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REGIONAL WAGE DIFFERENTIALS: STATIC AND DYNAMIC APPROACHES

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ABSTRACT

This work aims at studying regional wage differentials both in a static and in a dynamic perspective. Previous studies have typically studied this issue using the Blinder and Oaxaca static decomposition. This approach does not provide clear information about the sources explaining the change in regional wage differentials along the years. To overcome this problem this study also uses Junh, Murphy and Pierce (1991,1993) decomposition. We analyse the case of Portugal for 1995 and 2002. Our results show that, although there are small changes in the interregional wage inequality, particularly between the region of Lisboa and the other regions, there are important and counteracting factors shaping this outcome. In fact, Lisboa has reinforced its position as the region with more qualified workers, but the gap in unobserved characteristics has decreased.

Key words: regions, wage differentials, wage gap decompositions

JEL Classification: J31; J38; J49

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1. INTRODUCTION

Spatial wage differentials is an important issue which usually attracts policy makers and general public attention. These differentials may be the result of equilibrium or compensating differentials, as the competitive model predicts, or a consequence of either temporary disequilibrium situations or external economies. Each of these situations has different implications for economic development and therefore for public policy. For example, spatial wage differentials caused by climatic differences do not require any policy intervention, whereas differentials explained by inefficiencies due to low labour mobility deserve policy measures to improve economic efficiency. A correct understanding of the causes of wage differentials and of their evolution is of crucial importance to apply the appropriate policy measures.

Several international studies have analysed this subject using human capital wage equations (for example: Blackaby and Murphy, 1995; García and Molina, 2000; Duranton and Monastiriotis, 2002). To the exception of Duranton and Monastiriotis (2002), all take a static perspective and use Blinder and Oaxaca decomposition. This is the major drawback of these studies as they typically only identify the causes of these differentials in a given year. Hence, nothing can be learned about the dynamics, namely, if there are converging or diverging forces driving the process, or about the factors explaining the change of these wage differentials.

The aim of this paper it to perform a different analysis from previous ones, by considering the dynamic perspective provided by the Junh, Murphy and Pierce (1991, 1993) decomposition (henceforth, JMP), in addition to the static information of Blinder and Oaxaca decomposition. JMP decomposition explains the factors driving the changes in wage inequality between two time periods. This has been a methodology widely used in studies about labour market discrimination and income inequality, but not in studies about regional wage differentials (see for example: Blau and Kahn, 1997; Dávila and Mora, 2005; Kidd and Shannon, 2001). As we conclude, this approach allows a more detailed investigation on the regional wage differentials.

In this study we identify the causes of wages differentials in Portugal and its evolution over the period of 1995 to 2002. Portugal is a small country with important and persisting wage differentials among its regions (see Vieira et al, 2006, and Pereira, 2003). We try to understand the evolution of these differentials and the reasons for the observed changes. Our approach allows us to identify if there are converging or diverging forces driving the regional wage inequality in Portugal. The analysis was carried out using micro data from *Quadros de Pessoal*,, a data set from the Portuguese Ministry of Employment.

The results show that an important part of the regional wage differentials, those between the of Lisboa and the other regions, can be accounted by the fact that Lisboa's region has a higher

percentage of more educated workers, a more favourable occupational structure and a higher percentage of large firms, which, as our results indicate, pay higher wages. Nevertheless, a substantial fraction of the estimated wage differential is explained by differences in rewards for workers with equal level of skills, which is not compatible with a competitive equilibrium. The results of the JMP approach reveal that, in general, the change in the regional wage gap was very small. However, important and counteracting forces have shaped this outcome. In fact, whereas Lisboa has continued to reinforce its position in the number of workers with more qualifications (secondary degrees, university degrees and high paying occupations) and large firms, the regional gap on unobserved characteristics has been reduced from 1995 to 2002.

The paper is organized as follows. In section 2 we present a brief review of the literature about regional wage differentials. Section 3 describes the methodologies used in this study. Section 4 analyses the data. Section 5 presents and discusses the results. Finally, in section 6, we state the conclusions and suggest some policy measures to reduce regional wage differentials in Portugal.

2. BRIEF LITERATURE REVIEW ON SPATIAL WAGE DIFFERENTIALS

Neoclassical theory states that a spatial system of cities or regions in which labour and capital can move freely, information is perfect and transportation costs are moderate, generates a long-run economic equilibrium in which factor prices are equalized (Goldfarb and Yezer, 1976). However, if space is not homogenous and there are important differences in amenities – like extreme climatic conditions or pollution – economic equilibrium must be characterized by differences in prices to attract people to less amenable areas (Roback, 1982). These price (wage) differentials allow workers' utility to equalize across the space. Otherwise, they would not choose less amenable places to live (Rosen, 1986). Another important source of wage differentials is the permanent difference in the cost of living which requires some compensation, particularly of monetary nature, for interregional equilibrium of utility to be achieved.

However, as it is reasonable to admit, an economy is not always in equilibrium. Temporary shifts in demand and supply can cause wage differentials in addition to those which are explained by amenities (Blackaby and Manning, 1990). These disequilibrium situations are more likely to occur in cities or regions in which labour mobility is restricted, for example due to a non-competitive housing market (Henley, 1998).

Economic theory has considered other contexts in which payment differentials between cities or regions may arise. For example, concentration of human capital in cities or regions may cause important knowledge spillovers (Lucas, 1988) which increase economic efficiency and allow for higher wages. In fact, people who live in areas with more concentration of human capital have

the opportunity to learn from others and thus improve their own productivity (Glaeser et al., 1992; Lucas, 1988). External economies may also occur in the presence of industrial concentration in cities or regions (Marshall, 1890; Porter, 1990; Romer, 1986). Through imitation and movement of workers between firms, ideas are quickly disseminated between neighbouring firms. Jacobs (1969) defends the opposite view stating that the most important spillovers come from outside the industry. According to Jacobs, variety and diversity of geographically close industries rather than geographical specialization promote innovation and growth. Another issue on debate is the market structure, whether a competitive market or a monopoly is better for local wage growth. Porter (1990) refers that local competition accelerates imitation and improvement of innovators' ideas. On the other hand, Marshall (1890) sustains that if innovators had the monopoly of their ideas, the pace of innovation and growth would rise.

