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DETERMINANTS AND WAGE EFFECTS OF EDUCATIONAL MISMATCH IN SPAIN

DETERMINANTES E IMPACTO EN LOS SALARIOS DEL DESAJUSTE EDUCATIVO

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DOI: 10.5944/educXXI.30580

How to reference this article/Cómo referenciar este artículo:

Iriondo, I. (2022). Determinants and wage effects of educational mismatch in Spain. *Educación XXI*, 25(1), 219-249. <https://doi.org/10.5944/educXXI.30580>

Iriondo, I. (2022). Determinantes e impacto en los salarios del desajuste educativo. *Educación XXI*, 25(1), 219-249. <https://doi.org/10.5944/educXXI.30580>

ABSTRACT

This paper analyzes the impact of three alternative measures of educational mismatch (overeducation, horizontal mismatch and overskilling) on the wages of a sample of Spanish university graduates who have recently finished their studies. In the literature, two alternative theories have been proposed to explain educational mismatch: the assignment theory, which states that worker productivity is limited by job characteristics, so that overeducated workers underutilize their skills and, therefore, earn lower wages; and the heterogeneous skills theory, which states that educational mismatch is apparent to the extent that overeducated workers have a lower endowment of knowledge and skills. With the aim of trying to shed some light on this theoretical debate, the 2019 data from the "University Graduate Job Placement Survey", carried out by the Spanish National Institute of Statistics (INE), have been analyzed. For the empirical analysis, we estimated the wage penalties of the three types of educational mismatch. In order to control for individual heterogeneity in estimating wage effects, a fixed effects model was used. Empirical work results indicate that overeducated graduates suffer from a substantial and statistically significant wage penalty in both the fixed effects model and the ordinary least squares model. From an economic point of view, overeducation is a waste of resources. Therefore, public authorities should create the right conditions to strengthen demand for qualified labor, so that the labor market can absorb the growing supply of graduates that the Spanish university system has produced in recent decades.

KEYWORDS

Higher education, overeducation, overskilling, educational mismatch, wages, human capital

RESUMEN

En este trabajo se analiza el impacto de tres indicadores alternativos del desajuste educativo (horizontal, vertical y de habilidades) sobre los salarios de una muestra de titulados universitarios que recientemente finalizaron sus estudios en España. En la literatura se han propuesto dos enfoques alternativos para explicar el desajuste educativo: la teoría de la asignación, que plantea que la productividad de los trabajadores está limitada por las características de los empleos, de forma que los trabajadores sobreeducados infrautilizan su capacidad y por tanto ganan unos salarios inferiores, y la teoría de la heterogeneidad en las habilidades, que mantiene que el desajuste educativo es aparente en la medida en que los trabajadores sobreeducados tienen una menor dotación de habilidades y conocimientos. Con el ánimo de tratar de ofrecer alguna luz al debate teórico se han analizado los datos de 2019 de la Encuesta de Inserción Laboral de Titulados Universitarios, elaborada por el InE. En el análisis empírico se estima el impacto en los salarios de los tres tipos de desajuste educativo. además se utiliza el estimador de efectos fijos al objeto de controlar la heterogeneidad individual en la evaluación del impacto del desajuste educativo en los salarios. Los resultados del trabajo indican que los graduados sobreeducados sufren una penalización sustancial y estadísticamente significativa en sus retribuciones tanto en la estimación por mínimos cuadrados ordinarios como en el modelo de efectos fijos. Por tanto, desde el punto de vista económico el desajuste educativo vertical representa un despilfarro de recursos. Los poderes públicos deberían crear las condiciones para fortalecer la demanda de trabajo cualificado de forma que el mercado pueda absorber la oferta creciente de titulados que ha producido el sistema universitario español en las últimas décadas.

PALABRAS CLAVE

Enseñanza superior, sobreeducación, desajuste de habilidades, desajuste educativo, salario, capital humano

INTRODUCTION

According to Eurostat (2020), Spain was the European Union (EU) country with the highest incidence of overqualification in 2019. While the incidence of horizontal educational mismatch in Spain (27.8%) is close to the EU average (27.9%), vertical mismatch results place Spain (36.6%) at an unfavourable position compared to the EU as a whole (21.9%). These data reveal that the allocation of employment is inefficient to the extent that firms are unable to take advantage of Spanish graduates' productive capacity. In personal terms, educational mismatch leads to frustration and dissatisfaction, while from a private and social point of view, it means a waste of resources.

In specialized literature, three types of educational mismatch are defined: vertical, horizontal and skills mismatch. Vertical mismatch or overeducation occurs when a graduate carries out a job requiring a lower level of education than they possess. Horizontal educational mismatch happens when the worker performs a job unrelated to their field of study. Finally, skills mismatch or overskilling refers to the situation in which a graduate does not use the knowledge and skills they acquired during their formal education when performing their job.

The objective of this work is threefold. On the one hand, the incidence of the three types of mismatch will be studied in a sample of university graduates who have recently left the education system. On the other hand, the impact of horizontal, vertical and skills mismatch on wages will be evaluated. Finally, the factors that influence the probability of being affected by different types of mismatch will be analysed.

The latest edition of the University Graduate Job Placement Survey carried out by the Spanish National Institute of Statistics, will be used for the empirical analysis. This survey provides information on the process of transitioning into the labour market of a sample of around 30,000 graduates from Spanish universities. This is an extraordinarily rich survey when it comes to researching educational mismatch in the years following graduation from university.

As the main contributions of this work, the first one to mention is that empirical evidence will be provided in order to evaluate the temporary or permanent nature of educational mismatch. Furthermore, an attempt will be made to shed some light on the debate between the heterogeneous skills theory and the assignment theory, which emphasize, respectively, the supply and demand factors in the interpretation of the problem. For this, different specifications of the wage equations will be estimated, and the results of the ordinary least squares model will be compared to those of the fixed effects model. It should be noted that the use of panel data techniques in order to control for individual heterogeneity is a rather uncommon approach in the literature. Lastly, including the three indicators of educational mismatch in the estimates allows us to understand the relationships between the three dimensions of the problem.

