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## **ABSTRACT**

### **Inter-Regional Wage Dispersion in Portugal\***

This paper examines the size of inter-regional wage dispersion in Portugal. For this purpose, we estimate a Mincer-type human capital wage equation, including controls for a large number of regions, and calculate a weighted and adjusted standard deviation (WASD) of inter-regional wage differentials. The value is high and quite stable over time. The highest wages are found in the region of Lisbon. Moreover, the results are quite sensitive to inclusion of human capital and industry controls. A decomposition analysis reveals that differences in average years of education and in the return to education across regions account for a significant fraction of observed wage differentials.

JEL Classification: J31, R10

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## **1. Introduction**

The role of regions for wage differentials has been put forward in the literature by several authors (see e.g. Dumond et al., 1999, Duranton and Monastiriotis, 2002, Garcia e Molina, 2002 and Bernard et al., 2003). The main goal of this paper is to provide further evidence on the role of regions to wage determination as well as evaluate to the size of regional wage differentials in a small country as Portugal.

This is, however, a country for which a few studies have already addressed the effect of regions on wages. For instance, Cardoso (1991) documents the existence of large wage differentials among the Portuguese regions. Vieira (1999) indicates that after controlling for a large number of individual and job attributes employees working in the area of Lisbon and the Tagus Valley earn higher wages than their counterparts in other regions (the lowest wages were paid in the central region of the country). Teulings and Vieira (2004) compare wages in Lisbon and the Tagus Valley with those paid in the rest of the country and argue that higher wages in Lisbon result from differences in the returns to human capital between those two regions. In particular, they argue that equally skilled workers obtain higher returns on human capital due to differences in technology (complexity of the jobs). More recently, Vieira and Madruga (2005) examined low-pay employment incidence and mobility in Portugal and conclude that those working in the region of Lisbon are less likely to be found in the low pay segment and, once in such a situation, are more likely to escape from it.

A common feature of most of the aforementioned studies is a high level of aggregation of the regions (in some cases only Lisbon and the Tagus Valley versus the rest of the country), which may to some extent lead to misleading results. In this study, we examine the impact of regions on wages considering eighteen districts. Moreover, we make use of a decomposition analysis to disentangle how prices and differences in individual and job attributes contribute to observed wage differentials.

The paper is organised as follows. Next section describes the data. Section 3 presents the size of inter-regional wage differences for apparently equally-skilled workers. Section 4 decomposes observed raw (log) wage differentials among regions and the nationwide average into differences in individual and job attributes and differences in returns to these attributes. Finally, section 5 concludes and summarises.

## 2. Data

The data used here were drawn from *Quadros de Pessoal* (Personnel Records) for 1996 and 2000. This is a standardised questionnaire which all firms with wage earners must complete every year for the Department of Labour. The data include information on individual workers such as age, tenure with the current firm, the highest completed level of education, and gender. Information is also available on hours of work, firm size, industry affiliation, and regions. Years of education were calculated by attributing the nominal number of completed years in order to complete the reported level in the data. Potential labour market experience was computed as age minus years of education minus six. Hourly wages were calculated as monthly wages divided by the number of hours worked. Civil servants and others serving in the armed forces are not included in the data source. The final samples contain 1 439 158 and 1 713 488 of non-agricultural, and non-fishermen workers between 16 and 65 years of age in 1996 and 2000, respectively. Records with missing values were deleted from the original sample, as were the self-employed, unpaid family workers and apprentices. The data refers only to the mainland.

----- insert Table 1 about here -----

The results in Table 1 indicate that the individuals in the sample had an average education equal to 6.9 years in 1996 and 7.5 years in 2000. Years of tenure with the current employer amounted to 8.1 years in 1996 and 7.4 years in 2000. Average years of labour market experience were nearly 23 years. The share on males amounted to 61% in 1996 and 59% in 2000. The regions of Lisbon and Oporto command in terms of employment with 35% and 20% of the workers, respectively. The lowest share is found in the district of Bragança.

## 3. The size of inter-regional wage differentials

This section presents the estimation of regional wage gaps. The estimates are based on a human capital wage-equation of the type presented by Mincer (1974), expanded with a set of other covariates. The equation reads as follows:

$$\ln w_i = \beta' X_i + \theta' Z_i + \varepsilon_i \quad i=1,2,\dots,N \quad (1)$$

where  $\ln w_i$  denotes the natural logarithm of wages and  $X_i$  is a vector of explanatory variables which include a unit vector and controls for gender and human capital accumulation indicators such as years of education, years of labour marked experience and its square and years of tenure with the firm. It also includes controls for the logarithm of firm size, and eight industry dummies. The inclusion of these variables are justified by the fact that several authors have shown that firm size and industry affiliation play a role in explaining wage differences for apparently equally-skilled workers (see Krueger and Summers, 1988, Edin and Zatterberg, Arai 1994, Lausten, 1995, Idson and Feaster, 1990 and Oosterbeek and van Praag, 1995). In such a case, and to extent that industry location and firm size differ among regions, the effect of regions on wages would be biased in the absence of the inclusion of those variables. Finally,  $Z_i$  is a set of regional dummies; each of these dummies takes the value 1 if the individual works in an establishment located in specific region and 0 otherwise. For this purpose, we used the Portuguese districts (18 districts).

