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Abstract

Using data from the Personnel Records (*Quadros de Pessoal*) for the period 1985-2000, we analyse the gender wage gap in Portugal. We estimate wage discrimination and endowment differentials using four decomposition methods. Our main concern is to analyse the key factors that lie behind the persistent gender pay gap despite the deep changes that characterise the recent evolution of the Portuguese labour market and the high female participation rate that exists in the country. Moreover, using the Neumark methodology, we discuss the relative contribution of different factors in explaining the gender pay gap.

The results suggest that, in accordance with previous international research, the measured discrimination differential dominates the estimated endowment differential. Over time, a relevant discrimination gap persisted and it didn't show any tendency to decrease. Results are also consistent in showing that the most important difference in attributes to explain the gender pay gap is the way how males and females are distributed by sector of industry. As to human capital variables, their relative importance to the explanation of the gender pay gap has reduced sharply, particularly along the 90's.

Key words: Labour market; discrimination; wage differential; gender

JEL classification: J71; C50

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1. Introduction

Evidence on the gender wage inequality in the Portuguese labour market shows that women have consistently received lower wages than men. According to the data set used in this study, women earned, between 1985 and 2000, on average terms, less than 80% than men and there were no signs of any relevant change on this situation. Explaining the sources of gender earnings differences is a key issue to understand why this wage gap persists. Recently the analysis of the decomposition of the gender pay gap has been agreed a high relevance at the EU, as it has been considered a very useful tool to support policy on the area of the promotion of equal opportunities on a gender perspective[1].

The empirical estimation of overall gender wage gap and the decomposition of the portion of the wage differential imputable to differences in workers and job traits (endowment or attribute effect) and differences in the returns to those traits (price or discrimination effect) was introduced by Oaxaca (1973)[2] and developed by other authors, namely Cotton (1988) and Neumark (1988). This research has shown that the extent of the estimated effects of discrimination depends upon two factors: the choice of the non-discrimination wage structure and of the variables used in the wage regressions.

The Oaxaca methodology, considering that in the absence of discrimination the male or female wage structure would prevail, assumes that employers would either have discriminatory practices towards females or be nepotistic towards males. Later, Cotton (1988) and Neumark (1988) developed wage gap decomposition methods which allow identifying the part of the discrimination due to male advantage or female disadvantage.

The use of either wage structure, male or female, conduces to extreme results, whereas the methods proposed by Cotton and Neumark allow milder estimates of the discrimination effect (Oaxaca and Ransom, 1994). Also, the selection of the explanatory variables used in the wage regressions, which depends much on what is considered to be discrimination, is crucial to avoid over or underestimation of the discrimination effect (Oaxaca, 1973).

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[1] See, namely, European Commission (2002), Plasman *et al*. (2002), Grimshaw and Rubery (2002), Rubery *et al* (2002), Beblo *et al.* (2003).

[2] In simultaneous to the development of the methodology of Oaxaca, although independently, Blinder (1973) developed a similar technique, so this decomposition technique is often designated the Oaxaca-Blinder methodology.

The analysis of the gender wage differentials in Portugal using the Oaxaca procedure is sparse and limited in its scope. Kiker and Santos (1991), using the male structure as the non-discrimination wage structure with a sample from the 1985 data set of the Portuguese Labour Ministry (Personnel Records – *Quadros de Pessoal*), found evidence that the price (or discrimination) effect is more important (accounting for 67% of the wage gap) than the endowment effect. Although using data only for the Azores islands in 1989 and adopting the male wage structure as the non-discriminating one, the results of Vieira and Pereira (1993) study are in accordance with the previous conclusions. More recently, Vieira *et al*. (2003) decomposed the wage gap based on the Oaxaca males methodology and what is referred in their paper as the Cotton-Neumark methodology. Using Portuguese data from the Personnel Records for the period 1985-1999 they report results on the price effect (discrimination) that range between 56.9% and 68.2% of the total pay gap.

In this paper we aim at analysing the gender wage gap using and comparing the four traditional decomposition methods (Oaxaca, 1973, Cotton, 1988, Neumark, 1988), using Portuguese data from the Personnel Records for the period 1985-2000.[3] Moreover, using the Neumark methodology, we discuss the relative contribution of different factors in explaining the gender pay gap. Our main concern is to analyse the key factors that lie behind the persistent gender pay gap despite the deep changes that characterise the recent evolution of the Portuguese labour market and the high female participation rate that exists in the country.

We focus on the wage discrimination due to different levels of remuneration paid to employed individuals that can be attributed to discrimination practices. So, other relevant topics of discrimination analysis, such as discrimination on hiring and firing procedures and the implications of discrimination on the individual decisions of entering or not entering the labour market have not been treated in this paper.

In section 2, we briefly go over the definition of discrimination and its measurement. In section 3, we present the model specification and we discuss the explanatory variables used in the wage regressions. In section 4, we present the results from the wage gap decomposition methodologies and we analyse the relative contribution of different factors in explaining the gender pay gap, using the Neumark methodology. In section 5, we present the concluding remarks.

[3] This issue has been dealt by Santos and González (2003) in a preliminary study using a sample for the period 1985-1997.