As the main results, it should be noted that 5 years after finishing higher education, educational mismatch affects around a fifth of university graduates, for whom this problem may be permanent. On the other hand, the results of estimating the wage equations suggest that job characteristics limit the productivity of overeducated graduates. Finally, it has been observed that individuals from unfavourable family backgrounds are more likely to be affected by vertical mismatch, which, on the other hand, varies greatly depending on the graduates' field of study.

LITERATURE REVIEW

Since the seminal work by Freeman (1976), part of the specialized literature has tried to determine whether overeducation is a temporary or a permanent problem. Some authors interpret educational mismatch as a friction in the labour market, where university graduates temporarily accept low-skilled jobs until they find a position adequate to their education level (Kucel and Vilalta-Bufí, 2019). Similarly, other authors argue that educational mismatch arises from imperfect information (Hartog, 2000). This issue has also been analysed within the framework of the career mobility model, which suggests that overeducated workers are more likely to be promoted to higher positions (Sicherman and Galor, 1990; Alba-Ramírez, A. and Blázquez, M., 2002). The reduction in educational mismatch in the first years of the transition from university into the labour market, during which internal and external mobility are high, has led some authors to state that overeducation is a temporary phenomenon (Sicherman, 1991; Alba, 1993). Similarly,

it has been argued that recent graduates have a lower endowment of other unobservable characteristics of human capital, which is compensated as they accumulate experience in the labour market. However, the empirical evidence provided by other authors leads them to conclude that, for a significant part of the graduates, educational mismatch is persistent (García-Serrano and Malo, 1996; Battu et al, 1999; Dolton and Vignoles, 2000; Rubb, 2003; Frenette, 2004).

Another fruitful line of research analyses the impact of educational mismatch on wages (Duncan and Hoffman, 1981; Hartog, 2000; Leuven and Oosterbeck, 2001; and McGuinness, 2006). From the perspective of the human capital theory (Becker, 1964), each individual's endowment of knowledge and skills determines their productivity and remuneration. In the event that supply of a certain type of worker grows faster than demand for it, the relative wages of the group will tend to fall, without changing how much they use their skills and knowledge (Green et. Al, 1999; Biagi, Castaño and Di Pietro, 2020; and Green and Henseke, 2021).

Moreover, Thurow (1976), in his "job competition model", emphasizes demand and not supply when describing the functioning of the labour market. In his opinion, productivity and wages do not depend on a worker's characteristics, but on those of the job they occupy. Thus, workers do not compete for wages, but for jobs. In the event that supply of a certain qualification is higher than demand for it, part of the individuals will be forced to accept low-skilled jobs and the wages usually paid in those occupations. Sattinger (1993) similarly proposes the "assignment theory", according to which workers are assigned to jobs based on their knowledge and skills. In the event that a worker with certain skills occupies a less qualified position, the job will impose a restriction on the productivity that the worker can achieve (Allen and De Weert, 2007). In this case, the limitation would come from the occupation and not from the characteristics of the worker.

In contrast, from the supply side, the "heterogeneous skills theory" (Green and McIntosh, 2007) has been developed based on the fact that, within a group of people with the same level of education, there is great heterogeneity in relation to ability and skills endowment. In this sense, it is argued that overeducation is apparent when the individuals occupying less qualified positions are in the lower tail of the ability distribution (Di Pietro and Urwin, 2006).

In order to discriminate between the assignment theory and the heterogeneous skills theory, some authors propose to introduce variables measuring educational and skills mismatch into the wage equations (Allen and van der Velden, 2001). It is argued that, if the educational mismatch coefficient is significantly reduced or even disappears when introducing skills mismatch, then the fact that overeducation wage penalty is associated with the non-use of the worker's knowledge and skills is confirmed, and so the assignment theory will provide a plausible explanation of the problem (Di Pietro and Urwin, 2006; Green and McInstosh, 2007; Allen and De Weert, 2007; Green and Zhu, 2010; McGuinness and Sloane, 2011; Nieto and Ramos, 2017). However, this literature has not taken into account that, although educational and skills mismatch are correlated, the non-use of the worker's knowledge and skills is not always explained by overeducation and, therefore, does not have to result in a wage penalty as it does when there is voluntary horizontal mismatch. This makes the correlation between wages and vertical mismatch stronger than between wages and horizontal and skills mismatch; therefore, it is recommended to use other complementary techniques, such as panel data, when comparing these theories. In the empirical section we will return to this question.

Most of the work estimating the impact of educational mismatch on wages has been criticized for not taking the problem of the omission of ability into account, as it can bias overeducation wage penalty upward (Chevalier, 2003). The identification strategy used in the literature to deal with the problem has been to use the fixed effects model. Some studies, such as Bauer (2002), Frenette (2004) and Tsai (2010), conclude that the overeducation wage penalty obtained by OLS is reduced or even disappears when estimated via the fixed effects model. In contrast, in other studies, results do not substantially change when differences in individual ability are controlled for (Dolton and Silles, 2008; Korpi and Tahlin, 2009; Iriondo y Pérez-Amaral, 2016; and McGuinness et al., 2018).

Another line of research that is getting growing interest is the study of horizontal mismatch, which takes place when an individual works outside their field of study (Almasi et al., 2020; and Choi and Hur, 2020). Nordin, Persson and Rooth (2010) verify that most graduates in Biology, Mathematics, Physics, Engineering, History, Journalism, Humanities, among other degrees, are weakly matched with their area of knowledge. The

authors point out that such horizontal mismatch may be involuntary, to the extent that the vacancies available in their own field of study have been filled, or voluntary, if it is the result of a better knowledge of the pecuniary or non-pecuniary attributes associated with some jobs outside their own field of study. In estimating the model, the authors find that horizontal mismatch has a negative impact on wages. In contrast, Budría and Moro-Egido (2008) observe that horizontal mismatch does not have a significant effect on income, once vertical mismatch is controlled for. In a more recent work, Somers et al. (2019) review the literature on horizontal educational mismatch published between 1995 and 2015. The authors state that, depending on how it is defined, horizontal mismatch affects between 21% and 46% of workers. On the other hand, they confirm that the prevalence of horizontal mismatch varies notably by field of study.

