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Education and gender wage differentials in Portugal: what can we learn from an age cohort analysis?

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Important changes characterize the recent evolution of the schooling of workers in Portugal. The purpose of this paper is to investigate the consequences of those changes in the gender wage gap. In particular, we analyze and compare the way that this process has evolved in the groups of young workers and older workers. Our findings suggest that the major part of the pay gap refers to employer discrimination practices for both age group cohorts: in the case of the younger workers, discrimination plays an increasing role in explaining the wage gap; whereas for the older workers, discrimination remains stable over time.

Keywords: labor market; discrimination; salary wage differentials

1. Introduction

The Portuguese labor market may be considered an interesting case in the European Union context, for two reasons: the low average schooling of workers, and the high female participation rate. Regarding the former, average schooling is one of the lowest when compared with other European countries. In 2005 the working-age population with nine years of education or less was 72.8% for Portugal, whereas for the European Union (EU25) this percentage only stood at 32.8 (European Commission 2006a). Only Malta had a similar profile regarding the educational attainment of its working-age education (in 2005, 73% of the population aged from 15 to 64 years had nine years of education or less). Following are Spain and Italy, although further ahead, with values of 51.9% and 50.7%, respectively. All the other EU25 countries performed clearly better on education indicators. However, very significant efforts have been taken since the early 1970s towards an increase of the educational attainment of workers. The educational system has gone through profound changes, including an expansion of compulsory schooling (from six years for individuals who entered the school system in 1969, to nine years for those who entered in 1986), the reform of the secondary school curricula, and the extension of the university system. Also, non-formal education has had a more visible role in labor market policies; namely through increasing investments in training, particularly after Portugal's entrance to the European Community in 1986.

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These educational policies, although improving the average education of both men and women, have favored the latter, increasing the already existent gender educational gap. In 2005, among the population aged 15–64 years, 13.1% of females held a college degree whereas only 8.7% of males held such a degree (in the EU25, for the same year, these percentages were 19.9% for both groups) (European Commission 2006a).

As to the second reason, Portugal is a country where the female participation rate is high as compared with the other EU25 member-states, and particularly compared with the other southern European countries. In 2005 the female participation rate was 67.9%, almost five percentage points above that of the EU25, while the average value for Spain, Italy and Greece stood at 54.4% (European Commission 2006a).

Notwithstanding the notable investment in education made by females and their high engagement in the labor market, our research on gender wage differentials for Portugal reveals strong evidence of a persistent wage gap between male and female workers (Kiker and Santos 1991; González, Santos, and Santos 2005).

The role of discrimination as a source of male–female wage differentials is in line with an extensive body of literature on the issue. Following the seminal work of Oaxaca (1973), the most important feature of the numerous empirical studies on this matter has been the evidence of a certain extent of discrimination against female workers. This finding has been pervasive in most of the studies using different estimation methodologies and data-sets, although the proportion attributed to discrimination differs and the sources of the gender gap vary (see, for example, Cotton 1988; Neumark 1988; Oaxaca and Ransom 1994; Plasman et al. 2001; Rubery, Grimshaw, and Figueiredo 2002).

Despite the robustness of our findings on the effective importance of wage discrimination practices, further investigation is needed on the effects of changes in the supply of educated workers to explain the gender wage gap. The investment in education made by females is perceived as inducing a wage gap reduction, especially felt among the younger generation as compared with the older one. It is expected that the profiles of younger males and females regarding their level of education will converge contributing to such reduction.

According to the above we can expect that the educational reforms affect diversely different cohorts of workers. Therefore, a deeper understanding of the reasons involved in the explanation of the gender wage gap requires a separate analysis of the extent of discrimination for the younger and older cohorts of workers. The use of global data, as has been the procedure in similar studies, is somewhat limited since it can hide significant differences between the two referred to groups of workers, either regarding the part of the gap that can be explained by the diversity of characteristics of workers and jobs (endowment effect) or regarding the unexplained part of that gap (discrimination effect).

In this study we apply wage decomposition techniques to analyze the gender wage gap in Portugal, following the Oaxaca methodology and employing the Neumark decomposition method. To distinguish the impact of the policy reforms across cohorts of workers, we analyze, separately, young workers (defined as those aged 15–34 years) and older ones (workers aged 35 years and older) using a large data-set of Portuguese workers for the period 1991–2005. The focus of the paper on this period allows us to investigate more deeply the effects of educational reforms on the evolution of the gender wage gap in the Portuguese labor market.