We have also estimated some restricted specifications of the aforementioned equation, namely by excluding the human capital controls, excluding the industry dummies and one equation which only includes controls for regions (i.e.  $Z_i$ ). In order to evaluate the importance of regions in shaping the wage structure, conventional F-tests were performed. The null hypothesis that regions play no role in explaining the wage structure (i.e.  $\theta' = 0$ ) is rejected in all cases at the 1% level of significance.<sup>1</sup>

Table 2 includes the estimated region coefficients in deviations from the employment-weighted mean. A similar procedure has been used in other works that examine the role of industry affiliation to wages (see e.g. Krueger and Summers, 1988 and Lausten, 1995). A negative (positive) sign indicates that the respective region pays below (above) the weighted average. Normalisation to deviations from the weighted mean was

performed through the formula  $\bar{\theta}_j = \hat{\theta}_j - \sum_{s=1}^K \alpha_s \hat{\theta}_s$  where  $\hat{\theta}_j$  is the estimated coefficient associated to industry  $j$ ,  $\alpha_s$  is the employment share of region  $s$ , and  $K$  is the number of

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<sup>1</sup> The F-statistic amounted to 2235 in 1996 and to 2496 in 2000.

regions. Thus, for the omitted category in the regression we have that the deviation is

$$\text{given by } \bar{\theta}_j = -\sum_{s=1}^K \alpha_s \hat{\theta}_s .$$

The results included in Table 2 for the unrestricted specification indicate that the range of differentials is significant. In 1996 the wage premium varies between -15.1% in Bragança and 8.9% in Lisbon. In 2000 the differences amount to -13.8% in Castelo Branco and 8.8% in Lisbon.<sup>2</sup> Indeed, if we only use dummy variables in the regression the only region that pays above the average of the country is Lisbon. The regions of Faro and Setúbal also pay above the average once controls human capital, gender, firm size, and industries are included in the regression. The Pearson and Spearman correlation are included in the bottom of Table 2 and reveal that the rankings of pay among regions remained very stable between 1996 and 2000.

----- insert Table 2 about here -----

A summary statistic which can measure the magnitude of inter-regional wage differentials, conditional on worker and job characteristics, is the weighted and adjusted standard deviation presented by Krueger and Summers (1988). The adjusted standard deviation of the regional wage premiums in a given year is given by:

$$\text{ASD}(\theta) = \left[ \text{var}(\hat{\theta}) - \sum_{j=1}^K \frac{\hat{\sigma}_j^2}{K} + \sum_{j=1}^K \sum_{p=1}^K \frac{\hat{\sigma}_{jp}}{K^2} \right]^{1/2} \quad (2)$$

where  $\text{var}(\hat{\theta})$  is the variance of the estimated industry coefficients,  $\hat{\sigma}_j$  is estimated standard error of  $\hat{\theta}_j$ ,  $\hat{\sigma}_{jp}$  is the covariance between  $\hat{\theta}_j$  and  $\hat{\theta}_p$  ( $j \neq p$ ), and  $K$  is the number of regions. By ignoring covariance terms and weighting, the weighted and adjusted standard deviation of the inter-regional wage differentials is calculated as:

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<sup>2</sup> These values were computed as  $d = (\exp(r) - 1) \times 100$ , where  $r$  denotes the value of the coefficient in difference from the weighted mean.

$$\text{WASD}(\theta) = \left[ w \text{var}(\hat{\theta}) - \sum_{j=1}^k \alpha_j \hat{\sigma}_j^2 \right]^{1/2} \quad (3)$$

where  $\alpha_j$  is the share of workers in industry  $j$  and  $w \text{var}(\hat{\theta})$  is the employment weighted differences of the industry wage differences.

Calculated  $\text{WASD}(\theta)$  are included at the bottom of Table 2. This table also compares the values for the main (unrestricted) wage equation with three restricted versions (without industry controls, without human capital controls and only region controls). For the sake of comparison, we also include the unweighted and unadjusted standard deviation,  $\text{SD}(\theta)$ .

As can be seen, weighting and adjusting does not change the size of inter-industry dispersion, as far as the main (i.e. unrestricted) wage specification is concerned. The size tends however to increase for the restricted specifications. This happens mainly due to weighting, since adjustments for sampling error play a minuscule role.

If the regression only includes regional dummies the  $\text{WASD}(\theta)$  equals 0.227 in 1996 and 0.211 in 2000. Including controls for education, experience, tenure, gender, firm size and industries the value reduces to 0.073 in 1996 and 0.070 in 2000. This value increases to 0.115 in 1996 and to 0.111 once we remove the human capital controls (education, experience and tenure with the firm). For the sake of comparison, it is interesting to notice that if instead of human capital we had removed the industry controls, the  $\text{WASD}(\theta)$  would have slightly increased to 0.089 in 1996 and to 0.082 in 2002. This suggests that differences in human capital among regions are much more important to the explanation of observed wage differentials among regions than are industry differences.

