears to be crucial for both males and females in all countries. At the same time there are fields of education which serve expanding sectors and thus are able to reduce overeducation but sustain high rates of undereducation (e.g. Science, Health and Education). Engineering remains "male-friendly" in that it allows men to find a better match, less so for women.

In some countries, including Portugal and Spain but also Finland, men appear to be more responsive to the demand factors, compared to women. Moreover, it is worth noticing that in the UK (and to a lesser extent in France) the number of patents applications seems to increase overeducation and educational mismatch for women (but not for men).

Overall, the supply factors play an important role for both increasing participation and reducing overeducation, whereas the demand factors considered are more effective in pushing up participation rather than reducing educational mismatch.

Finally, we also perform the estimates without correcting for sample selection for those countries where it has not been found (for men or women, or both). This allows incorporating some additional variables of interest, in particular: the size of the firm (dummy for small firm), part-time worker, temporary contract and mover (see Table A.5 in the Appendix).

Working for a small firm tends to increase the risk of overeducation/reduce the risk of undereducation. This is in line with existing findings (Dolton and Silles, 2001) and our expectations. In fact as long as the size of the firm gets larger the recruitment procedures tend to be more formalized. Moreover, there is more space for career advancement, which renders underutilization of human capital less probable. On the opposite, small firms have less possibilities for on-the-job specific training, thus the employer's forward looking behavior would

[21] This data was not available for the Czech Republic and the United Kingdom.

[22] Robinson (2009) in fact argues that lifelong learning is a response to over-education rather than under-education necessary for a knowledge society.

preclude the recruitment of a person which is undereducated. It holds true for men in Portugal, Hungary, France and Germany, as well as for women in Finland, Hungary and France.

The effects of part-time and temporary contracts are not univocal. Being on part-time has practically no effect on men, also because it is less common among men (see Tab. A3). At the same time it tends to considerably increase the risk of overeducation for women. The reason is that part-time is often a solution for women with children, who have less bargaining power. Thus there is more possibility that employers will be setting higher requirements for entry into job (with no big costs implied), giving rise to overeducation.

On the opposite, temporary contracts have less of an impact for women, while they have important consequences for men: increasing overeducation/reducing undereducation in Hungary and France, and quite the opposite in Germany and Finland. Importantly, they also tend to considerably reduce the probability of being well-matched in the case of men (except for France). These results point out that the hypothesis of an "exchange" between "good match" and "security" of jobs is not always confirmed. Similar results were obtained by Croce and Ghignoni (2012).

Finally, we check for the effect of spatial mobility. Indeed, an increasing literature recognizes that overeducation can arise when workers dislike or are prevented from the geographical mobility needed to search for a suitable job if demand and supply of skills do not have a homogeneous spatial distribution (see, amongst others, Büchel and van Ham, 2003; Croce and Ghignoni, 2011). According to our results, commuting allows reducing the probability of being overeducated, while increasing the probability of being undereducated, but the effect is statistically significant in few countries only, for men and women in France and for women in Portugal.

These findings raise an issue of an optimal mix of educational and labour market policies to counter the problem of educational mismatch; they will differ for men and women, and among countries.

5. Discussion

The general context, including the way *educational systems (supply side)* and *labour markets (demand side)* operate, may shed some light on our understanding of the revealed cross-country differences.

What counts for the outcome of interest (probability of educational mismatch), is how easy/difficult it is to get higher levels of education, whereby there is a risk of overeducation/ undereducation. The share of ISCED 5 and 6 graduates among the working age population, which has been used for the empirical analysis, is one of the characteristics of the actual

outcome, in turn it can be influenced e.g. by the possibility for parents to choose a public versus private school for their children at all levels of education, by the financial incentives/disincentives for school choice (such as school vouchers and/or tuition tax credits available to help families offset the costs of private schooling), by the share of public versus private universities, by access to credit for students, and, more generally, by all types of public subsidies for education provided by national and local governments.

None of the ten European countries considered in this study is characterized by too tight conditions to access higher education (with the partial exception of Portugal) (OECD 2010), nevertheless, the percentage of ISCED 5 and 6 graduates among the working age population varies a lot (Table A.1).

The inflow of graduates can also be affected by the stimulus that the labour market creates in the form of private returns to education and the way school-to-work transitions operate.

By comparing Table A.1 with Table A.6, one can see that the aggregate human capital is higher in those countries in which youth unemployment rate and the duration of school-to-work transitions are lower (in particular, Germany and the UK). On the other hand, high returns to education may provide an incentive to continue studying. In practice, however, the economic incentive to education can be neutralized by the lack of public subsidies for needy students, which seem to be the case of Portugal. The facilitated access to education, revealed by the high share of tertiary graduates among the working age population, theoretically might affect the probability of overeducation. In this framework, very low aggregate human capital (as compared to other European countries), can be one of the explanations for the low level of overeducation in Portugal (see Table A.l). In other countries, characteristics other than the "quantity" of aggregate human capital matter. Indeed, economic literature often rejected the hypothesis that the increase of the supply of skilled labour *per se* can be seen as a relevant factor fuelling overeducation[23] (Croce and Ghignoni, 2012). In this paper we thus investigate the role of other factors influencing educational mismatch.

In particular, despite formal education remains the most important stage of the education process, there is an increasing role of *non-formal education*, including LLL. In this respect too there is much heterogeneity among countries. The share of population participating into LLL activities (Table A.l) ranges from 1.8% in Greece to more than 23% in Finland. As shown by our estimation results (Tables A.4.1-A.4.10), participation into LLL is essential for reducing overeducation. At the same time, it operates at different scales depending on how much the

[23] The educational expansion *per se* cannot be considered a major factor influencing overeducation, but as long as long as poorer quality individuals enter the labour market it may cause a "grade drift".

country invests in cultural infrastructure (by that we mean e.g. libraries and internet supported computer labs).

Another important worker's characteristic which affects the risk of educational mismatch is the field of education obtained. In Mediterranean countries Engineering attracts 18% of students at most (the figure stands for Italy) compared to about 30% of students in Western European countries considered and more than 40% of students in Eastern European countries considered (see Table A.6)[24]. At the same time, Humanities, Languages and Arts together with Social Sciences attract almost half of the graduates in Italy. This is an additional explanation as to why Italian high education graduates have difficulties to face labour demand becoming ever more sophisticated. As a result the country features one of the highest rates of both under- and overeducation among workers (Table 2). Few in numbers[25] and yet misplaced, as rightly emphasized in Franzini and Raitano (2009). These facts are difficult to reconcile and are revealing of the deficiencies in the way the labour market and the educational system operate.

Italy (as other Mediterranean countries) is also known for one of the highest youth unemployment rates and lacking opportunities for young people at the start of career, thus difficult school-to-work transition (see Table A.6). This process is much facilitated in countries like Germany, and to some extent Finland and France, where the "dual" education system operates[26]. Despite the high aggregate human capital, these three countries are characterized by relatively low incidence of overeducation. At the same time, Germany, Finland and France are characterized by high rates of undereducation. These results can be explained by the widespread use of apprenticeship. Indeed, apprenticeship can improve workers screening by allowing employers to discover qualities and innate individual attributes of future employees, and by providing employees with work-related skills and competences, besides their formal degree of education (Ryan, 1998). In this case employers may get convinced that some workers are fully qualified to perform a specific job, for which they could appear to be formally undereducated. At the same time the better knowledge of workers' characteristics would also improve the match of individuals with a high educational degree.

Other factors influencing the educational mismatch reside in the demand side of the market, namely, in labour market characteristics and the level of technological development.

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[24] As reported by Walker and Zhu (2005) graduates in engineering are less likely to be overeducated, thus they can be regarded as a valid control in order to take into account the distribution of tertiary graduates by fields of education.

[25] Only 10.7% of the working age population in Italy possess university degree, see Table A.1.

[26] The "Dual Education System" combines apprenticeships within a firm and vocational education at a vocational school. In the firm, the apprentice receives practical training which is supplemented by theoretical education in the vocational school.

The empirical analysis showed that the demand factors played minor role in determining educational mismatch. Their potential for reducing educational mismatch is expected to further weaken over the crisis, so there may be little space for policy interventions. Yet the effects of demand factors were found to be higher in technologically advanced countries and can possibly be amplified also in other contexts e.g. by increasing expenditure on/ improving the efficiency of research and development. This goal has been pursued by the majority of the European countries. Nevertheless, they rank lower in terms of research intensity (expenditure on R&D as a percentage of GDP) compared to the USA or Japan, as well as in terms of the real output (measured by patents applications to the EPO)[27].

Finland is an interesting case in point. It often appears at the top of the ranking in Science and Technology Report *(ibidem),* moreover has the highest share of ISCED 5 and 6 graduates among the working population and at the same time the lowest share of overeducated workers (see Table 2). What makes it possible?

The well-known fact is that the higher the efficiency of research, the more investment it is going to attract. In turn the efficiency of research is largely determined by a proper mixture of fundamental and applied research. Some countries are known for achievement in applied research (e.g. the US), while others are more successful is pursuing fundamental research (e.g. France). Fundamental (mainly state financed) research on its own does not bring about technological growth. It is in combination with applied research (mainly financed by enterprises) that the result of interest is achieved. Only three EU Member States reached the goal set by the Lisbon strategy of having two thirds of the R&D expenditure financed by the business enterprise sector: Luxembourg (76.0%), Finland (70.3%) and Germany (67.9%) (Eurostat 2011). Finland again features as a country with an optimal mix of public and private spending on R&D.

Additional insight may be drawn from the general setting. The Scandinavian economic model places Sweden, Denmark, Finland and the Netherlands all at the top of the Technology axis in Figure 1. Alongside the flexicurity nexus it also implies the whole range of active and passive labour market policies. Moreover these countries are known for large investments into human capital, from the point of view of both quantity and quality[28]. All this is expected to create a self-sustaining mechanism of human capital production and utilization resulting in the low incidence of overeducation.

[27] On average, European countries spend 1.9% of GDP on R&D (in 2009), which is lower compared to a 3% goal set by the Lisbon strategy for 2010. Out of the countries considered only Finland has overcome the 3% mark of GDP spent on R&D, Germany was above the EU-average, and the rest of the countries considered lag behind. The output, measured in terms of patents applications to the EPO, is also relatively modest compared to the world leaders, again the USA and Japan. Nevertheless, in terms of the number of patents per million of inhabitants some countries, including Germany, Sweden and Finland, outperform even the world leaders (Eurostat 2011).

[28] The evidence can be drawn from PISA scores reported in Tab. A6. Finland has the highest level out of the ten countries considered.

Another remarkable feature of Scandinavian labour markets is the high female labour force participation. For Mediterranean countries instead it remains a policy objective, and the main way used to achieve it is increasing the educational attainments of women.

While entering the labour market women nevertheless are more exposed to overeducation compared to men, at least this holds true for countries where female participation is high (France, Finland and the United Kingdom). Instead, in Mediterranean countries, where women remain underrepresented among employees, their increasing educational attainments remain obscured. At the same time, the situation when women obtain education and do not work is certainly the worst outcome, resulting in the major waste of human capital[29].

The realities moreover are such that women generally tend to perform less qualified and less paid jobs (Bettio and Verashchagina, 2009). This is partly explained by pre-market choices of specialization which guides them to traditionally female dominated sectors (*ibidem*). However, horizontal segregation does not always cause overeducation. An example of school teaching (largely performed by women) represents the case when there is practically no mismatch, due to formalized recruitment procedures. A completely different situation is when women try to enter the traditionally male dominated occupations. They often do not manage to compete due to higher family burden and thus hold positions which do not correspond to the level of education obtained (on par or even higher than men's). Thus there are two actions to be supported. One is to encourage atypical choices of professions by women. Another is to eliminate the obstacles they meet further entering the labour market. Given the ever increasing input from female labour, this may result in reducing educational mismatch.

Concluding remarks and policy implications

This paper deals with the effects of demand and supply factors on educational qualifications mismatch in Europe.

