Gender wage differentials, educational attainment and educational mismatch: an application to the Spanish case

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Abstract

This paper aims to analyse gender wage differentials in Spain by taking account of levels of educational attainment and studying whether educational mismatch affects the gender wage gap. Focusing on returns to education, evidence is found on the existence of educational mismatch and on its contribution to determine wages, with women suffering greater wage penalties associated to educational mismatch. Furthermore, although the gender wage gap is lower for individuals with low educational levels, we find that the part of this gap due to differences in returns is greater in this group. On the contrary, the gender gap is greater among highly-educated workers, but in this case most of the wage differentials are due to differences in productive characteristics. In any case, our results suggest that gender wage discrimination tends to be greater for those workers showing educational mismatch.

Keywords: Gender wage gap; returns to education; educational mismatch.
JEL codes: I20, I24, J31.

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Abstract

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1. Introduction

The existence of gender wage differentials has been widely documented in most developed countries and the Spanish case represents no exception, with women's earnings being on average lower than men's even when account is taken of differences in productive characteristics[1]. The study of wage differentials by levels of education is often applied to control for individual heterogeneity. As noted by Katz and Murphy

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[1] A comprehensive survey of the literature on the gender wage gap is provided by Blau and Kahn (2000). For a meta-analysis based on 263 articles on gender wage differentials, see also Weichselbaumer and Winter-Ebmer (2005).

(1992), highly- and low-educated workers will access occupations with different skill-contents which will determine different earning capacities, so the interest of analysing wages differentials separately for workers with different levels of education. In Spain, the study by De la Rica et al. (2008) follows this perspective and analyses gender wage differentials throughout the wage distribution for individuals with a level of college/tertiary education and for individuals with a lower level of education. While the gender wage gap is found to be higher at the bottom of the distribution for individuals with lower levels of schooling, the gender gap appears to be greater at the top of the distribution for individuals with higher education[2]. Favaro and Magrini (2008) also study gender differentials in wages by levels of education for the Italian case and find that highly educated women tend to experience lower gender gaps than low-educated women. More recently, Addabbo and Favaro (2011) confirm sharp differences by educational levels and highlight the significant incidence of differences in rewards for highly-educated Italian women. The authors interpret this result as suggesting that the incidence of over-education is greater among highly-educated Italian women and that the pay penalty they suffer compared to their well-matched counterparts is higher than that of men. Educational mismatch and returns to education are however not under analysis in their study. In fact, there is an extensive literature on gender differences in returns to education and on educational mismatch, but the question of whether educational mismatch affects the gender wage gap has not attracted the attention of the literature on gender differentials to date.

We aim to contribute to this literature analysing gender wage differentials in Spain by taking into account workers' educational attainment and educational

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[2] This result is in accordance with the 'glass ceiling' hypothesis, which implies that gender differences in pay not explained by the employees' qualifications or other job-relevant characteristics are stronger at the top of the distribution (Albrecht et al. 2003).

mismatch. Although recognizing other sources of wage differentials by gender (e.g. gender segregation by sector, industry or/and occupation, experience, or gender heterogeneity in preferences), in this study we will focus on levels of attained education and on the match degree between education acquired by workers and that required by their jobs. Under the standard approach, wage differentials are usually decomposed into differences in productive characteristics (e.g. differences in levels of education) and differences in returns associated with these characteristics (e.g. differences in the effects of education on earnings). In the past, part of the gender wage gap in Spain could be attributed to the lower levels of education acquired by women, but in recent decades women have progressively increased their education levels and have become a majority in higher education, so gender wage differentials may hardly be explained by differences in education at the current time. Nevertheless, different rewards to education by gender may still contribute to gender wage differentials. Moreover, the contribution of differences in returns to the gender gap could be even more relevant if educational mismatch affects women and men to different extents and if returns to over- (under-) education differ depending either on gender or on educational attainments.

On these bases we first examine the incidence of educational mismatch and then we estimate the returns to education for women and men separately in order to allow for different returns by gender. Returns to education are estimated both for actual years of schooling, thus following the theoretical framework proposed by Mincer (1974), and for years of required, over- and under-education, thus applying the ORU specifications proposed by Duncan and Hoffman (1981). Next, we will analyse to which extent gender differences in returns contribute to the gender wage gap. To this end we follow the Blinder (1973) and Oaxaca (1973) decomposition to break down the gender wage gap

into a part explained by differences in productive characteristics and a part due to different returns to such characteristics.