#### **4. Decomposition of observed wage differentials**

In this section we intend to untie the contribution in average attributes (endowments) from differences in rewards to those attributes to the observed average log-wage differential between each region and the whole country average. To do this, we apply a



wage decomposition analysis that separates out these effects. Oaxaca (1973) and Blinder (1973) were pioneers of this technique, which was designed to analyse labour market discrimination. The decomposition used here is encompassed in the more general formula presented by Cotton (1988).

In order to pursue we have to estimate a separate wage equation for each region of the type:

$$\ln w_{ij} = \beta_j' X_{ij} + \varepsilon_{ij} \quad (4)$$

where  $X_{ij}$  is a set of explanatory variables (including a vector of ones)  $\beta_j$  are vectors of unknown parameters to be estimated and  $\varepsilon_{ij}$  is an error term. The subscripts  $i$  and  $j$  index individual workers and the corresponding region, respectively. We also estimate an equation for the whole country (reference category) of the type:

$$\ln w_{is} = \beta_s' X_{is} + \varepsilon_{is} \quad (5)$$

The sample differential in observed average log-wages between region  $j$  and the country-wide average is decomposed as:

$$\Delta = \overline{\ln w_j} - \overline{\ln w_s} = \sum_c \Delta^{ce} + \sum_c \Delta^{cr} \quad (6)$$

where  $\Delta^{ce} = 0.5(\hat{\beta}_j^c + \hat{\beta}_s^c)'(\bar{X}_j^c - \bar{X}_s^c)$  and  $\Delta^{cr} = 0.5(\bar{X}_j^c + \bar{X}_s^c)'(\hat{\beta}_j^c - \hat{\beta}_s^c)$ . The subscript  $c$  denotes the  $c$ th characteristic included in the covariates list (e.g. education),  $\beta_j^c$  and  $\beta_s^c$  are estimated parameter vectors estimated by regressing separate wage equations for each region, and  $\bar{X}$  denotes the mean values of explanatory variables over the individuals in a particular region.<sup>3</sup>

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<sup>3</sup> The decomposition based on Oaxaca (1973) suffers from an index number problem. Cotton (1988) dealt with this problem by using weighted averages. The decomposition used here is encompassed in the more general formula presented by Cotton (1988). The application of that formula implies the choice of a weighting number between zero and one. But the choice of the weights is somewhat ad hoc as note by Idson and Feaster (1990, p. 112). We use a weight equal to 0.5.

Equation (6) separates out the observed sample differential of average log-wage between regions that may be attributed to: (i) differences in individual/job characteristics (endowments), captured by  $\sum_c \Delta^{ce}$  where  $\Delta^{ce}$  denotes the contribution of differences in endowments associated with the *cth* characteristics and (ii) differences in the returns to these characteristics, captured by  $\sum_c \Delta^{cr}$  where  $\Delta^{cr}$  stands for the contribution of differences in returns associated to the *cth* characteristic.

As has been noted by Jones (1983), the contribution of the ‘return’ component in the intercept is flawed in the presence of dummy variables, since the magnitude of the constant term depends on the excluded reference group. But the problem goes beyond identifying the intercept component. In general, it is not possible to identify the separate contributions of the ‘return’ component associated with the binary variables in the wage decomposition, since they will depend on the reference group. Nevertheless, neither the contribution of the endowment nor overall decomposition are affected by the choice of the reference groups (Oaxaca and Ransom, 1997). Given that limitation, we separate only the contribution of the continuous variables and lump together the intercept and the dummies.

The decomposition results are included in Table 1 and Table 2 in Appendix. As we can observe, differences log-wages are lower in all regions than the nationwide average, except in Lisbon. This implies that the region of Lisbon, the one with most workers, plays a prominent role to the whole average. As we can see from the results in Table 1 in Appendix, the difference in log-wages between Lisbon and the whole country amounts to 0.286 in 1996. Of this, 0.181 are due to the effect of education (0.106 to differences in average years of education, i.e. endowments, and 0.075 to differences in the return to education). For 2000, the results in Table 3 in Appendix indicate the log-wages in Lisbon are 0.274 above the nationwide average.<sup>4</sup> Of this difference, 0.229 is due to the effect of education (0.114 to differences in endowments and 0.116 to differences in returns to education).

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<sup>4</sup> Lisbon and the Tagus Valley has been a region with a fast growth over the last decades. Over the 1990s this region has overtaken 75% of the European Union GDP per capita and moved out the group of regions elected as objective 1 for the EU structural funds.

Indeed, the values plotted in Figure 1 and in Figure 2, clearly indicate that Lisbon stands apart in the national context with the highest return (price) to education but also with the highest average years of education (see also the information in Table 4 in Appendix). Such a situation suggests the demand for education, likely due to differences in technology, is higher in Lisbon.

----- insert Figure 1 about here -----

----- insert Figure 2 about here -----

The reverse occurs for the other regions: lower average years of education and lower returns to education are responsible for most of the observed log-wage differentials between those regions and the country average. Indeed, the results indicate that if the returns to education and endowments were in those regions equal to those verified for the whole country, average log-wages would exceed the country average in ten of them in 1996, *ceteris paribus*. The figure would equal fourteen regions in 2000.