We estimated country-specific ordered probit models (separately for men and women, and taking into account the issue of sample selection) in order to assess the effects of demand and supply factors on the probability of being under-/properly or overeducated in ten European countries representing different patterns of labour market regulation, degrees of technological intensity and the incidence of educational mismatch.

The empirical findings are supportive to the hypothesis that the adoption of new technologies produces a relative demand shift which favours highly educated workers and

[29] One cannot even identify these cases by looking at employed only, like in case of Table 2.

reduces overeducation. What counts nevertheless is the level of technological development that has been achieved and the pace of it. The demand side factors appear to function better in technologically advanced countries, whereas supply side factors are more efficient in balancing the educational mismatch in countries with lower technological development. In this respect, we also want to highlight that EPL does not appear to hinder the technological change.

Our results show that the joint effect of demand factors does not exceed the joint effect of supply factors. Moreover, demand factors are often more effective in pushing up labour force participation rather than reducing overeducation, whereas supply factors play important role for both increasing participation and reducing overeducation.

Overall, policy initiatives targeted at reducing educational mismatch are expected to be more effective when dealing with the supply side effects and need to take into account country specificities as well as to identify the target groups, e.g. men/women, younger/older workers.

At the same time, demand factors should not be neglected, especially during the times of the crisis in Europe. The revealed potential of increasing the efficiency of R&D sector as the mean to counter educational mismatch is particularly important. More generally, enhancing the technological level is expected to improve job-education matches.

Other policy implications that emerge from our study include the improvement of school-to-work transition (the German system can be an example to follow), by also promoting a better use of temporary contracts. In particular, temporary contract should imply for young workers giving up some job-security in exchange for a better match. At the limit, they should be used as a 'stepping stone' to higher quality jobs.

Our results also show that increasing investments into cultural infrastructure, in order to incentivize participation into LLL, would improve educational match throughout Europe.

Providing guidance in the choice of field of study, especially for women, has a potential to reduce educational mismatch. Reconciliation policies are also expected to produce positive effects by augmenting aspirations about future job possibilities and, eventually, making women more competitive in the labour markets.

The positive examples here identified, in particular Finland for Scandinavian countries and Germany for Western European countries, are characterizes by the capacity to create a self-sustaining mechanism of human capital production and utilization. These countries also adhere to a flexicurity model able to effectively include the groups of vulnerable workers, in particular women and youth. All this results in the lower incidence of overeducation.

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A. Appendix of Tables

Table A.1. Technology, aggregate human capital, employment protection and the incidence of overeducation, by country

Country	Pat	R&D	Temp	EPL	LMP_GDP	LLL	HC (% of 5&6 ISCED)	% of overeducated
AT	47.74	2.05	7.2	2.2	1.8	12.9	18	**8.91**
BE	64.28	1.5	8.5	2.5	3.5	9.5	29	**21.49**
CZ	1.455	2.19	8.5	1.9	0.5	6.3	12	**16.57**
DK	82.97	1.63	9.5	1.8	4.3	26.5	31.9	**10.51**
FI	231.12	1.46	17.9	2.1	2.9	23.5	33.2	**12.39**
FR	68.38	1.56	13.4	2.9	2.7	7.9	23.9	**16.57**
DE	95.98	1.88	12.2	2.5	3.4	7.4	24	**14.41**
EL	3.532	0.76	11.3	2.9	0.6	1.8	18.5	**23.04**
ES	7.374	1.19	31.8	3.1	2.1	5.1	25.2	**23.56**
HU	6.327	1.52	7.6	1.7	0.7	4.6	15.4	**22.44**
IE	33.69	1.46	4.6	1.3	1.6	7.2	26.7	**26.47**
IT	19.3	1.5	9.5	2.4	1.3	6.8	10.7	**19.95**
NL	142.75	1.63	14.4	2.3	3.5	17.3	27.5	**12.69**
PL	0.588	1.07	18.9	2.1	1.3	5.5	14.1	**18.32**
PT	1.288	1.65	20.6	3.5	1.8	4.8	11	**15.26**
SK	1.554	0.91	4.7	2	0.5	4.6	11.8	**20.7**
SE	113.63	2.39	15.6	2.6	2.4	35.8	27.2	**7.61**
UK	55.6	1.64	5.7	1.1	0.6	35.5	28.3	**19.52**

Sourc: Eurostat online database (for Pat, R&D, Temp, LMP_GDP and LLL), OECD indicators (for EPL) and EU-LFS 2003.

Table A.2. Variables definition

Variable name	Definition
Dependent variable	
Educational mismatch	=1 if the person is undereducated, i.e. the number of years of education obtained are lower than the mode within occupation, at 2-digit ISCO; =2 if the person is properly matched, i.e. years of education are equal to the mode; =3 if the person is overeducated, i.e. years of education are higher than the mode.
Work	=1 if the person is working, 0 otherwise (unemployed or inactive).
*Demand factors**, by regions (at NUTS 2 level)	
Patent application	High-tech patent applications to the EPO, per mln. labour force.
Youth unemployment rate	Youth unemployment rate.
Gross fixed capital formation	Gross fixed capital formation, in mln. Euro per population aged 15+.
ISCO123	Share of ISCO 1, 2 and 3 occupations among the employed population (%).
Expenditure per worker	Expenditure per worker in R&D sector , in percentage of GDP.
Supply factors	
Age (Age2)	Age(Age squared).
Married	=1 if the person is married, 0 otherwise.
Small firm	=1 if the person is working for a small firm, less than 50 employees, 0 otherwise.
Part-time worker	=1 if the person is working part-time, 0 otherwise.
Temporary contract	=1 if the person is on temporary contract, 0 otherwise.
Sector of employment: Agr_hunt_forestry_fish, Constr, Trade, Hot&Rest, Transp_communic, Finance, Business, Publ_Admin, Educ, Health, Services.	Dummies for: Agriculture, hunting, forestry and fishing; Construction; Trade; Hotels and Restaurants, Transport and Communications, Finance, Business, Public administration, Education, Health, Services.
Mover	=1 if the person works in a different region from where s/he lives, 0 otherwise.
Index LLL	Index with values ranging from 0 to 4. The maximum corresponds to a situation when the person participates in all of the following activities: - self studying by making use of printed materials (books, magazines); - computer-based learning/training; internet based education; - studying by making use of educational broadcasting or off-line computer based; - visiting libraries, learning centers and the like. 0, if the person participates in none of the above activities.
High/Medium/Low level of education	=1 if the education level corresponds to ISCED 5 and 6 – tertiary and above/ upper secondary/ lower secondary.
Field of education: general programs, education, humanities, social, science, engineering, agriculture, health, services	Dummies for the field of highest level of education successfully completed. The baseline is general programs/services, depending on the coding of variables (for details see Table A2 with descriptive statistics).
Instrumental variable	
Live_alone	=1 if the person lives alone, 0 otherwise.
Young_children	=1 presence of children under 5 years.

Note: * In order to account for the lagged effect of the demand factors, whenever possible, they have been defined as an average values between the years 2000-2003 (see Eurostat online database, section Science, Technology and Innovation http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/database].

Table A.3. Descriptive statistics

Variable	ITALY		GREECE		PORTUGAL		SPAIN		FRANCE	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Educational mismatch	1.97 (0.68)	1.86 (0.70)	2.05 (0.70)	1.89 (0.63)	1.20 (0.57)	1.96 (0.58)	1.90 (0.74)	1.96 (0.72)	1.66 (0.69)	1.76 (0.73)
*Patents application	0.18 (0.15)	0.17 (0.14)	0.04 (0.02)	0.04 (0.02)	0.02 (0.02)	0.02 (0.02)	0.06 (0.04)	0.06 (0.04)	0.61 (0.59)	0.61 (0.58)
*Youth unemployment rate	27.29 (18.49)	27.47 (18.47)	27.07 (4.53)	27.02 (4.52)	14.36 (3.97)	14.4 (3.94)	22.87 (4.62)	22.92 (4.62)	18.57 (3.58)	18.58 (3.58)
*Expenditure per worker in R&D sector	1.48 (0.13)	1.48 (0.13)	0.83 (0.24)	0.83 (0.24)	1.70 (1.02)	1.70 (1.01)	1.16 (0.14)	1.16 (0.14)	1.49 (0.21)	1.49 (0.21)
*Gross fixed capital formation	5.60 (1.52)	5.58 (1.50)	4.44 (0.96)	4.44 (0.95)	3.93 (1.14)	3.91 (1.12)	5.75 (1.06)	5.74 (1.06)	6.11 (2.00)	6.07 (1.97)
*ISCO123 among employed	32.89 (2.68)	32.89 (2.67)	29.38 (5.13)	29.5 (5.11)	22.35 (6.02)	22.39 (6.06)	30.74 (2.90)	30.70 (2.89)	39.06 (7.20)	39.01 (7.10)
Age	44.07 (11.22)	44.21 (11.27)	44.19 (11.34)	44.53 (11.20)	44.3 (11.23)	44.96 (11.14)	43.22 (11.18)	43.62 (11.11)	44.0 (10.81)	43.98 (10.80)
Married	0.28	0.20	0.26	0.14	0.20	0.13	0.29	0.20	0.29	0.24
Small firm	0.39	0.26	0.38	0.27	0.28	0.22	0.26	0.19	0.23	0.24
Part-time worker	0.02	0.08	0.01	0.03	0.03	0.10	0.02	0.08	0.04	0.19
Temporary contract	0.03	0.04	0.04	0.04	0.09	0.09	0.15	0.12	0.05	0.06
Mover	0.02	0.01	0.002	0.001	0.03	0.01	0.02	0.01	0.06	0.03
Index LLL	1.07	0.96	0.30	0.23	0.83	0.79	0.29	0.28	0.15	0.13
High level of education	0.10	0.11	0.18	0.16	0.07	0.11	0.24	0.24	0.22	0.24
Medium level of education	0.36	0.35	0.36	0.34	0.10	0.10	0.17	0.16	0.44	0.38
Low level of education	0.54	0.55	0.46	0.49	0.83	0.79	0.59	0.60	0.34	0.38
General programs	0.0	0.0	0.23	0.26	0.85	0.80	0.11	0.10	0.00	0.001
Education	0.01	0.08	0.01	0.03	0.01	0.04	0.02	0.05	0.01	0.02
Humanities	0.04	0.07	0.02	0.04	0.02	0.04	0.02	0.03	0.04	0.08
Social sciences	0.12	0.16	0.06	0.07	0.04	0.05	0.25	0.12	0.12	0.29
Science	0.04	0.04	0.03	0.02	0.03	0.02	0.02	0.02	0.05	0.04
Engineering	0.13	0.02	0.13	0.02	0.03	0.01	0.12	0.04	0.32	0.05
Agriculture	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.01
Health	0.02	0.02	0.02	0.04	0.01	0.02	0.02	0.06	0.03	0.09
Services	0.04	0.02	0.04	0.02	0.01	0.01	0.01	0.02	0.02	0.04
Work	0.76	0.46	0.82	0.49	0.82	0.64	0.80	0.48	0.77	0.63
Live_alone	0.08	0.07	-	-	-	-	0.04	0.04	0.14	0.12
Young_children	-	-	0.11	0.11	0.14	0.14	-	-	-	-
Nobs	***52052***	***54341***	***18759***	***19704***	***11512***	***12456***	***45969***	***47411***	***84515***	***90730***