The choice of the age cohorts of workers used in this study deserves an explanation as other possibilities of grouping population by age could have been used. As we can

Table 1. Educational attainment, by age group.

	< 25 years	25–34 years	35–44 years	45–54 years	>= 55 years
Educational attainment (%)					
Less than 4 years	0.5	0.8	1.6	2.6	4.6
4 years	6.4	10.1	25.3	45.6	58.0
6 years	21.3	23.1	26.9	17.9	12.0
9 years	40.0	22.5	18.3	16.0	12.1
12 years	27.3	25.0	17.5	11.2	6.6
14 years	1.0	3.9	2.5	1.7	1.7
College degree	3.5	14.6	7.9	5.1	5.0

observe in Table 1, there is a clear change of the education profile of Portuguese workers precisely amongst the groups aged younger than and older than 35 years. The majority of workers aged less than 35 years (both male and female) had nine years of education or more while the majority of workers aged 35 years or older (both male and female) had, in average terms in 2005, only six years of education or less. Also the percentage of workers holding a college degree for the group of the workers aged 25–35 years almost doubles that in the group of those aged 35 years or older. This pattern seems to be supportive of the chosen criterion to split the sample.

The results of our analysis show that the gender wage gap remained quite stable for the older cohorts while it substantially decreased for the younger ones. Results appear to corroborate that shifts in the supply of skills, especially advantageous to women, have had positive effects in narrowing the wage gap for the younger cohorts rather than for the older ones. Also, the finding that the role of discrimination in explaining such a gap has increased over time for the younger workers whereas it remained stable over time for the older workers seems to be supportive of the methodology used in this work.

The paper is organized as follows. In Section 2, we briefly present the data and point out some major changes regarding educational attainment that characterized the Portuguese labor market during the period from 1991 to 2005. Section 3 presents the model used. In Section 4, we present and discuss the results of the decomposition of the gender pay gap for the two age group cohorts using the Neumark methodology. In Section 5, we present our concluding remarks.

2. The data

In the present work we use data from the personnel records database (*Quadros de Pessoal*), an administrative data-set collected annually by the Portuguese Ministry of Employment. This data-set provides information on workers' attributes – such as gender, age, education, occupation, qualification level, years with the firm, hours worked and earnings – and job-related attributes –such as type of industry, geographic location and plant size. Response to the questionnaire is mandatory for all private-sector firms with at least one employee.[1]

Table 2 summarizes the educational workforce characteristics for the whole working population and for the two age groups considered. As expected, the share of women is higher in the younger cohort than in the older one (46.8% against 43.0% in 2005, and 43.3% against 31.0% in 1991). Also, the relative amount of women

Table 2. Educational workforce characteristics, by age group and gender.

	Less than 35			35 and more			Pooled		
Year 1991	Male	Female	All	Male	Female	All	Male	Female	All
School (average, in years)	6.46	6.81	6.61	5.54	5.48	5.52	5.96	6.26	6.07
Educational attainment (%)									
Less than 4 years	2.1	1.5	1.8	7.7	10.0	8.4	5.1	5.0	5.1
4 years	43.0	38.3	41.0	62.3	59.1	61.3	53.4	46.8	51.0
6 years	26.9	27.3	27.1	10.0	9.7	9.9	17.8	20.1	18.6
9 years	12.3	13.7	12.9	6.5	9.1	7.3	9.2	11.8	10.1
12 years	13.4	17.3	15.1	10.7	10.4	10.6	11.9	14.5	12.9
14 years	0.7	0.6	0.7	0.8	0.5	0.7	0.8	0.6	0.7
College degree	1.6	1.3	1.5	2.0	1.2	1.8	1.8	1.2	1.6
Obs. (n° of workers)	397,541	304,149	701,690	469,470	211,082	680,552	867,011	515,231	1,382,242
Obs. (% from total)	28.8	22.0	50.8	34.0	15.3	49.2	62.7	37.3	100.0
Obs. (% of women)		43.3			31.0			37.3	

Table 2. (*Continued*).