#### **4. Conclusions and remarks**

In this paper we have examined the size and the determinants of inter-regional wage dispersion in Portugal. For this purpose, we have estimated a Mincer-type human capital wage equation, including controls for a large number of districts, and calculate a weighted and adjusted standard deviation (WASD) of inter-regional wage differences. The value is high and quite stable over time. The highest wages for apparently equally-skilled workers are found in the region of Lisbon. Moreover, the results are quite sensitive to inclusion of human capital and industry controls.

A decomposition analysis reveals that differences in the average years of education and the return to education across regions accounts for a significant fraction of observed wage differentials. We could also observe that Lisbon stands apart at this level. It has an average wage rate quite above the country average which is mostly due to a higher average education in this region and a higher average return to an additional year of education. This also suggests that the demand for educated labour largely surpasses that verified in the other regions, which is in line with findings provided by Teulings and Vieira (2004). Otherwise, we would expect a lower return in Lisbon due to a higher supply of educated labour, *ceteris paribus*.

In a near future it would be however interesting to analyse to what extent differences in the cost of living or other amenities play any role in the explanation of observed wage differentials among regions. It would also be worth to examine the contribution of unobserved individual productive characteristics regional wage differences.

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## TABLES TO BE INSERTED IN THE TEXT

Table 1 - Sample descriptive statistics

|   | 1996    |                | 2000    |                |
|---|---------|----------------|---------|----------------|
|   | mean    | std. deviation | mean    | std. deviation |
| ln hourly wages                           | 6.431   | 0.593          | 6.648   | 0.571          |
| years of education                        | 6.857   | 3.568          | 7.472   | 3.766          |
| years of tenure                           | 8.101   | 8.808          | 7.425   | 8.701          |
| years of experience                       | 23.12   | 12.43          | 23.17   | 12.61          |
| ln firm size                              | 4.459   | 2.242          | 4.205   | 2.254          |
| male                                      | 0.608   |                | 0.585   |                |
| <i>industries:</i>                        |         |                |         |                |
| wood, paper, textiles, rubber and leather | 0.203   |                | 0.165   |                |
| electronics and transp. equipment         | 0.156   |                | 0.141   |                |
| electricity and construction              | 0.058   |                | 0.058   |                |
| wholesale and retail trade                | 0.107   |                | 0.116   |                |
| transport and communications              | 0.253   |                | 0.263   |                |
| banking and insurance                     | 0.118   |                | 0.106   |                |
| real state and allied services            | 0.051   |                | 0.073   |                |
| education, health and related services    | 0.037   |                | 0.055   |                |
| other personnel and collective services   | 0.017   |                | 0.023   |                |
| <i>regions:</i>                           |         |                |         |                |
| Aveiro                                    | 0.081   |                | 0.077   |                |
| Beja                                      | 0.006   |                | 0.006   |                |
| Braga                                     | 0.099   |                | 0.094   |                |
| Bragança                                  | 0.003   |                | 0.004   |                |
| Castelo Branco                            | 0.016   |                | 0.015   |                |
| Coimbra                                   | 0.030   |                | 0.030   |                |
| Évora                                     | 0.009   |                | 0.011   |                |
| Faro                                      | 0.026   |                | 0.031   |                |
| Guarda                                    | 0.009   |                | 0.009   |                |
| Leiria                                    | 0.040   |                | 0.043   |                |
| Lisbon                                    | 0.355   |                | 0.350   |                |
| Portalegre                                | 0.007   |                | 0.006   |                |
| Oporto                                    | 0.204   |                | 0.197   |                |
| Santarém                                  | 0.031   |                | 0.034   |                |
| Setúbal                                   | 0.045   |                | 0.046   |                |
| Viana do Castelo                          | 0.016   |                | 0.016   |                |
| Vila Real                                 | 0.007   |                | 0.008   |                |
| Viseu                                     | 0.018   |                | 0.022   |                |
|   | 1439158 |                | 1713488 |                |

Table 2 - Regional wage differentials (deviations from the employment-weighted mean)