Table A.3 continued

Variable	GERMANY		CZECH REPUBLIC		HUNGARY		FINLAND		UNITED KINGDOM	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Educational mismatch	1.97 (0.59)	1.90 (0.57)	2.0 (0.59)	1.87 (0.60)	2.04 (0.66)	1.95 (0.67)	1.71 (0.64)	1.77 (0.69)	1.79 (0.74)	1.77 (0.77)
*Patents application	0.97 (0.65)	0.96 (0.64)	0.02 (0.01)	0.02 (0.01)	0.05 (0.05)	0.05 (0.05)	2.25 (0.86)	2.25 (0.87)	0.47(0.37)	0.47 (0.37)
*Youth unemployment rate	10.94 (4.03)	10.95 (4.04)	18.20 (7.02)	18.27 (7.07)	13.80 (3.71)	13.86 (3.69)	21.9 (4.07)	21.9 (4.1)	12.31 (2.63)	12.27 (2.61)
*Expenditure per worker in R&D sector	1.92 (0.26)	1.92 (0.25)	2.37 (0.91)	2.37 (0.92)	1.40 (0.27)	1.41 (0.27)	1.44 (0.16)	1.43 (0.16)	1.41 (0.57)	1.40 (0.57)
*Gross fixed capital formation	5.82 (1.33)	5.79 (1.31)	2.44 (0.9)	2.42 (0.87)	1.71 (0.40)	1.70 (0.40)	6.17 (0.99)	6.18 (0.99)	5.82 (1.72)	5.80 (1.71)
*ISCO123 among employed	41.92 (3.31)	41.89 (3.28)	35.42 (6.11)	35.25 (5.93)	28.76 (5.05	28.69 (4.99)	40.5 (4.6)	40.60 (4.63)	37.44 (9.81)	37.26 (9.84)
Age	44.51 (11.03)	44.77 (11.07)	44.1 (11.4)	44.66 (11)	43.68 (11.22)	44.67 (11.36)	44.6 (10.9)	44.95 (10.72)	44.20 (10.89)	43.86 (10.94)
Married	0.27	0.17	0.19	0.09	0.22	0.11	0.31	0.23	0.24	0.19
Small firm	0.21	0.24	0.23	0.24	0.23	0.20	0.27	0.29	0.19	0.19
Part-time worker	0.04	0.27	0.01	0.05	0.02	0.03	0.04	0.10	0.05	0.30
Temporary contract	0.04	0.04	0.04	0.05	0.04	0.03	0.05	0.10	0.03	0.04
Mover	0.62	0.50	0.04	0.02	0.04	0.02	0.16	0.13	0.07	0.03
Index LLL	0.97	0.86	na	na	0.11	0.11	1.11	1.28	na	na
High level of education	0.27	0.19	0.12	0.10	0.11	0.13	0.29	0.37	0.28	0.25
Medium level of education	0.57	0.58	0.80	0.73	0.63	0.51	0.45	0.41	0.38	0.26
Low level of education	0.11	0.19	0.08	0.17	0.26	0.36	0.26	0.23	0.25	0.34
General programs	0.03	0.02	0.02	0.05	0.04	0.11	0.06	0.05	0.01	0.01
Education	0.03	0.06	0.01	0.06	0.02	0.06	0.01	0.04	0.01	0.03
Humanities	0.03	0.03	0.01	0.02	0.01	0.01	0.02	0.05	0.04	0.06
Social sciences	0.14	0.31	0.05	0.26	0.04	0.19	0.09	0.20	0.09	0.11
Science	0.03	0.01	0.02	0.01	0.01	0.01	0.02	0.02	0.06	0.03
Engineering	0.46	0.08	0.69	0.22	0.54	0.13	0.41	0.08	0.19	0.01
Agriculture	0.03	0.02	0.07	0.05	0.05	0.02	0.05	0.02	0.01	0.003
Health	0.03	0.11	0.01	0.08	0.01	0.06	0.03	0.18	0.02	0.08
Services	0.05	0.08	0.05	0.08	0.04	0.05	0.05	0.14	0.02	0.03
Work	0.76	0.62	0.82	0.63	0.68	0.53	0.78	0.73	0.83	0.68
Live_alone	0.18	0.14	0.08	0.07	0.06	0.08	na	na	0.15	0.12
Nobs	***91010***	***91363***	***16339***	***17490***	***22955***	***24671***	***12913***	***13170***	***32523***	***35656***

Note: Means of variables (standard deviations are in parenthesis, except for dummies); * variables defined at regional level.

Table A.4. Ordered probit estimates, correcting for sample selection bias

A.4.1. ITALY

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application	-0.083	-0.010	0.003	-0.0003	-0.002	0.028	-0.111	0.039	-0.013	-0.025
	0.062	*0.065*	*0.018*	*0.002*	*0.016*	*0.210*	*0.128*	*0.044*	*0.015*	*0.029*
Youth_UR	-0.009***	0.002	-0.001	0.0001	0.0005	-0.017***	0.006**	-0.002**	0.001**	0.001**
	0.001	*0.001*	*0.0003*	*0.0001*	*0.0003*	*0.002*	*0.002*	*0.001*	*0.000*	*0.001*
Gross fixed capital formation ǂ	0.011	-0.016	0.004	-0.0005	-0.004	0.020	-0.033	0.012	-0.004	-0.008
	0.015	*0.013*	*0.004*	*0.0004*	*0.003*	*0.025*	*0.018*	*0.006*	*0.002*	*0.004*
Expenditure/worker in R&D sector ǂ	-0.065	0.120	-0.033	0.004	0.029	0.040	0.224	-0.078	0.027	0.051
	0.113	*0.100*	*0.026*	*0.003*	*0.023*	*0.210*	*0.140*	*0.048*	*0.016*	*0.031*
ISCO123 among employed	0.013*	-0.007	0.002	-0.0002	-0.002	0.010	-0.003	0.001	-0.0003	-0.0006
	0.005	*0.006*	*0.002*	*0.0002*	*0.001*	*0.006*	*0.006*	*0.002*	*0.0008*	*0.001*
Supply factors										
Age	-0.055***	-0.015***	0.004***	0.0005***	-0.004***	-0.025***	-0.017***	0.006***	-0.002***	-0.004***
	0.006	*0.002*	*0.001*	*0.0001*	*0.0005*	*-0.01*	*0.002*	*0.001*	*0.000*	*0.001*
Married	-1.036***	0.138***	-0.037***	0.002***	0.034***	-0.022	-0.050**	0.017**	-0.006**	-0.011**
	0.032	*0.039*	*0.010*	*0.001*	*0.010*	*-0.04*	*0.017*	*0.006*	*0.002*	*0.004*
Index LLL	0.018*	-0.154***	0.042***	-0.005***	-0.037***	0.089***	-0.197***	0.068***	-0.024***	-0.045***
	0.007	*0.009*	*0.003*	*0.001*	*0.002*	*-0.01*	*0.013*	*0.005*	*0.002*	*0.003*
High level of education	0.691***	1.730***	-0.246***	-0.338***	0.584***	0.949***	1.085***	-0.290***	-0.039**	0.329***
	0.03	*0.064*	*0.007*	*0.017*	*0.021*	*-0.09*	*0.080*	*0.017*	*0.013*	*0.028*
Medium level of education	0.353***	1.384***	-0.329***	-0.044***	0.372***	0.499***	0.609***	-0.206***	0.065***	0.142***
	0.026	*0.049*	*0.009*	*0.007*	*0.012*	*-0.04*	*0.051*	*0.017*	*0.006*	*0.012*
Education	-0.024	-0.300***	0.091**	-0.030	-0.062***	0.269***	-0.737***	0.279***	-0.158***	-0.121***
	0.063	*0.09*	*0.031*	*0.015*	*0.016*	*-0.04*	*0.055*	*0.022*	*0.016*	*0.006*
Humanities	-0.268***	-0.132**	0.038*	-0.008	-0.030**	-0.148**	0.007	-0.002	0.001	0.001
	0.038	*0.051*	*0.015*	*0.005*	*0.011*	*-0.05*	*0.031*	*0.011*	*0.004*	*0.007*
Social	-0.065*	-0.132**	0.037**	-0.007	-0.030**	0.079*	0.004	-0.001	0.000	0.001
	0.031	*0.046*	*0.014*	*0.004*	*0.010*	*-0.04*	*0.041*	*0.014*	*0.005*	*0.009*
Science	-0.492***	-0.301***	0.091***	-0.029**	-0.063***	-0.181***	-0.157***	0.056***	-0.023***	-0.033***
	0.05	*0.058*	*0.020*	*0.009*	*0.010*	*-0.05*	*0.027*	*0.010*	*0.005*	*0.005*
Engineering	0.01	-0.096**	0.027**	-0.005*	-0.022**	0.078	0.029	-0.010	0.003	0.007
	0.034	*0.036*	*0.010*	*0.002*	*0.008*	*-0.05*	*0.044*	*0.015*	*0.005*	*0.010*
Agriculture	0.012	0.089	-0.023	0.001	0.022	-0.152	0.231	-0.075	0.016***	0.059
	0.084	*0.083*	*0.021*	*0.001*	*0.022*	*-0.11*	*0.153*	*0.046*	*0.003*	*0.043*
Health	0.212**	-0.474***	0.152***	-0.063***	-0.089***	0.254***	-0.356***	0.132***	-0.065***	-0.067***
	0.066	*0.081*	*0.030*	*0.019*	*0.012*	*-0.06*	*0.060*	*0.024*	*0.015*	*0.009*
Live_alone	0.446***	-	-	-	-	0.278***	-	-	-	-
	0.035	-	-	-	-	*-0.02*	-	-	-	-
Invmills	-	-0.490***	0.133***	-0.015***	-0.118***	-	-0.759***	0.263***	-0.091***	-0.172***
	-	*0.09*	*0.024*	*0.003*	*0.022*	-	*-0.15*	*0.051*	*0.017*	*0.034*
Const	3.060***	-	-	-	-	0.592	-	-	-	-
	0.387	-	-	-	-	*-0.47*	-	-	-	-
cut1 Const	-	-1.382***	-	-	-	-	-1.843***	-	-	-
	-	*0.204*	-	-	-	-	*0.275*	-	-	-
cut2 Const	-	0.498*	-	-	-	-	-0.252	-	-	-
	-	*0.206*	-	-	-	-	*0.280*	-	-	-
Pseudo R2	0.16	0.17	-	-	-	0.16	0.12	-	-	-
Nobs	47907	35312	-	-	-	53846	24534	-	-	-