	Less than 35			35 and more			Pooled		
Year 2005	Male	Female	All	Male	Female	All	Male	Female	All
School (average, in years)	9.05	10.09	9.54	7.19	7.34	7.25	8.00	8.65	8.29
Educational attainment (%)									
Less than 4 years	1.0	0.5	0.8	2.4	2.4	2.4	1.7	1.5	1.6
4 years	10.4	7.7	9.1	37.8	36.3	37.2	25.8	22.7	24.4
6 years	25.6	19.3	22.6	22.0	21.0	21.6	23.6	20.2	22.1
9 years	29.3	24.5	27.0	16.5	16.7	16.6	22.1	20.4	21.3
12 years	22.3	29.3	25.6	12.6	15.2	13.7	16.8	21.9	19.1
14 years	2.7	3.7	3.2	2.0	2.3	2.1	2.3	3.0	2.6
College degree	8.9	14.9	11.7	6.7	6.2	6.5	7.7	10.3	8.9
Obs. (n° of workers)	571,949	503,517	1,075,466	738,615	556,710	1,295,325	1,310,564	1,060,227	2,370,791
Obs. (% from total)	24.1	21.2	45.4	31.2	23.5	54.6	55.3	44.7	100.0
Obs. (% of women)		46.8			43.0			44.7	

increased in the two age groups between 1991 and 2005, being more pronounced in the group of older workers.

There are visible educational changes in the Portuguese workforce over the period under analysis as the average years of education of the employees increased by 37% from 1991 to 2005. Still, the average schooling remains low: on average, each employee had 6.07 years of school in 1991 and 8.29 years in 2005.

The improvement of the workforce educational attainment is more noticeable for the younger cohort since the average years of schooling increased by almost three years in the period 1991–2005 (from 6.61 to 9.54 years) whereas it increased less than two years for the older cohort (from 5.52 to 7.25 years). In particular, the percentage of the younger employees having 12 years of education or more increased substantially, through the period (from 17.3% to 40.5%), while the percentage of older workers with that same level of education had a less pronounced increase (from 13.1% to 22.3%). On the other hand, the percentage of younger employees with four years of education or less declined more drastically than that of the older ones.

These figures also show the considerable investment in education made by women is more pronounced among the younger cohort, especially at the highest qualification levels. Women were already more educated than men in 1991 and the educational gap increased during the period studied. In 2005, 14.9% of young females had a college degree whereas only 8.9% of the men had such a degree, overcoming their disadvantage among the older workers (6.2% and 6.7% for females and males, respectively).

In the econometric analysis that will be made in the following section, we analyze the gender wage gap as related to the educational attainment of workers and other variables; namely, occupation and industry. In Table 3 we present the values of the wage per hour, for women and men, controlling for those variables. It appears clear that there is a significant correlation of wages with the education level, the occupation and the industry, particularly relevant in the group of the older workers.

3. Model specification

The empirical estimation of the overall gender wage gap and its decomposition in the portion of the wage differential imputable to differences in workers and job traits (endowment or attribute effect) and to differences in the returns for those traits (price or discrimination effect) was introduced by Oaxaca (1973) and Blinder (1973), and was later developed by other authors, namely Cotton (1988) and Neumark (1988).

To analyze and decompose the gender wage gap in the Portuguese labor market, we started by estimating Mincerian-type wage equations (Mincer 1974).

Let

$$\ln W_m = X_m \hat{\beta}_m + v_m \quad \text{and} \quad \ln W_f = X_f \hat{\beta}_f + v_f \tag{1}$$

represent the estimated male wage equation and the estimated female wage equation, respectively – where $\ln W_m$ and $\ln W_f$ are the natural logarithms of the male and female wages, X_m and X_f are the appropriate vectors of regressors for the relevant male and female attributes, and $\hat{\beta}_m$ and $\hat{\beta}_f$ represent the corresponding vectors of estimated coefficients, respectively; v_m and v_f are residual terms.

The average wage gap (in logarithms) between males and females is given by:

Table 3. Hourly wage (€).

