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Educational Mismatch and Gender: A Comparison between Industry and Services in Spain

Elena Lasso-Dela-Vega, José Luis Sánchez-Ollero and Alejandro García-Pozo *

Department of Applied Economics (Economic Structure), University of Malaga, 29016 Malaga, Spain; elenalasso@uma.es (E.L.-D.-V.); jlsanchez@uma.es (J.L.S.-O.)
* Correspondence: alegarcia@uma.es

Abstract: This study analysed the presence and influence of educational mismatch in the service and industry sectors in Spain, due to the lack of studies of this phenomenon in the latter sector. We also analyse its effect on wages and its role in creating a gender wage gap in the returns to a set of professional and personal characteristics. The heterogeneity in the improvement of workers' qualifications between sectors in Spain and the lack of studies of this phenomenon in the industrial sector motivates interest in this comparative research between industry and services, which includes a gender perspective, given the interest of this topic in wage studies. To this end, an extension of the Mincer wage equation was applied to data from the 2018 Wages Structure Survey conducted by the Spanish National Statistics Institute. The results suggest that educational mismatch has a greater impact on women's wages in the service sector than on those in the industrial sector and on men's wages in both sectors. We also found wage differences in the returns to a set of professional and personal characteristics that suggest that the gender wage gap is greater in the service sector than in the industrial sector.

Keywords: educational mismatch; gender wage differences; services; industry; wages; Spain

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1. Introduction

In 2012, 2016 and 2021, the Spanish National Statistics Institute (INE) published reports entitled Las cifras de la educación en España ("Education Figures in Spain") (INE 2012, 2016, 2021). The data show that early school dropout in Spain decreased from around 28.4% in 2010 to 22% in 2013, which is when the country started to emerge from the 2008 economic crisis; it was further reduced to 17.3% in 2019. This steady increase in the educational level of the Spanish population seemed to intensify in the post-crisis period. This could be understood as an attempt to compensate for the high levels of unemployment by improving the qualifications of the labour force. In this setting, the situation of women is of particular relevance. During the economic crisis, the difficulties they encountered when attempting to enter the labour market were compounded by a phenomenon known as the 'glass ceiling', which adversely affected career development. The number of tertiary education qualifications gained by women is greater than that of men, which could be explained as an effort to compensate for this additional hurdle.

This improvement in worker qualifications should be reflected in labour market demand. However, there is no homogeneity in the educational requirements across economic sectors. In Spain, as in all developed Western economies, significant differences in education have been found according to the type of activity. In general, higher educational qualifications are demanded by the industrial sector than by the service sector. Some authors, such as Sánchez-Ollero et al. (2014), have shown that tourism activities are typically characterised by a significant number of unskilled workers, despite these activities being a main contributor to the economy in terms of wealth and employment generation.

However, with regard to the industrial sector, there is a lack of research on how education is rewarded through wages. This also raises the issue of whether the recent

increase in qualification levels in Spain has caused a mismatch between labour supply and demand in different productive sectors—that is, in industry, given the scarcity of literature on this phenomenon in this sector and in the Spanish services sector, given the aforementioned low skill demands. These differences, together with the precarious situation of Spanish women with higher qualifications, raise the question of whether the phenomenon of educational mismatch has a differential impact on wages depending on the sector and the gender of the worker.

Thus, the main objective of this study was to analyse potential differences between these industrial and service sectors in the impact of educational mismatch on wages and whether it causes a gender pay gap in relation to returns to education and returns to a set of personal and professional characteristics. To this end, we used a variation of the Mincer wage equation (1974) that not only included the traditional human capital variables but also a set of additional variables (e.g., type of contract, part- or full-time contract, experience, tenure, and nationality).

The rest of the paper is structured as follows: the second section presents a brief review of the literature on educational mismatch and wage differences in the sectors analysed; the third section describes the methodology used and the research variables; the fourth section presents the data and a brief descriptive analysis; the fifth section presents and discusses the main results; and the final section offers the main conclusions and recommendations for economic policy.

2. Review of Literature

Neoclassical economic theory suggests that resources are remunerated according to their productivity. According to this theory, individuals' wages are determined by their work productivity, and marginal increases in productivity result in proportional increases in wages. Under this premise, and according to Becker (1983), education facilitates increased worker productivity, which would lead to higher wages.

This view considers education to be an investment that increases individual incomes and, from a social point of view, increases collective incomes, thus making investment in education a key element in the economic development of societies. This economic perspective on education was expanded by the development of the 'Theory of Human Capital'.

Studies by Mincer (1958), Schultz (1960, 1961, 1962, 1963), and Becker (1964) laid the foundations of this theory by viewing education not as a consumer good, but as an investment. Mincer (1974) developed this theory mathematically and considered anything that increases worker productivity to be an investment (e.g., education, experience, and tenure).