The growing interest for the study of educational mismatch is manifested in the development of empirical research on said phenomenon in many countries other than the EU and the United States, among which we find, to mention a few examples: Russia (Rudakov et al., 2019), Bosnia-Herzegovina (Veselinović, Mangafić and Turulja, 2020), Australia (Li, Harris and Sloane, 2018), Canada (Banerjee, Verma and Zhang, 2019) and South Korea (Park, 2018).

Research about educational mismatch in Spain dates back to the 1990s (Alba, 1993). Since then, a large group of researchers have addressed, among other issues, the study of the overeducation wage penalty and its evolution over time (Murillo, Rahona and Salinas, 2012), the heterogeneous skills hypothesis (Nieto and Ramos, 2017), the overeducation phenomenon from the perspective of signalling theory (García-Mainar and Montuenga, 2019), the impact of entrepreneurship and the academic prestige of educational programs in reducing educational mismatch (Kucel and Vilalta-Bufi, 2019), and the determinants of horizontal and vertical mismatch (Rodríguez-Esteban, Vidal and Vieira, 2019; and Rodríguez-Esteban and Vidal, 2020).

METHODOLOGY

The objective of this section is to present the wage equations with which the link between different types of educational mismatch and wages will be studied. In order to

shed some light on the previous theoretical debate, we will estimate the different specifications of the following general wage equation:

$$w_i = \alpha + \beta_1 \text{over}_i + \beta_2 \text{horiz}_i + \beta_3 \text{nousk}_i + X_{ki} \gamma_k + \varepsilon_i \quad (1)$$

Where w_i is the natural logarithm of the wages of graduate "i", over_i is a dichotomous variable that takes a value of 1 if the individual is overeducated and of 0 if they are not; horiz_i is a dichotomous variable that takes a value of 1 if the individual works outside their area of study and of 0 if they do not suffer from horizontal mismatch; nousk_i is a dichotomous variable that takes a value of 1 if the individual does not use the knowledge and skills acquired at university at their job and of 0 otherwise; X_{ki} is a vector that contains other "k" explanatory variables (sex, age, parents' educational level, general grant, excellence scholarship, master's degree, private university, distance university, part-time work, recognized disability above 33%, foreign nationality, autonomous community and field of study) and, finally, ε_i represents the error term. The coefficients to be estimated in the equation are: β_1 , which represents the wage penalty ($\beta_1 < 0$) suffered by overeducated university graduates; β_2 , which represents the impact on income of horizontal mismatch ($\beta_2 < 0$); β_3 , which measures the wage penalty due to not using the skills and knowledge acquired at university ($\beta_3 < 0$); γ_k , which represents the coefficients of the rest of the controls; and, finally, α , which is the constant.

The heterogeneous skills theory is based on the fact that overeducated workers have lower skills or qualifications that are less in demand in the labour market. To the extent that individual ability is not observable and may be correlated with overeducation, the omission of this variable makes the ordinary least squares estimator inconsistent. A common procedure used to correct the endogeneity generated by the omission of ability is estimation with panel data, by introducing individual fixed effects into the wage equation (Leuven and Oosterbeek, 2011). Let's assume we want to estimate the following equation:

$$w_{it} = \mu + \beta \text{over}_{it} + X_{kit} \gamma_k + \delta \text{ability}_i + u_{it} \quad (2)$$

Where, unlike in the previous model, a time dimension is introduced, $ability_i$ represents individual capacity, and δ measures the impact of ability on wages ($\delta > 0$). The bias generated by the omission of ability in the OLS estimation is:

$$E(\beta^*) = \beta + \delta \frac{Cov(over, ability)}{Var(over)} \quad (3)$$

In the event that ability is negatively correlated with overeducation and positively with earnings, the estimate of the effect of overeducation on wages will be biased upward. The identification strategy that is usually applied to correct the problem is to transform the data in deviations with respect to individual means, following the expression below:

$$(w_{it} - \bar{w}_i) = \beta (over_{it} - \overline{over}_i) + (X_{kit} - \bar{X}_{ki})\gamma_k + (u_{it} - \bar{u}_i) \quad (4)$$

Variables that do not change over time, such as gender, ability or the knowledge and skills acquired at university, disappear in the model in differences.

The analysis of wages will be complemented with the estimation of a logit model used to investigate the determinants of the different types of educational mismatch (vertical, horizontal and skills). For example, in the study of vertical mismatch, the probability that the graduate is overeducated ($y_i = 1$) will depend, among other explanatory variables, on the field of study of the graduate, and it takes the form of the logistic function:

$$\Pr(y_i = 1 | x_i) = \frac{\exp(\beta_0 + \beta_1 \text{field}_i + X_{ki} \gamma_k)}{1 + \exp(\beta_0 + \beta_1 \text{field}_i + X_{ki} \gamma_k)} \quad (5)$$

In order to calculate the marginal effects, we must obtain the partial derivatives of the probability that ($y_i = 1$) in relation to the variable of interest. In the case that the independent variable is binary, as in the case of the field of study, the marginal effect is calculated as follows:

$$\frac{\partial \Pr(y_i = 1 | x_{ki})}{\partial field} = \frac{\exp(\beta_0 + \beta_1 + X_{ki} \gamma_k)}{1 + \exp(\beta_0 + \beta_1 + X_{ki} \gamma_k)} - \frac{\exp(\beta_0 + X_{ki} \gamma_k)}{1 + \exp(\beta_0 + X_{ki} \gamma_k)} \quad (6)$$

DATA

The source of statistical information used in this work is the University Graduate Job Placement Survey (EILU) carried out by the Spanish National Institute of Statistics (INE, 2020). The EILU investigates the transition from university into the labour market of 31,651 graduates from Spanish universities. The survey provides information on the time spent job searching, the characteristics of the jobs performed, mobility and, among other aspects, periods of unemployment and inactivity. The sample analyzed in this article is that of the cohort of graduates from the 2013-2014 academic year, while the field work was carried out between July and December 2019, before the outbreak of the COVID-19 crisis.