2. Defining and measuring discrimination

There are various definitions of discrimination in the labour market, most of them issued from the pioneer work of Becker (1957). In general terms, "labour market discrimination is said to currently exist if individual workers who have identical productive characteristics are treated differently because of the demographic group to which they belong" (Ehrenberg and Smith, 1994: 402). In his pioneer work on the decomposition of the wage gap, Oaxaca (1973: 694) states that "discrimination against females can be said to exist whenever the relative wage of males exceeds the relative wage that would have prevailed if males and females were paid according to the same criteria".

The first definition emphasises the fact that discrimination means remunerating differently individuals that are identical in terms of their potential contribution to the economic process, which is, having the same "productive characteristics". The obvious question to be answered being then what are the relevant "productive characteristics" that have to be considered. Do they refer only to the human capital that different individuals have accumulated or do they also concern the "productive characteristics" that are issued from the type of jobs, sectors and firms that correspond to the integration of the individual in employment?

The second definition is broader in the sense that it puts the accent on the "criteria" of remuneration. This issue implies, as the previous one, the clear identification of the variables that are relevant to explain wage diversity but also stresses the importance of identifying the wage structure that corresponds to the situation of non-existence of discrimination.

Oaxaca (1973) decomposed the gender pay gap in two different components: one that could be explained by "differences in individual characteristics" and a second one corresponding to the "estimated effects of discrimination". In his procedure two relevant questions had to be answered: i) how can we represent the non-discriminating wage structure and ii) which variables must be considered when we are measuring the part of the gender gap that is explained by the so-called "differences in individual characteristics".

In the following sections, we attempt to answer to these two specific questions.

3. Model specification

Let W_m and W_f represent the current wages of males and females, respectively, and W_m^* and W_f^* denote the males and females wages in the absence of discrimination in the labor market. Following Oaxaca and Ransom (1994)

$G_{mf} = \frac{W_m}{W_f} - 1$ represents the actual gross wage gap

$Q_{mf} = \frac{W_m^*}{W_f^*} - 1$ reflects the wage gap that would exist if there were only differences in attributes between males and females.

Defining the market discrimination coefficient (D_{mf}) as:

$$D_{mf} = \frac{\frac{W_m}{W_f} - \frac{W_m^*}{W_f^*}}{\frac{W_m^*}{W_f^*}}$$

it can be show that

$$\overline{\ln W}_m - \overline{\ln W}_f = \ln(G_{mf}+1) = \ln(Q_{mf}+1) + \ln(D_{mf}+1) =$$
$$= \ln(Q_{mf}+1) + [\ln(\partial_{m^*}+1) + \ln(\partial_{*f}+1)]$$

Where $\ln W_m$ and $\ln W_f$ are the natural logarithms of the males and females wages

$\partial_{m^*} = \frac{W_m}{W_m^*} - 1$ expresses the males' wage advantage due to labor market discrimination, and

$\partial_{*f} = \frac{W_f^*}{W_f} - 1$ expresses the females' wage disadvantage due to discrimination.

Let $\ln W_m = X_m \hat{\beta}_m + v_m$ represent the estimated males wage equation, and

$\ln W_f = X_f \hat{\beta}_f + v_f$ represent the estimated females wage equation

where X_m and X_f are the appropriate vectors of regressors for the relevant males and females attributes and $\hat{\beta}_m$ and $\hat{\beta}_f$ represent the corresponding vectors of estimated coefficients. v_m and v_f are residual terms.

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

$$\overline{\ln W}_m - \overline{\ln W}_f = \overline{X}_m \hat{\beta}_m - \overline{X}_f \hat{\beta}_f$$

Letting β^* denote the estimated non-discriminating wage structure, the average wage gap can be rewritten as

$$\overline{\ln W}_m - \overline{\ln W}_f = (\overline{X}_m - \overline{X}_f)\beta^* + \overline{X}_m(\hat{\beta}_m - \beta^*) + \overline{X}_f(\beta^* - \hat{\beta}_f)$$

where

$\beta^* = \Omega \hat{\beta}_m + (I - \Omega)\hat{\beta}_f$ is a weighted vector of the estimated vectors of coefficients, and

$$\overline{\ln W}_m - \overline{\ln W}_f = \ln(G_{mf} + 1)$$

$$(\overline{X}_m - \overline{X}_f)\beta^* = \ln(Q_{mf} + 1)$$

$$\overline{X}_m(\hat{\beta}_m - \beta^*) = \ln(\partial_{m*} + 1)$$

$$\overline{X}_f(\beta^* - \hat{\beta}_f) = \ln(\partial_{*f} + 1)$$

The definition of the basic non-discriminating wage structure corresponds then to the choice of the weighting matrix Ω. Several alternative choices have been suggested in the literature. According to Oaxaca (1973) either the current male wage structure (Ω=I) or the current female wage structure (Ω=0) could be used. This procedure has been often discussed afterwards as some authors argued that the rationale behind these proposals was too extreme essentially because it implied to conceive that discrimination

affected only one group: if we consider the male wage structure as the non-discriminating one we are assuming that wage discrimination disadvantages women while if we take the female structure as the non-discriminating one we are assuming that wage discrimination acts in favour of men.