A.4.2. GREECE

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	3.675***	-0.425	0.119	0.017	-0.136	3.150**	-3.964	1.225	-0.398	-0.827
	0.856	*1.242*	*0.349*	*0.049*	*0.397*	*1.182*	*2.692*	*0.833*	*0.256*	*0.581*
Youth_UR	0.003	0.003	-0.001	0.000	0.001	-0.003	-0.007	0.002	-0.001	-0.001
	0.003	*0.005*	*0.001*	*0.000*	*0.001*	*0.004*	*0.006*	*0.002*	*0.001*	*0.001*
Gross fixed capital formation	-0.043***	0.022	-0.006	-0.001	0.007	-0.052***	0.037	-0.011	0.004	0.008
	0.012	*0.026*	*0.007*	*0.001*	*0.008*	*0.016*	*0.042*	*0.013*	*0.004*	*0.009*
Expenditure/worker in R&D sector ǂ	-0.003	0.115	-0.032	-0.005	0.037	0.073	0.451*	-0.140*	0.045*	0.094*
	0.090	*0.090*	*0.025*	*0.004*	*0.028*	*0.130*	*0.200*	*0.061*	*0.020*	*0.042*
ISCO123 among employed	-0.018***	-0.01	0.003	0.000	-0.003	-0.029***	0.000	0.000	0.000	0.000
	0.003	*0.006*	*0.002*	*0.000*	*0.002*	*0.005*	*0.012*	*0.004*	*0.001*	*0.002*
Supply factors										
Age	-0.053***	-0.025***	0.007***	0.001***	-0.008***	-0.024***	-0.003	0.001	0.000	-0.001
	0.001	*0.003*	*0.001*	*0.000*	*0.001*	*0.003*	*0.004*	*0.001*	*0.000*	*0.001*
Married	-0.935***	-0.256*	0.076*	0.003	-0.079*	0.048	-0.221***	0.072***	-0.029***	-0.043***
	0.049	*0.109*	*0.035*	*0.002*	*0.033*	*0.070*	*0.048*	*0.017*	*0.007*	*0.010*
Index LLL	0.048**	-0.156***	0.044***	0.006***	-0.050***	0.086**	-0.183***	0.057***	-0.018***	-0.038***
	0.017	*0.016*	*0.004*	*0.001*	*0.005*	*0.026*	*0.023*	*0.007*	*0.003*	*0.005*
High level of education	0.011	1.187***	-0.235***	-0.195***	0.430***	0.575***	2.026***	-0.407***	-0.190***	0.597***
	0.063	*0.052*	*0.011*	*0.012*	*0.020*	*0.059*	*0.110*	*0.021*	*0.022*	*0.031*
Medium level of education	-0.106**	0.574***	-0.150***	-0.041***	0.191***	0.07	0.583***	-0.168***	0.034***	0.134***
	0.035	*0.040*	*0.007*	*0.005*	*0.011*	*0.068*	*0.053*	*0.012*	*0.008*	*0.013*
Education	-0.165**	-0.805***	0.285***	-0.100***	-0.185***	0.298***	-1.355***	0.500***	-0.367***	-0.133***
	0.054	*0.087*	*0.035*	*0.022*	*0.015*	*0.074*	*0.083*	*0.028*	*0.031*	*0.007*
Humanities	0.137**	-0.718***	0.250***	-0.078***	-0.172***	0.260***	-1.344***	0.495***	-0.357***	-0.138***
	0.047	*0.040*	*0.015*	*0.009*	*0.008*	*0.045*	*0.083*	*0.030*	*0.029*	*0.009*
Social	0.123*	-0.630***	0.212***	-0.051***	-0.161***	0.179***	-1.159***	0.426***	-0.288***	-0.138***
	0.059	*0.090*	*0.037*	*0.017*	*0.021*	*0.034*	*0.106*	*0.041*	*0.036*	*0.011*
Science	0.115*	-0.648***	0.221***	-0.060***	-0.162***	0.324*	-1.207***	0.450***	-0.326***	-0.123***
	0.050	*0.055*	*0.022*	*0.011*	*0.012*	*0.142*	*0.063*	*0.023*	*0.024*	*0.007*
Engineering	0.115**	-0.078	0.022	0.002*	-0.024	0.243***	-0.727***	0.266***	-0.167***	-0.099***
	0.035	*0.052*	*0.016*	*0.001*	*0.016*	*0.067*	*0.133*	*0.055*	*0.044*	*0.013*
Agriculture	0.031	-0.008	0.002	0.000	-0.002	0.176	-0.646**	0.235**	-0.144*	-0.091***
	0.195	*0.122*	*0.035*	*0.004*	*0.039*	*0.140*	*0.205*	*0.083*	*0.068*	*0.016*
Health	0.159	-0.809***	0.285***	-0.098***	-0.187***	0.332***	-1.389***	0.510***	-0.371***	-0.139***
	0.103	*0.091*	*0.038*	*0.021*	*0.017*	*0.040*	*0.045*	*0.016*	*0.017*	*0.009*
Young_children	0.114*	-	-	-	-	-0.372***	-	-	-	-
	0.049	-	-	-	-	*0.025*	-	-	-	-
Invmills	-	0.610***	-0.171***	-0.024**	0.195***	-	0.067	-0.021	0.007	0.014
	-	*0.174*	*0.051*	*0.008*	*0.059*	-	*0.225*	*0.069*	*0.023*	*0.047*
Const	4.140***	-	-	-	-	1.929***	-	-	-	-
	0.189	-	-	-	-	*0.219*	-	-	-	-
cut1 Const	-	-1.675***	-	-	-	-	-0.746	-	-	-
	-	*0.317*	-	-	-	-	*0.403*	-	-	-
cut2 Const	-	-0.174	-	-	-	-	1.106**	-	-	-
	-	*0.329*	-	-	-	-	*0.392*	-	-	-
Pseudo R2	0.12	0.055	-	-	-	0.09	0.08	-	-	-
Nobs	18759	15416	-	-	-	19704	9653	-	-	-

A.4.3. PORTUGAL

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	-4.671*	-1.591**	0.295**	0.090**	-0.385**	-7.303	-3.829***	0.719***	0.153***	-0.872***
	1.960	*0.570*	*0.094*	*0.034*	*0.128*	*-4.350*	*-0.830*	*0.195*	*0.026*	*0.220*
Youth_UR	-0.016*	0.007**	-0.001**	-0.0004***	0.002**	-0.016	-0.005*	0.001*	0.0002*	-0.001*
	0.010	*0.000*	*0.000*	*0.000*	*0.001*	*-0.020*	*0.000*	*0.000*	*0.000*	*0.001*
Gross fixed capital formation	0.147***	0.065***	-0.012***	-0.004***	0.016***	0.087	0.064***	-0.012***	-0.003***	0.015***
	0.040	*0.020*	*0.003*	*0.001*	*0.004*	*-0.090*	*-0.010*	*0.002*	*0.000*	*0.003*
Expenditure/worker in R&D sector ǂ	0.066	0.007	-0.001	-0.0004	0.002	0.094	-0.108*	0.020*	0.004*	-0.025*
	0.080	*0.030*	*0.005*	*0.002*	*0.007*	*0.120*	*0.050*	*0.009*	*0.002*	*0.011*
ISCO123 among employed	-0.010***	-0.005***	0.001***	0.0003***	-0.001***	-0.004	0.001	0.000	0.000	0.000
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*-0.010*	*0.000*	*0.000*	*0.000*	*0.000*
Supply factors										
Age	-0.049***	-0.013*	0.002*	0.001*	-0.003*	-0.030***	-0.013**	0.002*	0.001***	-0.003**
	0.000	*0.010*	*0.001*	*0.000*	*0.001*	*0.000*	*0.000*	*0.001*	*0.000*	*0.001*
Married	-0.944***	-0.080	0.015	0.004	-0.019	-0.120	-0.136***	0.027***	0.002***	-0.030***
	0.050	*0.110*	*0.022*	*0.004*	*0.026*	*-0.080*	*-0.040*	*0.007*	*0.000*	*0.007*
Index LLL	0.043***	-0.091***	0.017***	0.005***	-0.022***	0.071***	-0.172***	0.032***	0.007***	-0.039***
	0.010	*0.010*	*0.003*	*0.001*	*0.003*	*-0.020*	*-0.020*	*0.004*	*0.001*	*0.005*
High level of education	0.191	0.672***	-0.086***	-0.119***	0.206***	0.621***	1.144***	-0.132***	-0.225***	0.356***
	0.110	*-0.100*	*0.014*	*0.029*	*0.041*	*-0.180*	*-0.160*	*0.018*	*0.047*	*0.062*
Medium level of education	-0.179*	0.787***	-0.099***	-0.145***	0.244***	0.284*	0.910***	-0.113***	-0.162***	0.274***
	0.070	*0.150*	*0.017*	*0.042*	*0.058*	*-0.130*	*-0.150*	*0.012*	*0.042*	*0.049*
Education	0.467*	-0.426	0.100	-0.018	-0.082	-0.160	-0.895***	0.252***	-0.126**	-0.126***
	0.220	*0.240*	*0.073*	*0.034*	*0.039*	*-0.150*	*-0.170*	*0.060*	*0.050*	*0.013*
Humanities	0.067	-0.187	0.039	0.003	-0.041	-0.045	-0.207	0.043	-0.001	-0.042
	0.130	*0.110*	*0.024*	*0.003*	*0.021*	*-0.100*	*-0.180*	*0.041*	*0.008*	*0.032*
Social	-0.037	0.159	-0.027	-0.014	0.041	-0.097	-0.300**	0.066*	-0.006	-0.059**
	0.110	*0.150*	*0.021*	*0.018*	*0.039*	*-0.130*	*-0.110*	*0.028*	*0.009*	*0.020*
Science	-0.211	-0.208	0.043	0.002	-0.046	-0.094	-0.384**	0.089*	-0.017	-0.071***
	0.110	*0.160*	*0.040*	*0.006*	*0.033*	*-0.140*	*-0.150*	*0.037*	*0.018*	*0.019*
Engineering	0.025	0.220**	-0.036***	-0.023	0.059**	-0.377	-0.363	0.084	-0.016	-0.068*
	0.190	*0.080*	*0.010*	*0.013*	*0.023*	*-0.230*	*-0.220*	*0.057*	*0.028*	*0.030*
Agriculture	-0.011	0.314	-0.048	-0.040	0.088	-0.268	-0.131	0.027	0.001	-0.028
	0.470	*0.390*	*0.045*	*0.076*	*0.121*	*-0.360*	*-0.390*	*0.085*	*0.008*	*0.077*
Health	0.670	-0.303	0.067	-0.004	-0.063	0.256	-0.690***	0.183***	-0.075*	-0.107***
	0.370	*0.280*	*0.074*	*0.024*	*0.050*	*-0.160*	*-0.140*	*0.047*	*0.035*	*0.014*
Young_children	-0.011	-	-	-	-	-0.232***	-	-	-	-
	0.070	-	-	-	-	*-0.060*	-	-	-	-
Invmills	-	0.071	-0.013	-0.004	0.017	-	0.009	-0.002	0.000	0.002
	-	*0.360*	*0.067*	*0.021*	*0.087*	-	*-0.230*	*0.044*	*0.009*	*0.053*
Const	3.390***	-	-	-	-	1.830***	-	-	-	-
	0.180	-	-	-	-	*-0.200*	-	-	-	-
cut1 Const	-	-1.531***	-	-	-	-	-1.667***	-	-	-
	-	*0.200*	-	-	-	-	*-0.070*	-	-	-
cut2 Const	-	0.707***	-	-	-	-	0.619***	-	-	-
	-	*0.17*	-	-	-	-	*-0.17*	-	-	-
Pseudo R2	0.12	0.04	-	-	-	0.08	0.05	-	-	-
Nobs	10176	8507	-	-	-	10587	7110	-	-	-