	Less than 35 years		35 years or more	
	Male	Female	Male	Female
All workers	5.4	4.8	7.4	5.3
Education				
< 9 years	4.1	3.2	5.1	3.6
9–12 years	5.2	4.2	8.6	6.0
> 12 years	10.7	8.8	20.1	14.4
Occupation				
occ0	12.3	10.8	19.6	14.3
occ1	10.8	9.9	16.8	14.3
occ2	8.2	7.0	11.1	9.0
occ3	5.5	4.9	7.5	6.2
occ4	4.3	3.7	5.0	3.7
occ5	4.3	3.3	5.1	3.5
Industry				
primsect	4.7	4.6	5.9	4.6
manuf	5.2	4.7	7.1	5.4
textile	3.8	3.0	5.1	3.3
util	9.8	9.8	14.1	12.7
constru	4.5	5.1	5.4	5.7
whole	5.3	5.1	7.6	6.0
retail	4.6	4.2	5.9	4.3
resthot	4.0	3.5	5.2	3.7
transp	7.0	6.9	8.7	9.6
finance	7.2	6.0	12.4	6.7
service	8.3	5.7	10.1	5.7

$$\overline{\ln W_m} - \overline{\ln W_f} = \overline{X}_m \hat{\beta}_m - \overline{X}_f \hat{\beta}_f. \quad (2)$$

Considering β^* an estimated non-discriminating wage structure, the average wage gap can be rewritten as:

$$\overline{\ln W_m} - \overline{\ln W_f} = (\overline{X}_m - \overline{X}_f)\beta^* + \overline{X}_m(\hat{\beta}_m - \beta^*) + \overline{X}_f(\beta^* - \hat{\beta}_f). \quad (3)$$

On the right-hand side of this equation, the first term represents the endowment effect (the wage gap that would prevail if groups differed only in their observable attributes), while the two other terms represent the price or discrimination effect (the second term measures the so-called male-advantage due to labor market discrimination computed as the wage males receive above what would be due if their characteristics were to be rewarded at the non-discriminating wage structure β^*; and the third term measures the female disadvantage due to labor market discrimination and so computes the difference between the wage women should receive if the non-discriminating wage structure was enforced and the wage they actually receive).

Oaxaca and Ransom (1994) showed that Equation (3) can be re-written as:

$$\overline{\ln W}_m - \overline{\ln W}_f = \ln(Q_{mf} + 1) + [\ln(\partial_{m*} + 1) + \ln(\partial_{*f} + 1)], \quad (4)$$

where $Q_{mf} = (W^*_m / W^*_f) - 1$ reflects the wage gap that would exist if there were only differences in attributes between males and females, $\partial_{m*} = (W_m / W^*_m) - 1$ expresses the male wage advantage due to labor market discrimination, and $\partial_{*f} = (W^*_f / W_f) - 1$ expresses the female wage disadvantage due to discrimination (W^*_m and W^*_f denote the male and female wages in the absence of discrimination in the labor market, respectively).

The sum of the last two terms of Equation (4), $[\ln(\partial_{m*} + 1) + \ln(\partial_{*f} + 1)]$, equals $\ln(D_{mf} + 1)$, where $D_{mf} = (W_m / W_f - W^*_m / W^*_f) / (W^*_m / W^*_f)$ is the market discrimination coefficient, the summary measure of the intensity of gender discrimination in the labor market most frequently used in the literature (Becker 1957). The value of the discrimination coefficient allows us to evaluate, shortly, the effect of both the dimension of the gender wage gap and the relative importance of discrimination practices towards its explanation. The discrimination coefficient measures the penalty that, in average terms, employers associate with recruiting a woman as compared with a man with identical productive characteristics.

At this point, two major questions emerge: the choice of both the variables to be used in the wage regressions and of the non-discriminating wage structure. In the regressions estimated, the dependent variable used is the natural logarithm of hourly wages. Regarding the factors that must be considered to explain the gender wage gap (vectors X_m and X_f), we used the different individual endowments of human capital, both general and firm specific: education (six schooling levels proxied by the number of years of completed schooling), job tenure with the actual employer, and general work experience calculated as the number of years of presumed work experience in firms other than the actual. Also included is a number of dummy variables that were constructed to control for different occupations, industry of employment, plant size and location and type of contract (full-time or part-time). The definition of variables used in the study is reported in Appendix 1.