The structure of the remainder of the paper is as follows. Section 2 offers a brief review of the literature on returns to education and educational mismatch. Section 3 presents the data and the estimates for educational mismatch by gender and levels of education. Section 4 focuses on the analysis of returns to education in Spain for year 2006, paying special attention to differences by gender and to the match between attained and required education. Section 5 evaluates gender wage differentials by both educational attainments and educational mismatch. Finally, the paper closes with the main findings and conclusions of this study.

2. Returns to education and educational mismatch

In the framework of the human capital theory, education is a key variable to determine individual productivity and therefore wages. The empirical approach to asses this prediction was developed by Mincer (1974) and bases on an earnings equation where years of schooling are central to explain wages (together with experience and other control variables). Within this framework marginal productivity is determined by labour supply and overeducation appears as an inconsistent long-term outcome since it would be associated with the underutilization of workers' human capital. As opposed, the job-competition model (Thurow, 1975) focuses on the demand side and suggests that job characteristics are the main factor determining earnings. Workers compete for high-wage jobs, and education (and even surplus education) contribute to preserve an individual's position within a particular job queue. Nevertheless, once individuals are allocated into jobs, the marginal productivity is determined by job characteristics, so returns to surplus education (i.e. education in excess of that required for a particular job)

will be zero. The assignment model (Sattinger, 1993) provides a middle ground between these opposite views by arguing that workers' marginal productivity, and consequently wages, depends on both the demand and supply sides of the labour market, being determined in part by job characteristics (e.g. required education) and in part by individual characteristics (e.g. acquired education) [3].

The empirical literature on the wage effects of educational mismatch started with the seminal paper by Duncan and Hoffman (1981), where a distinction was made between the individuals' educational attainments and the requirements of their jobs. Returns to education were then estimated for both years of required education and years of surplus (or deficit) education. As noted by Hartog (2000), this approach proved to be attractive mainly for two reasons: first, because of its simplicity, with a straightforward specification, easy to estimate and clear to interpret; and second, because of the link established between the demand and supply sides of the labour market, allowing for different allocation processes which lead to evident differentials in returns depending not only on levels of schooling but on jobs' characteristics.

In order to take account of the demand and supply sides of the labour market, it becomes necessary to previously estimate the match degree between the workers' level of educational attainment and that required for their job. Different measures of educational mismatch have been proposed in the literature and are generally grouped into objective, subjective, and statistical measures. Objective measures are based on the analysis of job characteristics, with individuals' characteristics being then compared to job requirements; subjective measures base on information provided by the workers themselves about some personal and job-related characteristics; and statistical measures compare the worker's educational level with that of other workers doing a similar job,

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[3] A good review of the literature on overeducation as regards different theoretical frameworks can be found in McGuinness (2006).

taking as reference the statistical mean or the modal value of the distribution[4]. Each of these measures shows advantages and disadvantages both methodologically and in the conditions needed for their implementation. Furthermore, there is no clear preference for the use of one or other measure in the empirical literature and the choice is usually determined by data availability. In any case, as emphasized by Hartog (2000), results obtained in different studies that estimate returns to years of over- (under-) education tend to be consistent regardless of the measure used to estimate educational mismatch.

Among the empirical results, there is broad consensus on the negative effects of educational mismatch on wages, with returns to years of undereducation being negative whereas returns to years of overeducation tend to be positive but smaller than those to years of required education. It is hence generally found that wages earned by an undereducated worker are lower than those earned by co-workers with an educational level in accordance with their job while overeducated workers get indeed higher wages, although below the average expected given their educational level[5]. Moreover, it also stands out that over- (under-) educated workers tend to receive lower (higher) wages than those they would have get in a job for which they were adequately educated[6]. Finally, when the focus is placed on gender differences in returns, we find that the empirical evidence is mixed. On the one hand, some works suggest that the negative effects of educational mismatch on workers´ earnings are greater in the case of men (Dolton and Vignoles, 2000, for the UK; Daly et al., 2000, for Germany; Ren and

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[4] For example, Verdugo and Verdugo (1989) consider that workers are over- (under-) educated when years of formal education exceed (are below) in more than one standard deviation the mean value of a particular job. Alternatively, Kiker et al. (1997) propose the use of the modal value, arguing that this statistic is less sensitive to the existence of outliers in the distribution.