As a result of this consolidation of the Human Capital Theory, a current of authors interested in analysing the wage differences that arise from differences in the returns to human capital began to take shape. In this way, a large international body of literature was generated, which studies the origin and existence of the gender pay gap (Blau and Kahn 2017), the explanatory factors of these differences (Christofides et al. 2013; Maume et al. 2019), and even the existence of discrimination in these wage differences (Matteazzi et al. 2014; Aldan 2021).

Subsequently, interest in this issue led to the proliferation of a rich and extensive literature in Spain (e.g., Dueñas-Fernández et al. 2015; Ons-Cappa et al. 2017; Moreno-Mencía et al. 2020; Segovia-Pérez et al. 2020; Marfil Cotilla and Campos-Soria 2021). These studies demonstrated the existence of a wage penalty for female workers, mainly in the service sector, and determined the factors related to human capital that explained these wage differences.

The methodology used to identify wage differences between individuals and to measure the effect of human capital on wages can also be used to analyse the so-called educational mismatch. This concept also emerged within the Theory of Human Capital and was originally developed through the pioneering work of Duncan and Hoffman (1982). These authors challenged the explanatory power of Mincer's theory on returns and his wage equation, regarding it as an unrealistic perspective of the economic world. They were

the first to compare and find differences between workers' years of education and those required by their jobs. These differences can be classified into three categories: overeducation, where workers have a level of education higher than that required for the job; required education, where the worker has the required level of education; and undereducation, where workers have a level of education lower than that required for the job (Alba-Ramírez 1993; Sánchez-Ollero 2001).

Various explanations have been proposed to explain the existence of a mismatch between education systems and the labour market. An initial explanation was proposed by supporters of the job-market signalling or filter models, in which educational level is considered to be a kind of credential or passport that allows individuals to access the labour market, regardless of whether the job they ultimately perform matches their educational profile (Rumberger 1981; Arrow 1973; Spence 1973; Stiglitz 1975; Thurow 1975). An alternative explanation suggests that there may be a trade-off between formal education and other forms of human capital. In this case, two workers may have equivalent human capital profiles for a particular occupation but different levels of formal education (Sicherman 1991; Welch 1970; García Montalvo 1995). A third explanation proposes that mismatch between the level of education and occupation is a temporary phase in individuals' careers (Jovanovic 1979; Sicherman and Galor 1990; Alba-Ramírez 1993).

Due to the relevance of this topic to economics, an extensive body of literature has arisen that has attempted to explain the origin and the factors of this phenomenon (Ghignoni and Verashchagina 2014; Caroleo and Pastore 2018; Salas-Velasco 2021), and various authors have tried to explain its consequences. After Freeman (1976), who analysed the impact of educational mismatch on the returns to education of North American workers, other works study its effects on wages (Iriondo and Pérez-Amaral 2016; Sellami et al. 2020), productivity (Marchante and Ortega 2012; Verhaest and Verhofstadt 2016), and job satisfaction (Lillo-Bañuls and Casado-Díaz 2015). They show the presence of over-and undereducation in various economies, in addition to a wage penalty and a loss of motivation for individuals whose academic training does not match that which is required for the job they hold, which in turn generates productivity losses for the company and the economy in general. Finally, the concept of education is sometimes difficult to define in relation to employment. Recent studies have attempted to define the line between education and professional competence (Brunello et al. 2019).

Three methods have been developed to measure the appropriate educational level for jobs: worker surveys (subjective method[1]); the classification of jobs according to their characteristics, degree of complexity, and the level of education and experience needed to perform them (objective method); and the application of various statistical formulas (statistical method).

In principle, the objective method would be the most appropriate; however, it is rarely used because of the costs involved in constructing a catalogue of occupations that would allow for comparisons, as well as increasing inaccuracy due to the time that elapses between updates. For example, the Dictionary of Occupational Titles (DOT) is published by the US government and was used in a study by Rumberger (1987). It is published once a decade; thus, some information can become outdated due to changing circumstances. In general, the subjective method has been more frequently used by authors, who have been able to include questions relevant to the study of educational mismatch in the surveys. Finally, the statistical method enables the calculation of appropriate education levels through estimators such as mean or mode (Verdugo and Verdugo 1989; Kiker et al. 1997). The choice of method is relevant because each one can lead to different results (Sánchez-Ollero 2001; Madrigal 2002; Naguib et al. 2019). However, according to Hartog (2000), the method used to measure educational mismatch makes little difference to the wage effects of this phenomenon, such that the choice of method mainly depends on the availability of data.

The empirical literature on the effects of educational mismatch is often enriched by the inclusion of control variables such as the type of contract, a part- or full-time contract,

company size, the nationality of the individual, and collective labour agreement (Green and McIntosh 2007; Mahy et al. 2015; Mateos-Romero et al. 2017).

3. Material and Methods

3.1. Methodology

As mentioned in the Introduction, within the context of the Spanish labour market and the aforementioned lack of studies on educational mismatch in the industrial sector in previous literature, this paper aims to answer the following research questions:

- Is there educational mismatch between the Spanish industry and service sectors?
- Are there differences in the wage effects of educational mismatch by the productive sector?
- Is there a gender difference—as well as differences due to other individual characteristics—in the impact of this phenomenon within the Spanish industry and services?