The data collected in the EILU are extraordinarily rich and provide information on graduates' personal characteristics (among others, sex, age, nationality, parents' education level, disability, autonomous community), their learning process (branch of knowledge, field of study and degree, type of university, scholarships and postgraduate training) and their insertion into the labor market (employment situation, professional situation, subjective perception of the adequacy between training and employment and wages).

The variables of interest in this work are wages, as well as the variables that measure educational mismatch, which have been constructed from the following survey questions:

- *Net monthly wage received at the graduate's first job or at their current job at time of recruitment (PR_SUELDO), and net monthly wage received at their current job (TR_SUELDO).* A discrete variable has been created, which is equivalent to the midpoint of the categories into which wages have been stratified ("Less than 700 euros", "700 to 999 euros", "1,000 to 1,499 euros", "1,500 to 1,999 euros", "2,000 to 2,499 euros", "2,500 to 2,999 euros", "Over 3,000 euros").

- *Most appropriate level of training to carry out the graduate's current job (TR_D19) or their first job (PR_NIVEL).* From these questions, a dichotomous variable has been created in order to measure the subjective perception of overeducation (*over*), which takes a value of 1 in the event that the graduate responds that the most appropriate level of training is "Higher-level vocational training", "High School Diploma or Middle Grade Vocational Training" or "Secondary, Primary education, etc.", and it takes a value of 0 if the graduate responds that the most appropriate level of training is "PhD or post-doctorate" or "University degree (except PhD or post-doctorate)". Therefore, in this work, overeducation is defined as a situation in which the graduate's level of studies is above the level required by their job, which, in the case of university graduates, becomes operative when the job requires a level of studies lower than or equal to "Higher-level vocational training".

- *Most suitable area of study for your current job (TR_D20) or for their first job (PR_AREA).* From these variables, a dichotomous variable has been constructed which measures horizontal mismatch (*horiz*). The variable takes a value of 1 when the graduate responds that the most appropriate area of study for their employment is "A totally different area" or "No particular area", and it takes a value of 0 when the most appropriate area is "Exclusively their own area of study" or "Their own area or a related one".

- *Knowledge and skills acquired in these studies are used at the graduate's current job (TR_D21) or at their first job (PR_CONOC).* From this question, a dichotomous variable has been created which measures skills mismatch (*nousk*); it takes the value 1 if the graduate disagrees with the statement and 0 if they agree with it.

The variables related to vertical (*over*), horizontal (*horiz*) and skills (*nousk*) educational mismatch are constructed from the subjective responses of graduates. Subjective indicators have frequently been used in educational mismatch literature. For example, Di Pietro and Urwin (2006) conclude that their results "*confirm the view that employee perceptions of the educational requirements of a particular job are more reliable indicators of the true nature of jobs*". However, this type of indicator is not without its problems, among which it should be noted that the subjective assessment of jobs' educational requirements can vary across individuals.

Table 1

Descriptive statistics

Variables	Mean
% women	57,0
% with disability	1,2
% mother with primary education	22,3
% mother with higher education	28,6
% father with primary education	22,3
% father with higher education	30,6
% with general grant	38,2
% with excellence scholarship	4,4
% private university	14,8
% postgraduate education: master's degree	47,5
% Arts and Humanities	10,0
% Sciences	8,8
% Social Sciences and Law	45,8
% Engineering and Architecture	21,2
% Health Sciences	14,2
% employment rate (5 years later)	85,7
monthly wage in € (1 st job)	1.056,0
monthly wage in € (5 years later)	1.604,4
% vertical mismatch (1 st job)	37,5
% vertical mismatch (5 years later)	21,3
% horizontal mismatch (1 st job)	35,2
% horizontal mismatch (5 years later)	26,2
% skills mismatch (1 st job)	33,6
% skills mismatch (5 years later)	24,3
number of observations	31.651

Note: in order to simplify the presentation of the table, the standard deviations of the variables are not included. Since most of the variables are dichotomous, standard deviation can be calculated as the square root of $p * (1-p)$, where "p" is the probability that $X = 1$. The standard deviation of the monthly wage, the only discrete variable in the table, is 492.0 euros for the graduates' first job and 632.9 euros for their current employment (5 years later).

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

Table 1 presents a summary of the descriptive statistics of the main variables. Among other results, it should be noted that 57.0% of the surveyed graduates are women and 1.2% are people with disabilities. In 28.6% of cases, the graduate's mother had university education and in 30.6% the father had completed higher education. 14.8% of the graduates had studied at a private university and 47.5% had completed a master's

degree. Regarding branches of knowledge, the graduates of "Social and Legal Sciences" predominate (45.8%). The employment rate in 2019 is high and stands at 85.7%, which is consistent with the recovery that the Spanish economy has been experiencing since 2014. Similarly, graduates' net salaries had increased, on average, by 51.9% in nominal terms.

The evolution of the variables that measure educational mismatch indicates that, for a significant proportion of graduates, mismatch is a temporary problem. Thus, between their first job and their current job, overeducation is reduced by 16.2 percentage points –henceforth pp–, horizontal mismatch by 9.0 pp and overskilling by 9.3 pp. However, at the end of the period, around a fifth of all graduates (21.3%) continue to be overeducated, and approximately a quarter of them work outside their area of knowledge (26.2%) or do not use the knowledge and skills they acquired at university (24.3%). For these graduates, educational mismatch may be permanent.

The above assessment is confirmed by the analysis of the transition probability matrix (see Table 2). The table measures the changes in status between the graduates' first job and their current employment regarding the three indicators of educational mismatch. For example, in relation to vertical mismatch (top panel), the first row ("well-matched") shows the current employment situation of graduates who, in their first job, were in a position adequate to their training. The results reveal that 94.5% of these graduates are currently in jobs appropriate to their education level, while the situation of 5.5% of the total worsened, since they stated being overeducated 5 years after finishing their studies. Similarly, the second row ("overeducated") shows the current job status of graduates who claimed to be overeducated at their first job. In this case, we see that 50.2% of the graduates who were overeducated in their first job hold a position adequate to their training at the current job. However, 49.8% of the graduates who were overqualified in their first job are still overeducated at their current job; this is a group for which educational mismatch may be permanent. The third row ("total") reports on the current employment situation of all graduates, regardless of their educational mismatch status at their first job, and shows that, five years after completing their university studies, 78.7% of them have jobs adequate to their education level, while 21.3% work in positions that require a lower level of studies.