|                      | 1996                  |                           |                                |                      | 2000                  |                           |                                |                      |
|----------------------|-----------------------|---------------------------|--------------------------------|----------------------|-----------------------|---------------------------|--------------------------------|----------------------|
|                      | Unrestricted Equation | without industry controls | without human capital controls | only region controls | unrestricted equation | without industry controls | without human capital controls | only region controls |
| Aveiro               | -0.061                | -0.065                    | -0.118                         | -0.188               | -0.050                | -0.052                    | -0.095                         | -0.147               |
| Beja                 | 0.030                 | 0.012                     | 0.024                          | -0.129               | 0.006                 | -0.010                    | -0.005                         | -0.137               |
| Braga                | -0.085                | -0.127                    | -0.146                         | -0.308               | -0.081                | -0.111                    | -0.134                         | -0.270               |
| Bragança             | -0.164                | -0.155                    | -0.195                         | -0.387               | -0.144                | -0.143                    | -0.181                         | -0.336               |
| Castelo Branco       | -0.156                | -0.189                    | -0.164                         | -0.310               | -0.147                | -0.167                    | -0.164                         | -0.284               |
| Coimbra              | -0.066                | -0.067                    | -0.080                         | -0.152               | -0.068                | -0.072                    | -0.092                         | -0.170               |
| Évora                | 0.001                 | -0.002                    | -0.015                         | -0.157               | -0.010                | -0.016                    | -0.038                         | -0.146               |
| Faro                 | 0.054                 | 0.055                     | 0.032                          | -0.102               | 0.043                 | 0.041                     | 0.015                          | -0.096               |
| Guarda               | -0.130                | -0.152                    | -0.146                         | -0.322               | -0.130                | -0.144                    | -0.161                         | -0.299               |
| Leiria               | -0.014                | 0.005                     | -0.052                         | -0.123               | -0.003                | 0.008                     | -0.040                         | -0.102               |
| Lisboa               | 0.085                 | 0.103                     | 0.140                          | 0.286                | 0.084                 | 0.099                     | 0.141                          | 0.274                |
| Portalegre           | 0.015                 | 0.001                     | 0.009                          | -0.088               | -0.024                | -0.032                    | -0.047                         | -0.134               |
| Oporto               | -0.040                | -0.049                    | -0.062                         | -0.086               | -0.045                | -0.054                    | -0.068                         | -0.101               |
| Santarém             | -0.023                | -0.025                    | -0.035                         | -0.118               | -0.030                | -0.033                    | -0.046                         | -0.117               |
| Setúbal              | 0.033                 | 0.038                     | 0.052                          | 0.010                | 0.021                 | 0.020                     | 0.028                          | -0.011               |
| Viana do Castelo     | -0.111                | -0.110                    | -0.157                         | -0.291               | -0.090                | -0.097                    | -0.135                         | -0.245               |
| Vila Real            | -0.147                | -0.139                    | -0.191                         | -0.313               | -0.144                | -0.144                    | -0.185                         | -0.302               |
| Viseu                | -0.109                | -0.110                    | -0.156                         | -0.279               | -0.058                | -0.058                    | -0.121                         | -0.197               |
| WASD( $\theta$ )     | 0.073                 | 0.089                     | 0.115                          | 0.227                | 0.070                 | 0.082                     | 0.111                          | 0.211                |
| SD( $\theta$ )       | 0.077                 | 0.083                     | 0.096                          | 0.158                | 0.067                 | 0.072                     | 0.085                          | 0.140                |
| Pearson correlation  | 0.973                 | 0.978                     | 0.977                          | 0.985                |                       |                           |                                |                      |
| Spearman correlation | 0.982                 | 0.983                     | 0.972                          | 0.973                |                       |                           |                                |                      |

**TABLES TO BE INSERTED IN APPENDIX**

Table 1 – Decomposition of wage differentials, 1996 (reference: nationwide average)

|            | Aveiro     |        |        | Beja           |        |        | Braga      |        |        |
|------------|------------|--------|--------|----------------|--------|--------|------------|--------|--------|
|            | Endowments | Prices | Total  | Endowments     | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.074     | -0.134 | -0.207 | -0.014         | -0.196 | -0.210 | -0.095     | -0.143 | -0.238 |
| Tenure     | -0.003     | -0.024 | -0.027 | -0.019         | 0.006  | -0.013 | -0.001     | -0.048 | -0.049 |
| Experience | -0.008     | -0.072 | -0.079 | -0.006         | -0.154 | -0.160 | -0.019     | -0.141 | -0.161 |
| Firm size  | -0.023     | 0.037  | 0.015  | -0.160         | 0.283  | 0.123  | -0.025     | 0.011  | -0.014 |
| Other      | -0.030     | 0.141  | 0.111  | -0.045         | 0.176  | 0.131  | -0.090     | 0.244  | 0.153  |
| Total      | -0.137     | -0.051 | -0.188 | -0.243         | 0.115  | -0.129 | -0.231     | -0.077 | -0.308 |
|            |            |        |        |                |        |        |            |        |        |
|            | Bragança   |        |        | Castelo Branco |        |        | Coimbra    |        |        |
|            | Endowments | Prices | Total  | Endowments     | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.027     | -0.365 | -0.392 | -0.070         | -0.122 | -0.191 | -0.043     | -0.131 | -0.174 |
| Tenure     | -0.031     | 0.016  | -0.015 | -0.001         | -0.015 | -0.016 | 0.000      | -0.005 | -0.005 |
| Experience | -0.014     | -0.233 | -0.247 | 0.017          | -0.103 | -0.086 | 0.006      | -0.079 | -0.072 |
| Firm size  | -0.188     | 0.088  | -0.100 | -0.042         | -0.039 | -0.080 | -0.052     | 0.095  | 0.043  |
| Other      | -0.002     | 0.370  | 0.368  | -0.064         | 0.127  | 0.064  | -0.009     | 0.065  | 0.056  |
| Total      | -0.262     | -0.125 | -0.387 | -0.160         | -0.151 | -0.310 | -0.097     | -0.055 | -0.152 |



Table 1 – Cont.