To answer these questions, we first chose a method to measure educational mismatch. Of the three methods mentioned in previous sections (objective method, subjective method, and statistical method), we chose the statistical method due to the lack of external evaluations and workers' self-evaluations, and we employed the statistical method proposed by Kiker et al. (1997). This approach considers workers to be overeducated when their years of formal education are above the mode, rather than when their years of formal education is one standard deviation above the average years of education needed for their occupation, as stated by Verdugo and Verdugo (1989). We believe that the mode (the most frequent number of years of education for that post and the immediately adjacent values) is the statistical value that best represents the educational level of those with required education. In addition, it allows us to reduce the sensitivity of outliers, thus providing us with more concise measures for appropriate education.

Having chosen the measurement method, this paper uses a variant of Mincer's (1974) wage equations as an econometric methodology, in which we have included some variables related to worker characteristics, which we define below. This wage equation was estimated for male workers, female workers, and for the service and industrial sectors by gender. For the construction of the variable relating to the sector and following the National Classification of Economic Activities of 2009 (CNAE-09), codes 44-96 have been included in the services sector and codes 05-43 of the aforementioned CNAE-09 in the industrial sector. In this way, we generated the sectoral groups to be analysed.

The model to be estimated was as follows:

$$\begin{aligned} Ln\ Wbh = {} & \beta 0 + \beta 1\text{Level\_Education} + \beta 2\text{Experience} + \beta 3\text{Experience2} + \beta 4\text{Tenure} + \beta 5\text{Tenure2} + \\ & \beta 6\text{Over}\textit{edu}\text{cation} + \beta 7\text{Under}\textit{edu}\text{cation} + \beta 8\text{Part\_full\_time} + \beta 9\text{Duration\_contract} + \beta 10\text{Responsibiliy} + \\ & \beta 11\ \text{Laboral\_agree} + \beta 12\ \text{Small enterprise} + \beta 13\ \text{EU\_}\textit{non}\text{\_spanish} + \beta 14\ \textit{Rest}\ \text{\_world} + \varepsilon \end{aligned} \quad (1)$$

where the dependent variable is the Napierian logarithm of the gross hourly wage, which has been deflated to take into account the price differential.

The constant $\beta 0$ is on the right side of Equation (1) and refers to the part of the wage that is not explained by the independent variables but by other extraneous factors.

Among the explanatory factors, we highlight those related to educational mismatch. $\beta 6$ and $\beta 7$ show the wage effects of the educational mismatch variables of being overeducated ("OVEREDUCATION") and undereducated ("UNDEREDUCATION"). These variables take the value 1 when the individual is in this mismatch situation and 0 otherwise. As discussed above, this paper follows the work of Kiker et al. (1997) and uses the statistical method with the mode as an estimator to measure educational mismatch. To do this, we calculated the mode of years of education in each occupational category, following the Spanish National Classification of Occupations (CNO-11) disaggregated to two digits. We consider this approach to be indicative of the appropriate education level for that position. Thus, if individuals in a given occupation have an educational level above the mode

(which we consider as appropriate education) or below the mode, they are overeducated or undereducated for that occupation, respectively.

We also included the following series of explanatory variables:

LEVEL_EDUCATION: average years of education: values are divided into eight categories covering 2 to 17 years of education. We followed the work of Arrazola et al. (2003) to create equivalences between the level of education and years of education;

EXPERIENCE: the individual's years of work experience[2];

EXPERIENCE2: the individual's years of work experience squared;

TENURE: years of tenure in the job;

TENURE2: years of tenure in the job squared;

PART-FULL_TIME: a dummy variable that takes the value 1 if the contract is full-time and 0 if the contract is part-time;

DURATION_CONTRACT: a dummy variable that takes the value 1 if the contract is permanent and 0 if the contract is temporary;

RESPONSIBILITY: a dummy variable that takes value 1 if the individual has a position of responsibility and 0 otherwise;

LABORAL_AGREE: a dummy variable that takes the value 1 if the contract is under a collective agreement at the company level and 0 if it is under another type of labour agreement;

SMALL ENTERPRISE: a dummy variable that takes the value 1 if the enterprise is small[3] (less than 50 employees) and 0 if it is at least medium or large (more than 50 employees);

EU_NON-SPANISH: a dummy variable that takes the value 1 if the individual is from an EU country other than Spain and 0 otherwise;

REST_WORLD: a dummy variable that takes the value 1 if the individual is from a country other than an EU country and 0 otherwise.

Based on the previous literature, the variables of the proposed model can be split into two groups according to their expected effects. The real gross hourly wage is expected to be positively affected by the variables years of education (S), experience (Prev_exp), tenure (Tenure), undereducation (Undereduc), part- or full-time contract (part-full_time), type of contract type (Typecont), the position of responsibility (Post-respons), company labour agreement (lab_agree), and non-Spanish EU nationality (EU_non-Spanish). However, it is expected to be negatively affected by the variables overeducation (Overeduc), enterprise size (Small enterprise), and non-EU nationality (Rest_world).