As to the choice of the non-discriminating wage structure, we followed the Neumark (1988) methodology obtaining β^* from the estimation of a wage equation similar to Equation (1) with a pooled sample of male and female workers.[2]

To analyze the eventual existence of relevant differences between the group of younger workers (defined as those aged from 15 to 34 years) and older workers (aged 35 years and older), wage equations were estimated separately for these two groups.

Estimations of the gender pay gap and its decomposition were made for the years 1991, 1995, 2000 and 2005. All the equations were estimated by ordinary least squares using the White heteroscedasticity-consistent standard errors (the Cook–Weisberg test for heteroscedasticity rejects, in all the equations, the null hypothesis of equal variance).[3]

In this study we did not use a specific variable to control for the femaleness (percentage of females) within sectors, occupations or firms/establishments as we use dummy variables that take into account the different job characteristics of men and women that already capture the effect of their different distribution within jobs and firms.[4] In general terms, those two possibilities (to include variables of the percentage of females by sector, occupation and firm or to include dummy variables for sectors, occupations and firms) must be considered as alternatives, as discussed by Bayard et al. (1999) – who pointed out the benefits and costs associated with both procedures

and who suggested that similar results could be expected by using dummies or the femaleness variable.[5]

4. Results

Table 4 presents the gender wage gap for the total sample of workers and for each of the two considered age groups for the four years under analysis.

The data show that, as expected, the gender wage gap for the younger employees is lower than that for the older ones. This result is in line with international evidence illustrating that the difference of earnings among individuals with different school attainment increases with age (Mincer 1974; Filer, Hammermesh, and Rees 1996).

Still, the magnitude of this difference is particularly striking: in 2005, the wage gap of the younger workers is only about one-third of that for the older workers. The data also show that, through the period, the gender wage gap remained quite stable for the older cohort of workers but decreased substantially for the younger one. These results suggest that the policy reforms contributing to the reduction of the observed gender educational attainment differential were felt mostly among the younger workers.

The results of the decomposition of the overall wage gap for both age groups of employees are presented in Table 5. They show that, for both age groups and through the period, the wage differential is mainly explained by discrimination. However, the discrimination differential is more pronounced for the young workers than for the older ones. Additionally, for this younger group of workers, discrimination plays an increasing role in explaining the wage gap, contributing to 67% of the gap in 1991 and 101% in 2005. With regards to the older workers, discrimination remains stable over time since it explains around 60% of the gap in the four analyzed years.

The data in Table 5 show that the penalty associated by employers with recruiting a female, as measured by the discrimination coefficient, is smaller for the younger group as compared with older workers. Through the 15 years under analysis this coefficient (as it occurred with the gender wage gap) remained quite stable for the older cohort of workers and slightly decreased for the younger one, contrasting with the substantial decrease that characterizes the evolution of the gender wage gap in this age cohort.

For the older cohort, endowment factors have an important and stable role along the period to explain the gap (about 40%); however, their relative effect decreases substantially for the younger cohort, leaving discrimination practices to account for 80% of the gap in 2000 and leading, in 2005, to a situation where all of the gap is explained by discrimination. In fact, in the present day the differences in attributes of young males and young females, if they play any role, act towards decreasing the

Table 4. Gender wage gap by age group.

	Pooled	<35 years	>=35 years
1991	0.279	0.199	0.299
1995	0.255	0.170	0.292
2000	0.241	0.149	0.307
2005	0.221	0.115	0.301

Note: Gender wage gap in ln (see Equation (2)).

Table 5. Decomposition of the gender wage gap and discrimination coefficient, by age group and by year.

Workers aged less than 35 years								
	1991		1995		2000		2005	
Total gender gap	0.199		0.170		0.149		0.115	
Endowment differential		33%		31%		20%		−1%
Discrimination differential		67%		69%		80%		101%
Male advantage	0.057		0.053		0.055		0.055	
Female disadvantage	0.075		0.064		0.063		0.062	
Discrimination coefficient (Dmf)		0.141		0.124		0.126		0.124
Workers aged 35 years or more								
	1991		1995		2000		2005	
Total gender gap	0.299		0.292		0.307		0.301	
Endowment differential		40%		42%		42%		42%
Discrimination differential		60%		58%		58%		58%
Male advantage	0.056		0.060		0.070		0.078	
Female disadvantage	0.124		0.109		0.108		0.104	
Discrimination coefficient (Dmf)		0.196		0.184		0.195		0.190

gender pay gap (although the effect is very small: –1.0%). Still, this almost null effect on differences in attributes remains the outcome of two different processes: the more favorable productive characteristics of female workers as compared with those of males have a relevant effect towards reducing the gap, and they were sufficiently important to overcome the effect towards increasing the pay gap that the different characteristics of female and male jobs still have. As in the case of older workers, the main differences in young male and female jobs that affect (increasing) the gender pay gap is the different way in which they distribute amongst the sectors of activity.