The two bottom panels analyse the transition between the graduates' first job and their current job in terms of horizontal mismatch and skills mismatch, respectively. The pattern of results is quite similar to what was described in relation to vertical mismatch. On the one hand, 91.1% of the graduates who worked in a suitable area at their first job are still in the same situation 5 years later. On the other hand, 91.4% of the graduates who, according to the survey, stated that they used the knowledge and skills acquired at university at their first job, state that they still use them at their current jobs.

The analysis of the bottom panels' second row reveals an improvement in relation to current employment in 40.3% of graduates who worked in an area outside their training at their first job and in 42.6% of those who did not use their knowledge and skills at their first job, for whom mismatch represents a temporary problem. However, for 59.7% of those who suffered horizontal mismatch at their first job and 57.4% of those who did not use their skills and knowledge at their first job, the situation remains the same at their current job and educational mismatch can be of a permanent nature.

Table 2
Transition probabilities of educational mismatch indicators

A. Vertical mismatch		Current employment		
		Well-matched	Overeducated	Total
1 st job	Well-matched	94.54	5.46	100.00
	Overeducated	50.20	49.80	100.00
	Total	78.68	21.32	100.00
B. Horizontal mismatch		Current employment		
		Well-matched	Horizontal mismatch	Total
1 st job	Well-matched	91.08	8.92	100.00
	Horizontal mismatch	40.29	59.71	100.00
	Total	73.81	26.19	100.00
C. Skills mismatch		Current employment		
		Well-matched	Overskilled	Total
1 st job	Well-matched	91.40	8.60	100.00
	Overskilled	42.62	57.38	100.00
	Total	75.68	24.32	100.00

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

RESULTS

Tables 3, 4 and 5 show the results of the ordinary least squares (OLS) estimates of the effect of the three mismatch indicators on graduates' wages. The software used to estimate the income equations and for the subsequent logistic regression is Stata/MP version 15.0. The first column shows the estimate of the income equation in relation to the first job. In the second column, the same is done with the current job's wages. In the third, the data from both years are pooled. In the last two columns, panel data techniques are used to estimate the income equations. The fourth column shows the results of the random effects model and the fifth of the fixed effects model. In Table 3, our variable of interest is overeducation, which presents a negative and statistically significant sign in all estimates. The wage penalty for overeducation goes from -10.2% for the first job (to convert the coefficient from -0.108 into a percentage, we must calculate $\exp[\text{coefficient}]$, subtract the unit and multiply the result by 100) to -18.3 % for current employment. In the pooled model, the penalty is -13.0%. The random effects model shows results that are very similar to those of the pooled model, with a wage penalty of -12.5%. Finally, in the estimation of the fixed effects model, the penalty for overeducation is slightly reduced to -8.0%. These estimates are similar to those found in the literature. For example, in the review by McGuinness et al. (2018), 23 works in which the wage penalty for overeducation is estimated are analysed, resulting in an average wage penalty of -13.6%. Regarding the remaining coefficients, the results obtained are those usually found in the literature. The reduced wage effect of completing a master's degree could be considered particularly striking (+ 0.8%).

The aim of the fixed effects estimate is to identify the impact of educational mismatch on the wages of graduates who changed status in relation to overeducation between their first job and their current job, 21.5% of them in total. This variability is sufficient to estimate the impact of educational mismatch on graduates' wages. On the other hand, the fixed effects model estimation allows for controlling the bias which the omission of ability (skills and knowledge) can generate in the OLS estimation. Therefore, the first conclusion that can be drawn from examining the results is that controlling for unobservable individual ability differences reduces the size of the coefficient by around 40%, but that the wage penalty remains substantial and statistically significant. Therefore,

the results of the estimations do not confirm the heterogeneous skills theory and suggest that job characteristics lead to underutilizing the productivity of overeducated graduates.

Table 3

Estimation of the effect of vertical mismatch on wages

variables	(1) 1 st job (OLS)	(2) Current employment (OLS)	(3) Pooled (OLS)	(4) Random effects	(5) Fixed effects
over	-0.108***	-0.202***	-0.139***	-0.133***	-0.083***
female	-0.055***	-0.067***	-0.061***	-0.062***	
age_30_34	-0.004	0.002	-0.002	-0.003	
age_mt34	0.123***	0.091***	0.104***	0.104***	
general_grant	-0.030***	-0.040***	-0.035***	-0.035***	
excellence_sch	0.013	0.077***	0.043***	0.043***	
master		0.001	0.008*	0.008*	0.009
private_uni	0.035***	0.048***	0.040***	0.041***	
partial	-0.359***	-0.505***	-0.404***	-0.399***	-0.373***
year2			0.322***	0.325***	0.338***
Constant	6.966***	7.449***	7.044***	7.042***	7.026***
Observations	27,240	24,270	51,510	51,510	51,510
R ²	0.347	0.443	0.502	0.502	0.423
Individuals				27,907	27,907

Note: Regressions also include controls for parents' educational level, distance university, disability greater than 33%, foreign nationality, autonomous community and degree.

*** p<0.01, ** p<0.05, * p<0.1

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

Table 4

Estimation of the effect of horizontal mismatch on wages

variables	(1) 1 st job (OLS)	(2) Current employment (OLS)	(3) Pooled (OLS)	(4) Random effects	(5) Fixed effects
horiz	-0.051***	-0.081***	-0.058***	-0.055***	-0.026***
female	-0.055***	-0.067***	-0.061***	-0.062***	
age_30_34	-0.010*	-0.005	-0.009**	-0.009**	
age_mt34	0.124***	0.090***	0.104***	0.104***	
general_grant	-0.035***	-0.046***	-0.040***	-0.040***	
excellence_sch	0.020*	0.083***	0.050***	0.050***	
master		0.017***	0.018***	0.016***	0.011**
private_uni	0.041***	0.054***	0.047***	0.047***	
partial	-0.373***	-0.528***	-0.422***	-0.416***	-0.385***
year2			0.331***	0.334***	0.345***
Constant	6.954***	7.426***	7.024***	7.022***	7.008***
Observations	27,254	24,258	51,512	51,512	51,512
R ²	0.337	0.414	0.489	0.489	0.405
Individuals				27,888	27,888

Note: Regressions also include controls for parents' educational level, distance university, disability greater than 33%, foreign nationality, autonomous community and degree.