3.2. Data and Descriptive Analysis

3.2.1. Data

The INE Wages Structure Survey (WSS) collects information on the Spanish wage structure every 4 years. This study used data from the 2018 edition[4]. The survey is administered to workers in their workplace, thus obtaining individualised information on their wages, productive characteristics, and the characteristics of the company. The INE Wages Structure Survey forms part of a larger initiative conducted across the European Union using common criteria and methodologies, thus allowing for comparisons between its Member States.

The survey structures data by sector using the National Classification of Activities (CNAE-2009). This study used data from the industrial sector (including manufacturing and construction) and the service sector. Thus, we obtained 174.027 observations, of which 118.788 corresponded to the service sector and 55.239 corresponded to the industrial sector.

However, we removed observations corresponding to wages below the 2018 inter-professional minimum gross wage of EUR 3.66 per hour. Table 1 shows the descriptive statistics of the variables used (i.e., the average of the variables and their standard deviations in brackets).

Table 1. Descriptive analysis of the variables.

Variables	Sample		Services		Industry	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
Real gross wage per hour, (EUR)	16.23 (11.74)	14.01 (9.29)	16.61 (12.74)	14.03 (9.39)	15.76 (10.33)	13.94 (8.77)
Age, (years)	44.10 (10.47)	43.82 (10.40)	43.75 (10.74)	43.88 (10.55)	44.55 (10.10)	43.50 (9.54
Years of education	10.11 (4.08)	11.14 (4.15)	10.99 (4.19)	11.24 (4.14)	9.03 (3.66)	10.63 (4.19)
Experience, (years)	15.69 (10.37)	15.01 (10.41)	14.70 (10.07)	15.04 (10.46)	16.92 (10.61)	14.82 (10.14)
Tenure, (years)	11.20 (10.60)	10.87 (9.66)	11.20 (10.52)	10.83 (9.55)	11.20 (10.70)	11.09 (10.21)
Overeducation, (%)	0.22 (0.41)	0.21 (0.40)	0.20 (0.40)	0.20 (0.40)	0.24 (0.43)	0.22 (0.42)
Undereducation, (%)	0.19 (0.39)	0.21 (0.41)	0.23 (0.42)	0.21 (0.41)	0.15 (0.36)	0.20 (0.40)
Part-/full-time	0.89 (0.31)	0.71 (0.45)	0.85 (0.36)	0.69 (0.46)	0.94 (0.23)	0.83 (0.38)
Type of contract	0.79 (0.41)	0.78 (0.41)	0.79 (0.41)	0.77 (0.42)	0.79 (0.40)	0.87 (0.34)
Position of responsibility	0.17 (0.37)	0.11 (0.32)	0.17 (0.27)	0.11 (0.31)	0.16 (0.37)	0.13 (0.33)
Company labour agreement	0.31 (0.46)	0.34 (0.47)	0.36 (0.48)	0.36 (0.48)	0.25 (0.43)	0.22 (0.41)
Small-size enterprise	0.34 (0.47)	0.26 (0.44)	0.27 (0.45)	0.24 (0.43)	0.42 (0.49)	0.40 (0.49)
Non-Spanish EU worker	0.03 (0.16)	0.02 (0.15)	0.02 (0.15)	0.02 (0.15)	0.03 (0.17)	0.02 (0.15)
Non-EU worker	0.002 (0.05)	0.002 (0.05)	0.001 (0.04)	0.002 (0.05)	0.004 (0.06)	0.004 (0.06)
Sector	0.44 (0.50)	0.16 (0.36)	-	-	-	-
Observations	96.477 (55.44%)	77.539 (44.56%)	53.537 (45.07%)	65.242 (54.93%)	42.940 (77.74%)	12.297 (22.26%)
Total	174,016 (100%)		118,779 (68.26%)		55,237 (31.74%)	

Note: Standard deviations are shown in parentheses. Source: Own work based on WSS-2018 data.

3.2.2. Descriptive Analysis

Firstly, we draw attention to the relevance of services in the productive structure of the Spanish economy; that is, a higher percentage of workers are employed in the service than in the industrial sector.

Although there are similar percentages of male and female workers in Spain, within the industrial sector, 77.74% of workers are men, whereas just 22.26% are women. Other studies conducted in Spain have also found there are more men employed in the industrial sector, especially in construction, and more women employed in the service sector (e.g., Alonso-Villar and Del Río 2010; Echebarría and Larrañaga 2004; Infante et al. 2012). Similar percentages have been found in other developed countries (e.g., Hutchings et al. 2020).

Secondly, the workers in the sample had an average age of around 44 years, indicating the relevance of the baby boom generation in the active and employed segments of the Spanish population. This result is similar to that of Almodóvar et al. (2013).

We found that men and women had a similar number of years of education, although in both sectors and the general economy, the average number of years of education was higher among women than among men. These results are consistent with those of previous research (e.g., Rahona-López 2009; Salinas-Jiménez et al. 2013). Of note, the average number of years of education was slightly higher in the service sector than in the industrial sector.