For both cohorts, discrimination is due mainly to female disadvantage, this share being relatively more important for the older cohort.

The analysis of the contribution of the different attributes (Table 6) shows that the relative importance of the human capital variables reduced sharply over time. For younger workers these variables contributed, increasingly along the decade, to the reduction of the gender pay gap. As for older workers, human capital variables contributed to increasing that gap, despite the reduction of its relative weight along the period. As expected, the significant investments in education and training had a key effect on the evolution of the explained part of the gender pay gap.

So, the favorable performance of women regarding education had a strategic role in the evolution of the wage gap of the youngest age cohort, strongly acting towards its reduction. Among the older workers, the effects of the different levels of education are less assertive whilst average schooling, tenure, and experience act to increase the gap.

These results suggest that women invested in education as a means of increasing their productive characteristics recognizable by employers. Also, it can be noticed that young female workers have longer tenure, facing lower turnover than young men do, and that this acts towards the reduction of the gap. Two main facts can lie behind this:

Table 6. Contribution of variables to the gap due to endowment differential, by age group and by year.

Workers aged less than 35 years				
Contribution Source	**1991**	**1995**	**2000**	**2005**
Education	−0.012	−0.016	−0.021	−0.043
Tenure	−0.009	−0.004	−0.004	−0.002
Tenure^2	0.003	0.001	0.001	0.000
Experience	0.041	0.030	0.025	0.037
Experience^2	−0.020	−0.016	−0.012	−0.014
Education*Tenure	−0.004	−0.007	−0.009	−0.014
Education*Experience	−0.001	0.000	−0.003	−0.009
Plant size	−0.008	−0.013	−0.005	0.002
Location	0.001	0.001	0.000	−0.001
Occupation	0.001	0.008	0.011	0.000
Industry	0.076	0.074	0.050	0.046
Partime	−0.002	−0.004	−0.003	−0.003
Total (endowment differential)	0.066	0.053	0.030	−0.001
Workers aged 35 years or more				
Contribution Source	**1991**	**1995**	**2000**	**2005**
Education	0.007	0.004	0.003	−0.005
Tenure	0.013	0.016	0.015	0.010
Tenure^2	−0.007	−0.010	−0.008	−0.004
Experience	0.015	0.013	0.006	0.005
Experience^2	−0.010	−0.009	−0.004	−0.003
Education*Tenure	0.007	0.005	0.007	0.002
Education*Experience	−0.001	0.000	0.001	0.000
Plant size	0.001	−0.002	0.006	0.003
Location	−0.001	−0.002	−0.003	−0.001
Occupation	0.010	0.027	0.031	0.026
Industry	0.092	0.085	0.077	0.088
Partime	−0.005	−0.006	0.000	0.006
Total (endowment differential)	0.120	0.123	0.129	0.127

in average terms, young female employees want (and the same occurs with their employers) to invest more in specific training; and a more reduced scope of jobs is available for young female, on grounds of discrimination, leaving them less opportunities of experiencing job matching and, by this means, reducing their choice in the process of searching for a more adequate job. If these two processes did occur, the positive effect that tenure had on the reduction of the gender pay gap would be the outcome of both a positive and a negative characteristic of young females' integration in the labor market: relative to young men, they have more incentive to invest in specific training, which is positive, but this incentive is the result of a more constrained scope of choices shaped by discrimination practices, which is obviously negative.

For the two cohorts of workers, Industry is the variable that has the highest importance to explain the pay gap during the decade; however, its relative importance increased for the younger workers and had a more irregular evolution for the older ones.[6] These results are not unexpected since the structure of male and female jobs by industry does not show relevant diversities amongst the older and the younger workers.