As neoclassical economic theory stresses that after controlling for amenities differences, wages should be the same in different parts of the country for workers with the same level of skills, most empirical studies base their analysis on the estimation of human capital wage equations and on the explanation of the wage differentials in terms of different regional characteristics or on the fact that these characteristics are rewarded differently in different locations (Blackaby and Manning, 1990; Blackaby and Murphy, 1995; Garcia and Molina, 2002; Duranton and Monastiriotis, 2002, Simón et al, 2006). Wage differentials explained by differences in the both human capital and industry related characteristics are compatible with the neoclassical view. On the other hand, if the same productivity related characteristics are not reward at the same price throughout the space, we might have either a temporary situation of disequilibrium or a more complex process of agglomeration economies and cumulative disequilibrium. Typically these studies consider a static perspective of analysis and employ the Blinder and Oaxaca decomposition.

Empirical evidence on regional wage differentials varies among countries. For instance, the results of Blackaby and Murphy (1995) for Britain show that the wage differentials between the North and the South are relatively small and the situation is not too far from the neoclassical equilibrium – the wage differential that can be explained by differences in the reward of workers with the same skills is about 2.4%, favourable to the South.

For Spain, Garcia and Molina (2002) found important wage differences between Madrid and the other Spanish regions. The explanations for these differences are mixed and depend on the specific case, but both differences in characteristics and their rewards play an important role in the explanation of the regional wage gap in Spain.

For Portugal, studies on regional wage differentials are scarce. While some studies have documented the existence of large wage differentials between Lisboa and the rest of the country (Teulings and Vieira, 2004, and Vieira and Madruga, 2005), to our knowledge only two previous

studies have analysed this issue applying Oaxaca's decomposition and a higher level of regional disaggregation: Pereira (2003) and Vieira et al. (2006). These studies use different data sets and different regional aggregations. Pereira (2003) uses information from the *European Community Household Panel (ECHP)*, which includes workers in the private and in the public sector, while Vieira et al. (2006) use information from *Quadros de Pessoal*, which only comprises information about workers in the private sector. As regard to the regional aggregation, Pereira (2003) uses level two of regional aggregation (NUTs 2), whereas Vieira et al (2006) use a more disaggregated administrative division (*distritos)*. Although there are some differences in the explanatory variables, both studies conclude that there are important regional wage differentials in Portugal, namely between Lisboa, where the capital of the country is located, and the other regions.

In this paper we extend these previous analyses by applying the JMP decomposition which gives a dynamic perspective of the interregional wage differential. In fact, we analyse whether there have been converging or diverging forces shaping the regional wage inequality in Portugal in the period between 1995 and 2002.

3. REGIONAL WAGE GAP DECOMPOSITIONS

The decomposition of Blinder (1973) and Oaxaca (1973) is the typical framework to analyse regional wage differentials at a given point in time. It may be written as:

$$W_t^b - W_t^i = (X_t^b - X_t^i)\hat{\beta}_t^b + X_t^i\left(\hat{\beta}_t^b - \hat{\beta}_t^i\right) \qquad (1)$$

where the left side of (1) represents the difference in the mean wage (in logs) between the benchmark region, *b*, and another region, *i*, in period t*;* X_t^b and X_t^i are vectors of mean human capital characteristics; and $\hat{\beta}_t^b$ and $\hat{\beta}_t^i$ are the OLS parameter estimates of the human capital wage equations for the regions *b* and *i*. Equation (1) states that the wage differential between two regions can be decomposed into a fraction due to differences in measured characteristics, the first term on the right side of (1), and a fraction due to differences in the reward of those characteristics, the last term of the right side of (1). This term is usually known as the Oaxaca's unexplained component.

Juhn et al. (1991, 1993) developed a solution which extends the Oaxaca's methodology to analyse changes in wage inequality between two time periods. The first innovation in this approach is to consider the last term of equation (1), the Oaxaca unexplained component, as a group difference in residuals. Indeed, the mean wage differential between *b* and *i* can be expressed also as:

$$D_t = W_t^b - W_t^i = \Delta X_t \hat{\beta}_t^b + \sigma_t^b \Delta\theta_t \qquad (2)$$

where the prefix Δ stands for regional difference in the mean of the variable immediately following, σ_t^b is the residual standard deviation for the distribution of residuals in *b* and θ_t is a standardized residual (i.e, with mean zero and variance one for each year). The wage differential between *b* and *i* is now the result of differences in measured characteristics between the individuals of each region, as it was on the Oaxaca's formulation, but the last term can now be interpreted as regional differences in the standardized residual from the equation of *b* ($\Delta\theta_t$) multiplied by the money value per unit difference in the standardized residual (σ_t^b). The standardized residual is regarded as a measure of unobserved productivity related characteristics (a quantity) and σ_t^b as the return to these characteristics (a price). Hence, $\Delta\theta_t$ estimates differences of unobserved productivity related to the differences of unobserved characteristics between two regions.

The change in wage inequality between two regions (or groups) over a given time period, t, can be decomposed according to[1]:

$$\begin{aligned} D_t - D_0 = & \underbrace{\left(\Delta X_1 - \Delta X_0\right)\hat{\beta}_1^b}_{observed\ X's} + \underbrace{\Delta X_0\left(\hat{\beta}_1^b - \hat{\beta}_0^b\right)}_{observed\ prices} \\ & + \underbrace{\left(\Delta\theta_1 - \Delta\theta_0\right)\sigma_1^b}_{gap\ effect} + \underbrace{\Delta\theta_0\left(\sigma_1^b - \sigma_0^b\right)}_{unobserved\ prices} \end{aligned} \qquad (3)$$

The first term in the right hand side of (3) reflects the contribution of the change over time in relative observed labour market qualifications (*X*) (first effect). Similarly the second term evaluates the effect of changing prices of these labour market qualifications (second effect). The third term, usually known as the "gap effect", quantifies the effect of changing differences in the relative wage position of the mean individual of each one of the regions after controlling for observed characteristics. That is, it gives the contribution to the change in the regional wage differential that would result if the level of residual wage inequality had remained constant in *b* and only the percentile rankings of the region *i* wage residuals had changed. The fourth term estimates the contribution to the change in the regional wage inequality that would result if the percentile rankings of the region *i* wage residuals had remained the same and only the extent of region *b* wage inequality had changed. It is an unobserved price effect.

[1] We follow Blau and Kahn (1997) notation.