This result may seem surprising given that, as mentioned, there is a general preconception that jobs in the Spanish service sector require less training. However, it should be recalled that in this study, the term "service sector" covers all the service industries, which include highly qualified jobs requiring extensive education.

In general, overeducation was the most common type of educational mismatch in the Spanish economy as a whole. However, if we distinguish between the sectors, undereducation was more common in the service sector, whereas overeducation was more prominent in the industrial sector. In terms of gender, the educational mismatch results shown in Table 1 are in line with those obtained by Ons-Cappa et al. (2017), who found that undereducation in women was common in the industrial sector. They suggested that the jobs held by women in this sector are physically less demanding than those held by men and that they require more training.

More positions of responsibility were held by men than by women. However, it is noteworthy that the responsibility gap was smaller in the industrial sector. This result could be related to the type of job held by women in this sector, because these jobs often entail intermediate levels of responsibility (Trigueros et al. 2009).

Regarding nationality, there were very similar percentages of non-Spanish workers in both sectors with little difference by gender. Around 2% to 3% of the workers were non-Spanish EU nationals with similar percentages of non-EU nationals. The percentages of non-EU workers were different from those found by García-Pozo et al. (2014), who reported a higher percentage of these workers. However, this study addresses two sectors that include many subsectors. Given that the number of non-EU workers within the full sample is relatively small, the distribution of non-EU workers across the subsectors as a whole may show greater dispersion.

The average values of the remaining variables were very similar to those found in the literature. The average experience and tenure were higher among men than among women, except in the service sector, in which average experience was slightly higher among women (García-Pozo et al. 2011). The percentage of full-time contracts was higher among men, whereas the percentage of part-time contracts was higher among women, especially in services. These results are in line with those obtained by other authors (e.g., De Pedraza et al. 2010). The number of permanent contracts and collective labour agreements were similar between genders.

In the overall economy and by sector, the average wage was higher among men than among women. An average test (see Appendix B, Tables A2 and A3 showed that this difference was significant for the entire sample and each sector. These results are consistent with those reported in previous studies (e.g., Murillo Huertas et al. 2017; Rahona-López et al. 2016; Ropero 2018). In addition, it is noted that, although the average wage earned by women in the service sector was slightly higher than that earned in the industrial sector, the wage gap observed between men and women was slightly reduced in the industrial sector. This finding will be discussed in more depth in the rest of the article.

4. Results and Discussion

Table 2 shows the results of the estimation of wage using Equation (1) by sector and gender.

Of note, the F-statistic reached statistical significance in all cases. Furthermore, adjusted R2 showed that around 40% of the variance in wage variability was explained by the proposed model, thus confirming its goodness-of-fit. Furthermore, Annex A shows an estimation of the complete sample to determine if the variable gender influences wages. We found that the wages of male workers in the service sector and industrial sectors were, respectively, 13.1 percentage points and 17.3 percentage points higher than those of female workers. The Chow test (see Appendix B, Tables A4 and A5 supported the conclusion above by confirming that there was a structural change in the wages of both sexes in the two sectors of interest.

Next, we interpreted the coefficients[5] obtained from the estimation of Equation (1).

Returning to the theme of educational mismatch, the values obtained for overeducation and undereducation were negative and positive, respectively. These results are in line with those of previous studies (e.g., Verdugo and Verdugo 1989; Campos-Soria et al. 2011; Badillo-Amador et al. 2005).

The wage penalty for overeducation was greater among women than among men in both sectors (e.g., Iriondo and Pérez-Amaral 2016; Lillo-Bañuls and Casado-Díaz 2015; García-Serrano and Malo 1997). This result may be due to the higher average level of female education (see Section 3), which does not always lead to them gaining positions of higher responsibility in the labour market. However, the higher penalisation of overeducation in services is noted for both genders, which may be due to the greater capacity of the industry to absorb qualified profiles due to the higher training requirements that its jobs require, on average, compared to those in the services sector.

Table 2. Results of the estimations.