|            | Évora      |        |        | Faro       |        |        | Guarda     |        |        |
|------------|------------|--------|--------|------------|--------|--------|------------|--------|--------|
|            | Endowments | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.031     | -0.240 | -0.271 | -0.014     | -0.244 | -0.257 | -0.075     | -0.168 | -0.242 |
| Tenure     | -0.010     | 0.009  | -0.001 | -0.016     | -0.019 | -0.035 | -0.001     | -0.038 | -0.039 |
| Experience | -0.008     | -0.078 | -0.086 | -0.001     | -0.124 | -0.125 | 0.012      | -0.168 | -0.155 |
| Firm size  | -0.112     | 0.050  | -0.062 | -0.117     | 0.096  | -0.021 | -0.075     | -0.046 | -0.121 |
| Other      | -0.022     | 0.285  | 0.263  | -0.010     | 0.346  | 0.336  | -0.055     | 0.290  | 0.236  |
| Total      | -0.183     | 0.026  | -0.157 | -0.157     | 0.055  | -0.102 | -0.194     | -0.129 | -0.322 |
|            |            |        |        |            |        |        |            |        |        |
|            | Leiria     |        |        | Lisbon     |        |        | Portalegre |        |        |
|            | Endowments | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.053     | -0.162 | -0.214 | 0.106      | 0.075  | 0.181  | -0.019     | -0.161 | -0.180 |
| Tenure     | -0.006     | -0.004 | -0.010 | 0.009      | 0.035  | 0.044  | -0.007     | -0.018 | -0.024 |
| Experience | -0.002     | -0.091 | -0.093 | 0.009      | 0.047  | 0.056  | -0.003     | -0.120 | -0.123 |
| Firm size  | -0.056     | 0.023  | -0.034 | 0.050      | -0.102 | -0.052 | -0.074     | 0.169  | 0.095  |
| Other      | -0.011     | 0.239  | 0.228  | 0.034      | 0.022  | 0.056  | -0.025     | 0.170  | 0.145  |
| Total      | -0.128     | 0.005  | -0.123 | 0.208      | 0.078  | 0.286  | -0.128     | 0.040  | -0.088 |

Table 1 – Cont.

|            | Oporto           |        |        | Santarém   |        |        | Setúbal    |        |        |
|------------|------------------|--------|--------|------------|--------|--------|------------|--------|--------|
|            | Endowments       | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.038           | -0.021 | -0.059 | -0.035     | -0.169 | -0.204 | 0.002      | -0.126 | -0.123 |
| Tenure     | 0.001            | -0.012 | -0.010 | -0.005     | -0.024 | -0.028 | -0.008     | 0.004  | -0.004 |
| Experience | -0.001           | -0.031 | -0.032 | 0.001      | -0.068 | -0.067 | 0.014      | -0.070 | -0.056 |
| Firm size  | 0.001            | 0.010  | 0.012  | -0.060     | 0.024  | -0.036 | -0.039     | 0.018  | -0.021 |
| Other      | -0.018           | 0.021  | 0.004  | -0.004     | 0.222  | 0.217  | 0.008      | 0.206  | 0.214  |
| Total      | -0.055           | -0.031 | -0.086 | -0.103     | -0.016 | -0.118 | -0.023     | 0.033  | 0.010  |
|            |                  |        |        |            |        |        |            |        |        |
|            | Viana do Castelo |        |        | Vila Real  |        |        | Viseu      |        |        |
|            | Endowments       | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.040           | -0.213 | -0.253 | -0.048     | -0.231 | -0.279 | -0.054     | -0.175 | -0.229 |
| Tenure     | -0.018           | 0.035  | 0.016  | -0.013     | -0.011 | -0.025 | -0.014     | -0.011 | -0.025 |
| Experience | -0.031           | -0.158 | -0.188 | -0.010     | -0.197 | -0.207 | -0.013     | -0.136 | -0.149 |
| Firm size  | -0.098           | 0.090  | -0.007 | -0.114     | 0.053  | -0.061 | -0.085     | 0.019  | -0.066 |
| Other      | -0.014           | 0.156  | 0.142  | 0.006      | 0.253  | 0.259  | -0.012     | 0.202  | 0.189  |
| Total      | -0.201           | -0.090 | -0.291 | -0.179     | -0.134 | -0.313 | -0.178     | -0.101 | -0.279 |

Table 2 – Decomposition of wage differentials, 2000 (reference: nationwide average)