A.4.4. SPAIN

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application	0.794	0.001	-0.044	0.009	0.035	1.088	-1.777***	0.585***	-0.047**	-0.538***
	0.851	*0.010*	*0.205*	*0.043*	*0.162*	*0.923*	*0.509*	*0.164*	*0.017*	*0.157*
Youth_UR	-0.024***	-0.025**	0.009**	-0.002**	-0.007**	-0.005	0.004	-0.001	0.0001	0.001
	0.005	*0.009*	*0.003*	*0.001*	*0.002*	*0.010*	*0.010*	*0.003*	*0.0002*	*0.003*
Gross fixed capital formation ǂ	0.048	-0.087*	0.030*	-0.006*	-0.024*	0.102*	-0.085*	0.028**	-0.002*	-0.026*
	0.035	*0.041*	*0.014*	*0.003*	*0.011*	*0.040*	*0.034*	*0.011*	*0.001*	*0.010*
Expenditure/worker in R&D sector ǂ	0.012	0.064	-0.022	0.005	0.018	-0.144	-0.146	0.048	-0.004	-0.044
	0.150	*0.260*	*0.090*	*0.018*	*0.071*	*0.210*	*0.180*	*0.060*	*0.005*	*0.055*
ISCO123 among employed	-0.003	-0.011	0.004	-0.001	-0.003	-0.017	0.016	-0.005	0.0004	0.005
	0.008	*0.009*	*0.003*	*0.001*	*0.002*	*0.010*	*0.008*	*0.003*	*0.0003*	*0.002*
Supply factors										
Age	-0.041***	-0.032***	0.011***	-0.002***	-0.009***	-0.020***	-0.005*	0.002*	-0.0001	-0.001*
	0.001	*0.004*	*0.001*	*0.000*	*0.001*	*0.000*	*0.000*	*0.001*	*0.0001*	*0.001*
Married	-0.907***	-0.237***	0.084***	-0.023***	-0.062***	0.143***	-0.254***	0.086***	-0.013***	-0.074***
	0.030	*0.060*	*0.023*	*0.007*	*0.016*	*0.030*	*0.020*	*0.007*	*0.002*	*0.006*
Index LLL	-0.011	-0.204***	0.071***	-0.015***	-0.056***	0.032***	-0.212***	0.070***	-0.006**	-0.064***
	0.010	*0.010*	*0.005*	*0.003*	*0.004*	*0.010*	*0.010*	*0.004*	*0.002*	*0.005*
High level of education	0.113**	0.855***	-0.255***	-0.015	0.270***	0.804***	-0.211	0.070	-0.008	-0.062
	0.040	*0.080*	*0.023*	*0.009*	*0.025*	*0.040*	*0.120*	*0.040*	*0.006*	*0.034*
Medium level of education	0.124***	0.910***	-0.256***	-0.044***	0.300***	0.397***	0.015	-0.005	0.000	0.005
	0.030	*0.050*	*0.014*	*0.011*	*0.019*	*0.030*	*0.060*	*0.020*	*0.001*	*0.018*
Education	0.191***	0.091	-0.031	0.005**	0.026	0.173***	-0.014	0.005	0.000	-0.004
	0.040	*0.060*	*0.019*	*0.002*	*0.018*	*0.050*	*0.060*	*0.021*	*0.002*	*0.019*
Humanities	0.229***	0.155**	-0.052**	0.006***	0.045**	-0.106*	0.125	-0.040	0.000	0.040
	0.060	*0.050*	*0.016*	*0.002*	*0.017*	*0.050*	*0.070*	*0.021*	*0.002*	*0.023*
Social	0.127**	0.048	-0.017	0.003	0.013	-0.093**	0.086	-0.028	0.001	0.026
	0.040	*0.060*	*0.020*	*0.003*	*0.017*	*0.030*	*0.060*	*0.019*	*0.001*	*0.019*
Science	-0.032	0.046	-0.016	0.003	0.013	-0.011	0.060	-0.019	0.001	0.019
	0.050	*0.040*	*0.013*	*0.002*	*0.011*	*0.070*	*0.080*	*0.025*	*0.001*	*0.025*
Engineering	0.199***	0.699***	-0.202***	-0.027	0.229***	-0.166*	0.256***	-0.077***	-0.007	0.084***
	0.040	*0.050*	*0.010*	*0.014*	*0.022*	*0.070*	*0.070*	*0.021*	*0.006*	*0.027*
Agriculture	0.281**	0.464***	-0.138***	-0.011	0.149***	-0.245	0.128	-0.040	0.000	0.041
	0.090	*0.090*	*0.021*	*0.015*	*0.035*	*0.140*	*0.070*	*0.022*	*0.002*	*0.024*
Health	0.443***	0.168**	-0.056**	0.006***	0.049**	0.361***	0.140*	-0.044*	0.000	0.044*
	0.060	*0.060*	*0.019*	*0.002*	*0.020*	*0.040*	*0.060*	*0.019*	*0.002*	*0.020*
Live_alone	0.240***	-	-	-	-	0.344***	-	-	-	-
	0.030	-	-	-	-	*0.050*	-	-	-	-
Invmills	-	0.706***	-0.245***	0.051***	0.193**	-	-1.132***	0.372***	-0.030***	-0.343***
	-	*0.210*	*0.072*	*0.013*	*0.061*	-	*0.180*	*0.058*	*0.011*	*0.055*
Const	3.145***	-	-	-	-	0.481	-	-	-	-
	0.360	-	-	-	-	*0.410*	-	-	-	-
cut1 Const	-	-2.685***	-	-	-	-	-1.867***	-	-	-
	-	*0.480*	-	-	-	-	*0.540*	-	-	-
cut2 Const	-	-1.285**	-	-	-	-	-0.505	-	-	-
	-	*0.470*	-	-	-	-	*0.540*	-	-	-
Pseudo R2	0.11	0.12	-	-	-	0.12	0.04	-	-	-
Nobs	43468	34666	-	-	-	44949	21546	-	-	-

A.4.5. CZECH REPUBLIC

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	-5.741	6.22	-1.529	0.125	1.404	-11.092***	8.095	-2.642	1.532	1.110
	3.423	*3.306*	*0.819*	*0.076*	*0.750*	*2.887*	*5.068*	*1.660*	*0.959*	*0.703*
Youth_UR	-0.023***	-0.003	0.0008	-0.0001	-0.0008	-0.009***	-0.003	0.001	-0.0005	-0.0004
	0.002	*0.002*	*0.0005*	*0.0001*	*0.0005*	*0.002*	*0.003*	*0.001*	*0.0005*	*0.0004*
Gross fixed capital formation	0.092*	-0.150***	0.037***	-0.003***	-0.034***	0.126***	-0.212***	0.069***	-0.041***	-0.029***
	0.044	*0.039*	*0.010*	*0.001*	*0.009*	*0.030*	*0.061*	*0.020*	*0.012*	*0.008*
Expenditure/worker in R&D sector ǂ	0.020	-0.010	0.002	-0.0002	-0.002	0.004	-0.016	0.005	-0.003	-0.002
	0.050	*0.010*	*0.002*	*0.0002*	*0.003*	*0.050*	*0.010*	*0.004*	*0.003*	*0.002*
ISCO123 among employed	0.009*	0.0007	-0.0002	0.0001	0.0002	0.014***	0.000	0.0001	0.0001	0.0001
	0.004	*0.003*	*0.001*	*0.0001*	*0.0007*	*0.004*	*0.004*	*0.0012*	*0.0007*	*0.0005*
Supply factors										
Age	-0.059***	0.011**	-0.003**	0.0002***	0.002**	-0.021***	0.010	-0.003	0.002	0.001
	0.002	*0.003*	*0.0009*	*0.0001*	*0.001*	*0.002*	*0.006*	*0.002*	*0.001*	*0.001*
Married	-0.802***	0.167**	-0.034**	-0.001	0.040**	-0.073*	0.038	-0.012	0.007	0.005
	0.031	*0.060*	*0.013*	*0.002*	*0.016*	*0.037*	*0.088*	*0.028*	*0.016*	*0.013*
Index LLL	na	na	-	-	-	na	na	-	-	-
	-	-	-	-	-	-	-	-	-	-
High level of education	1.021***	3.215***	-0.296***	-0.594***	0.891***	0.792***	3.338***	-0.408***	-0.490***	0.899***
	0.110	*0.080*	*0.009*	*0.011*	*0.008*	*0.080*	*0.240*	*0.017*	*0.021*	*0.031*
Medium level of education	0.626***	2.451***	-0.769***	0.497***	0.271***	0.499***	2.930***	-0.852***	0.637***	0.215***
	0.080	*0.040*	*0.008*	*0.012*	*0.008*	*0.030*	*0.200*	*0.024*	*0.016*	*0.016*
Education	0.406*	-0.604***	0.188***	-0.091*	-0.097***	0.155*	-0.719***	0.267***	-0.204***	-0.063***
	0.170	*0.160*	*0.059*	*0.042*	*0.017*	*0.070*	*0.090*	*0.033*	*0.031*	*0.003*
Humanities	0.042	-0.348	0.100	-0.035	-0.065	0.180*	-0.148	0.050	-0.032	-0.018
	0.120	*0.230*	*0.076*	*0.040*	*0.035*	*0.070*	*0.090*	*0.033*	*0.023*	*0.010*
Social	0.175	-0.095	0.024	-0.004	-0.020	0.028	-0.057	0.019	-0.011	-0.008
	0.100	*0.100*	*0.027*	*0.006*	*0.021*	*0.030*	*0.030*	*0.011*	*0.007*	*0.004*
Science	0.065	-0.213	0.058	-0.015	-0.043	-0.030	-0.130	0.044	-0.028	-0.016
	0.130	*0.120*	*0.037*	*0.014*	*0.022*	*0.070*	*0.110*	*0.039*	*0.026*	*0.013*
Engineering	0.191***	-0.100***	0.024***	-0.001*	-0.023**	-0.057*	-0.012	0.004	-0.002	-0.002
	0.040	*0.030*	*0.007*	*0.000*	*0.008*	*0.030*	*0.030*	*0.010*	*0.006*	*0.004*
Agriculture	0.214**	0.185**	-0.042***	-0.003	0.045***	-0.051	0.401***	-0.115***	0.044***	0.071***
	0.080	*0.060*	*0.011*	*0.003*	*0.014*	*0.040*	*0.070*	*0.017*	*0.003*	*0.014*
Health	0.914***	-0.831***	0.276***	-0.160***	-0.115***	0.238***	-0.198***	0.068***	-0.044***	-0.024***
	0.270	*0.100*	*0.040*	*0.033*	*0.008*	*0.040*	*0.050*	*0.017*	*0.013*	*0.005*
Live_alone	-0.202*	-	-	-	-	-0.196***	-	-	-	-
	0.100	-	-	-	-	*0.040*	-	-	-	-
Invmills	-	-0.615***	0.151***	-0.012***	-0.139**	-	-1.100**	0.359**	-0.208**	-0.151**
	-	*0.190*	*0.047*	*0.003*	*0.045*	-	*0.460*	*0.149*	*0.088*	*0.061*
Const	3.081***	-	-	-	-	0.426**	-	-	-	-
	0.180	-	-	-	-	*0.150*	-	-	-	-
cut1 Const	-	1.407***	-	-	-	-	1.359***	-	-	-
	-	*0.100*	-	-	-	-	*0.220*	-	-	-
cut2 Const	-	3.458***	-	-	-	-	3.454***	-	-	-
	-	*0.090*	-	-	-	-	*0.210*	-	-	-
Pseudo R2	0.21	0.12	-	-	-	0.07	0.20	-	-	-
Nobs	16266	13318	-	-	-	17457	10966	-	-	-

A.4.6. HUNGARY

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	4.850 *2.843*	1.130 *0.598*	-0.275 *0.147*	-0.030* *0.015*	0.306 *0.161*	2.913* *1.336*	2.638* *1.027*	-0.774* *0.305*	0.140* *0.058*	0.634* *0.249*
Youth_UR	-0.034** *0.011*	0.018** *0.006*	-0.004*** *0.001*	-0.0005** *0.0002*	0.005** *0.002*	-0.007 *0.005*	0.008 *0.005*	-0.002 *0.002*	0.0004 *0.0003*	0.002 *0.001*
Gross fixed capital formation	0.379* *0.181*	0.029 *0.041*	-0.007 *0.011*	-0.0008 *0.001*	0.008 *0.012*	0.332*** *0.054*	0.147 *0.075*	-0.043 *0.022*	0.008* *0.004*	0.035 *0.018*
Expenditure/worker in R&D sector ǂ	-0.280* *0.140*	-0.029 *0.040*	0.007 *0.010*	0.001 *0.001*	-0.008 *0.011*	-0.144*** *0.050*	-0.131** *0.040*	0.038** *0.013*	-0.007** *0.003*	-0.031** *0.011*
ISCO123 among employed	-0.067 *0.038*	-0.017* *0.005*	0.004* *0.002*	0.0005* *0.0002*	-0.005* *0.002*	-0.047** *0.016*	-0.039** *0.014*	0.011** *0.004*	-0.002** *0.0008*	-0.009** *0.003*
Supply factors										
Age	-0.052*** *0.003*	0.016*** *0.005*	-0.004*** *0.001*	-0.0004** *0.0002*	0.004*** *0.001*	-0.022*** *0.0002*	0.004 *0.006*	-0.001 *0.002*	0.0002 *0.0003*	0.001 *0.001*
Married	-0.601*** *0.057*	0.151** *0.057*	-0.035** *0.012*	-0.007 *0.004*	0.042** *0.016*	0.005 *0.035*	-0.068*** *0.020*	0.020*** *0.006*	-0.004** *0.002*	-0.016*** *0.004*
Index LLL	0.167* *0.066*	-0.316*** *0.031*	0.077*** *0.008*	0.008*** *0.002*	-0.085*** *0.009*	0.166*** *0.043*	-0.273*** *0.048*	0.080*** *0.014*	-0.015*** *0.003*	-0.066*** *0.011*
High level of education	1.054*** *0.085*	2.267*** *0.132*	-0.251*** *0.011*	-0.491*** *0.023*	0.742*** *0.030*	1.049*** *0.056*	2.305*** *0.271*	-0.358*** *0.024*	-0.375*** *0.045*	0.732*** *0.068*
Medium level of education	0.565*** *0.075*	1.849*** *0.129*	-0.556*** *0.041*	0.197*** *0.021*	0.359*** *0.020*	0.690*** *0.053*	1.717*** *0.181*	-0.530*** *0.054*	0.181*** *0.021*	0.349*** *0.034*
Education	0.158 *0.133*	-0.631*** *0.085*	0.196*** *0.030*	-0.071*** *0.020*	-0.126*** *0.010*	0.126 *0.073*	-0.764*** *0.082*	0.267*** *0.030*	-0.137*** *0.024*	-0.130*** *0.006*
Humanities	0.202 *0.173*	-0.365*** *0.078*	0.104*** *0.024*	-0.021* *0.010*	-0.083*** *0.014*	-0.095 *0.083*	-0.366*** *0.054*	0.121*** *0.020*	-0.048*** *0.012*	-0.073*** *0.008*
Social	0.067 *0.050*	-0.344*** *0.060*	0.096*** *0.019*	-0.016* *0.007*	-0.080*** *0.012*	0.056** *0.019*	-0.247*** *0.035*	0.076*** *0.011*	-0.020*** *0.004*	-0.056*** *0.007*
Science	0.134 *0.094*	-0.420*** *0.071*	0.122*** *0.025*	-0.029** *0.012*	-0.093*** *0.014*	0.086 *0.100*	-0.161** *0.058*	0.050** *0.019*	-0.015* *0.007*	-0.036** *0.012*
Engineering	0.151* *0.061*	-0.256*** *0.034*	0.061*** *0.008*	0.010*** *0.002*	-0.071*** *0.009*	-0.161*** *0.025*	-0.104 *0.058*	0.031 *0.018*	-0.007 *0.005*	-0.024 *0.013*
Agriculture	0.116 *0.084*	0.047 *0.071*	-0.011 *0.016*	-0.002 *0.003*	0.013 *0.020*	-0.255*** *0.059*	0.212 *0.157*	-0.057 *0.038*	0.001 *0.007*	0.056 *0.045*
Health	0.422** *0.143*	-0.670*** *0.126*	0.212*** *0.045*	-0.082** *0.031*	-0.130*** *0.014*	0.227*** *0.036*	-0.441*** *0.066*	0.146*** *0.024*	-0.060*** *0.014*	-0.087*** *0.010*
Live_alone	-0.126* *0.060*	- -	- -	- -	- -	-0.144*** *0.030*	- -	- -	- -	- -
Invmills	- -	-0.286 *0.198*	0.069 *0.047*	0.008 *0.006*	-0.077 *0.053*	- -	0.361 *0.413*	-0.106 *0.122*	0.019 *0.022*	0.087 *0.100*
Const	3.843*** *0.616*	- -	- -	- -	- -	1.331*** *0.300*	- -	- -	- -	- -
cut1 Const	- -	0.808*** *0.222*	- -	- -	- -	- -	0.241 *0.235*	- -	- -	- -
cut2 Const	- -	2.685*** *0.241*	- -	- -	- -	- -	2.032*** *0.240*	- -	- -	- -
Pseudo R2	0.21	0.15	-	-	-	0.13	0.12	-	-	-
Nobs	22857	15446	-	-	-	24656	13171	-	-	-