*** p<0.01, ** p<0.05, * p<0.1

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

Table 5

Estimation of the effect of overskilling on wages

variables	(1) 1 st job (OLS)	(2) Current employment (OLS)	(3) Pooled (OLS)	(4) Random effects	(5) Fixed effects
nousk	-0.048***	-0.089***	-0.062***	-0.059***	-0.035***
female	-0.053***	-0.065***	-0.060***	-0.060***	
age_30_34	-0.010*	-0.006	-0.009**	-0.010**	
age_mt34	0.123***	0.086***	0.102***	0.102***	
general_grant	-0.035***	-0.047***	-0.040***	-0.041***	
excellence_sch	0.020*	0.080***	0.049***	0.049***	
master		0.017***	0.018***	0.016***	0.011**
private_uni	0.041***	0.052***	0.045***	0.045***	
partial	-0.374***	-0.527***	-0.423***	-0.416***	-0.384***
year2			0.330***	0.333***	0.344***
Constant	6.954***	7.424***	7.025***	7.023***	7.010***
Observations	27,082	24,261	51,343	51,343	51,343
R ²	0.337	0.416	0.490	0.489	0.406
Individuals				27,862	27,862

Note: Regressions also include controls for parents' educational level, distance university, disability greater than 33%, foreign nationality, autonomous community and degree.

*** p<0.01, ** p<0.05, * p<0.1

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

Table 4 shows the results of the income equation estimation with horizontal mismatch as the variable of interest. As in the previous case, graduates who work outside the area of specialization of their university studies suffer a statistically significant income penalty, although said penalty is smaller than the one found in relation to vertical

mismatch. The wage penalty ranges from -5.0% for the first job to -7.8% for the current job. In the pooled model, the penalty amounts to -5.6%, while in the fixed effects model it drops to -2.6%, although the coefficient is still statistically significant. On the other hand, the results of the skills mismatch penalty estimation (see Table 5) are very similar, at -6.0% in the pooled model and -3.4% in the fixed effects model. These results are in line with those found by McGuinness et al. (2018) in their review of the literature on skills mismatch, where they concluded that the impact of horizontal mismatch on wages is smaller than in the case of overeducation, at 7.5% on average.

In order to study the robustness of the results obtained in the first part of the analysis, Table 6 shows the estimation of the income equations combining the different measures of educational mismatch and using two alternative estimators: the OLS pooled model and the fixed effects model. In the first column, the overeducation and horizontal mismatch variables are combined. Compared to the results obtained in Table 3, in the OLS model, the overeducation penalty increases slightly from 13.0% to 13.8%, while the coefficient of horizontal mismatch becomes positive and statistically significant, although small in size (+ 1.7%). In other words, once overeducation is controlled for, graduates who work outside their area of study earn more than those who work in their own area of specialization. Somers et al. (2019) reach a similar conclusion regarding the impact of horizontal mismatch on wages.

Column 2 combines overeducation with skills mismatch. The overeducation wage penalty hardly varies, while skills mismatch has an effect close to 0 and is not statistically significant. When educational mismatch is omitted and the indicators of horizontal mismatch and overskilling are included in the income equation, both variables are statistically significant and partially capture the overeducation wage penalty (see the third column of the Table 6). Working outside one's field of study has a penalty of 3.1%, while not using the knowledge and skills acquired at university reduces pay by 4.2%. Finally, when the three variables are included in the pooled model, the overeducation wage penalty is once again 13.7% and working outside one's field of study increases income by 2.1%, while not using the knowledge and skills acquired at university does not have a statistically significant effect. In conclusion, overeducation shows a notable penalty on graduates' wages, while working outside their study area has a positive impact on their

earnings, as long as horizontal mismatch does not result from performing jobs not requiring university education.

Table 6

Estimation of the effect of the three educational mismatch indicators on wages

variables	(1) Pooled (OLS)	(2) Pooled (OLS)	(3) Pooled (OLS)	(4) Pooled (OLS)	(5) Fixed effects	(6) Fixed effects	(7) Fixed effects	(8) Fixed effects
over	-0.148***	-0.140***		-0.147***	-0.099***	-0.085***		-0.096***
horiz	0.017***		-0.031***	0.021***	0.030***		-0.006	0.035***
nousk		0.003	-0.043***	-0.007		0.006	-0.032***	-0.011
female	-0.061***	-0.061***	-0.060***	-0.061***				
age_30_34	-0.002	-0.002	-0.008**	-0.002				
age_mt34	0.103***	0.104***	0.104***	0.104***				
general_grant	-0.034***	-0.035***	-0.040***	-0.034***				
excellence_sch	0.044***	0.044***	0.049***	0.044***				
master	0.008*	0.008*	0.017***	0.008*	0.009	0.009	0.011**	0.009
private_uni	0.041***	0.040***	0.045***	0.040***				
partial	-0.405***	-0.404***	-0.421***	-0.405***	-0.374***	-0.373***	-0.383***	-0.373***
year2	0.322***	0.323***	0.330***	0.322***	0.338***	0.338***	0.345***	0.338***
Constant	7.041***	7.044***	7.028***	7.042***	7.021***	7.024***	7.011***	7.022***
Observations	51,380	51,188	51,229	51,100	51,380	51,188	51,229	51,100
R ²	0.502	0.502	0.490	0.502	0.422	0.422	0.406	0.422
Individuals					27,849	27,811	27,812	27,773

Note: Regressions also include controls for parents' educational level, distance university, disability greater than 33%, foreign nationality, autonomous community and degree.