Other authors worked with wage structures that do reflect the existence of diversity in pay within the labour market and use non-discriminating wage structures that reflect both male and female pay in the labour market. This procedure allows the hypothesis that practices of wage discrimination in the labour market may have the two effects: to advantage, that is, to rise the wage of the members of the non-discriminated group (men if we are analysing the gender pay gap) and to disadvantage, that is, to reduce the wage of the members of the discriminated group (women).

In this paper we will use, aside the Oaxaca procedure, the Cotton (1988) methodology (the considered non-discriminating wage structure is a weighted average of the male and female wage structures, and so $\Omega = \ell_m I$ where ℓ_m is the fraction of males in the sample) and the Neumark (1988) methodology (proposes an estimation of the non-discriminating wage structure on the basis of the pooled sample of males and females.

Regarding the factors that must be considered to explain the gender wage gap (vectors X_m and X_f), it is consensual that different endowments in human capital, within or between groups, such as schooling, experience, and tenure, are relevant for explaining the diversity of wages as individuals that have accumulated more human capital are more productive and have more favorable "productive characteristics". If men and women have, on average terms, different endowments in human capital this will obviously have an effect on their average wages and this difference must not be confused with discrimination practices within the labour market[4].

Aside the inclusion of the human capital variables, we also use variables to control for characteristics of jobs, sectors, and firms. Differences on these last characteristics imply different productivity profiles for individuals with similar personal characteristics. For this purpose we use dummy variables for firm size, region, occupation, sector of activity, and type of contract (part-time job).

[4] This type of statement, as we stressed before, refers only to wage discrimination. In fact the existence of relevant gender wage gaps in human capital variables can indicate the existence of "social discrimination" that obviously also need to be studied and understood. Still this is not the subject of the present paper and so will not be considered here.

To capture those characteristics of jobs, sectors and firms some authors use, instead of dummy variables, the femaleness (% of females) of sectors, occupations or firms/ establishments (see, among others, Johnson and Solon (1984 and 1996), Groshen (1991), Carrington and Troske (1998), Reilly and Wijanto, (1999), Bayard *et al.* (1999)). In general terms, those two possibilities must be considered as alternatives, as discussed by Bayard *et al.* (1999) who pointed out the benefits and costs associated with the two procedures and who suggest that similar results could be expected by using dummies or the femaleness. Our option has been to use dummy variables for controlling for job and firm differences in the integration of male and female workers in the labour market.[5]

4. Empirical estimation

Data used in this study come from Personnel Records (*Quadros de Pessoal*) collected annually by the Portuguese Ministry of Employment from all business firms with at least one employee. 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 on job attributes such as type of industry, geographic location and plant size. Information about employees in public administration, the self-employees and military personnel is not provided by the data set.

To measure gender wage discrimination in the Portuguese labour market and to analyse its recent evolution, estimations of the gender pay gap and its decomposition were made for the years 1985, 1991, 1995 and 2000. The rationale behind this choice is the following: i) 2000 is the last year for which the data set is available; ii) we considered 1985 as the first year of study in order to allow the comparison of the situation before and after the integration in the EU (Portugal joined the EU in 1986); iii) two intermediate years have been considered, 1991 and 1995, as they allow to decompose the period on four sub-periods of similar length[6] but also in order to consider years that reflect different situations of the Portuguese labour market: in 1991 Portugal had the

[5] We estimated models including both the dummy variables and the proportion of women in occupation, sector, and establishment. The results show clear signs of multicolinearity, suggesting that those variables should, in effect, be used in alternative.

[6] Data is not available for the year 1990.

lowest unemployment rate of the entire period (4.0%) and in 1995 this rate was the highest in the period after the Portuguese integration in the EU[7].

After exclusion of observations with incomplete or inconsistent data and of a number of categories of individuals for whom reported earnings may impart a bias upon correct evaluation of labour income (we excluded from the analysis individuals who were simultaneously owners and executives, unpaid family workers, individuals under 14 years of age, farmers and farm labourers), the number of total observations in 2000 includes 1,877,753 individuals (1,083,403 males and 794,350 females)[8].

The variables used in the estimations are listed in Appendix A; sample means referring to the years 1985 and 2000 are given in Appendix B.

The regression coefficients estimates of the model used to decompose the gender wage gap, for the year 2000, are presented in Appendix C[9]. Separate wage regressions were specified and estimated for males and females. For both models, the results of the Chow test performed with the gender-specific and pooled earnings functions indicated that the earnings structure is different between males and females.

The total gender logarithmic wage gap for all years considered is presented in Table 1: this gap was 0.238 in the year 2000, a similar value to the one of 1985, despite having higher values in the intermediate reported years.

Table 1 – Total wage gap (ln)

	1985	1991	1995	2000
Total wage gap	0.237	0.276	0.252	0.238

The wage gap of the year 2000 has been decomposed using the previously four referred methodologies, results being reported in Table 2. In accordance with previous international estimates (Oaxaca and Ransom, 1994; Reilly and Wirjanto, 1999), whatever the structure used as the non-discriminatory one, the measured discrimination

[7] EC, *Employment in Europe*, several years.