A.4.7. FRANCE

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application	0.017	0.024	-0.010	0.007	0.002	-0.029	0.115*	-0.045**	0.025**	0.020*
	0.030	*0.032*	*0.013*	*0.010*	*0.003*	*0.032*	*0.045*	*0.018*	*0.010*	*0.008*
Youth_UR	-0.013***	0.006*	-0.002*	0.002*	0.0005*	-0.017***	0.004	-0.001	0.001	0.001
	0.003	*0.003*	*0.001*	*0.001*	*0.0002*	*0.003*	*0.005*	*0.002*	*0.001*	*0.001*
Gross fixed capital formation ǂ	0.059***	-0.022	0.009	-0.007	-0.002	0.078***	-0.069**	0.027**	-0.015**	-0.012**
	0.011	*0.016*	*0.006*	*0.005*	*0.001*	*0.012*	*0.024*	*0.009*	*0.005*	*0.004*
Expenditure/worker in R&D sector ǂ	-0.066	-0.016	0.006	-0.005	-0.001	-0.070	0.053	-0.021	0.012	0.009
	0.070	*0.050*	*0.021*	*0.017*	*0.005*	*0.100*	*0.080*	*0.033*	*0.018*	*0.014*
ISCO123 among employed	-0.014***	-0.001	0.0003	-0.0003	-0.0001	-0.013**	0.000	-0.0002	0.0001	0.0001
	0.004	*0.005*	*0.002*	*0.002*	*0.0004*	*0.005*	*0.006*	*0.002*	*0.001*	*0.001*
Supply factors										
Age	-0.055***	-0.008*	0.003*	-0.002*	-0.001*	-0.023***	-0.013***	0.005***	-0.003***	-0.002***
	0.004	*0.004*	*0.001*	*0.001*	*0.0003*	*0.002*	*0.003*	*0.001*	*0.001*	*0.001*
Married	-0.523***	0.153**	-0.061***	0.047***	0.014***	-0.037	-0.042*	0.016*	-0.009*	-0.007*
	0.040	*0.050*	*0.019*	*0.014*	*0.004*	*0.030*	*0.020*	*0.007*	*0.004*	*0.003*
Index LLL	0.088***	-0.136***	0.054***	-0.042***	-0.012***	0.133***	-0.128***	0.050***	-0.028***	-0.022***
	0.020	*0.010*	*0.003*	*0.002*	*0.001*	*0.010*	*0.020*	*0.007*	*0.004*	*0.003*
High level of education	0.291**	2.736***	-0.722***	0.108***	0.615***	0.463***	2.093***	-0.612***	0.073***	0.539***
	0.090	*0.060*	*0.007*	*0.014*	*0.018*	*0.070*	*0.110*	*0.018*	*0.016*	*0.032*
Medium level of education	0.143	2.204***	-0.725***	0.433***	0.292***	0.300***	1.949***	-0.632***	0.205***	0.426***
	0.070	*0.070*	*0.014*	*0.008*	*0.011*	*0.040*	*0.070*	*0.014*	*0.007*	*0.018*
Education	0.110	-0.397***	0.156***	-0.131***	-0.025***	0.171*	-0.327***	0.130***	-0.085***	-0.045***
	0.120	*0.050*	*0.019*	*0.017*	*0.002*	*0.080*	*0.050*	*0.021*	*0.015*	*0.006*
Humanities	-0.025	-0.170*	0.068*	-0.055**	-0.013*	-0.031	-0.151**	0.059***	-0.036**	-0.024***
	0.090	*0.070*	*0.026*	*0.022*	*0.004*	*0.060*	*0.050*	*0.019*	*0.012*	*0.007*
Social	0.055	-0.206***	0.082***	-0.066***	-0.016***	0.127**	-0.089	0.035	-0.020	-0.015
	0.080	*0.040*	*0.016*	*0.013*	*0.003*	*0.040*	*0.050*	*0.020*	*0.012*	*0.008*
Science	0.030	-0.212***	0.084***	-0.069***	-0.016***	0.070	-0.179*	0.071	-0.043	-0.027*
	0.090	*0.050*	*0.022*	*0.018*	*0.003*	*0.040*	*0.080*	*0.034*	*0.022*	*0.011*
Engineering	0.165*	-0.135***	0.054***	-0.042***	-0.011***	-0.082	-0.058	0.023	-0.013	-0.009
	0.070	*0.040*	*0.015*	*0.012*	*0.003*	*0.050*	*0.050*	*0.022*	*0.013*	*0.009*
Agriculture	0.560***	0.101*	-0.040*	0.030*	0.010	0.225**	-0.066	0.026	-0.015	-0.011
	0.100	*0.050*	*0.019*	*0.014*	*0.005*	*0.090*	*0.050*	*0.022*	*0.013*	*0.009*
Health	0.436***	-0.655***	0.248***	-0.214***	-0.034***	0.342***	-0.392***	0.155***	-0.101***	-0.055***
	0.100	*0.060*	*0.021*	*0.020*	*0.002*	*0.050*	*0.060*	*0.023*	*0.017*	*0.006*
Live_alone	-0.168***	-	-	-	-	0.088***	-	-	-	-
	0.030	-	-	-	-	*0.020*	-	-	-	-
Invmills	-	-0.249	0.099	-0.077	-0.022	-	-0.185	0.072	-0.041	-0.031
	-	*0.220*	*0.088*	*0.069*	*0.019*	-	*0.290*	*0.115*	*0.065*	*0.050*
Const	3.606***	-	-	-	-	1.444***	-	-	-	-
	0.210	-	-	-	-	*0.100*	-	-	-	-
cut1 Const	-	1.108***	-	-	-	-	0.147	-	-	-
	-	*0.160*	-	-	-	-	*0.120*	-	-	-
cut2 Const	-	2.887***	-	-	-	-	1.665***	-	-	-
	-	*0.170*	-	-	-	-	*0.120*	-	-	-
Pseudo R2	0.15	0.27	-	-	-	0.08	0.22	-	-	-
Nobs	81761	62972	-	-	-	88197	55434	-	-	-

A.4.8. GERMANY

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application	0.056*	-0.052***	0.010***	-0.003***	-0.007***	0.054*	-0.078***	0.019***	-0.012***	-0.007***
	0.022	*0.013*	*0.003*	*0.001*	*0.002*	*0.023*	*0.022*	*0.005*	*0.003*	*0.002*
Youth_UR	-0.040***	0.011*	-0.002*	0.0007*	0.001*	-0.008*	0.014*	-0.003*	0.002*	0.001*
	0.005	*0.005*	*0.001*	*0.0003*	*0.001*	*0.004*	*0.006*	*0.001*	*0.001*	*0.001*
Gross fixed capital formation ǂ	0.009	0.021	-0.004	0.001	0.003	0.035*	0.004	-0.001	0.001	0.0004
	0.013	*0.010*	*0.002*	*0.001*	*0.001*	*0.014*	*0.013*	*0.003*	*0.002*	*0.001**
Expenditure/worker in R&D sector ǂ	0.014***	-0.010*	0.002**	-0.001**	-0.001**	0.003	-0.011*	0.003*	-0.002*	-0.001*
	0.004	*0.004*	*0.001*	*0.0002*	*0.0005*	*0.0003*	*0.005*	*0.001*	*0.001*	*0.0005*
ISCO123 among employed	0.014***	-0.010*	0.002**	-0.001**	-0.001**	0.003	-0.011*	0.003*	-0.002*	-0.001*
	0.004	*0.004*	*0.001*	*0.0002*	*0.0005*	*0.0003*	*0.005*	*0.001*	*0.001*	*0.0005*
Supply factors										
Age	-0.046***	0.009***	-0.002***	0.001***	0.001***	-0.031***	0.017***	-0.004***	0.003***	0.001***
	0.001	*0.002*	*0.0005*	*0.0001*	*0.0003*	*0.001*	*0.004*	*0.001*	*0.001*	*0.000*
Married	-0.488***	-0.055	0.011	-0.004	-0.007	0.085	-0.209***	0.053***	-0.036***	-0.017***
	0.027	*0.040*	*0.008*	*0.003*	*0.005*	*0.051*	*0.023*	*0.006*	*0.005*	*0.002*
Index LLL	0.052***	-0.155***	0.031***	-0.010***	-0.021***	0.083***	-0.202***	0.048***	-0.030***	-0.018***
	0.004	*0.004*	*0.001*	*0.001*	*0.001*	*0.004*	*0.008*	*0.002*	*0.002*	*0.002*
High level of education	0.383***	3.104***	-0.421***	-0.314***	0.735***	0.446***	3.287***	-0.406***	-0.371***	0.777***
	0.045	*0.087*	*0.011*	*0.010*	*0.015*	*0.056*	*0.113*	*0.011*	*0.014*	*0.018*
Medium level of education	-0.024	1.430***	-0.307***	0.111***	0.196***	0.139***	1.808***	-0.471***	0.303***	0.168***
	0.035	*0.060*	*0.014*	*0.009*	*0.009*	*0.023*	*0.083*	*0.019*	*0.020*	*0.008*
Education	0.469***	-0.606***	0.161***	-0.108***	-0.053***	0.384***	-0.663***	0.201***	-0.164***	-0.037***
	0.049	*0.056*	*0.018*	*0.015*	*0.004*	*0.020*	*0.061*	*0.021*	*0.019*	*0.004*
Humanities	0.407***	0.083	-0.016	0.004	0.012	0.146***	-0.194***	0.051***	-0.036***	-0.015***
	0.066	*0.055*	*0.010*	*0.002*	*0.008*	*0.016*	*0.051*	*0.014*	*0.010*	*0.004*
Social	0.535***	-0.080	0.016	-0.006	-0.010	0.318***	0.072	0.017	-0.011	-0.006
	0.045	*0.045*	*0.009*	*0.004*	*0.006*	*0.017*	*0.053*	*0.013*	*0.008*	*0.005*
Science	0.468***	-0.119*	0.025*	-0.011	-0.015*	0.204***	-0.223***	0.059**	-0.043**	-0.016***
	0.044	*0.058*	*0.013*	*0.006*	*0.007*	*0.034*	*0.068*	*0.019*	*0.016*	*0.004*
Engineering	0.359***	0.260***	-0.051***	0.016***	0.036***	0.149***	0.049	-0.011	0.007	0.005
	0.041	*0.038*	*0.008*	*0.003*	*0.005*	*0.021*	*0.034*	*0.008*	*0.005*	*0.003*
Agriculture	0.532***	0.392***	-0.062***	-0.006	0.068***	0.106*	0.151**	-0.034**	0.018***	0.015**
	0.092	*0.060*	*0.008*	*0.005*	*0.013*	*0.055*	*0.055*	*0.011*	*0.005*	*0.006*
Health	0.738***	-0.268***	0.061***	-0.032***	-0.030***	0.434***	-0.103	0.025	-0.017	-0.009
	0.041	*0.062*	*0.015*	*0.010*	*0.006*	*0.017*	*0.072*	*0.018*	*0.013*	*0.006*
Live_alone	-0.129***	-	-	-	-	0.067*	-	-	-	-
	0.027	-	-	-	-	*0.030*	-	-	-	-
Invmills	-	-0.087	0.017	-0.006	-0.012	-	-0.831***	0.199***	-0.125***	-0.075***
	-	*-0.11*	*0.021*	*0.007*	*0.014*	-	*0.236*	*0.055*	*0.034*	*0.022*
Const	2.299***	-	-	-	-	0.953***	-	-	-	-
	0.13	-	-	-	-	*0.141*	-	-	-	-
cut1 Const	-	0.616***	-	-	-	-	0.317	-	-	-
	-	*-0.14*	-	-	-	-	*0.221*	-	-	-
cut2 Const	-	3.269***	-	-	-	-	3.059***	-	-	-
	-	*-0.12*	-	-	-	-	*0.241*	-	-	-
Pseudo R2	0.15	0.29	-	-	-	0.11	0.32	-	-	-
Nobs	77779	58328	-	-	-	79850	49028	-	-	-