*** p<0.01, ** p<0.05, * p<0.1

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

The last four columns repeat the same exercise using the fixed effects model. Assuming that the fixed effects estimation slightly reduces the size of the coefficients compared to OLS, results are very consistent. In all the equations in which the overeducation variable is included, the coefficient is always negative and statistically significant, and it reduces graduates' wages between -8.1% and -9.4%. When the previous variable is combined with that of horizontal mismatch, working outside one's study area increases wages by 3.0 to 3.6%. Finally, skills mismatch shows a negative and statistically significant effect on the specification in which overeducation is omitted. Therefore, once differences in ability are controlled for, overeducation is strongly associated with a reduction of graduates' income, while carrying out a job outside one's study area does not reduce wages, but, on the contrary, leads to better compensation.

The results of the fixed-effect models estimations suggest that overeducation is not explained by the graduates' lack of skills or knowledge, since, when individual heterogeneity is controlled for, the wage penalty remains high and statistically significant. Furthermore, although there is a high correlation between the three variables used to measure mismatch (horizontal, vertical and skills), the relationship between the three variables is complex. Most overeducated graduates do not use the knowledge and skills they acquired at university; however, while in some cases the association is very clear (such as when a university graduate works as a clerk, or especially when they work as a waiter), in other cases it is more a matter of degrees (e.g. an economist working at a bank branch). The problem is compounded when horizontal mismatch is studied. When analysed in isolation, working outside the area of study of one's degree is associated with a reduction in wages (see Table 4). This wage penalty is explained by the fact that most overeducated workers stated working outside their study area (71.4%). However, once overeducation is controlled for, working outside their field of study increases graduates' salaries, as, for example, when a physicist or a mathematician works in finance. These graduates work outside the field of physical sciences or mathematics and they mostly state that they do not use the knowledge or skills they acquired at university, and yet they do not suffer a wage penalty but, on the contrary, they usually earn more than other graduate colleagues who work in sectors such as research or teaching. Therefore, while overeducation limits graduates' productivity and wages, horizontal mismatch and skills mismatch often do not have the same effect, to the extent that the general knowledge and abilities that are valued and rewarded in other skilled occupations are transferred.

Table 7 shows the marginal effects of a logit model in which the determinants of the three indicators used to measure educational mismatch are studied. Column 1 presents the results of vertical mismatch determinants, column 2 shows those for horizontal mismatch, and column 3, those for skills mismatch. This empirical exercise focuses on the employment situation of graduates at the present time, that is, in 2019, five years after their transition from university to the job market. Therefore, the analysis aims to identify the characteristics associated with educational mismatch that are more permanent in nature.

Table 7

Determinants of educational mismatch. Marginal effects

variables	vertical mismatch	horizontal mismatch	overskilling
Pr (y = 1)	0.164	0.219	0.211
female	0.001	-0.009	0.015*
age_30_34	0.046***	0.043***	0.027***
age_mt34	0.014	0.038***	-0.012
father_uni	-0.042***	-0.002	-0.010
mother_uni	-0.019***	-0.019*	-0.007
father_pri	0.012*	0.013**	0.007
mother_pri	0.001	-0.001	0.004
general_grant	0.034***	0.012*	0.010
excellence_sch	-0.057***	-0.050***	-0.073***
master	-0.110***	-0.074***	-0.061***
private_uni	-0.044***	-0.042***	-0.060***
disabled	-0.027	0.001	0.033
foreign	0.025	0.014	-0.005
distance	0.021	0.085***	0.091***
National Univ.	-0.001	-0.013	-0.064***
Andalusia	0.040**	-0.010	-0.009
Aragon	0.023*	-0.003	0.001
Asturias	0.029	-0.003	-0.005
Balearic Islands	-0.000	-0.035	-0.025
Canary Islands	0.043**	0.015	-0.014
Cantabria	0.023	-0.024	-0.019
Castile and Leon	0.013	-0.033**	-0.019
Castile-La Mancha	0.031	0.003	-0.007
Catalonia	-0.025**	-0.047***	-0.056***
Valencian Com.	0.034**	-0.027**	-0.021
Extremadura	0.056***	0.042*	0.017
Galicia	0.015	-0.022	-0.049***

Murcia	0.052**	-0.011	-0.029*
Navarre	0.008	-0.039**	-0.031
Basque Country	0.027*	-0.015	-0.030**
La Rioja	-0.039	-0.071***	-0.093***
Education (Other studies)	-0.001	0.000	0.015***
Arts (Other studies)	0.204***	0.208***	0.216***
Humanities	0.207***	0.300***	0.309***
Languages	0.030***	0.110***	0.076***
Social/Behavioral Sc.	0.115***	0.305***	0.275***
Journalism/Documentation	0.067***	0.114***	0.147***
Business/Administration	0.052***	0.083***	0.142***
Life Sciences	0.030***	0.012**	0.054***
Environmental Sciences	0.073***	0.193***	0.241***
Chemical / Phys. / Geol. Sc.	0.040***	0.054***	0.093***
Mathematics/Statistics	-0.050***	-0.033***	0.035***
Computing	-0.069***	-0.147***	-0.124***
Engineering/Related profes.	-0.077***	-0.068***	0.012***
Manufact./Production ind.	-0.051***	0.038***	0.109***
Architecture/Construction	-0.046***	-0.011***	0.021***
Agriculture/Livestock	0.008	0.009	0.055***
Forestry	0.063***	0.085***	0.131***
Veterinary	-0.117***	-0.140***	-0.121***
Health (Other studies)	-0.109***	-0.106***	-0.080***
Social services	0.011**	-0.017***	0.018***
Services/(Other studies)	-0.027***	0.009	0.023***
Teacher training/Early edu.	0.051***	-0.000	0.076***
Teacher training/Prim. edu.	-0.053***	-0.057***	0.028***
Audiovisual techn./Media	0.185***	0.200***	0.238***
Economics	0.050***	0.022***	0.124***
Psychology	0.059***	0.065***	0.058***
Management/Administr.	0.053***	0.003	0.051***
Medicine	-0.171***	-0.235***	-0.185***
Nursing	-0.156***	-0.190***	-0.189***
Physical activities/Sport	0.128***	0.077***	0.106***
Travel/Tourism/Leisure	0.185***	0.159***	0.221***
Observations	24,773	24,755	24,753

*** p<0.01, ** p<0.05, * p<0.1

Source: University Graduate Job Placement Survey 2019 (INE). Own calculations.