[8] A similar procedure has been used for the other years under analysis. The total number of observations being 1,190,174 in 1985, 1,328,893 in 1991 and 1,489,548 in 1995.

[9] We used the Cook-Weisberg test for heteroscedasticity that rejects the null hypothesis of equal variance, so the t-statistics reported in the appendix are based on the White heteroscedasticity-consistent standard errors.

differential dominates the estimated endowment differential. In fact, the discrimination differential ranges from 64%, if the Neumark methodology is chosen, to 91% when the female wage structure is used as the base. Being so, the endowment differential estimate ranges between 36% and 9%, respectively.

Table 2 - Decomposition of total wage gap (ln) – year 2000 (alternative non-discriminatory wage structures)

	Oaxaca Males	Oaxaca Females	Cotton	Neumark
Total gender gap	0.238	0.238	0.238	0.238
Endowment differential	0.044	0.021	0.034	0.086
	18%	9%	14%	36%
Discrimination differential	0.194	0.217	0.204	0.152
	82%	91%	86%	64%
Male advantage	---	0.217	0.092	0.064
		100%	45%	42%
Female disadvantage	0.194	---	0.112	0.087
	100%		55%	58%
Discrimination Coef. (D)	0.214	0.242	0.226	0.163

The Cotton procedure, as expected, yields results that perform between the estimates obtained using the male and female wage structures as the non-discriminatory one. The assumption of considering the weighted average of the men and women structures as the wage structure that would prevail in the absence of discrimination constraints to such estimates.

However, using the Neumark pooled method, the difference between the estimated discrimination gap and the measured endowment differential is not as wide as in the other methods. The discrimination differential is, in this case, smaller than that of the other procedures (0.152 against 0.194 and 0.217 when the male and female wage structures are respectively used as non-discriminatory wage structure and 0.204 if the Cotton technique is applied). The log wage gap due to attributes, 0.086, is sensibly larger than that obtained from other procedures (0.044 and 0.021 if the male and the female structures are respectively used as reference and 0.034 when adopting the Cotton method).

The Cotton and Neumark methods allow the decomposition of the overall logarithmic differential due to discrimination into male wage advantage and female wage

disadvantage. The Cotton method yields estimates for male wage advantage of 0.092 and female disadvantage of 0.112. Using the Neumark procedure the discrimination effect estimates are lower than the previously referred. Males have a wage advantage of 0.064 whereas females have a disadvantage of 0.087. Both methods show that the female disadvantage has the highest relative weight in the part of the gap attributable to discrimination.

When the female wage structure is considered as the base, all of discriminatory logarithmic wage gap is inevitably attributable to male advantage wage (0.217). In the case of adopting the male wage structure as the structure of reference, the wage differential due to discrimination of 0.194 represents necessarily a female pay disadvantage.

According to the calculations made using the different methodologies the discrimination coefficient ranges between 16.3% and 24.2% in the year 2000.

Table 3 shows that the results obtained with the different decomposition methods are quite similar in the four years under analysis. Despite the changes in the total gender gap previously referred (Table 1), all the used decomposition techniques show an increase of the relative importance of discrimination to explain the gender pay gap along the period. Using, as an example, the Oaxaca males' methodology, the percentage of the gender pay gap attributable to discrimination has a consistent increase, along the period under analysis, from 62% to 82%. Results sorted out from the other methodologies show a similar pattern allowing to conclude that differences in the wage gap due to differences in the workers' attributes have been decreasing in the last 20 years: they explained 38% of the total wage gap in 1985 but only 18% in 2000 (according to Oaxaca males methodology), 25% and 9% (according to Oaxaca females methodology), 34% and 14% (according to the Cotton methodology). Even using the Neumark methodology, the one that estimates the highest value for the differences in attributes, the decrease of their relative importance to explain the gender wage gap is also observed, despite being less wide (differences in attributes explain 48% of the gender pay gap in 1985 but only 36% in 2000).

Table 3 – Decomposition of total wage gap (ln) on differences in attributes and discrimination (alternative non-discriminatory wage structures)

Oaxaca Males

	1985	1991	1995	2000
Total gender gap	0.237	0.276	0.252	0.238
Endowment differential	38%	32%	28%	18%
Discrimination differential	62%	68%	72%	82%
Male advantage	----	----	----	----
Female disadvantage	100%	100%	100%	100%

Oaxaca Females

	1985	1991	1995	2000
Total gender gap	0.237	0.276	0.252	0.238
Endowment differential	25%	28%	24%	9%
Discrimination differential	75%	72%	76%	91%
Male advantage	100%	100%	100%	100%
Female disadvantage	----	----	----	----

Cotton

	1985	1991	1995	2000
Total gender gap	0.237	0.276	0.252	0.238
Endowment differential	34%	31%	26%	14%
Discrimination differential	66%	69%	74%	86%
Male advantage	37%	38%	41%	45%
Female disadvantage	63%	62%	59%	55%

Neumark

	1985	1991	1995	2000
Total gender gap	0.237	0.276	0.252	0.238
Endowment differential	48%	45%	44%	36%
Discrimination differential	52%	55%	56%	64%
Male advantage	33%	37%	40%	42%
Female disadvantage	67%	63%	60%	58%

Both the Cotton and the Neumark methodologies show a consistent increase in the relative importance of the male advantage along the period under analysis and the consequent decrease of the relative importance of the female disadvantage (calculations on this relative weights are very similar in the two methodologies).