The estimation of both the gap and the unobserved price effect deserves some further clarification. For the first period, we have to compute the wage that each individual of region *i* would earn if rewarded according to the parameters of *b.* Subsequently, we subtract the wage of each individual of *i* from the earlier hypothetical wage and we obtain what is called the (hypothetical) residual. The average of these residuals is labelled as $\Delta\theta_1\sigma_1^b$. Performing similar calculus for the period *0* we obtain $\Delta\theta_0\sigma_0^b$. Finally, $\Delta\theta_0\sigma_1^b$ has to be estimated. This term is derived by first dividing the hypothetical residuals of the region *i* individuals (from the equation of *b*) into percentiles. For each individual of region *i* is then assigned a percentile number based on the position of his (her) residual. Based on this percentile number, the period *0* individual from *i* is assigned the value of the corresponding residual (at the same percentile) in the period *1* distribution of *b* wage residuals. The average of these inputted residuals is designed by $\Delta\theta_0\sigma_1^b$.

4. DATA DESCRIPTION AND ANALYSIS

In this study we use micro data from *Quadros de Pessoal* for 1995 and 2002. This is a standardized questionnaire that all private firms, with at least one employee, complete annually for the Portuguese Ministry of Employment. The survey does not provide information about employees in public administration, self-employees and armed forces. The available data includes earnings, hours of work, age, education, tenure, firm size, industry affiliation, occupation and information about the region where the establishment is located. We chose data from 1995 and 2002 because this is the most recent and longest time period with compatible data on industrial and occupational classifications available.

In our final sample, we considered only workers between 16 and 65 years of age and excluded those individuals working in agriculture and fisheries as well as unpaid family workers and apprentices. Individuals working in the islands of Madeira and Açores were also not considered[2]. Our final sample comprises for 1995, 976504 males and 642916 females and for 2002, 1230839 males and 893319 females.

We base our analysis on Mincer type wage equations, estimating separate equations for each region and considering as explanatory variables the workers' experience; tenure; dummies controlling for industry affiliation; occupational dummies, dummies for secondary education and university degree and the logarithm of the firm's size[3]. To take into account regional differences in the cost of living, the wages were deflated by the regional consumer price index from INE and are

[2] These regions are islands and therefore present a quite different situation than the regions in mainland Portugal.

[3] Detailed information about the variables is provided in the appendixes A and B.

at constant prices. The inclusion of occupational dummies is also an innovation in the case of Portugal as these were not considered in previous studies.

Figures 1 and 2 show that there are important and persistent differences in average raw wages between the Portuguese regions, in particular between the region of Lisboa, where the capital of the country is located, and the remaining regions (more than 30% in some cases). Along with these differences there is an uneven distribution of human capital across the country, specially on the percentage of males and females with university degrees and in a lesser extent on the percentage of individuals with secondary education degrees (figure 3: a) and b); figure 4: a) and b)). This pattern remains quite stable between 1995 and 2002.

Figure 1: Wage differentials 1995 and 2002, males

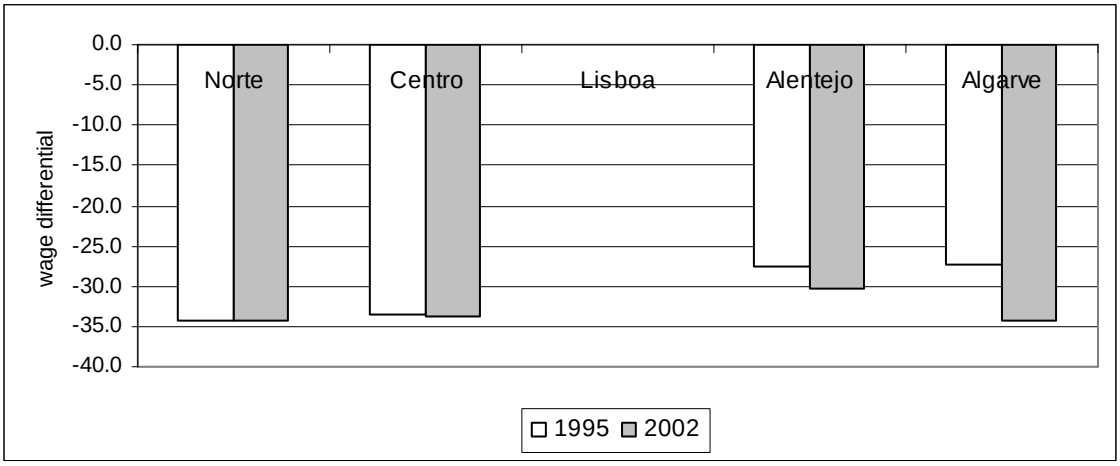


Figure 2: Wage differentials 1995 and 2002, females

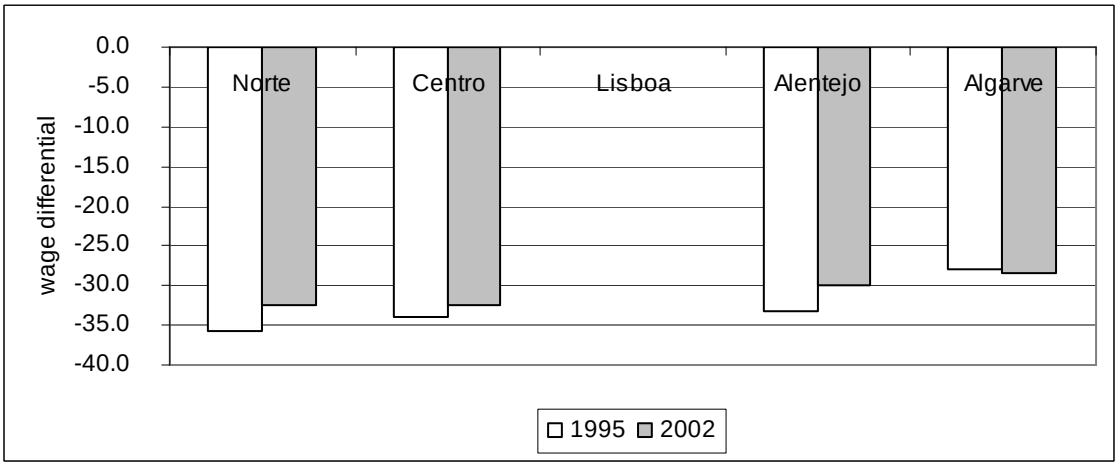
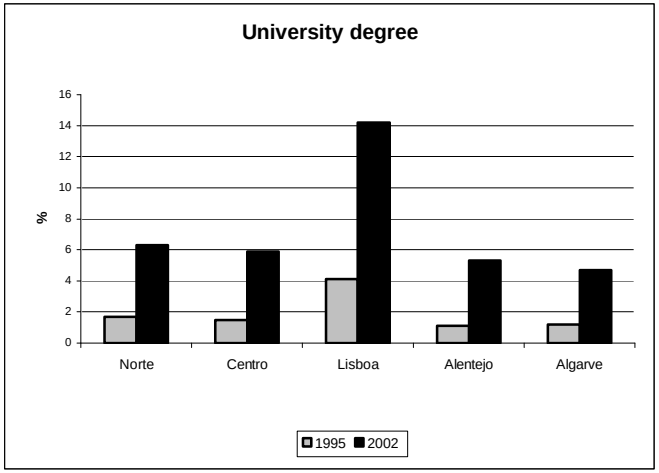
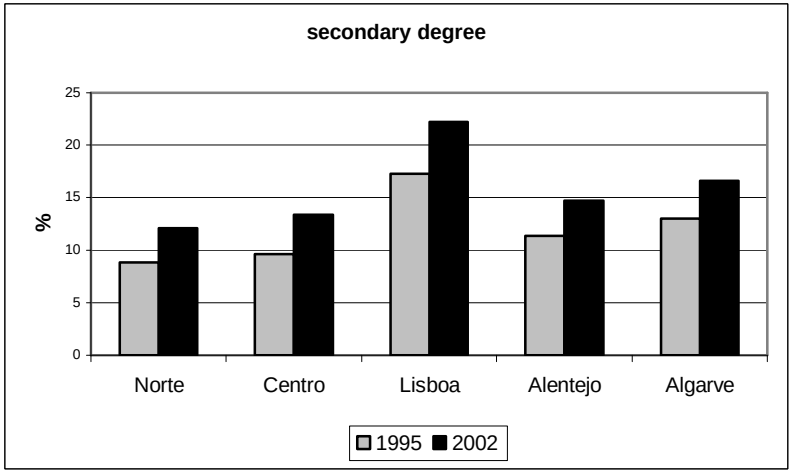