[5] See for example Hartog and Oosterbeek (1988) for the Netherlands; Daly et al. (2000) for USA and Germany; Cohn and Ng (2000) for Hong Kong; Ren and Miller (2011) for China; or Alba-Ramírez (1993) and Budría and Moro-Egido (2008) for the Spanish case.

[6] Kiker et al. (1997) for Portugal; Di Pietro and Urwin (2006) for Italy; Groot (1996) and Dolton and Silles (2008) for UK; or Cohn and Khan (1995) and Tsai (2010) for USA.

Miller, 2011, for China) whereas, on the other, different studies point to the opposite result, with women being more penalized by educational mismatch than men do (Cohn and Ng, 2000, for Hong Kong; or Budría and Moro-Egido, 2009, for the Spanish and German cases).

3. Data and descriptive analysis

Data used in this study come from the last available wave of the Spanish Wage Structure Survey (hereafter WSS), which refer to year 2006. This survey is conducted by the Spanish National Institute of Statistics as part of a European project providing harmonized four-year-period information on the structure and distribution of wages. The WSS offers a comprehensive matched employer-employee data set. Variables referred to workers include monetary pay, gender, age, education, occupation, working hours, supervisory tasks, type of contract (permanent or temporary) and full-/part-time status. Firm related variables provide information on the activity sector, size, public/private ownership and location by region. The sample used in this paper is restricted to workers aged 16-65 and contains 118,996 men and 69,519 women.

The earnings measure used in this study is the gross hourly wage. Looking at education, the database provides information on the highest educational level completed by workers, with years of schooling being proxied in the present study by the theoretical years of schooling required to complete that educational level[7]. Finally, given that the WSS does not include the individual's actual experience in the labour market, the potential experience (age minus years of schooling minus six) is used as proxy.

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[7] In particular we work with seven educational levels (grouped into three broad categories for the sake of presentation): primary education, first stage secondary education and upper secondary education (these three educational levels correspond to 'up to secondary education'); middle-grade vocational training and upper-grade vocational training (grouped as 'vocational training'); and short-cycle university and long-cycle university ('higher education').

More than sixty occupations corresponding to the two-digit occupational code proposed by the National Occupational Classification-1994 are considered when estimating educational (mis)match. A modal-based statistical measure is used to estimate years of required, over- and under-schooling[8]. Years of required education (S_r) correspond to the modal value of years of schooling for those individuals who are appropriately educated in each occupation whereas years of over- and under-education (S_o and S_u) are given by the difference between the actual years of schooling and the modal value in each occupation for over- and under-educated workers, respectively.

Table 1. Descriptive statistics by gender and educational mismatch

	Men				Women			
	Total	Required education	Over-education	Under-education	Total	Required education	Over-education	Under-education
No. Obs.	118996	49230	44475	25291	69519	32706	24063	12750
(%)	(100)	(41.37)	(37.38)	(21.25)	(100)	(47.05)	(34.61)	(18.34)
Gross hourly wage	13.93	14.42	13.07	14.50	11.23	12.07	10.67	10.14
Years of schooling	10.74	10.37	12.84	7.78	11.92	11.85	13.95	8.27
Potential experience	22.53	23.21	18.61	28.09	19.23	20.18	15.63	24.04
Educational distribution	100	100	100	100	100	100	100	100
Up to secondary	66.85	74.45	44.77	90.87	52.91	53.73	32.80	88.78
Vocational Training	15.81	6.28	32.48	5.05	17.97	16.15	27.05	5.51
Higher education	17.34	19.27	22.75	4.08	29.12	30.12	40.16	5.72

Source: Wage Structure Survey (2006) and own elaboration.

Table 1 offers descriptive statistics on wages, schooling, experience and educational mismatch. It can be observed that gross hourly wages are higher for men, with women's wages being on average around 80% of those earned by their male counterparts. Nevertheless, some differences appear when account is taken of educational mismatch, with a female-to-male earnings ratio of 83.7% for workers with the required education whereas this ratio does not reach 70% in the case of undereducated workers. A priori, gender wage differentials do not respond to

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[8] Other studies using this same measure of educational mismatch are those by Kiker *et al.* (1997), Cohn & Ng (2000), Mendes de Oliveira *et al.* (2000), and Bauer (2002).

differences in education since years of schooling are on average greater for women in more than one year, this being so for the sample as a whole and when educational mismatch is taken into account (only in the case of undereducated workers the difference in years of schooling is slightly lower, even if women continue to show more years of schooling than men do). Moreover, looking at the educational distribution we observe that the percentage of women with higher education exceeds the corresponding value of men in more than 11 p.p. Nonetheless, differences in other productive characteristics such as experience in the labour market, which is higher in the case of men (on average, men's experience is more than three years greater than that of women), could lay behind gender wage differentials.