The part of the gap due to differences in attributes has been decomposed in its components (Table 4) showing the different importance of the independent variables that have been included in the model. The different methodologies yield, as expected, different decomposition values, but the main conclusions are similar. In the presentation of the detailed results we will follow the Neumark methodology as it considers that gender pay differences result both from nepotism and discrimination behaviour of employers; we follow Oaxaca and Ransom (1994: 18) when they argue that the pooled estimate is the one that better expresses the wage structure that would prevail if the labour market was not influenced by employers' discrimination behaviour.

Table 4 – Contributions of variables to the gap due to endowment differential

Contribution Source	1985		1991		1995		2000	
	Value (ln)	%	Value (ln)	%	Value (ln)	%	Value (ln)	%
Human capital	0.031	27.4%	0.033	26.7%	0.020	18.6%	0.006	7.3%
Plant size	-0.002	-2.1%	-0.004	-3.4%	-0.006	-5.8%	0.000	0.1%
Location	0.003	2.3%	0.001	0.6%	0.000	-0.1%	-0.001	-1.3%
Occupation	0.005	4.1%	0.005	4.4%	0.016	14.6%	0.016	19,0%
Industry	0.080	70.6%	0.092	74.8%	0.086	77.6%	0.066	77.2%
Partime	-0.003	-2.4%	-0.004	-3.2%	-0.005	-4.8%	-0.002	-2.3%
Gap due to attribute dif.	0.113	100,0%	0.123	100,0%	0.110	100,0%	0.086	100,0%
(% attr. dif. in total)	(48%)		(45%)		(44%)		(36%)	
Total gender gap	0.237		0.276		0.251		0.238	

The main factors that explain the part of the gap due to the attribute differential are linked to the characteristics of jobs and firms. Results suggest that industry is the largest source of this gap, contributing to its widening, explaining, in the year 2000, 77.2% of that part of the gap.[10]

A more detailed analysis of the relative importance of the different sectors in explaining the pay gap[11], shows that *Textile*, *Transports*, and *Services* contributed the most to its widening in 2000. In the same year, *Finance* was the only sector that acted to the

[10] For our purposes we considered industry and occupation at a relatively high aggregated level. An illustrative discussion on the effects of using higher or lower levels of aggregation of these variables can be found in Bayard *et al* (1999).

[11] The analysis of the relative importance of the different variables is presented in Appendix D and the means of the variables are presented in Appendix B.

reduction of the gap. This fact is associated to the different distribution of women and men among sectors in the Portuguese labour market: *Textile* and *Service* sectors have proportionately more women than men employees (19.6% against 6.0% on the textile sector and 14.2% of women and 3.8% of men on the services sector). *Transports* is essentially important on male employment structure: 9.1% of employed men worked on this sector the percentage reducing to 3.3% if we consider employed women. *Finance* appears clearly as the sector with the lowest level of gender segregation of workers.
The strong influence of industry to the explanation of the pay gap due to differences in the attributes persisted along the whole period and a slight increase of its relative importance is noticeable in more recent years. Recent evolution shows a significant decrease on the relative weight of employment in *Textile* and a significant increase in the relative importance of *Finance*.

Occupation accounts for 19% of the gender wage differential due to attributes, contributing for its widening, despite the relevant contribution of *Laborers* (occ5) to the reduction of the gap (mostly due to the strong importance of these occupations in both male and female job structure). The role played by occupations at the intermediate level, mainly *Services and Sales* (occ4), in increasing the wage gap more than compensated that effect. A different distribution of men and women among occupations is clearly associated with these results as men are more concentrated on top and bottom occupation levels, whereas women are relatively more concentrated at intermediate occupation level jobs. Occupation clearly reinforces its importance in explaining the gender pay gap over time: a relative weight of 4% at the beginning of the period increased sharply by the end of the 90's .
Results also show that human capital variables (education, tenure, and experience) only explain 7.3% of the gap due to the endowment differential in 2000 (see Table 4). This percentage has significantly decreased along the period under analysis, since in 1985 it ranked at 27.4%. Taking only the last five years, the loss in its relative weight was as high as 11 percentage points. It is worth noting that this global evolution of the human capital variables occurred in a context where education has contributed to the reduction of the gender wage gap; still, this effect has been offset by the higher contribution of experience and tenure towards the increase of this gap (see Appendix D). It is interesting to note that the mean years of schooling completed of the employees had a relevant increase (37% higher in 2000 as compared to 1985) despite remaining low (on

average each employee had 5.50 years of school in 1985 and the value increased to 7.52 years in 2000); women were slightly more educated than men in 1985 and the gap increased along the period: in 1985 the average number of school years was 5.60 for women and 5.45 for men and in 2000 the values were 7.83 and 7.30, respectively (see Appendix B).