Figure 3: Regional distribution of endowments, Men

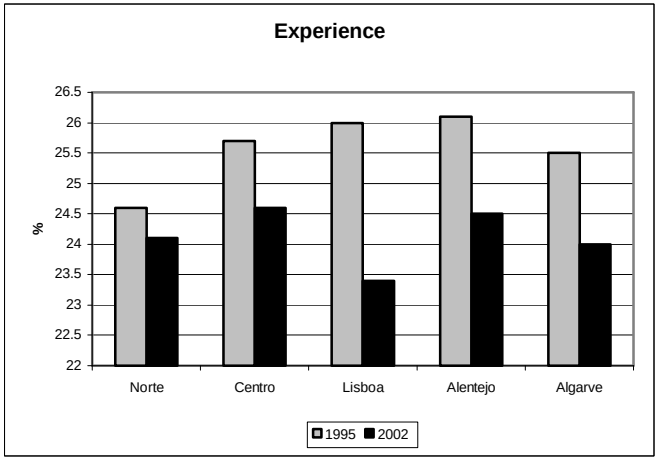
a)



b)



c)



d)

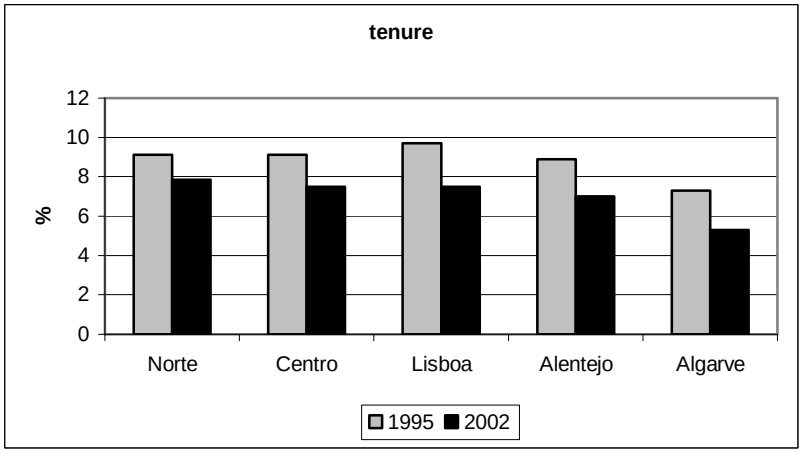
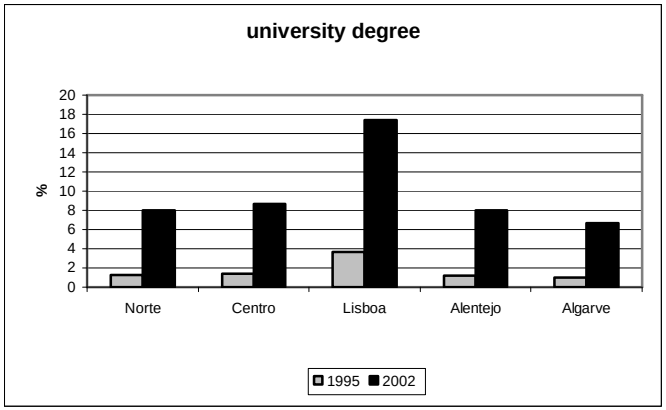
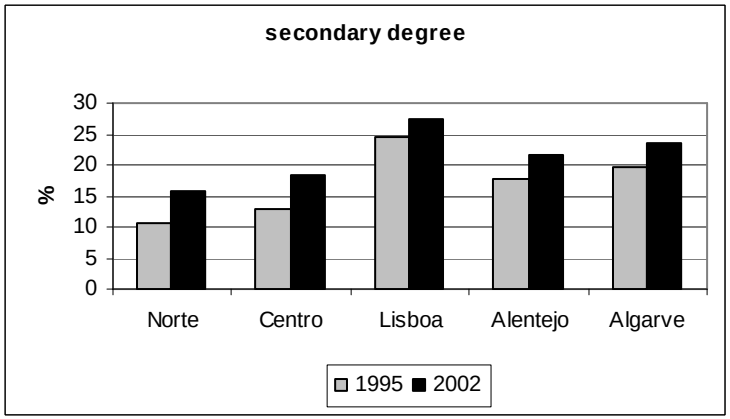


Figure 4: Regional distribution of endowments, Women

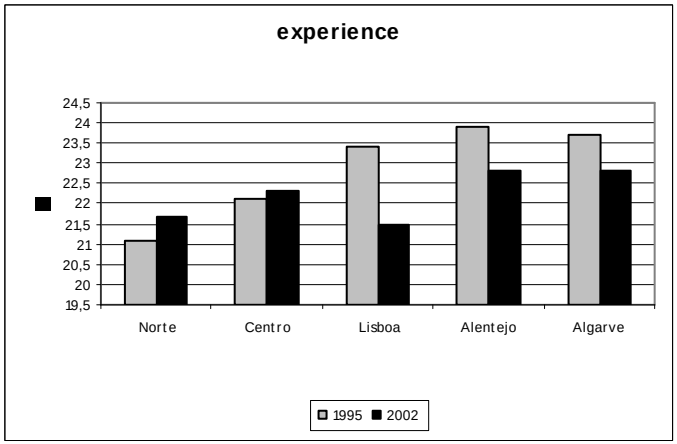
a)