Variables	Services		Industry	
	Men	**Women**	**Men**	**Women**
Level of Education	0.0574 ***	0.0578 ***	0.0418 ***	0.0506 ***
	(111.85)	(123.21)	(68.68)	(47.89)
Experience	0.0090 ***	0.0011 **	0.0063 ***	0.0073 ***
	(13.72)	(2.03)	(9.37)	(5.78)
Experience2	−0.0001 ***	−0.0000 **	−0.0000 ***	−0.000 ***
	(−7.13)	(3.25)	(−4.16)	(−3.24)
Tenure	0.0233 ***	0.0210 ***	0.0185 ***	0.0142 ***
	(39.40)	(41.70)	(32.31)	(13.53)
Tenure2	−0.0002 ***	−0.0002 ***	−0.0001 ***	−0.0000
	(−10.44)	(−11.44)	(−8.97)	(−0.70)
Overeducation	−0.1535 ***	−0.1974 ***	−0.0871 ***	−0.1269 ***
	(−31.57)	(−4873)	(−18.66)	(−14.05)
Undereducation	0.0583 ***	0.0766 ***	0.0696 ***	0.0727 ***
	(12.58)	(19.10)	(13.50)	(8.13)
Part-Full_time	0.0832 ***	0.0505 ***	0.0530 ***	0.0636 ***
	(15.73)	(13.91)	(6.58)	(6.81)
Duration of contract	0.0350 ***	−0.0286 ***	0.0330 ***	0.1017 ***
	(6.85)	(−6.97)	(6.22)	(8.85)
Responsibility	0.2591 ***	0.1914 ***	0.2339 ***	0.2233 ***
	(50.06)	(37.81)	(44.65)	(20.57)
Laboral_agree	0.0609 ***	0.0512 ***	0.2177 ***	0.1681 ***
	(14.96)	(14.68)	(46.70)	(19.37)
Small enterprise	−0.1231 ***	−0.1496 ***	−0.1506 ***	−0.1657 ***
	(−28.57)	(−39.26)	(−37.58)	(−22.03)
EU_non-Spanish	0.0802 ***	0.0677 ***	0.0353 ***	0.0877 ***
	(6.76)	(6.65)	(3.25)	(3.98)
Rest_world	0.1383 ***	0.0195	−0.0187	0.0004
	(2.84)	(0.64)	(−0.64)	(−0.01)
Constant	1.571 ***	1.6256 ***	1.8926 ***	1.6040 ***
	(146.81)	(178.08)	(145.16)	(71.55)
Adjusted R2	0.4200	0.4067	0.4260	0.4042
F-statistic	2769.84	3195.63	2276.84	596.75
RMSE	0.4237	0.3938	0.3704	0.3766
Observations	53.537	65.242	42.940	12.297

Notes: Significance: * 10%; ** 5%; *** 1%. T-values are shown in parentheses. Source: Own work based on WSS-2018 data.

Regarding undereducation, in both cases, the wage premium for under-educated women was higher than for under-educated men. In the industry, this result may be due to the occupational segregation by gender that has led to a concentration of women in administrative positions in recent years. The results in the service sector could be due to

the trade-off between formal education and informal education for women in this sector, who have qualities such as experience above those of their male counterparts and could facilitate their internal promotion.

Apart from the results on educational mismatch, we also obtained results for human capital variables and control variables.

In terms of human capital variables, in this paper, we first found that men and women in the service sector had very similar returns to education. These results on returns were similar to those reported in previous studies[6] (e.g., Lillo-Bañuls and Casado-Díaz 2010; Yeo and Maani 2017). However, in the industrial sector, returns to additional years of education were greater among women. This result could be due to women in this sector experiencing occupational segregation, which generally leads them to occupying posts that require higher qualifications.

The results for tenure and experience[7] are consistent with those of previous studies. In both sectors, returns to tenure were greater among men than among women (e.g., Sánchez-Ollero et al. 2014) and higher returns to experience occurred for female workers (García-Pozo et al. 2011). This latter result may reflect the fact that greater female human capital—higher educational attainment and experience—is beginning to be recognised with higher pay, in a move towards combating gender pay discrimination.

Concerning contractual conditions, positive wage effects were observed for a full-time versus a part-time contract and for an open-ended versus a temporary contract; these results are consistent with previous literature (Hu and Tijdens 2003; Russo and Hassink 2008; Bentolila and Dolado 1994; Motellón et al. 2010). Regarding working-day contracts, we found that the greatest wage advantages of full-time contracts were found in the service sector and for male workers (e.g., Pagán Rodríguez 2007; Simón et al. 2008). This may be explained by the fact that part-time jobs are more commonly occupied by women in the attempt to balance work and family life. In the industry, on the other hand, although we found lower full-time pay, there was a greater return of this variable for female workers, which fits in with the lower proportion of part-time work for women in this sector compared to services and may also represent the beginning of a change in the archetype of part-time work for women. It is also in this industrial sector where we highlight that the returns to permanent contracts versus temporary ones were higher for women than for men. This result is similar to those found in previous studies (e.g., Aller and Arce 2000; De la Rica 2007).

Regarding labour characteristics, positions of responsibility had a direct and positive effect on wages. In both sectors, returns to this characteristic were greater among male workers than among female workers. This result is in line with those of previous studies (e.g., Vega Catena et al. 2016). However, it is interesting to note that the remuneration of women with responsibility in the industry—although lower than that of their male counterparts—is significantly higher than the remuneration obtained by women with responsibility in the service sector. This result could be an echo of the greater difficulties women face in holding positions with a certain level of responsibility in the service sector, where they are segregated in lower-paid positions (Marfil Cotilla and Campos-Soria 2021).