Part-time (-2,3%), location (-1,3%) and plant size (0,1%) have a minor or almost null effect in the explanation of the wage differential along the four years under analysis, they never had a relevant importance to its explanation along the period.

5. Conclusions

In this paper, we have analysed the gender wage differentials in the Portuguese private sector for the period 1985-2000. We attempt to estimate wage discrimination and endowment differentials using four different methodologies. In accordance with previous international research, whatever the structure used as the non-discrimination wage structure, the measured discrimination differential dominates the estimated endowment differential However, we obtain different results for the differentials according to the used non-discrimination wage structure. When using the female or the male structure the estimates obtained are very extreme, whereas the Cotton and Neumark methods allow less wide estimates.

Over time, a relevant discrimination gap persisted and it didn't show any tendency to decrease: in 2000, discrimination explains 64 to 91 percent of the total gender wage depending on the methodology used; in 1985 this interval ranged only from 52 to 75 percent. This conclusion is quite striking given the high participation rate of women in the Portuguese labour market as compared to other European countries and the substantial increase on their average years of schooling.

The results based on the methodologies that allow the decomposition of the discrimination effect into male advantage and female disadvantage show a higher importance of the latter, despite the reduction of its importance along the period.

Results are also consistent in showing that the most important difference in attributes to explain of the gender pay gap is, clearly, the different way how males and females are distributed by sector of industry. Sectoral segregation of employment is, in Portugal, an

important source of gender wage inequality: the sectors that have the highest contribution to increasing the gender pay gap are sectors highly feminised (as is the case of textile and services) or have a very high concentration of male workers (as it is the case of transports). Finance, where can be observed the lowest level of gender segregation, is the only sector that contributes, in 2000, to reducing the gender pay gap. Differences in the distribution of male and female workers by occupation also increased their relative importance to explaining the gender pay gap.

As to human capital variables, their relative importance to the explanation of the gender pay gap has reduced sharply, particularly along the 90's, showing that the situation of women and men in the Portuguese labour market has progressed towards more similar human capital profiles. Still, our analysis shows that this reduction has occurred in a context where education had an important and increasing role in reducing the wage gap but that differences in experience and tenure are sufficient to neutralise the effect of education, keeping the global influence of human capital factors as acting to the increasing of the gap.

These targets are clearly referred in the European Employment Strategy and Portugal has had, on the recent past, explicit recommendations on the need to promote adequate policy measures aimed at reducing the gender pay gap in the private sector. The conclusions of this paper are important for the identification of employment policy measures concerning the definition of an adequate strategy to reduce the gender pay gap and to fight against discrimination practices.

Appendix A - Definition of variables

Variable	Description
ln W	Natural logarithm of hourly earnings
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 in the Northern region
CENTER	Dummy variable, 1 if job in the Central region
LISBON	Dummy variable, 1 if job in the Lisbon-and-Tagus-Valley region
ALENT	Dummy variable, 1 if job in the Alentejo region
ALGAR	Dummy variable, 1 if job 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*
OCC5	Dummy variable, 1 if employees are *Laborers*
PRIMSECT	Dummy variable, 1 if job in *Primary Sector*
MANUF	Dummy variable, 1 if job in *Manufacturing*
TEXTILE	Dummy variable, 1 if job in *Textile*
UTIL	Dummy variable, 1 if job in *Utilities*
CONSTRU	Dummy variable, 1 if job in *Construction*
WHOLE	Dummy variable, 1 if job in *Whole Trade*
RETAIL	Dummy variable, 1 if job in *Retail Trade*
RESTHOT	Dummy variable, 1 if job in *Restaurants and Hotels*
TRANSP	Dummy variable, 1 if job in *Transports*
FINANCE	Dummy variable, 1 if job in *Finance*
SERVICE	Dummy variable, 1 if job in *Services*
PARTIME	Dummy variable, 1 if part-time job

Appendix B - Means of variables (1985 and 2000)