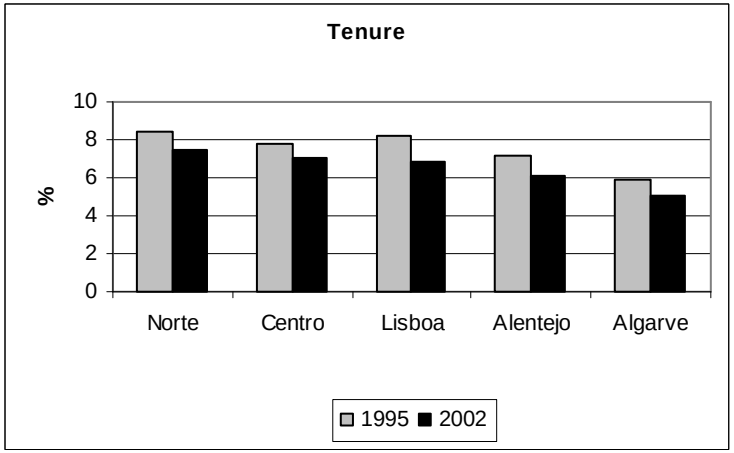
b)



c)



d)



Regional inequalities are not so evident in what concerns the levels of *experience* and *tenure* (figure 3: c) and d); figure 4: c) and d)). The existent differences do not seem to be the main factor explaining regional wage differentials. However, as these figures suggest, there was a general decline in the levels of *experience* and *tenure* across the regions from 1995 to 2002, which may be synonym of industrial change and/or more labour market turnover.

Portuguese regions are also different in their industrial and occupational structure (table A1 and table A2 in appendix): For instance, in Lisboa the most important industries are manufacturing, real state services and transport and communications, whereas in Algarve tourism and related activities have a crucial significance. As regard to occupations, Lisboa displays a higher weight of managers, professionals and associate professionals than other regions, where craft workers, plant and machine operators and unqualified workers are dominant.

5. ANALYSIS OF RESULTS

5.1 STATIC ANALYSYS

In order to employ Oaxaca's and the JMP decompositions, we chose Lisboa as reference region, as it is the region in Portugal where the average wages are higher. Another hypothesis would be to adopt as reference region the country's average by estimating a pooled wage equation for the whole country and comparing it with the wage equation of each region. However, as all the Portuguese regions, apart from Lisboa, display very similar wages, we consider this a better solution.

In order to apply the wage decompositions we first estimate the regional wage equations for both 1995 and 2002. We previously tested the hypothesis of pooling male and females in the same human capital wage equation, carrying out the classical *F* test for equal coefficients for both genders, but the results of these tests pointed out to the rejection of the null hypothesis of equal coefficients[4]. Therefore, we estimated separate equations for males and females. The results were according to what is usual in wage equations estimates and can be seen in appendix. (tables A3 to A6).

[4] We got the following statistics: F_{1995} (25, 1393576) = 4607 and F_{2002} (25, 1822930) = 6819.

Before analysing the forces driving the change in the wages differentials between 1995 and 2002, we consider the Oaxaca's decomposition for 1995, the initial year of our analysis, which give us the static picture of the regional wage inequalities (see tables 1 and 2). We do not present detailed information of this decomposition for 2002, as the determinants of the regional wage differentials' evolution will be analysed according to the JMP decomposition.

Table 1: Oaxaca's decomposition for males

	Norte	**Centro**	**Alentejo**	**Algarve**
Wage differential: 1995	0.3271	0.2947	0.2230	0.2100
endowments (%)	0.1315	0.1333	0.1241	0.2101
secondary degree	14.5	12.8	10.5	4.8
university degree	9.2	9.8	12.1	6.7
exp+exp2	0	0.0	2.4	2.4
tenure+tenure2	3.8	3.8	4.8	7.1
occupation variables	39.7	40.6	40.3	26.7
industry variables	-2.3	-3.0	-10.5	25.7
lfsize	33.6	36.1	40.3	25.7
Prices (%)	0.1956	0.1614	0.0988	-0.0001
constant	40.3	37.3	105.1	-123000.0
secondary degree	0.5	4.3	9.1	-8000.0
university degree	0.0	0.6	0.0	-2000.0
exp+exp2	41.3	65.8	76.8	-73000.0
tenure+tenure2	10.7	8.1	-14.1	2000.0
occupation variables	10.7	2.5	13.1	-6000.0
industry variables	-8.2	-32.9	-102.0	168000.0
lfsize	6.1	14.3	10.1	1000.0
Wage differential: 2002	0.3324	0.2843	0.2468	0.3040
endowments	0.1552	0.1737	0.1919	0.2861
Prices	0.1772	0.1107	0.0549	0.0179

Note: (%) - the percentage of each effect (prices or endowments) explained by a given variable. For example, secondary degree in the Norte column means that this variable explains 14.5% of the endowment effect.

As we have seen in figures 1 and 2, there are important wage differentials between Lisboa and the other regions in Portugal. In 1995, for males, the estimated differential goes from 21%, the minimum, relatively to the Algarve, to 33%, the maximum, relatively to the Norte. For females, we have a minimum of 20% and a maximum of 35%, for the same regions. In 2002 the situation is quite similar.

Table 2: Oaxaca's decomposition for females

	Norte	Centro	Alentejo	Algarve
Wage differential: 1995	0.3479	0.3365	0.3040	0.1981
endowments (%)	0.1835	0.1811	0.1901	0.2378
secondary degree	13.7	11.6	6.8	4.6
university degree	6.6	6.6	6.3	5.9
exp+exp2	-1.1	-1.1	0.0	-0.8
tenure+tenure2	2.2	4.4	8.4	12.6
occupation variables	57.9	54.7	42.1	30.3
industry variables	14.8	14.4	12.1	25.2
lfsize	6.0	9.4	24.7	21.8
Prices (%)	0.1644	0.1554	0.1139	-0.0397
constant	-42.1	-27.7	-36.0	160.0
secondary degree	-0.6	3.9	9.6	-17.5
university degree	0.6	0.0	0.0	0.0
exp+exp2	53.7	70.3	103.5	-95.0
tenure+tenure2	42.1	28.4	-5.3	-65.0
occupation variables	-6.7	11.0	2.6	-45.0
industry variables	27.4	11.0	-14.9	200.0
lfsize	26.2	2.6	41.2	-40.0
Wage differential: 2002	0.3402	0.3251	0.2842	0.2563
endowments	0.2068	0.1983	0.2215	0.2659
Prices	0.1334	0.1267	0.0627	-0.0096

Note: (%): idem table 1.