A.4.9. FINLAND

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	-0.162***	0.038**	-0.011**	0.011**	0.0001**	-0.178***	0.155*	-0.052*	0.049*	0.003
	0.0003	*0.013*	*0.004*	*0.004*	*0.0000*	*0.003*	*0.074*	*0.024*	*0.023*	*0.002*
Youth_UR	-0.070***	0.010	-0.003	0.003	0.0001	-0.049***	0.039	-0.013	0.012	0.001
	0.001	*0.008*	*0.002*	*0.002*	*0.0001*	*0.001*	*0.021*	*0.007*	*0.006*	*0.0004*
Gross fixed capital formation	0.162***	0.049***	-0.015***	0.014***	0.0002***	0.169***	-0.123	0.041	-0.039	-0.002
	0.003	*0.015*	*0.005*	*0.005*	*0.0001*	*0.003*	*0.074*	*0.024*	*0.023*	*0.001*
Expenditure/worker in R&D sector ǂ	-0.540***	0.128***	-0.038**	0.037**	0.0004**	-0.597***	0.517*	-0.173*	0.164*	0.009
	0.010	*0.040*	*0.013*	*0.013*	*0.0002*	*0.010*	*0.250*	*0.081*	*0.076*	*0.005*
ISCO123 among employed	-0.043***	-0.018***	0.005***	-0.005***	-0.001***	-0.020***	-0.001	0.0005	-0.0005	-0.0001
	0.0004	*0.005*	*0.001*	*0.001*	*0.0000*	*0.0005*	*0.008*	*0.003*	*0.003*	*0.0001*
Supply factors										
Age	-0.045***	0.007	-0.002	0.002	0.0001	-0.014***	0.014*	-0.005*	0.004*	0.0002
	0.000	*0.000*	*0.001*	*0.001*	*0.0000*	*0.002*	*0.006*	*0.002*	*0.002*	*0.0001*
Married	-0.542***	0.092*	-0.028*	0.027*	0.0003	-0.09	0.064*	-0.022*	0.020*	0.001*
	0.01	*0.050*	*0.014*	*0.014*	*0.0002*	*0.058*	*0.026*	*0.009*	*0.008*	*0.001*
Index LLL	0.093***	-0.227***	0.067***	-0.066***	-0.001***	0.151***	-0.285***	0.095***	-0.090***	-0.005**
	0.01	*0.030*	*0.008*	*0.008*	*0.0002*	*0.009*	*0.080*	*0.025*	*0.023*	*0.002*
High level of education	0.275***	6.747***	-0.999***	0.073***	0.925***	0.509***	6.605***	-0.999***	0.090***	0.909***
	0.06	*0.130*	*0.000*	*0.011*	*0.011*	*0.1*	*0.350*	*0.001*	*0.027*	*0.028*
Medium level of education	-0.068*	6.117***	-0.994***	0.403***	0.591***	0.288***	6.131***	-0.998***	0.124***	0.873***
	0.03	*0.120*	*0.001*	*0.021*	*0.022*	*0.08*	*0.250*	*0.001*	*0.022*	*0.023*
Education	0.412	0.267*	-0.087	0.085	0.001	-0.023	-0.300**	0.091**	-0.087**	-0.004***
	0.25	*0.130*	*0.047*	*0.046*	*0.001*	*0.06*	*0.100*	*0.029*	*0.028*	*0.001*
Humanities	-0.003	0.338***	-0.112***	0.110***	0.002***	-0.148	0.017	-0.006	0.005	0.000
	0.1	*0.040*	*0.017*	*0.016*	*0.000*	*0.12*	*0.080*	*0.028*	*0.027*	*0.002*
Social	0.255*	0.557***	-0.189***	0.185***	0.004***	0.111	0.097***	-0.033***	0.031**	0.002***
	0.1	*0.020*	*0.010*	*0.009*	*0.000*	*0.06*	*0.030*	*0.010*	*0.010*	*0.000*
Science	0.434***	0.318***	-0.104**	0.103**	0.002**	-0.081	-0.200	0.063	-0.060	-0.003*
	0.11	*0.100*	*0.034*	*0.033*	*0.001*	*0.1*	*0.150*	*0.045*	*0.043*	*0.001*
Engineering	0.324***	0.435***	-0.131***	0.129***	0.002***	-0.081	-0.010	0.003	-0.003	0.000
	0.04	*0.020*	*0.009*	*0.009*	*0.000*	*0.06*	*0.050*	*0.018*	*0.017*	*0.001*
Agriculture	0.469***	0.615***	-0.214***	0.209***	0.005***	-0.102**	0.258***	-0.092***	0.086***	0.006***
	0.05	*0.040*	*0.016*	*0.015*	*0.001*	*0.03*	*0.050*	*0.018*	*0.016*	*0.002*
Health	0.654***	0.342***	-0.113***	0.111***	0.002***	0.151**	-0.108***	0.035***	-0.034***	-0.002***
	0.16	*0.080*	*0.027*	*0.026*	*0.001*	*0.05*	*0.020*	*0.007*	*0.007*	*0.000*
Live_alone	na	-	-	-	-	na	-	-	-	-
	-	-	-	-	-	-	-	-	-	-
Invmills	-	-0.173	0.051	-0.051	-0.001	-	-1.489	0.497	-0.472	-0.026
	-	*0.370*	*0.108*	*0.107*	*0.001*	-	*1.070*	*0.355*	*0.335*	*0.021*
Const	5.203***	-	-	-	-	1.905***	-	-	-	-
	0.08	-	-	-	-	*0.08*	-	-	-	-
cut1 Const	-	5.930***	-	-	-	-	5.663***	-	-	-
	-	*0.3*	-	-	-	-	*0.11*	-	-	-
cut2 Const	-	8.244***	-	-	-	-	7.574***	-	-	-
	-	*0.29*	-	-	-	-	*0.14*	-	-	-
Pseudo R2	0.14	0.32	-	-	-	0.08	0.24	-	-	-
Nobs	11031	8146	-	-	-	11489	7968	-	-	-

A.4.10. UNITED KINGDOM

Variables	Men					Women				
	Coefficients		Marginal effects			Coefficients		Marginal effects		
	Selection equation	Educat. mismatch	Under-	Properly educated	Over-	Selection equation	Educat. mismatch	Under-	Properly educated	Over-
Demand factors										
Patents application ǂ	0.185**	-0.070	0.027	-0.009	-0.018	0.071	0.146***	-0.058***	0.017***	0.041***
	0.062	*0.037*	*0.014*	*0.005*	*0.010*	*0.039*	*0.033*	*0.017*	*0.004*	*0.009*
Youth_UR	-0.007	-0.004	0.001	-0.0005	-0.001	-0.016**	-0.025***	0.010***	-0.003***	-0.007***
	0.011	*0.004*	*0.002*	*0.0006*	*0.001*	*0.005*	*0.007*	*0.003*	*0.001*	*0.002*
Gross fixed capital formation	-0.016	0.003	-0.001	0.0003	0.0005	-0.002	-0.005	0.002	-0.006	-0.001
	0.015	*0.003*	*0.001*	*0.0004*	*0.0008*	*0.004*	*0.008*	*0.003*	*0.0009*	*0.002*
Expenditure/worker in R&D sector ǂ	-0.003	-0.035	0.013	-0.004	-0.009	0.011	0.033	-0.013	0.004	0.009
	0.050	*0.020*	*0.009*	*0.003*	*0.006*	*0.030*	*0.020*	*0.007*	*0.002*	*0.005*
ISCO123 among employed	0.004	-0.002*	0.0008*	-0.0003*	-0.0005*	-0.001**	-0.003***	0.0014***	-0.0004***	-0.0009***
	0.002	*0.001*	*0.0003*	*0.0001*	*0.0002*	*0.0005*	*0.001*	*0.0004*	*0.0001*	*0.0003*
Supply factors										
Age	-0.037***	0.005***	-0.002***	0.0006***	0.001***	-0.015***	-0.024***	0.009***	-0.003***	-0.007***
	0.002	*0.001*	*0.0006*	*0.0002*	*0.0004*	*0.002*	*0.003*	*0.001*	*0.000*	*0.0009*
Married	-0.476***	0.042*	-0.016*	0.005*	0.011*	-0.070	-0.170***	0.067***	-0.022***	-0.045***
	0.034	*0.020*	*0.007*	*0.002*	*0.005*	*0.047*	*0.023*	*0.009*	*0.0035*	*0.006*
Index LLL	na	na	na	na	na	na	na	na	na	na
	-	-	-	-	-	-	-	-	-	-
High level of education	0.575***	0.468***	-0.174***	0.042***	0.131***	0.859***	2.295***	-0.665***	-0.045***	0.710***
	0.068	*0.066*	*0.024*	*0.003*	*0.021*	*0.082*	*0.233*	*0.040*	*0.018*	*0.058*
Medium level of education	0.386***	0.587***	-0.219***	0.058***	0.161***	0.597***	2.115***	-0.630***	-0.037***	0.666***
	0.041	*0.086*	*0.031*	*0.005*	*0.026*	*0.039*	*0.207*	*0.039*	*0.018*	*0.056*
Education	-0.170	-0.001	0.0004	-0.0001	-0.0002	0.169*	0.106	-0.041	0.010	0.031
	0.088	*0.067*	*0.026*	*0.009*	*0.017*	*0.071*	*0.077*	*0.030*	*0.006*	*0.023*
Humanities	0.020	0.312***	-0.114***	0.023***	0.091***	-0.025	-0.135*	0.053	-0.018	-0.036
	0.073	*0.044*	*0.015*	*0.002*	*0.014*	*0.035*	*0.057*	*0.023*	*0.008*	*0.015*
Social	0.040	0.152***	-0.057***	0.016***	0.042***	0.069	0.137**	-0.053**	0.013***	0.040**
	0.044	*0.038*	*0.014*	*0.003*	*0.011*	*0.038*	*0.046*	*0.018*	*0.004*	*0.014*
Science	-0.140**	0.202***	-0.075***	0.019***	0.056***	-0.079	-0.176***	0.070***	-0.024***	-0.046***
	0.050	*0.051*	*0.018*	*0.003*	*0.015*	*0.045*	*0.046*	*0.018*	*0.007*	*0.011*
Engineering	0.120**	0.475***	-0.173***	0.035***	0.138***	0.056	0.196*	-0.075*	0.016***	0.059*
	0.037	*0.030*	*0.010*	*0.002*	*0.009*	*0.085*	*0.092*	*0.034*	*0.005*	*0.030*
Agriculture	0.020	0.976***	-0.290***	-0.051***	0.341***	-0.189	-0.400**	0.159**	-0.066*	-0.093***
	0.143	*0.074*	*0.015*	*0.014*	*0.029*	*0.160*	*0.141*	*0.055*	*0.029*	*0.026*
Health	0.151*	-0.076	0.030	-0.011	-0.019	0.146*	0.116*	-0.045*	0.012*	0.034
	0.075	*0.056*	*0.022*	*0.008*	*0.013*	*0.062*	*0.058*	*0.022*	*0.005*	*0.017*
Live_alone	-0.289***	-	-	-	-	0.020	-	-	-	-
	0.032	-	-	-	-	*0.032*	-	-	-	-
Invmills	-	0.319**	-0.123***	0.040***	0.083***	-	4.633***	-1.819***	0.526***	1.293***
	-	*0.110*	*0.043*	*0.013*	*0.029*	-	*0.526*	*0.208*	*0.061*	*0.149*
Const	2.463***	-	-	-	-	1.007***	-	-	-	-
	0.235	-	-	-	-	*0.121*	-	-	-	-
cut1 Const	-	0.415**	-	-	-	-	1.961***	-	-	-
	-	*0.131*	-	-	-	-	*0.205*	-	-	-
cut2 Const	-	1.609***	-	-	-	-	2.985***	-	-	-
	-	*0.111*	-	-	-	-	*0.197*	-	-	-
Pseudo R2	0.11	0.05	-	-	-	0.09	0.03	-	-	-
Nobs	32266	26603	-	-	-	35529	24115	-	-	-