	1985			2000		
Variable	Pooled	Males	Females	Pooled	Males	Females
ln W	5.133	5.210	4.974	6.602	6.702	6.465
ed0	0.096	0.093	0.104	0.020	0.020	0.019
ed4	0.582	0.597	0.552	0.340	0.361	0.311
ed6	0.125	0.124	0.126	0.225	0.229	0.219
ed9	0.063	0.055	0.082	0.166	0.168	0.163
ed12	0.114	0.111	0.120	0.170	0.149	0.198
ed14	0.006	0.007	0.004	0.020	0.016	0.024
ed16	0.013	0.014	0.011	0.060	0.057	0.065
tenure	9.637	9.969	8.947	7.331	7.704	6.821
tenure2	164.436	178.184	135.886	129.265	141.427	112.678
exper	15.632	16.640	13.538	16.077	16.817	15.067
exper2	360.850	395.599	288.684	387.648	412.630	353.576
ed4ten	5.703	6.044	4.995	3.199	3.547	2.725
ed4exp	9.919	10.797	8.096	7.856	8.391	7.125
ed6ten	1.058	1.095	0.982	1.424	1.461	1.373
ed6exp	1.422	1.502	1.256	3.458	3.614	3.245
ed9ten	0.490	0.421	0.634	1.159	1.200	1.103
ed9exp	0.662	0.614	0.762	2.067	2.154	1.947
ed12ten	1.032	1.077	0.937	0.911	0.848	0.998
ed12exp	0.925	0.994	0.782	1.501	1.419	1.613
ed14ten	0.051	0.062	0.029	0.111	0.103	0.122
ed14exp	0.055	0.065	0.032	0.170	0.157	0.187
ed16ten	0.102	0.116	0.072	0.317	0.334	0.293
ed16exp	0.118	0.135	0.082	0.476	0.530	0.404
plant10	0.294	0.294	0.294	0.248	0.243	0.256
plant99	0.398	0.408	0.378	0.454	0.468	0.435
plant499	0.205	0.195	0.225	0.207	0.203	0.213
plantbig	0.103	0.103	0.102	0.090	0.086	0.096
north	0.394	0.373	0.438	0.376	0.378	0.374
center	0.175	0.187	0.149	0.157	0.160	0.154
lisbon	0.361	0.366	0.352	0.394	0.389	0.401
alent	0.033	0.039	0.022	0.034	0.036	0.030
algar	0.036	0.035	0.039	0.039	0.037	0.041
occ0	0.024	0.031	0.009	0.025	0.032	0.015
occ1	0.014	0.015	0.013	0.041	0.041	0.041
occ2	0.038	0.041	0.031	0.106	0.125	0.080
occ3	0.182	0.151	0.244	0.157	0.111	0.220
occ4	0.107	0.106	0.108	0.135	0.078	0.212
occ5	0.636	0.656	0.594	0.536	0.613	0.432
primsect	0.012	0.016	0.003	0.008	0.013	0.003
manuf	0.289	0.326	0.213	0.218	0.255	0.168
textile	0.161	0.090	0.309	0.117	0.060	0.196
util	0.015	0.020	0.006	0.007	0.010	0.003
constru	0.084	0.118	0.012	0.115	0.184	0.020
whole	0.115	0.123	0.097	0.114	0.139	0.079
retail	0.096	0.089	0.111	0.083	0.055	0.123
resthot	0.038	0.030	0.056	0.062	0.042	0.090
transp	0.076	0.090	0.049	0.067	0.091	0.033
finance	0.053	0.055	0.048	0.127	0.114	0.145
service	0.060	0.043	0.096	0.082	0.038	0.142
partime	0.057	0.039	0.093	0.068	0.047	0.096
school	5.499	5.452	5.596	7.523	7.299	7.828

Note: similar values for the other years are available upon request.

Appendix C - Coefficient Estimates (year 2000)

	Pooled		Males		Females	
Variables	Coef.	t stat.	Coef.	t stat.	Coef.	t stat.
ed4	-0.00408	-0.87	0.02088	3.44	0.03113	4.72
ed6	0.03537	7.39	0.04220	6.83	0.06850	10.20
ed9	0.07634	15.60	0.07225	11.41	0.09089	13.21
ed12	0.14718	29.58	0.15423	23.77	0.15930	22.91
ed14	0.37216	57.49	0.41453	44.93	0.39921	45.88
ed16	0.56709	100.95	0.61766	82.50	0.57329	73.19
tenure	0.01327	73.25	0.01421	60.01	0.01261	49.22
tenure2	-0.00025	-76.04	-0.00029	-69.07	-0.00022	-46.42
exper	0.01193	64.26	0.01443	59.38	0.01019	39.84
exper2	-0.00022	-95.77	-0.00025	-83.77	-0.00018	-56.04
ed4ten	0.00587	37.50	0.00604	29.19	0.00233	10.73
ed4exp	0.00152	11.50	0.00081	4.73	-0.00016	-0.88
ed6ten	0.01192	69.68	0.01310	58.64	0.00780	32.06
ed6exp	0.00171	11.70	0.00124	6.48	-0.00041	-2.01
ed9ten	0.01858	107.83	0.01924	84.64	0.01722	70.82
ed9exp	0.00326	19.84	0.00311	14.53	0.00093	4.07
ed12ten	0.02197	115.07	0.02263	88.32	0.02051	77.29
ed12exp	0.00721	37.51	0.00732	28.44	0.00452	17.25
ed14ten	0.02047	59.79	0.01890	40.96	0.02114	42.59
ed14exp	0.00829	19.02	0.00745	12.39	0.00486	8.18
ed16ten	0.02011	76.51	0.01794	53.40	0.02174	53.30
ed16exp	0.01318	41.59	0.00913	23.26	0.01271	25.06
plant99	0.14896	218.51	0.15620	170.18	0.13663	144.35
plant499	0.22122	258.49	0.24365	207.24	0.19816	174.01
plantbig	0.26824	240.18	0.28351	182.25	0.27028	179.59
center	-0.00860	-11.52	0.02824	28.03	-0.03360	-34.32
lisbon	0.08533	129.22	0.12436	143.00	0.05898	63.86
alent	0.04762	32.56	0.08380	44.41	0.00302	1.51
algar	0.08777	64.30	0.11325	58.97	0.07403	42.23
occ1	-0.18845	-55.84	-0.22947	-55.75	-0.08770	-15.38
occ2	-0.32967	-104.01	-0.34733	-91.80	-0.25353	-46.03
occ3	-0.58779	-187.29	-0.56236	-148.08	-0.46155	-85.05
occ4	-0.71698	-221.21	-0.67102	-166.76	-0.62163	-112.59
occ5	-0.71054	-224.82	-0.69460	-183.73	-0.68220	-124.26
primsect	0.14073	48.04	0.09554	31.51	0.03472	4.52
textile	-0.21363	-262.85	-0.13785	-98.71	-0.11329	-108.94
util	0.41256	128.86	0.38501	110.46	0.34304	54.16
constru	0.02285	24.53	-0.03893	-37.62	-0.04956	-16.53
whole	0.02162	20.53	-0.00077	-0.61	0.02056	12.01
retail	-0.05630	-46.35	-0.06244	-33.89	0.00180	1.16
resthot	-0.13299	-105.95	-0.17541	-79.86	-0.04427	-29.65
transp	0.20143	174.26	0.14568	109.84	0.21775	91.80
finance	0.07883	69.43	0.12113	78.56	0.07358	47.09
service	-0.08290	-67.12	0.00909	3.55	-0.02410	-17.06
partime	0.04005	28.93	0.09411	41.09	0.07212	43.99
constant	6.66206	1145.10	6.64998	904.17	6.52194	741.37