An important part of the estimated mean wage differential is explained by differences in endowments. For men, this component represents something between 40% (Norte) and 100% (Algarve) of the estimated wage gap; for women represents always more than 50% of the estimated gap in all the regions. The results reveal that the most important factors explaining this quantitative effect are in general very similar for men and women and three main explanations may be suggested. First, the average wage of the Portuguese regions is different because they display an asymmetric occupational structure. In fact, Lisboa has a higher share of senior officials and managers, professionals, technicians and associate professionals than other regions, which pushes-up the average wage of Lisboa. For males, between Lisboa and Centro, this factor explains 40.6% of the difference that is explained by differences of endowments, or 26.7% in the case of Algarve (table 1). Second, Lisboa has also advantage in the percentage of large firms, which pay higher wages. Finally, Lisboa displays also a higher share of workers with secondary education and university degree. In the case of women the industrial structure - favourable to Lisboa - is another important cause explaining this quantitative effect (table 2).

As most of the large firms – namely, those with national dimension - have their headquarters and other main offices in the region of Lisboa, this might contribute to concentrate in this region workers on high paying occupations, as managers, senior officials, professionals and technicians. In addition, since these occupations generally require higher educational qualifications, it is also normal that in the region of Lisboa there is the highest percentage of workers with secondary education and university degree.

The other part of the estimated mean wage differential is explained by differences on the parameter estimates across regions (price differentials). For instance in 1995, on average, a man in the Norte would have earned more 19.56% if had been rewarded according the wage equation of Lisboa (table 1). This component should not exist in a competitive equilibrium since within an homogeneous space equally- skilled workers should be paid the same wage. It is difficult to imagine that all these differentials are of equilibrium – compensating differentials – even if we were not able to control for house and land price differentials, which may explain some of these differentials. The fact that from 1995 to 2002 most of these differentials have narrowed indicates that they were not all of equilibrium.

In the case of men, this price effect is mainly explained by the *constant* in the wage equation, which represents the lower level of the hourly wage rate in the market, or the hourly wage rate for unqualified workers. This wage was higher in Lisboa than in other regions in 1995. In addition, labour market *experience* was also better rewarded in Lisboa. For women, the return for labour market *experience* is the main factor explaining this part of the estimated wage differential. However, the reward of *tenure* (for Norte and Centro) and of the logarithm of the firm size (*lfsize)* - for Norte and Alentejo - are also important.

5.2 DYNAMIC ANALYSIS: THE JUHN, MURPHY AND PIERCE APPROACH

The results of the JMP decomposition are displayed in table 3 for men and in table 4 for women. To the exception of Algarve, there were very small changes in the mean wage differential between Lisboa and the other regions over this period: for men it increased slightly relatively to the Norte (0.5%) and Alentejo (2.4%) and decreased relatively to the Centro (-1%). In the case of Algarve, the male gap widen 9.4%. For

women, the gap increased about 6% relatively to Algarve and decreased slightly relatively to all other regions.

Table 3: Juhn Murphy and Pierce decomposition, 1995-2002, males

	Norte	Centro	Alentejo	Algarve
Change in differential	0.0053	-0.0103	0.0238	0.0940
Observed X's (%)	0.0285	0.0439	0.0651	0.0761
secondary degree	14.4	5.2	4.6	3.9
university degree	91.2	59.0	40.0	40.3
exp+exp2	-38.6	-14.8	-11.0	-10.2
tenure+tenure2	-17.7	-5.5	-0.7	1.4
occupation variables	28.0	26.0	35.5	40.5
industry variables	0.4	11.3	19.6	0.9
lfsize	22.3	18.8	12.0	23.2
Observed prices (%)	-0.0048	-0.0035	0.0027	-0.0001
secondary degree	72.7	83.5	-92.4	1373.0
university degree	54.8	75.6	-106.6	2250.2
exp+exp2	-17.0	-8.8	3.9	-153.2
tenure+tenure2	43.4	-46.1	197.4	-13951.9
occupation variables	0.1	-12.7	53.1	-2655.6
industry variables	-163.5	-157.4	269.9	7870.9
lfsize	109.6	165.9	-225.4	5366.8
Mean residual percentile				
1995	33.5	36.7	42.5	50.4
2002	35.6	41.3	46.2	49.1
Gap	-0.0229	-0.0517	-0.0420	0.0204
Unobserved price effect	0.0045	0.0010	-0.0019	-0.0024

Note: (%): idem table 1.

However, between 1995 and 2002, the mean individual (for both genders) in all the regions, except for Algarve, ranked higher in the Lisboa's residual wage distribution. For instance, the mean female from Alentejo was positioned at 39.4 percentile of the Lisboa's residual wage distribution in 1995; seven years later she was at 44.6 percentile (table 4). In contrast, in Algarve, both the mean male and the mean female were positioned at a lower percentile: for males it was a decrease from the 50.4 percentile to the 49.1, while for females the decrease was from the 54.4 to the 51.9 percentile. The change in the percentile position of the mean individual of one given region in the Lisboa's residual wage distribution is an indicator of relative changes of unobserved productivity related characteristics and/or change of the gap that is explained by price differentials. For example, the advance of the mean Alentejo's women in the Lisboa's residual wage

distribution may me explained by relative improvements of unobserved productivity related characteristics and/or reduction of the interregional disequilibrium component.

Table 4: Juhn, Murphy and Pierce decomposition, 1995-2002, females

	Norte	**Centro**	**Alentejo**	**Algarve**
Change in differential	-0.0077	-0.0115	-0.0199	0.0582
Observed X's (%)	0.0457	0.0344	0.0482	0.0511
secondary degree	-6.3	-11.0	-2.3	-4.1
university degree	84.1	96.9	73.9	80.7
Exp+exp2	-19.6	-16.9	-7.4	-6.9
tenure+tenure2	-13.8	-19.4	-8.4	-12.1
occupation variables	26.5	-21.0	49.8	69.2
industry variables	-12.3	-11.8	0.2	-17.8
Lfsize	41.3	42.4	-5.9	-9.0
Observed prices (%)	-0.0224	-0.0173	-0.0169	-0.0230
secondary degree	-2.4	-2.4	-1.7	-0.9
university degree	10.6	12.2	13.2	11.1
Exp+exp2	1.8	6.3	9.3	6.5
tenure+tenure2	6.2	-1.0	-23.5	-37.4
occupation variables	28.2	22.4	30.2	20.0
industry variables	26.7	23.4	15.8	55.7
lfsize	28.9	39.2	56.6	44.9
Mean residual percentile				
1995	33.9	34.4	39.4	54.4
2002	36.9	37.8	44.6	51.9
Gap	-0.0317	-0.0283	-0.0485	0.0327
Unobserved price effect	0.0007	-0.0003	-0.0027	-0.0026

Note: (%): idem table 1.