The type of collective labour agreement can also affect wages. We found an association between higher wages and enterprise-level agreements (e.g., Card and De La Rica 2006; Infante 2013). These agreements have a greater effect on wages in the industrial sector than in the service sector (Marshall 2016). There are also differences by gender regarding the benefits of collective labour agreements. This result could be due to the type of position typically occupied in enterprises. More men occupy top management positions (Sarrió et al. 2002), which facilitates individual bargaining. Greater wage advantages can be obtained through this type of bargaining than through contracts regulated by collective labour agreements that include other occupational categories. However, this wage differences between gender with the same type of labour agreement have also been found in other studies, such as that of Peetz (2014). This author suggested that, despite workers having

the same type of labour agreement, 'performance bonuses' may be used to introduce a component of discrimination (Hall 1995; Rubery 1995).

Regarding the effect of the size of the enterprise on worker wages, we found negative coefficients, suggesting that there is a direct relationship between working in a small enterprise and receiving lower wages (García-Pozo et al. 2014). These findings could be explained by reference to the characteristics of these small companies. They tend to operate in local markets, be labour intensive, have high levels of precarious and part-time employment, and have little trade union organization. Working in small enterprises entails a higher wage penalty for female workers than for male workers in both sectors, although this difference is greater in the service sector.

Finally, in line with the results of previous studies (e.g., García-Pozo et al. 2014), a positive association was found between the variable nationality and worker wages among non-Spanish EU nationals. This finding could be explained by the type of positions they tend to hold, which usually require high qualifications. Regarding the effect of gender and sector, we observed a higher coefficient for men in services and for women in industry, which coincides with the results previously detailed for Spanish workers throughout this results section, where men find on average higher remuneration in services and women in industry.

5. Conclusions

This article contributes to the economic literature by presenting a sectoral analysis of the effect of educational mismatch on wages. Many authors have addressed the impact of mismatch on wages in the service sector or, in the case of Spain, on the tourism subsector, due to the weight of the tertiary sector in the Spanish economy. However, this study also includes the industrial sector in the analysis of this phenomenon. Using data from the 2018 INE Wages Structure Survey, the descriptive analyses show that there is an educational mismatch in both sectors: nearly 24% of workers in the industrial sector are overeducated, and around 22% of workers in services are undereducated. We identified inefficiencies in the distribution of resources and analysed the effect of this imbalance on worker wages. Subsequently, we investigated its effect on returns to education and returns to a set of personal and professional characteristics. The results of the analysis suggest that the effects of educational mismatch led to wage differences; that is, there are differences in returns for men and women and both sectors. The service sector appears to be the sector that incorporates the lowest levels of female education, generating the greatest wage penalties for the overeducation of these workers. This could be evidence of the over-representation of women in low-paid jobs in this sector. However, in both sectors, the wage advantage for female undereducation is higher than for men, which could be a sign that other aspects of female human capital are beginning to be valued beyond academic training, leading them to access jobs for which they have the appropriate informal but non-formal education.

The estimations yielded other relevant results, which include the following:

On the one hand, labour agreements at the company level led to a wage advantage over other collective labour agreements. This advantage was greater in the industrial sector and among male workers. This difference in returns could be related to the type of position that women occupy in this sector and the existence of performance-related pay bonuses.

On the other hand, in the industrial sector, we found that women obtained some advantages in relation to returns to other variables. For example, only in this sector were returns to education better among women than among men. In the industrial sector, women also had higher returns than men regarding the type of contract, understood as the duration of contract and the working day. This latter result could indicate that a change is beginning to take place in the predominant role of women in the decision to balance work and family life through shorter working hours. In line with this, the results obtained for women who hold positions of responsibility in the industry also stand out, given that, despite offering them a lower return than their male colleagues, the performance of these workers is higher

than that obtained in services, highlighting the greater management opportunities that the industrial companies provide for these workers.

Our analysis showed that educational mismatch leads to wage differences: the greatest differences were found in the service sector, where there was a gender wage gap in most areas related to human capital.

From the perspective of social and economic policy, evidence of the existence of educational mismatch in the labour market and its associated wage penalties leads us to recommend the implementation of changes or reforms to improve coordination between the education system and the demands of the labour market. For example, we recommend addressing the stigma associated with vocational education and training studies and encouraging and supporting the development of these studies to meet the high demand for mid-level professional positions in the Spanish labour market.

6. Limitations and Future Research Lines

This study is limited by the availability of the data. We only had access to cross-sectional data, which prevents us from incorporating observation error bias. Similarly, the existence in this database of information only on years of formal education as an indicator of an individual's education, coupled with the absence of self-assessments by workers or external evaluations, limits the investigation of education from alternative perspectives more related to skills or competences. It also hinders the possibility of defining overeducation in alternative terms. Finally, it should be borne in mind that this study addressed the service and industry sectors as a whole. Future research could therefore disaggregate these sectors by comparing subsectors or by taking into account occupational categories that may explain in greater depth some of the differences observed in performance.

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Appendix A

Table A1. Estimation of the general model including the sex variable.