Focusing on educational mismatch, we observe that women are more likely to have educational attainments that match the requirements of their jobs (Table 1). In particular, 47% of women are appropriately educated for their job whereas this percentage rises to 41% in the case of men. On the other hand, educational mismatch affects a large proportion of workers, most of them being overeducated (37.4% in the case of men and 34.6% in the case of women). Looking at the distribution by levels of education, we observe that most of the workers who are appropriately educated show an educational attainment up to secondary education (74.4% of men and 53.7% of women) although the percentage of women with the required education is also high for those women with a university degree (30%). Among the overeducated workers, some significant differences by gender appear. Most of the overeducated women show a level of higher education whereas, in the case of men, almost 43% of the overeducated workers are low-educated, thus showing a level of secondary education when the requirements of their job correspond to a level of primary schooling. It is also worth noting that the percentage of overeducated workers with higher education is relatively

low in the case of men, being 17 p.p. lower than that corresponding to overeducated women. Finally, as expected, most of the undereducated workers (males and females) show low levels of education, with around 90% of them having an educational attainment of primary or secondary education.

4. Analysis of returns to education in Spain by gender and educational attainment

The standard model to estimate returns to education comes from the empirical framework proposed by Mincer (1974) and bases on an earnings equation of the following type:

$$\ln(w_i) = \alpha + \beta S_i + \gamma E_i + \delta E_i^2 + \lambda X_i + u_i \tag{1}$$

where wages (*w*) are explained by years of attained school (*S*), experience in the labour market (*E*) and its square (E^2), a vector of controls (X_i), and a random variable (*u*).

When educational mismatch is taken into account this specification varies slightly as years of schooling are decomposed into years of required-schooling (S_r), years of over-schooling (S_o), and years of under-schooling (S_u). This specification was proposed by Duncan and Hoffman (1981) and is generally known as the ORU (Over-, Required-, Under-educated) equation:

$$\ln(w_i) = \alpha + \beta_o S_{oi} + \beta_r S_{ri} + \beta_u S_{ui} + \gamma E_i + \delta E_i^2 + \lambda X_i + u_i \tag{2}$$

In this specification, β_r gives the return to an additional year of job-required education whereas β_o and β_u show the returns to an additional year of over- and under-education respectively. Within this framework workers showing education mismatch are compared to other workers doing a similar job and who achieve a proper match between the required and their actual education. This form of the wage equation has the advantage of allowing one to quantify the returns to years of over-, job-required and

under-schooling separately, rather than having to settle for a single overall return to years of education.

It is noteworthy that whereas in equation (1) the education variable (i.e. actual years of schooling) refers to the individual's characteristics and therefore to the supply side of the labour market, in equation (2) we find variables referred to both the demand and supply sides, with wages being determined by job-required education and by deviations between the supply and the demand of qualifications (years of over- and under-schooling). This allows one to test for some predictions coming from different theoretical frameworks: if $\beta_r = \beta_o = \beta_u$ cannot be rejected, workers productivity would be solely explained by their actual decisions on schooling, as predicted within the framework of the human capital theory; conversely, if $\beta_o = \beta_u = 0$, workers productivity would be fully determined by the requirements of their job, giving hence support to the job-competition model; finally, if neither hypothesis is accepted, this would imply that educational mismatch occurs ($\beta_r \neq \beta_o \neq \beta_u$) and allows to explain wages, thus supporting the assignment views of the labour market.

Equations (1) and (2) are estimated for our Spanish sample of workers in year 2006. All regressions are run for men and women separately and control for full-/part-time status, type of contract, supervisory tasks, firm size, industry, public/private ownership and region. The Chow tests indicate that estimates for men and women are significantly different. Furthermore, the F-tests show that all variables are jointly significant. Finally, evidence is found on the existence of educational mismatch and on its contribution to determine wages, with both individual and job characteristics playing a role in the determination of earnings, so giving support to the assignment models[9].

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[9] Similar results supporting the assignment view are found in Groot (1996), Sloane et al. (1999) or Dolton and Vignoles (2000) for the United Kingdom or in Kiker et al. (1997) for the case of Portugal.