The JMP decomposition analysis reveals important and counteracting forces explaining the final outcome and situations slightly different for men and women. For men, two main and opposite effects determine the results. Namely, changes in relative endowments of the regions, the first effect, and the third effect or *gap effect*. Whereas, the relative evolution of the regional endowments contributed to widen the wage gap over the period 1995-2002, the *gap effect* contributed to reduce it. As in absolute value the first effect was generally higher than the *gap effect*, to the exception of Centro, there was a small increase in the regional wage gap. The relative evolution of both observed (second effect) and unobserved prices (fourth effect) was very small.

For women, the results of the first and third effect are similar to those of men, but in addition there is as well some convergence on the wage premiums associated with some

observed characteristics (second effect), in particular those linked to occupations, industry and large firms, which account for the most part of this effect. As a consequence, in the women's case, except for Algarve, there was a small reduction in the regional wage gap (less than 2%), while for men this only happened relatively in the Centro region.

Performing now a more detailed analysis of the first and third effects, which display a parallel evolution for both genders, we notice important characteristics of the Portuguese interregional wage differential problem. For instance, for males, the static picture provided by the Oaxaca's decomposition for 1995 showed that differences of endowments accounted for at least 40% of the estimated wage differential between Lisboa and the other Portuguese regions. This result was mainly due to three main advantages of this region relatively to the others: a higher educational qualification of his workers, a better occupation structure and a higher percentage of large firms.

Complementing this analysis with the JMP decomposition (table 3), we conclude that these factors of divergence of the regional mean wage have continued to push up the average wage of Lisboa relatively to the average wage of other regions. In fact, the first effect is positive and the main factors that were responsible for this are the same that explained the static position in 1995. For example, the growth in the number of men with university degree was higher in Lisboa than in any other region of the country during the period 1995-2002. Therefore, this factor accounts for something between 40% (Alentejo) and 91.2 % (Norte) of the change in the wage differential that is explained by the relative evolution of the regional endowments (first effect). Moreover, the process of concentration of large firms and high paying occupations has also contributed to reinforce the relative position of Lisboa. Similar dynamics has occurred for women. In fact, the increase in the number of women with a university degree and in those in high paying occupations has continued to reinforce the Lisboa's position.

The results of the *gap effect* are also similar for both men and women. This effect contributed to narrow the wage gap among the Portuguese regions. Apart from Algarve, both the mean male and the mean female not working in Lisboa advanced in the Lisboa's residual wage distribution (table 3 and table 4) from 1995 to 2002. For instance, the mean man from Centro was positioned at 36.7 percentile in 1995 and at 41.3 in 2002 of the Lisboa's residual wage distribution. This change pushed down the wage gap of the Portuguese regions by something between 2% (Norte) and 5% (Centro). In the case of

Algarve, the *gap effect* is positive and reinforced the relative change in observed characteristics. As suggested earlier, this may reflect either a narrowing in regions' difference of unobserved productivity related characteristics and/or the impact of a reduction in the level of interregional disequilibrium. Since during the period under analysis, the level of public infrastructures in the country has improved, particularly outside the Lisboa's region, this may have narrowed some productivity advantage that Lisboa had at this level. The result of Algarve is more difficult to justify, but one possible explanation is the fact that Algarve is a region where the presence of immigrants is particularly important, namely in tourism and construction industries, and this may contribute to the reduction in the wages level in this region.

Finally, the changes in the wage structure or in the price of the unobserved characteristics (fourth effect) were not important to explain the changes of the Portuguese regional wage gap over the period 1995-2002, for both genders.

6. CONCLUSIONS AND SOME POLICY IMPLICATIONS

Previous studies have typically analysed interregional wage differentials using the static perspective provided by the Oaxaca's decomposition. In this paper we have carried out a different analysis of this problem using the JMP decomposition in addition to the Oaxaca's decomposition. This double approach provides a better understanding of the interregional wage differential problem, as it uncovers the converging or diverging forces driving the change of those differentials. Our analysis has been applied to Portugal, a small country displaying important and persisting interregional wage differentials.

The results using the Oaxaca's decomposition for 1995 showed that endowments' differences explain an important part of the estimated mean wage differential both for men and women. For men, three main advantages of the region of Lisboa explained this effect: a higher level of educational qualification of his workers, a more favourable occupational structure and a higher percentage of large firms. For women, the industrial structure, favourable to Lisboa, is also an important factor explaining this effect in addition to the previous factors. Using the intertemporal decomposition of JMP we found that these factors have continued to push up the average wage of Lisboa relatively to the average of the other Portuguese regions from 1995 to 2002. This result indicates a clear process of

regional divergence, namely on the spatial distribution of the endowments, which is easier to identify using both JMP decomposition and Oaxaca's than using only Oaxaca's decomposition.

Yet, not all the estimated wage differential estimated for 1995 and 2002 can be accounted by endowments' differences. To the exception of Algarve, all other regions display wage differentials for workers with the same level of skills that should not exist in the competitive equilibrium – differences between 10% and 19%. Therefore, part of these differentials may be explained by a temporary disequilibrium situation and /or by external economies in Lisboa and Algarve. These external economies may increase productivity in these regions and, as a consequence, the level of wages. However, higher wages may also contribute to higher house and land prices. So, in fact, the unexplained part of the real wage differential may be somewhat lower. Unfortunately, we could not control for these factors, as in Portugal the regional price index only includes consumer goods.

The results of the JMP decomposition have showed that, apart from Algarve, the *gap effect* (unobserved quantity effect) contributed to narrow the interregional wage gap, which can be explained either by relative improvements of unobserved productivity related characteristics, like public infrastructures, outside the region of Lisboa or by the reduction of interregional disequilibrium components. This effect and, of course, its possible explanations, is not visible applying the Oaxaca's decomposition.