Variables	Total Sample	Services	Industry
Level_Education	0.0542 ***	0.0577 ***	0.0442 ***
	(189.57)	(167.03)	(84.39)
Experience	0.0049 ***	0.0046 ***	0.0063 ***
	(14.13)	(11.02)	(10.71)

Table A1. *Cont.*

Variables	Total Sample	Services	Industry
Experience2	−0.0000 *** (−4.26)	−0.0000 ** (−2.59)	−0.0000 *** (−4.94)
Tenure	0.0209 *** (68.45)	0.0222 *** (57.80)	0.0176 *** (35.02)
Tenure2	−0.0001 *** (−18.76)	−0.0002 *** (−15.76)	−0.0001 *** (−8.38)
Overeducation	−0.1546 *** (−62.00)	−0.1778 *** (−56.92)	−0.0969 *** (−23.37)
Undereducation	0.0647 *** (25.79)	0.0686 *** (22.58)	0.0697 *** (15.63)
Part-Full_time	0.0648 *** (24.69)	0.0634 *** (21.24)	0.0604 *** (10.06)
Duration_contract	0.0132 *** (5.00)	−0.0008 (−0.27)	0.0431 *** (9.00)
Responsibility	0.2242 *** (77.76)	0.2286 *** (63.36)	0.2300 *** (48.74)
Laboral_agree	0.0976 *** (43.87)	0.0569 *** (21.44)	0.2061 *** (50.26)
Small enterprise	−0.1471 *** (−66.00)	−0.1360 *** (−47.58)	−0.1538 *** (−43.52)
EU_non-Spanish	0.0669 *** (10.90)	0.0741 *** (9.56)	0.0468 *** (4.81)
Rest_world	−0.0241 (1.28)	0.0560 ** (2.13)	−0.0138 (−0.54)
Sex	0.1453 *** (69.86)	0.1310 *** (53.58)	0.1735 *** (43.35)
Sector	0.1078 ** (47.57)	-	-
Constant	1.5583 *** (266.83)	1.5426 *** (221.17)	1.6939 *** (150.09)
Observations	174.016	118.779	55.237

Source: Own work based on WSS-2018 data. Significance: * 10%; ** 5%; *** 1%. T-values are shown in parentheses. Source: Own work based on WSS-2018 data.

Appendix B

Table A2. Results of the Mean Difference Test of wage differentials by gender.

Variable	t-Statistic
Wage by gender	−53.18 ***

Note: The table shows the t-statistics of the mean difference test. *** significance 1%.

Table A3. Results of the Mean Difference Test of wage differentials by gender and sector.

Variable	Service	Industry
Wage by gender	−45.02 ***	−24.09 ***

Note: The table shows the t-statistics of the mean difference test. *** significance 1%.

Table A4. Results of Chow's test applied to the service and industry samples.

Variable	Sector (Service vs. Industry)
LR Chi^2 (15)	2387.85
p-value	0.000 ***

Note: This table shows the chi^2 statistics and their corresponding *p*-values (Chow tests) between the samples by sectors. *** significance 1%.

Table A5. Results of Chow's test applied to the sample of men and women by sectors.

Variable	Gender in Service (Men vs. Women)	Gender in Industry (Men vs. Women)
LR Chi^2 (14)	882.23	149.83
p-value	0.000 ***	0.000 ***

Note: This table shows the chi^2 statistics and their corresponding *p*-values (Chow tests) between the samples by gender and sectors. *** significance 1%.

Notes

[1] This method is divided into two variants: direct and indirect. In the direct method, workers are asked to classify themselves into one of the three groups (i.e., overeducation, required education, and overeducation). The indirect method compares the workers' level of education with the one they report as needed for the post.

[2] Previous experience (see García-Pozo et al. 2014) is defined as the difference between theoretical worker experience and tenure. Theoretical worker experience was calculated following Mincer (1974): Theoretical experience = Age − Years of formal education − 6.

[3] This variable was defined according to Annex I of the Commission Regulation (EU) 651/2014, which defines the micro, small, and medium enterprise categories. This regulation defines medium enterprises as those with 50 to 249 workers, small enterprises as those with 10 to 49 workers, and micro enterprises as those with less than 10 workers.

[4] The gross data used in this paper were obtained from the four-yearly version of the WSS-2018. We used the statistical software STATA 17 to process these data and generate the variables needed for this work.

[5] When using a semilogarithmic function, the impact on wages of the dummy variables is calculated by taking the antilogarithm of the corresponding coefficient, subtracting 1, and multiplying by 100 (Halvorsen and Palmquist 1980).

[6] The returns to education obtained in this work for this sector are slightly lower that those reported in the literature mentioned above. This may be due to the introduction of other variables such as the position of responsibility. However, this finding does not imply the existence of multicollinearity in the model. Variance inflation factor tests were conducted, finding no serious collinearity problems that could affect the standard errors and coefficients of the model.

[7] The estimated returns to experience and tenure were calculated as follows: ($\beta 2 + 2\beta 3$Experience) and ($\beta 4 + 2\beta 5$Tenure), where Experience and Tenure are the average values of these variables for each group of workers (García-Pozo et al. 2014).

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