Table 2 offers a summary of the results, showing the estimated returns to education when actual years of schooling are considered and when account is taken of educational mismatch. These results are shown for the sample as a whole and by levels of educational attainment. On average, returns to education tend to be higher for women than for men, with each additional year of actual schooling giving rise to 5.4% returns in the case of women whereas this percentage only reach 4.8% in the case of men. Private returns to education increase when moving from low to higher levels of education, going from 2.2% for men with a level up to secondary education to 4.1% for men with vocational training studies and 6.8% in the case of men with higher education (returns to education for women follow a similar pattern, being around 0.7-0.8 p.p. higher for women either with a level of up to secondary education or with vocational training and slightly lower than returns for men in the case of higher education).

However, some significant differences appear when educational mismatch is taken into account. Even though returns to education are found to be higher for years of required schooling than for actual schooling, the aforementioned patterns are maintained, with returns to years of required education being higher for women than for men (with the only exception of workers with higher education) and increasing with the level of educational attainment. Nevertheless, we find that returns to years of educational mismatch are in favour of men. Returns to years of schooling in excess of those required by a job tend to be half those for required years of schooling, with men obtaining higher returns to years of surplus education than women do. On the other hand, returns to years of underschooling tend to be negative, with women suffering greater penalties for each year of undereducation than their male counterparts. Thus, although returns to years of required education are higher for women, we find that

women suffer to a greater extent the earnings losses associated with educational mismatch[10].

Table 2. Estimated returns on education

	Total		Up to secondary		Vocational training		Higher education	
	Men	Women	Men	Women	Men	Women	Men	Women
i) Micerian model								
Actual years of schooling	4.79*	5.39*	2.23*	2.90*	4.12*	4.96*	6.76*	5.92*
	(0.0003)	(0.0004)	(0.0005)	(0.0007)	(0.0024)	(0.0029)	(0.0021)	(0.0018)
R-squared	0.48	0.49	0.38	0.34	0.42	0.38	0.43	0.39
F-statistic	4848.75*	2869.18*	2151.33*	819.84*	581.82*	337.86*	685.97*	572.53*
ii) ORU model								
Years of required schooling	7.07*	8.02*	4.57*	5.42*	5.33*	6.90*	9.63*	8.51*
	(0.0004)	(0.0005)	(0.0006)	(0.0009)	(0.0024)	(0.0031)	(0.0021)	(0.0018)
Years of overschooling	3.57*	3.42*	2.45*	2.37*	4.08*	4.14*	4.82*	3.33*
	(0.0005)	(0.0006)	(0.0007)	(0.0011)	(0.0024)	(0.0028)	(0.0021)	(0.0019)
Years of underschooling	-2.97*	-3.66*	-1.13*	-2.26*	1.71*	0.16	-2.36*	-4.47*
	(0.0006)	(0.0008)	(0.0007)	(0.0009)	(0.0038)	(0.0059)	(0.0044)	(0.0046)
R-squared	0.52	0.53	0.41	0.37	0.44	0.41	0.50	0.46
F-statistic	5174.38*	3169.39*	2201.91*	865.04*	595.84*	347.18*	819.15*	682.98*
F-test (H_0: $\beta r = \beta o = \beta u$)	7656.92*	6461.19*	1051.36*	1167.05*	75.48*	120.93*	1181.98*	1167.60*
F-test (H_0: $\beta o = \beta u = 0$)	4165.89*	2691.85*	592.87*	483.68*	240.56*	125.45*	247.02*	178.74*

* Significant at the 1% confidence level. Standard errors between brackets.

5. Decomposing the gender wage gap in Spain: the role of education and educational mismatch

The standard approach to analyse differences in wages was developed by Blinder (1973) and Oaxaca (1973). Within this framework wages differentials are decomposed into a part driven by differences in productivity and a residual or unexplained part that is often interpreted as a discrimination effect[11]. Wage differentials are hence analysed by comparing wages for equally productive workers so that the wage ratio between two groups of individuals (in our case, men and women) would be equal, in absence of discrimination, to the ratio of their respective productivities. This procedure requires the

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[10] Similar results are found in Cohn and Ng (2000) for Hong Kong and in Budría and Moro-Egido (2009) for the cases of Spain and Germany.