Note: * p<0.05, ** p <0.01, *** p<0.001; Standard errors in *italic*.
ǂ The sign marks those variables which have been used interchangeably. The remaining coefficients reported in the table refer to the estimates without *Expenditure per worker in R&D sector*, all other variables being included.

Source: own calculation using EU-LFS 2003.

Table A.5. Ordered probit estimates (without correcting for sample selection), selected countries

Variables	PORTUGAL			FINLAND			HUNGARY			FRANCE			GERMANY		
	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-
Men															
Small firm	-0.024***	-0.009***	0.033***	-0.041	0.040	0.000	-0.015**	-0.002*	0.017*	-0.027*	0.021**	0.006*	-0.031***	0.008***	0.023***
	0.006	*0.002*	*0.008*	*0.023*	*0.023*	*0.000*	*0.005*	*0.001*	*0.006*	*0.011*	*0.008*	*0.003*	*0.002*	*0.001*	*0.002*
Part-time worker	0.008	0.002	-0.010	0.016	-0.016	0.000	-0.024	-0.005	0.029	-0.019	0.015	0.004	0.076***	-0.041***	-0.035***
	0.013	*0.002*	*0.016*	*0.020*	*0.020*	*0.000*	*0.018*	*0.006*	*0.024*	*0.016*	*0.013*	*0.004*	*0.011*	*0.008*	*0.003*
Temporary contract	-0.001	0.000	0.001	0.059***	-0.059***	-0.001***	-0.047***	-0.015***	0.062***	-0.059***	0.045***	0.015***	0.086***	-0.048***	-0.038***
	0.007	*0.002*	*0.009*	*0.014*	*0.014*	*0.000*	*0.005*	*0.004*	*0.009*	*0.017*	*0.012*	*0.004*	*0.012*	*0.009*	*0.003*
Mover	0.000	0.000	0.000	0.010	-0.009	0.000	0.013	0.001**	-0.014	0.068***	-0.055***	-0.013***	-0.004	0.002	0.003
	0.013	*0.004*	*0.018*	*0.029*	*0.028*	*0.000*	*0.011*	*0.000*	*0.011*	*0.013*	*0.010*	*0.002*	*0.006*	*0.002*	*0.004*
	PORTUGAL			**FINLAND**			**HUNGARY**			**FRANCE**			**GREECE**		
	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-	Under-	Properly educated	Over-
Women															
Small firm	-0.023	-0.006	0.029	-0.052***	0.049***	0.003***	-0.049***	0.007***	0.041***	-0.060***	0.034***	0.027***	-0.021	0.007	0.014
	0.012	*0.004*	*0.016*	*0.011*	*0.011*	*0.001*	*0.012*	*0.002*	*0.011*	*0.010*	*0.005*	*0.004*	*0.014*	*0.004*	*0.010*
Part-time worker	0.008	0.001	-0.009	-0.039***	0.037***	0.002***	-0.051***	0.003	0.048**	-0.096***	0.051***	0.045***	-0.100***	0.010	0.091***
	0.009	*0.001*	*0.011*	*0.008*	*0.007*	*0.000*	*0.015*	*0.002*	*0.017*	*0.013*	*0.006*	*0.006*	*0.008*	*0.005*	*0.010*
Temporary contract	-0.015	-0.004	0.019	0.016	-0.016	-0.001	-0.056***	0.002	0.054***	-0.002	0.001	0.001	-0.038*	0.010***	0.028*
	0.011	*0.004*	*0.015*	*0.019*	*0.018*	*0.001*	*0.009*	*0.002*	*0.011*	*0.010*	*0.005*	*0.004*	*0.016*	*0.002*	*0.014*
Mover	0.140***	-0.048*	-0.092***	0.022	-0.021	-0.001	0.017	-0.004	-0.013	0.075***	-0.047**	-0.028***	0.037	-0.015	-0.023
	0.032	*0.020*	*0.013*	*0.051*	*0.048*	*0.002*	*0.028*	*0.007*	*0.021*	*0.022*	*0.015*	*0.007*	*0.063*	*0.029*	*0.034*

Note: The estimates without sample selection are provided only for those countries where it has not been found (either for men or women, or both). Here we report the coefficients for additional variables, but the specification includes also all the variables as in Table A.4 (except for the instrumental variables).

Source: own calculation using EU-LFS 2003.

Table A.6. Some characteristics of educational systems and labour market outcomes

Countries	Accessibility of education			Field of highest level of education or training successfully completed:	Dual system of education	PISA Scores 2003	Youth unemployment rate, 15-24 years old, 2003 (e)	Average duration of school-to-work transition in Europe, 1994-2000, (months) (b)		Private returns to education	
	% Public University (a)	Tuitions in public universities (a,c)	Availability of State support (a,c)	% of Engineering, manufacturing and construction (d)				Time spent to find *any* job	Time spent to find a *permanent* job	Return to upper-secondary education, males and females (c)	Return to tertiary education, males and females (c)
CZ	27 public universities, 40 private colleges	Free*	Low	49.04	No	511	18.6	19.9	-	15.0/15.2	29.1/23.8
FI	All	Free	High	30.19	Partially	546	21.8	27.6	44.3	10.2/7.9	10.7/9.3
FR	77 out of 97	Low	Low	30.10	Partially	509	19.1	24.3	40.7	6.1/5.6	8.4/7.4
DE	248 out of 331	Free/low depending on Länder	Low	34.28	Yes	503	11.0	18.0	33.8	7.0/8.1	8.0/4.8
EL	All	Free for Greek citizens	Low	12.75	No	462	26.8	21.3	51.5	-	-
ES	52 out of 74	Low	Low	14.73	No	484	22.7	34.6	56.6	9.5/10.2	7.6/8.7
HU	17 state-universities, 16 colleges, 26 religious colleges, 6 private-foundations	Low	High	43.35	No	494	13.4	30.2	-	8.6/8.4	19.8/13.8
IT	72 out of 86	Low	Low	17.73	No	474	27.1	25.5	44.8	-	-
PT	13 out of 22	Medium	Low	1.69	No	470	14.5	22.6	51.5	13.1/12.3	23.9/21.5
UK	All, except for the University of Buckingham	High	High	23.24	No	511	12.3	19.4	36.1	18.0/18.5	14.3/14.5

Note: * High for courses in English language. Data for CZ and HU refer to 2000.

Source: (a) National data, (b) Quintini et al. (2007), (c) OECD 2008. Data referring to 2004, (d) EU-LFS 2003, (e) Eurostat website.

B. Technical Appendix

Here we test the quality and the validity of the instrumental variables used in the empirical analysis (Live_alone or Young_children dummies).

Instrumental quality is ensured if there is a strong correlation between the instrument and the employment probability. A statistic commonly used in order to test this condition (Bound et al., 1995) is the R2 of the first stage regression with the included instrument "partialled-out", or Shea partial R2 (for an application to the analysis of overeducation see e.g. Di Pietro and Cutillo, 2006b). In our first stage regressions the partial R2 on the excluded instruments range from 9% to 6% for the variable Live_alone and from 13% to 8% for the variable Young_children, suggesting that both instruments make a relevant contribution to explaining labour market participation (see table B1).

Instrumental validity is ensured if the instrument can be legitimately excluded from the overeducation equation. This assumption is often checked through the Sargan test. Nevertheless, this test is valid only in case of over-identification (i.e. the number of valid instruments exceeds the number of endogenous variables), which is not our case. Indeed, having young children or living alone do not have the same impact on labour market participation (and on overeducation risks) in all countries. Then, we decided not to use both variables as instruments for all countries, but we choose the better instrument case by case. Following the suggestion of Cutillo and Ceccarelli (2010), we checked the validity of the instruments by using the approach proposed by Dolton and Vignoles (2002). According to these authors, a valid instrument must be uncorrelated with the error term of the outcome equation, and thus it should not affect the risk of overeducation conditional on the included explanatory variables. When the residuals from the overeducation equations were regressed on the instrument, we obtained R2 ranging from 0.0009 to 0.0001 (Live_alone) and from 0.0006 to 0.0004 (Young_children) as in Table B.1. This indicates that both instruments do not explain any significant variation in the residual variability and hence are valid.

Table B.1 – Tests on the quality and the validity of the instruments

Country and selection variable	Test	Test results	
		Men	Women
ITALY – Live_alone	Partial R^2	0.0921	0.0877
	Dolton-Vignoles	0.0003	0.0001
GREECE – Young_children	Partial R^2	0.1330	0.0807
	Dolton-Vignoles	0.0005	0.0006
PORTUGAL – Young_children	Partial R^2	0.1232	0.0767
	Dolton-Vignoles	0.0004	0.0005
SPAIN – Live_alone	Partial R^2	0.0960	0.0645
	Dolton-Vignoles	0.0001	0.0002
CZECH REPUBLIC – Live_alone	Partial R^2	0.0589	0.0601
	Dolton-Vignoles	0.0003	0.0009
HUNGARY – Live_alone	Partial R^2	0.0866	0.0657
	Dolton-Vignoles	0.0001	0.0002
FRANCE – Live_alone	Partial R^2	0.0617	0.0781
	Dolton-Vignoles	0.0008	0.0001
GERMANY – Live_alone	Partial R^2	0.0744	0.0631
	Dolton-Vignoles	0.0007	0.0002
UNITED KINGDOM – Live_alone	Partial R^2	0.0766	0.0616
	Dolton-Vignoles	0.0006	0.0007

Source: own calculation.