Occupation, accounting for a small portion of the wage gap for both cohorts in 1991, had an increasing influence on its explanation along the decade.

The other considered factors (part-time, location, and plant size) play a minor role in the explanation of the wage gap for both groups of workers.

In sum, investments in human capital – in particular, in education – favoring the younger Portuguese female workers pressured the decrease of the gender wage gap for the younger cohort through the 1990s and the first years of the current decade; however, the different distribution across sectors of activity and occupations of young females as compared with young males and, especially, discrimination practices have surmounted those effects.

5. Concluding remarks

The presented analysis of the gender wage gap in the Portuguese labor market has followed the Neumark methodology of decomposing the gap into workers and jobs effects and discrimination effects. We assess the relative importance of investment of workers in human capital characteristics and the role of workplace factors such as industry and occupation in the explained part of the gap. Further, we study the extent of the gap separately for the younger and older cohorts of workers to better evaluate the impact of educational reforms and changes in the workplace structure that have taken place in the Portuguese labor market since the early 1970s.

Our results suggest that most of the pay gap, for both cohorts, refers to discrimination practices by the employers. In the case of the younger workers, discrimination plays an increasing role in explaining the wage gap. With regards to the older workers, discrimination remains stable over time since it explains around 60% of the gap in the four analyzed years. The discrimination coefficient (i.e. the penalty associated by employers with female wages) is higher amongst older workers than amongst younger ones. During the studied period, its evolution did not show any strong tendency towards decreasing: it remained rather stable amongst the older cohort and reduced, but only slightly, amongst the younger.

As expected, the gender wage gap for the younger employees is lower than that of the older ones, although somewhat surprisingly such a gap is, in 2005, only about one-third of that of the older workers. Through the period of study the gender wage gap remained quite stable for the older cohort of workers but decreased substantially for the younger workers. These results suggest that the effects of the educational reforms were felt mainly among the younger group of workers and reflect the larger investment on education made by younger women, especially at the highest qualification levels. It is likely that the gender wage gap among the younger workers will further decrease in the future as the full effects of the reforms are felt, and the gap among the older ones will tend also to decrease as the new workers will be substitute for the older ones in the labor market.

Although the improvement of the productive characteristics of workers has been important to the reduction of the explained part of the gender pay gap, the attributes related to the characteristics of jobs appear as its major sources. In particular, the

different way men and women are distributed among the sectors of industry emerges as the main reason of the persistence of the wage gap for both cohorts. These results are consistent with those reported by the European Commission (2006b) for the EU25 member-states on the gender pay gap. Using data from the Structure of Earnings Survey 2002, it was found that the different distribution of women by occupation and industry penalizes women in terms of pay.

The observed persistence of the wage differential over time, in spite of the investment in human capital, especially amongst women, suggests that a different allocation of men and women by jobs and sectors of activity is required in order to change the prevailing rigidity of worker placement. Any further attempt to analyze the gender wage gap should more deeply address this issue.

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Notes

1. Information about employees in the public administration, self-employed and military personnel is not included in the data-set. In 2005, for a total estimated working population in Portugal of about five million individuals, this data-set provides information for about three million. Observations with incomplete or inconsistent data were excluded from the data-set. We also excluded a number of categories of individuals for whom reported earnings may impart a bias upon correct evaluation of labor income (individuals that were simultaneously owners and executives, unpaid family workers, individuals younger than 14 years of age, farmers and farm laborers).
2. For the discussion of alternative methodologies to obtain β^* see González, Santos, and Santos (2005), where – besides the Neumark methodology – the Oaxaca (1973) procedure (either using the male wage and the female wage structure as the non-discriminating one) and the Cotton (1988) methodology (the non-discriminating wage structure is a weighted average of the male and female wage structures) are used. The use of those four alternative methods to obtain β^* did show consistent results. In this paper we retain the Neumark procedure that is usually considered the one that better captures the wage structure that would prevail if employers were gender-blind (Oaxaca and Ransom 1994).
3. With the available data-set we could not use the Heckman (1979) procedure for selection bias. This two-step estimator implies a probit equation to modelize the female decision of participation in the labor market. To do so, data on women participating and not participating in the labor force would be needed. But the data-set we use only refers to employed individuals.
4. For a deeper discussion on this issue see, among others, Groshen (1991) and Bayard et al. (1999).
5. The results of the estimation of the wage equations using, simultaneously, the dummy variables and the proportion of women show clear signs of multicolinearity, suggesting that those variables must, in effect, be used as an alternative.
6. Also, the contribution of the different sectors to explain the wage gap does not vary sensibly in the two groups of workers. Textiles (with the highest percentage of female workers) and transportation (with the highest share of male workers) contributed to widening the gap, whereas finance was the only sector (with the lowest level of gender segregation) that acted towards its decrease.