[11] The expressions 'unexplained part' or 'discrimination' are used indistinctly throughout this paper to refer to the unexplained residual. An interesting discussion on the use of these expressions on the gender wage gap literature can be found in Weichselbaumer and Winter-Ebmer (2006).

estimation of separate earnings equations for male and female conditional on human capital characteristics, thus allowing productive characteristics to be differently rewarded. In order to do this, two standard wage equations are estimated, one for each gender group:

$$\ln(w_i) = \beta Z_i' + u_i \tag{3}$$

where w_i is the individual hourly wage, Z_i' is a vector of individual characteristics, and u_i is a random error term.

The raw wage gap is then decomposed into an explained part, which is due to differences in mean productive characteristics (proxied by observable variables such as education, experience, or industry, among others) and an unexplained part, which is due to different returns to such characteristics. The total difference in mean wages of male and female workers is decomposed as follows:

$$\overline{\ln(w_m)} - \overline{\ln(w_w)} = (\overline{Z_m'} - \overline{Z_w'})' \hat{\beta}_m + (\hat{\beta}_m - \hat{\beta}_w)\overline{Z_w'} \tag{4}$$

where the upper bar indicates the mean of the variables, $\hat{\beta}$ are the estimated parameters from equation (3), and subscripts m and w refer to men and women respectively. The first term on the right-side measures the component of the wage differential due to the differences in the mean of the explanatory variables (i.e. the explained part) whereas the second term stands for the part of the wage gap that is interpreted as discrimination (i.e. the unexplained part) since it refers to differences in market rewards to productive characteristics of male and female workers[12].

The Blinder-Oaxaca decomposition results are provided in Table 3. Results are shown for the sample as a whole and by levels of educational attainment. En each case, we provide the estimates for the total sample and for the sub-samples of workers who

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[12] In line with most of the empirical literature we assume men wages as being the non-discriminatory structure, so male and female characteristics would be paid at men prices in absence of discrimination.

achieve an educational level matching the requirements of their jobs and for those who are over- or under-educated. Overall, we find that gender differences in productive characteristics account for a minor part of wages differentials whereas the largest proportion of the gender wage gap is due to different returns to productive characteristics. In particular, focusing on the whole sample it is found that the unexplained part accounts, on average, for 90.6% of the gender wage differentials. When educational (mis)match is taken into account, the explained part is even negative for the sample of workers with the required education, thus indicating that women's productive characteristics are better than those of men and consequently individual characteristics do not contribute to explain the gender wage gap. In fact, if women had similar productive characteristics to those of men, the gender wage gap would be even greater. The unexplained part reach then a value greater than 100% since differences in returns account for the entire gender gap and even compensate for the better productive endowments of women.

By levels of educational attainment, differences in returns also account for most of the gender wage gap in the sub-sample of individuals who achieve a level up to secondary education (e.g, the unexplained part accounts for between 66.3% for the undereducated workers and 82.2% for workers with the required education) whereas the percentage of gender wage differentials explained by differences in productive characteristics is higher for individuals with vocational training studies (on average, 44.3% of the gender gap is explained by differences in productive characteristics) and mainly for individuals with higher education (where individual characteristics explain almost 80% of the gender gap for those individuals who are properly educated).

Analysing which characteristics contribute the most to explain gender wage differentials, we find that years of schooling, experience and industry are the main

factors behind explained wage differentials, with other variables accounting for a minor part of the gender wage gap. In fact, years of schooling tend to negatively contribute to gender wage differentials, thus suggesting that if women had similar schooling characteristics than men, the gender gap would be greater. Nevertheless, gender differences in experience and industry compensate for differences in schooling and account for most of the gender wage gap explained by differences in characteristics. Moreover, in the cases of workers with vocational training and higher education, it is found that the part explained by other variables such as working full-time, having a permanent contract or being supervisor also account for a significant part of gender wage differentials.