In examining the results of the table, we will focus on the determinants of overeducation, insofar as it is the form of educational mismatch that generates the greatest wage penalty and that, both from a private and social point of view, could represent a greater waste of resources. First, it should be noted that mismatch is associated with

different variables regarding the socioeconomic status of the university students' families. Taking as our reference a graduate with the average characteristics of the sample used, the result is that the probability of them being overeducated at their current job is 16.4%. Said average probability can vary by 7.3 pp depending on the parents' educational level. Graduates whose father (-4.2 pp) or mother (-1.9 pp) have university studies are less likely to be overeducated, while those who have a father with primary education or less (+1.2 pp) are more likely to be overeducated. Along the same lines, Kucel and Vilalta-Buñi (2019) and Capsada-Munsech (2020) find that the parents' educational level influences the probability of being overeducated.

Other variables that can provide indirect information about a household's socioeconomic status are being awarded a general grant, studying at a private university or pursuing a master's degree. Regarding general grants, it should be noted that they are aimed at students who live in households whose income is below a certain threshold. Being awarded a general grant increases the probability of being overeducated by 3.4 pp. Along the same lines, having studied at a private university reduces the probability of being overeducated by 4.4 pp, while completing a master's degree reduces vertical educational mismatch by 11.0 pp. In this sense, it should be emphasized that, although master's degrees have a very small impact on graduates' wages (they raise compensation by 1 to 2%), they show a very notable impact in terms of reducing educational mismatch.

Finally, it should be noted that a certain regional pattern emerges from the analysis of the determinants of overeducation. Graduates from regions with a lower development level (Andalusia, Canarias, Extremadura and Murcia) are at least 4.0 pp more likely to be overeducated than those from Madrid, the reference autonomous community. In turn, the only region showing a negative marginal effect is Catalonia, where the probability of being overeducated is 2.5 pp lower than in Madrid.

Inequality of opportunities, due to the graduate's family background or the region in which they live, is an important factor when it comes to understanding the phenomenon of overeducation in the Spanish university system. However, the factor with the greatest impact on the probability of being overeducated is the degree that the graduate completed. Table 7 shows the results for the 32 fields of study defined in the survey, taking the field of Law as a benchmark. To mention a few examples, graduates in Arts (+20.4 pp) and

Humanities (+20.7 pp) show a notably higher probability of being overeducated than graduates in Law. Other fields of study positively associated with overeducation are Audiovisual Techniques/Media (+18.5 pp) and Travel/Tourism/Leisure (+18.5 pp). At the opposite end, graduates in Medicine (-17.1 pp) and Nursing (-15.6 pp) are less likely to suffer from vertical mismatch. Other degrees with positive results are Mathematics/Statistics (-5.0 pp), Computer Science (-6.9 pp), Engineering (-7.7 pp), Manufacturing Industry/Production (-5.1 pp), Architecture/Construction (-4.6 pp), Veterinary Science (-11.7 pp) and Health (Other studies) (-10.9 pp). Therefore, depending on the field of study, the incidence of overeducation can vary by up to 38 pp, if we compare graduates from some Health Sciences fields to those from other branches of Social Sciences and Humanities.

The pattern of results described in relation to vertical mismatch is repeated when horizontal and skills mismatch are studied. In both cases, the variables that characterize the graduate's socioeconomic background lose some of their importance while, on the other hand, differences by field of study are accentuated. To mention some extreme examples, between Medicine (-23.5 pp) and Humanities (+30.0 pp) or Social/Behavioural Sciences (+30.5 pp) graduates, the probability of working outside one's area of studies varies by more than 50 pp. Along the same lines, while among Nursing graduates the probability of not using the knowledge and skills acquired at university is 18.9 pp lower than among Law graduates, the probability increases by 30.9 pp among Humanities graduates.

CONCLUSIONS

The results of the empirical analysis indicate that overeducation has an economically substantial and statistically significant impact, which suggests that job characteristics limit the use of our graduates' productive potential. This result is consistent with what Nieto and Ramos (2017) found in relation to the Spanish case. Heterogeneity in skills partially explains the wage penalty of vertical educational mismatch, but in order to improve the professional expectations of our university graduates, greater emphasis should be placed on the demand side, which has not generated enough skilled jobs to absorb the growing supply of graduates produced by the Spanish

university system in recent decades. This conclusion has a special reading at a time of serious economic crisis such as the one we are currently facing as a result of COVID-19, which disproportionately affects the youth labour market.

From the comparative analysis of the impact on wages of the three types of mismatch, the conclusion is that, although the three are closely related, vertical mismatch has the most serious economic implications. Working outside the graduate's own area of study or not using the knowledge and skills they acquired at university has a negative impact on graduates' wages only when they result from vertical mismatch. In fact, once overeducation is controlled for, working outside the graduate's area of study has a positive impact on wages, suggesting the transferability of some skills and abilities outside of the graduate's own field of knowledge.

The unequal incidence of educational mismatch by field of study makes it necessary to work on improving the supply side as well. As has been pointed out, academic counselling must be improved when young people have to choose their studies. At the same time, research, debate and dissemination of the job placement results of our university graduates should be promoted. In this sense, special emphasis should be placed on having information and academic guidance reach students from less favourable socioeconomic backgrounds, as they are more likely to be overeducated. Likewise, more fluid communication should be promoted between higher education institutions and employers in order to improve knowledge about the skills and competencies demanded by firms. However, we should not lose sight of the fact that, if demand is not strengthened, the relative position of some graduates compared to others can be improved in the hiring queue described by Thurow (1976), without obtaining a significant net effect in terms of reducing the problem.

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Article Reception Date: March 31, 2021

Article Revision Date: May 23, 2021

Article Acceptance Date: May 26, 2021

Review Date for Publication: September 13, 2021