R2	0.5916	0.5858	0.6326
n	1877753	1083403	794350

Note: similar estimates for the other years are available upon request.

Appendix D

Contributions of variables to the gap due to endowment differential (1985 and 2000)

Variable	1985			2000		
ed4	0.00277	2.4%		-0.00020	-0.2%	
ed6	-0.00021	-0.2%		0.00034	0.4%	
ed9	-0.00627	-5.5%		0.00036	0.4%	
ed12	-0.00387	-3.4%		-0.00727	-8.4%	
ed14	0.00204	1.8%		-0.00310	-3.6%	
ed16	0.00280	2.5%		-0.00436	-5.1%	
tenure	0.01757	15.5%		0.01173	13.6%	
tenure2	-0.01247	-11.0%		-0.00712	-8.3%	
exper	0.05527	48.8%		0.02089	24.3%	
exper2	-0.03350	-29.6%		-0.01299	-15.1%	
ed4ten	0.00604	5.3%		0.00483	5.6%	
ed4exp	-0.00011	-0.1%		0.00193	2.2%	
ed6ten	0.00158	1.4%		0.00104	1.2%	
ed6exp	0.00096	0.9%		0.00063	0.7%	
ed9ten	-0.00344	-3.0%		0.00180	2.1%	
ed9exp	-0.00042	-0.4%		0.00067	0.8%	
ed12ten	0.00155	1.4%		-0.00329	-3.8%	
ed12exp	0.00022	0.2%		-0.00140	-1.6%	
ed14ten	0.00019	0.2%		-0.00041	-0.5%	
ed14exp	0.00002	0.0%		-0.00024	-0.3%	
ed16ten	0.00019	0.2%		0.00082	1.0%	
ed16exp	0.00011	0.1%	27.4%	0.00165	1.9%	7.3%
plant99	0.00156	1.4%		0.00485	5.6%	
plant499	-0.00398	-3.5%		-0.00221	-2.6%	
plantbig	0.00010	0.1%	-2.1%	-0.00258	-3.0%	0.1%
center	0.00051	0.5%		-0.00005	-0.1%	
lisbon	0.00088	0.8%		-0.00096	-1.1%	
alent	0.00144	1.3%		0.00029	0.3%	
algar	-0.00025	-0.2%	2.3%	-0.00040	-0.5%	-1.3%
occ1	-0.00007	-0.1%		0.00011	0.1%	
occ2	-0.00118	-1.0%		-0.01466	-17.0%	
occ3	0.02808	24.8%		0.06362	73.9%	
occ4	0.00075	0.7%		0.09564	111.1%	
occ5	-0.02289	-20.2%	4.1%	-0.12835	-149.1%	19.0%
primsect	0.00049	0.4%		0.00143	1.7%	
textile	0.04500	39.8%		0.02903	33.7%	
util	0.01086	9.6%		0.00311	3.6%	
constru	0.00132	1.2%		0.00377	4.4%	
whole	0.00311	2.7%		0.00130	1.5%	
retail	0.00074	0.7%		0.00381	4.4%	
resthot	0.00290	2.6%		0.00639	7.4%	
transp	0.00992	8.8%		0.01153	13.4%	
finance	0.00357	3.2%		-0.00247	-2.9%	
service	0.00199	1.8%	70.6%	0.00858	10.0%	77.2%
partime	-0.00272	-2.4%	-2.4%	-0.00199	-2.3%	-2.3%
		100.0%	100.0%		100.0%	100.0%

Note: similar values for the other years are available upon request.

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