Table 3. Blinder-Oaxaca decomposition

	Wages (in log) differential	Explained part (%)	Unexplained part (%)	Raw wage ratio	Predicted wage ratio	Predicted wage ratio (without discrimin.)	Discrimi-nation
i) Whole sample							
Total	0.1969 (0.0023)	0.0184 (0.0020)	0.1785 (0.0021)	80.62%	82.13%	98.33%	16.20%
		9.35%	90.65%				
Adequated	0.1490 (0.0037)	-0.0191 (0.0034)	0.1681 (0.0032)	83.70%	86.16%	101.78%	15.62%
		-12.83%	112.83%				
Overeducated	0.1982 (0.0035)	0.0228 (0.0030)	0.1754 (0.0032)	81.64%	82.02%	97.93%	15.91%
		11.52%	88.48%				
Undereducated	0.3203 (0.0052)	0.1108 (0.0045)	0.2094 (0.0046)	69.93%	72.60%	90.52%	17.92%
		34.60%	65.40%				
ii) Up to secondary							
Total	0.2486 (0.0024)	0.0622 (0.0023)	0.1864 (0.0026)	76.43%	77.98%	94.49%	16.51%
		25.02%	74.98%				
Adequated	0.2128 (0.0035)	0.0378 (0.0033)	0.1749 (0.0038)	80.32%	80.83%	96.59%	15.76%
		17.78%	82.22%				
Overeducated	0.2432 (0.0042)	0.0686 (0.0044)	0.1746 (0.0051)	76.67%	78.41%	93.90%	15.50%
		28.24%	71.76%				
Undereducated	0.3208 (0.0051)	0.1082 (0.0043)	0.2126 (0.0047)	69.96%	72.56%	90.74%	18.19%
		33.73%	66.27%				
iii) Vocational training							
Total	0.3119 (0.0046)	0.1381 (0.0050)	0.1739 (0.0054)	72.20%	73.20%	88.14%	14.94%

		44.26%	55.74%				
Adequated	0.3598	0.2284	0.1314	67.42%	69.78%	80.81%	11.03%
	(0.0096)	(0.0114)	(0.0118)				
		63.49%	36.51%				
Overeducated	0.2872	0.0902	0.1970	75.17%	75.03%	92.16%	17.13%
	(0.0058)	(0.0052)	(0.0060)				
		31.39%	68.61%				
Undereducated	0.4838	0.3390	0.1448	61.16%	61.64%	73.12%	11.48%
	(0.0240)	(0.0245)	(0.0243)				
		70.07%	29.93%				
iv) Higher education							
Total	0.2788	0.1613	0.1174	71.74%	75.67%	85.92%	10.25%
	(0.0051)	(0.0043)	(0.0047)				
		57.86%	42.14%				
Adequated	0.2852	0.2269	0.0583	70.23%	75.19%	80.26%	5.07%
	(0.0071)	(0.0068)	(0.0070)				
		79.55%	20.45%				
Overeducated	0.2670	0.1330	0.1340	74.62%	76.57%	88.33%	11.76%
	(0.0069)	(0.0053)	(0.0061)				
		49.82%	50.18%				
Undereducated*							

Standard errors between brackets. * Estimations for undereducated workers with higher education are not run because zero variance is encountered for the schooling variable.

Focusing on the unexplained part, we can take account of differences in returns to construct counterfactual wages without discrimination (i.e. women's wages assuming that their productive characteristics are rewarded at men's prices). In order to do this, we add the part of the wage differentials which are due to differences in returns to women's wages. The right-hand side of Table 3 provides information on the raw and predicted wage ratios, on the predicted wage ratio in absence of discrimination and on the difference between the predicted ratios with and without discrimination (i.e. the discriminatory part). Little differences are found between the raw and the predicted wage ratios, showing that our estimates provide a good fit to observed wages. Gender wage gaps present a wide variability across the different sub-samples. On average, women earn about 80%-82% of men's wages, but the gender gap tend to be greater when one considers the sub-samples of undereducated workers (e.g. around 70% for the sample as a whole and for workers with up to secondary education, and around 62% for

workers with vocational training studies). In the case of workers with higher education, we find similar gender gaps regardless of whether educational mismatch is taken into account or not, with women's earnings being around 75% of men's wages.

A different picture is drawn when account is taken of gender differences in returns and the female-male wage ratios are estimated assuming that women's characteristics get similar returns to those of men. Looking at the whole sample of workers, it stands out that paying women's productive characteristics at men's prices would lead gender wage differentials to almost disappear. Thus, in absence of discrimination women would earn on average around 98% of men's wages, or put in another way, around 16% of men's wages are not received by women due to discrimination. When we focus on workers with the required education we see that, given the productive characteristics of women who attained an educational level matching the requirements of their job and assuming no gender differences in returns, women's wages would be even greater than those earned by their male counterparts. On the other hand, when the focus is placed on workers showing educational mismatch we find that discrimination is slightly higher, reaching nearly 18% in the case of the undereducated workers. By levels of educational attainment, a very similar pattern to that of the whole sample is found for the sample of workers with a level up to secondary education, so we do not expand herein on our comments. In the sub-sample of workers with vocational training studies, we find that the female-male wage ratio stand between 62% for undereducated workers, 70% for workers with the required education, and 75% for workers with a level of education above that required in their jobs. Nevertheless, when we assume that women characteristics are rewarded at men's prices these ratios raise to 73%, 81% and 92%, respectively. That is, discrimination accounts for 11 p.p for workers with the required education and for undereducated workers whereas it accounts