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Appendix 1. Definition of variables

Variable	Description
ln W	Natural logarithm of hourly earnings: hourly earnings were computed dividing total monthly earnings (wages + seniority bonuses + overtime premium + other premia) by the total number of hours worked per month.
ED0	Dummy variable, 1 if years of schooling is <4
ED4	Dummy variable, 1 if years of schooling is =4
ED6	Dummy variable, 1 if years of schooling is =6
ED9	Dummy variable, 1 if years of schooling is =9
ED12	Dummy variable, 1 if years of schooling is =12
ED14	Dummy variable, 1 if years of schooling is =14
ED16	Dummy variable, 1 if years of schooling is >14
TENURE	Number of years of tenure in the current job
$TENURE^2$	TENURE squared
EXPER	Number of years of presumed work experience in firms other than the current one (age – education – tenure – 6)
$EXPER^2$	EXPER squared
ED4TEN	Interaction term ED4 × TENURE
ED4EXP	Interaction term ED4 × EXPER
ED6TEN	Interaction term ED6 × TENURE
ED6EXP	Interaction term ED6 × EXPER
ED9TEN	Interaction term ED9 × TENURE
ED9EXP	Interaction term ED9 × EXPER
ED12TEN	Interaction term ED12 × TENURE
ED12EXP	Interaction term ED12 × EXPER
ED14TEN	Interaction term ED14 × TENURE
ED14EXP	Interaction term ED14 × EXPER
ED16TEN	Interaction term ED16 × TENURE
ED16EXP	Interaction term ED16 × EXPER
PLANT10	Dummy variable, 1 if number of employees in the plant is <10
PLANT99	Dummy variable, 1 if number of employees in the plant is ≥10 and ≤99
PLANT499	Dummy variable, 1 if number of employees in the plant is ≥100 and ≤499
PLANTBIG	Dummy variable, 1 if number of employees in the plant is ≥500
NORTH	Dummy variable, 1 if job is in the Northern region
CENTER	Dummy variable, 1 if job is in the Central region
LISBON	Dummy variable, 1 if job is in the Lisbon-and-Tagus-Valley region
ALENT	Dummy variable, 1 if job is in the Alentejo region
ALGAR	Dummy variable, 1 if job is in the Algarve region
OCC0	Dummy variable, 1 if employees are *Executive* or *Directors*
OCC1	Dummy variable, 1 if employees are *Professionals* or *Scientists*
OCC2	Dummy variable, 1 if employees are *Technicians* or in *Management Occupations at Intermediate Level*
OCC3	Dummy variable, 1 if employees are in *Administrative* or in *Related Occupations*
OCC4	Dummy variable, 1 if employees are in *Service* or *Sales Occupations*

Appendix 1. (*Continued*).

Variable	Description
OCC5	Dummy variable, 1 if employees are *Laborers*
PRIMSECT	Dummy variable, 1 if job is in *Primary Sector*
MANUF	Dummy variable, 1 if job is in *Manufacturing*
TEXTILE	Dummy variable, 1 if job is in *Textiles*
UTIL	Dummy variable, 1 if job is in *Utilities*
CONSTRU	Dummy variable, 1 if job is in *Construction*
WHOLE	Dummy variable, 1 if job is in *Whole Trade*
RETAIL	Dummy variable, 1 if job is in *Retail Trade*
RESTHOT	Dummy variable, 1 if job is in *Restaurants and Hotels*
TRANSP	Dummy variable, 1 if job is in *Transportation*
FINANCE	Dummy variable, 1 if job is in *Finance*
SERVICE	Dummy variable, 1 if job is in *Services*
PARTIME	Dummy variable, 1 if it is a part-time job