|            | Aveiro     |        |        | Beja           |        |        | Braga      |        |        |
|------------|------------|--------|--------|----------------|--------|--------|------------|--------|--------|
|            | Endowments | Prices | Total  | Endowments     | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.071     | -0.125 | -0.196 | -0.023         | -0.227 | -0.250 | -0.094     | -0.159 | -0.253 |
| Tenure     | 0.000      | -0.021 | -0.021 | -0.014         | 0.005  | -0.009 | 0.000      | -0.039 | -0.039 |
| Experience | 0.005      | -0.065 | -0.060 | 0.001          | -0.166 | -0.165 | -0.006     | -0.119 | -0.125 |
| Firm size  | -0.022     | 0.010  | -0.011 | -0.117         | 0.160  | 0.043  | -0.029     | 0.007  | -0.022 |
| Other      | -0.016     | 0.157  | 0.141  | -0.030         | 0.274  | 0.245  | -0.067     | 0.235  | 0.168  |
| Total      | -0.104     | -0.043 | -0.147 | -0.183         | 0.046  | -0.137 | -0.196     | -0.074 | -0.270 |
|            |            |        |        |                |        |        |            |        |        |
|            | Bragança   |        |        | Castelo Branco |        |        | Coimbra    |        |        |
|            | Endowments | Prices | Total  | Endowments     | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.042     | -0.322 | -0.364 | -0.082         | -0.147 | -0.229 | -0.039     | -0.135 | -0.174 |
| Tenure     | -0.025     | 0.002  | -0.023 | 0.002          | -0.029 | -0.027 | -0.004     | -0.020 | -0.024 |
| Experience | -0.001     | -0.241 | -0.242 | 0.026          | -0.120 | -0.094 | 0.002      | -0.091 | -0.089 |
| Firm size  | -0.147     | 0.072  | -0.075 | -0.037         | -0.080 | -0.117 | -0.046     | -0.015 | -0.061 |
| Other      | -0.005     | 0.372  | 0.368  | -0.044         | 0.226  | 0.182  | -0.018     | 0.196  | 0.178  |
| Total      | -0.220     | -0.116 | -0.336 | -0.134         | -0.150 | -0.284 | -0.105     | -0.065 | -0.170 |

Table 2 – Cont.

|            | Évora      |        |        | Faro       |        |        | Guarda     |        |        |
|------------|------------|--------|--------|------------|--------|--------|------------|--------|--------|
|            | Endowments | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.033     | -0.229 | -0.262 | -0.016     | -0.266 | -0.282 | -0.081     | -0.188 | -0.269 |
| Tenure     | -0.012     | -0.004 | -0.016 | -0.020     | -0.014 | -0.034 | -0.003     | -0.040 | -0.043 |
| Experience | -0.006     | -0.158 | -0.164 | 0.000      | -0.141 | -0.141 | 0.021      | -0.180 | -0.159 |
| Firm size  | -0.093     | 0.090  | -0.002 | -0.097     | 0.117  | 0.020  | -0.081     | 0.042  | -0.039 |
| Other      | -0.019     | 0.318  | 0.299  | -0.009     | 0.350  | 0.341  | -0.044     | 0.255  | 0.211  |
| Total      | -0.162     | 0.017  | -0.146 | -0.141     | 0.046  | -0.096 | -0.188     | -0.111 | -0.299 |
|            |            |        |        |            |        |        |            |        |        |
|            | Leiria     |        |        | Lisbon     |        |        | Portalegre |        |        |
|            | Endowments | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.048     | -0.185 | -0.233 | 0.114      | 0.116  | 0.229  | -0.037     | -0.167 | -0.203 |
| Tenure     | -0.006     | -0.014 | -0.020 | 0.010      | 0.031  | 0.041  | -0.008     | 0.004  | -0.004 |
| Experience | 0.002      | -0.104 | -0.102 | -0.002     | 0.055  | 0.053  | 0.002      | -0.092 | -0.090 |
| Firm size  | -0.049     | 0.030  | -0.019 | 0.051      | -0.094 | -0.044 | -0.066     | 0.157  | 0.091  |
| Other      | -0.006     | 0.277  | 0.272  | 0.030      | -0.035 | -0.006 | -0.036     | 0.108  | 0.073  |
| Total      | -0.107     | 0.005  | -0.102 | 0.202      | 0.072  | 0.274  | -0.144     | 0.010  | -0.134 |

Table 2 – Cont.

|            | Oporto           |        |        | Santarém   |        |        | Setúbal    |        |        |
|------------|------------------|--------|--------|------------|--------|--------|------------|--------|--------|
|            | Endowments       | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.042           | -0.033 | -0.075 | -0.034     | -0.192 | -0.227 | -0.004     | -0.165 | -0.170 |
| Tenure     | 0.000            | -0.013 | -0.013 | -0.006     | -0.020 | -0.026 | -0.008     | 0.003  | -0.005 |
| Experience | 0.001            | -0.015 | -0.015 | 0.003      | -0.102 | -0.099 | 0.011      | -0.105 | -0.094 |
| Firm size  | -0.007           | 0.000  | -0.007 | -0.051     | 0.030  | -0.021 | -0.036     | 0.032  | -0.004 |
| Other      | -0.016           | 0.024  | 0.008  | -0.006     | 0.262  | 0.256  | 0.003      | 0.258  | 0.261  |
| Total      | -0.064           | -0.037 | -0.101 | -0.095     | -0.022 | -0.117 | -0.035     | 0.023  | -0.011 |
|            |                  |        |        |            |        |        |            |        |        |
|            | Viana do Castelo |        |        | Vila Real  |        |        | Viseu      |        |        |
|            | Endowments       | Prices | Total  | Endowments | Prices | Total  | Endowments | Prices | Total  |
| Education  | -0.039           | -0.244 | -0.284 | -0.044     | -0.226 | -0.270 | -0.056     | -0.214 | -0.269 |
| Tenure     | -0.015           | 0.009  | -0.006 | -0.012     | -0.029 | -0.041 | -0.016     | -0.013 | -0.029 |
| Experience | -0.022           | -0.178 | -0.199 | -0.006     | -0.202 | -0.208 | -0.009     | -0.145 | -0.154 |
| Firm size  | -0.067           | 0.072  | 0.005  | -0.114     | 0.107  | -0.007 | -0.074     | 0.162  | 0.088  |
| Other      | -0.029           | 0.267  | 0.238  | 0.001      | 0.223  | 0.224  | -0.004     | 0.173  | 0.169  |
| Total      | -0.172           | -0.074 | -0.245 | -0.175     | -0.126 | -0.302 | -0.159     | -0.038 | -0.197 |