for 17 p.p. in the case of overeducated workers. Finally, as it was mentioned above, workers with higher education show a female-male wage ratio around 75%. Nevertheless, when we control for differences in returns we find that, if women's characteristics had similar returns to those of their male counterparts, the wage ratio will raise to 80% for workers with the required education and to 86% for overeducated workers.

In sum, it is found that whereas the gender gap tend to be lower for individuals with low educational levels (up to secondary education) the part due to discrimination is greater in this group. On the contrary, among the highly educated workers the gender wage gap is slightly higher, but this gap is to a greater extent due to differences in productive characteristics. In any case, the results suggest that wage discrimination is greater for those individuals showing educational mismatch, in particular for the undereducated workers among those with a level up to secondary education and for the overeducated workers among those with vocational training studies and with higher education, where discrimination for overeducated workers is found to double that of workers with the required education.

6. Conclusions

In this paper, we have analysed gender wage differentials in Spain by taking account of workers' educational attainment and educational mismatch. Looking at both the education level acquired by workers and that required by their jobs, we first estimated the incidence of educational mismatch, finding that a large proportion of workers (women and men) are over- or under-educated, with less than 50% showing a proper match. We then estimated returns to education by gender and levels of education and evidence was found on the existence of educational mismatch and on its

contribution to determine wages, thus supporting the assignment views for the Spanish labour market. As expected, returns to education proved to increase when moving from low to higher levels of education. Moreover, returns to years of overschooling were found to be positive, but lower than returns to years of required education, whereas negative returns were found for years of deficit education. By gender, women get higher returns to years of actual or required schooling than men (with the only exception of highly educated workers), but years of educational mismatch seem to penalize women's returns to a greater extent, with men getting higher returns to years of surplus education and lower penalties for years of deficit schooling than women do.

Women's earnings in Spain are around 80% of men's wages, but the female-to-male earnings ratio is even lower among highly-educated workers and among workers showing educational mismatch, so the interest of analysing gender wage differentials by both levels of educational attainment and the match degree between acquired and required education. On average, women show more years of schooling than men do, so gender wage differentials do not respond to differences in education. In fact, when wage differentials are decomposed into a part explained by differences in productive characteristics and a part due to differences in returns, we find that the contribution of years of schooling to the gender gap is negative, but gender differences in experience and in the industries where women and men work compensate the better women's endowments of schooling and explain part of the gender gap. Nevertheless, we find that a significant part of gender wage differentials is not explained by differences in individuals' characteristics but by differences in returns, this being so mainly among the less educated workers. Moreover, women's greater penalties to educational mismatch translate into greater differences in returns among workers showing educational mismatch, with the part of the gender wage gap due to differences in returns being

greater, regardless of the level of educational attainment, among workers with deficit or surplus education.

Finally, by levels of educational attainment, it stands out that whereas the gender wage gap is lower among low-educated workers, differences in productive characteristics explain little of this gap, with most of the wage differentials being due to differences in returns. In particular, for workers with a level up to secondary education we find that, if women's productive characteristics were rewarded at men's prices, the female-to-male earnings ratio would rise to more than 90% for undereducated workers and to near 97% for workers with the required education. On the contrary, greater wage differentials are found among highly-educated workers, but in this case most of the earnings gap is due to differences in productive characteristics. Hence, even if women's characteristics were paid at men's price, the female-to-male earnings ratio would only rise from 75% to 80% in the case of adequately educated workers. Moreover, it is worthy to note that, together with experience and industry, other variables such as working full- or part-time, having a permanent contract, or holding positions with supervisory tasks, are the main factors behind these gender wage differentials. Thus, some forms of discrimination other than differences in returns could be at play. Nevertheless, gender differences in working status or supervisory positions could also respond to gender differences in preferences, so further research would be needed to clarify the factors behind the greater gender wage gap among highly educated workers.

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