Table 3 - Returns to education by region

|                  | 1996   |           | 2000   |           |
|------------------|--------|-----------|--------|-----------|
|                  | return | # observ. | return | # observ. |
| Whole country    | 0.090  | 1439158   | 0.088  | 1713488   |
| Aveiro           | 0.069  | 116931    | 0.070  | 131844    |
| Beja             | 0.061  | 7999      | 0.057  | 10925     |
| Braga            | 0.067  | 141856    | 0.065  | 160593    |
| Bragança         | 0.035  | 4979      | 0.043  | 7645      |
| Castelo Branco   | 0.071  | 22713     | 0.067  | 26193     |
| Coimbra          | 0.070  | 43512     | 0.069  | 50962     |
| Évora            | 0.053  | 12790     | 0.056  | 19054     |
| Faro             | 0.054  | 37835     | 0.052  | 52472     |
| Guarda           | 0.063  | 12533     | 0.061  | 15906     |
| Leiria           | 0.065  | 56882     | 0.062  | 73873     |
| Lisbon           | 0.100  | 511892    | 0.102  | 599724    |
| Portalegre       | 0.066  | 9385      | 0.064  | 10818     |
| Oporto           | 0.086  | 293243    | 0.083  | 337320    |
| Santarém         | 0.064  | 43875     | 0.061  | 59115     |
| Setúbal          | 0.071  | 652262    | 0.066  | 79167     |
| Viana do Castelo | 0.057  | 22470     | 0.054  | 27868     |
| Vila Real        | 0.054  | 9672      | 0.056  | 12972     |
| Viseu            | 0.063  | 25248     | 0.058  | 37073     |

The return refers to the coefficient on years of education in the equation. The number of observations refers to the sample size used for each region.

**FIGURES TO BE INSERTED IN THE TEXT**

Figure 1 - Average years of education and returns to education, 1996

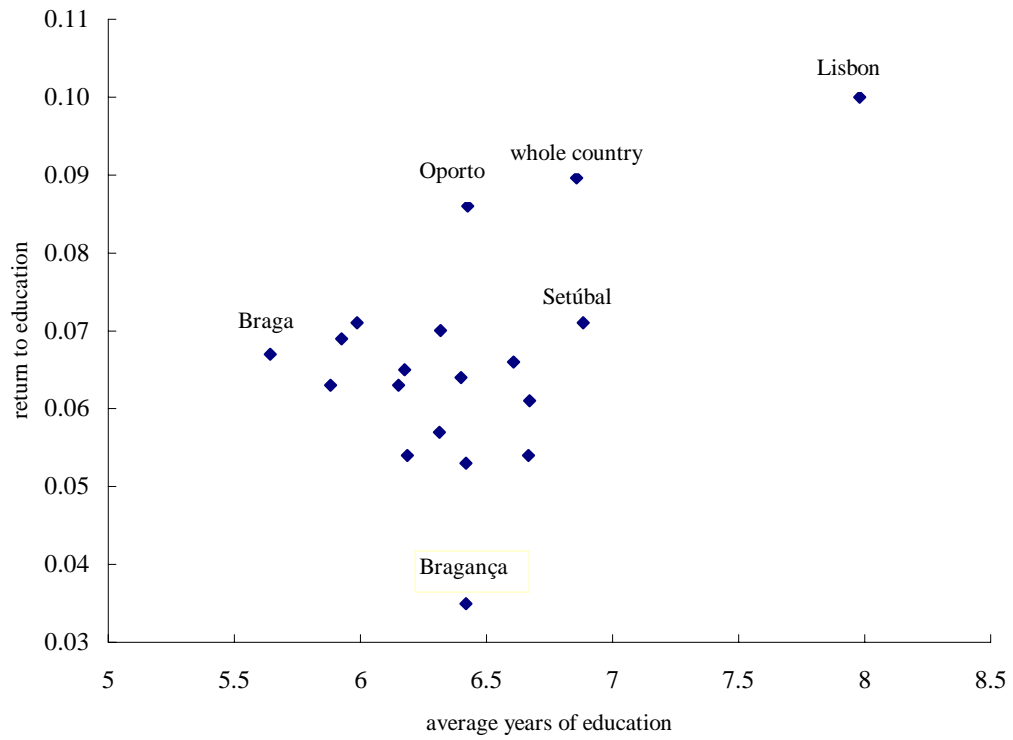


Figure 2 - Average years of education and returns to education, 2000