Another important result is that, apart from Algarve, the interregional wage gap decreased in the case of women, whereas, in general, the opposite has occurred for men. The results of the JMP decomposition show clearly that this was due to the convergence in the price of the observed characteristics (second effect) for women, which did not occur in the case of men. The most likely factor explaining this result for women is the reduction in the disequilibrium components related to the return of observed characteristics. All other effects, namely the evolution of the observed characteristics (first effect) and the gap effect (third effect) are qualitatively similar for both genders.

In sum, we used both the JMP and the Oaxaca's decompositions, which allowed a more complete understanding of the interregional wage differentials´ evolution than the traditional approach of the Oaxaca's decomposition. Namely, this approach makes it possible to recognize if the initial factors explaining the wage inequality are following a converging or diverging path. Moreover, we are also able to understand which factors,

prices or quantities, observed or unobserved, are influencing the changes. Therefore, this analysis helps on the suggestion of precise policy measures in order to reduce wage inequalities across regions.

In the case of Portugal, as we saw, an important part of the regional wage inequalities may be explained by the concentration in the region of Lisboa of large firms, their headquarters and other main offices. This has been a continuing process which causes other problems beyond the wage inequality. Namely, higher property prices, problems of congestion and pollution and a continuing pressure for new public infrastructures. Altogether, this means higher production costs, more public expense and a deeply unbalanced country. Nevertheless, the country has already good networks of public infrastructures and telecommunications and therefore there are good conditions for some of these firms having their main offices outside the region of Lisboa working with lower production costs. If municipal taxes are reduced, mainly the municipal surcharge on profits, important savings for some firms in addition to those provided by lower land prices can be achieved. So, municipal councils outside Lisboa have the option of giving these incentives to attract large firms. Another solution is a tax reduction for firms located in inland councils to attract new investments and to accelerate their growth. In fact, the Portuguese government has recently adopted this strategy in order to promote these regions' development.

In addition, from 1995 to 2002, the differences in reward between workers with the same observable characteristics in different regions of the country have narrowed. However, there are still important differences at this level. Some may be due to an inefficient housing market which contributes to a low level of internal labour mobility in Portugal (OECD, 2000). The law of renting has been recently changed, but its practical application has been difficult. These difficulties should be eliminated as this is an essential issue to improve the efficiency of the Portuguese labour market. The system of public transports is also of crucial importance to reduce wage differentials that are not explained by endowments' differences, since it facilitates the commuting of workers.

REFERENCES

Blackaby D. and Manning D. (1990) The north-south divide: questions of existence and stability?, *The Economic Journal* **100**, 510-527.

Blackaby D. and Murphy P. (1995) Earnings, unemployment and Britain's north-south divide: real or imaginary, *Oxford Bulletin of Economics and Statistics* **57**, 4, 487-512.

Blau F. and Kahn L. (1997) Simming upstream: trends in the gender wage differential in the 1980s, *Journal of Labor Economics* **15,** 1, 1-42.

Blinder A. (1973) Wage discrimination: reduced forms and structural estimates, *The Journal of Human Resources* **8**, 4, 436-55.

Dávila, A. and Mora, M. (2005) Changes in the earnings of Arab men in the US between 2000 and 2002, Journal of Population Economics **18**, 587-601.

Duranton G. and Monastiriotis V. (2002) Mind the gaps: the evolution of regional inequalities in the UK, 1982-1997, *Journal of Regional Science* **42**, 2, 219-256.

García I. and Molina J. (2002) Inter-regional wage differentials in Spain, *Applied Economic Letters* **9**, 209-215.

Glaeser E., Kallal H., Scheinkman J. and Shleifer A. (1992), Growth in Cities, *The Journal of Political* **100**, 6, 1126-1152.

Goldfarb R. and Yezer M. (1976) Evaluating alternative theories of intercity and interregional wage differentials, *Journal of Regional Science* **16**, 3, 345-363.

Henley A. (1998) Residential mobility, housing equity and the labour market, *The Economic Journal* **108**, 414-427.

Jacobs J. (1969) *The Economy of Cities*. Vintage, New York.

Juhn C., Murphy K. and Pierce B. (1991) Accounting for the slowdown in the black-white wage convergence, in Kosters M. (Ed) *Workers and their wages*, pp. 107-43, AEI Press.

Juhn C., Murphy K. and Pierce B. (1993) Wage inequality and the rise in returns to skill, Journal of Political Economy101,3, 410-442.

Lucas R. (1988) On the mechanisms of economic development, *Journal of Monetary Economics* **22**, 3-42.

Marshall, A. (1890) *Principles of Economics*. Macmillan.

Kidd M. and Shannon M. (2001) Convergence in the gender wage gap in Australia over the 1980s: identifying the role of counteracting forces via the Juhn, Murphy and Pierce Decomposition, *Applied Economics* **33**, 929-936.

Oaxaca R. (1973) Male-female wage differentials in urban labour markets, *International Economic Review* **14**, 693-709.

OECD (2000) *Employment Outlook*, June, Paris.

Pereira J. (2003) *Alguns Aspectos Espaciais do Mercado de Trabalho em Portugal: Diferenças Regionais de Salários e Mobilidade Geográfica*, PhD Thesis University of Évora, unpublished.

Porter M. (1990) *The Competitive Advantage of Nations*, Free Press, New York.

Roback J. (1982) Wages, rents, and the quality of life, *Journal of Political Economy* **90**, 6, 1257-1278.

Rosen S. (1986) The theory of equalizing differences, in Ashenfelter O. and Layard R. (Eds) *Handbook of Labor Economics*, vol. I, pp. 641-92, Elsevier Science Publishers.

Simón H., Ramos R. and Sanromá E. (2006) Collective bargaining and regional wage differences in Spain: an empirical analysis, *Applied Economics* **38**, 1749-1760.

Teulings, C. and Vieira, J. (2004) Urban versus rural return to human capital in Portugal: a cookbook recipe for applying assignment models, *Labour* **18**, 265-291.

Vieira, J. and Madruga, P. (2005) Regions and low-wage mobility in Portugal, *Regional and Sectoral Economic Studies*, Euro-American Association of Economic Development **4**,2, 41-52.

Vieira J., Couto J., and Tiago M. (2006) Inter-regional Wage Dispersion in Portugal, *Regional and Sectoral Economic Studies*, Euro-American Association of Economic Development 6**,** 1.

APPENDIX A: Descriptive statistics and Wages equations

Table A1: Descriptive statistics, Men

	Norte		Centro		Lisboa		Alentejo		Algarve	
	1995	2002	1995	2002	1995	2002	1995	2002	1995	2002
ln hourly wage	1.24	1.35	1.26	1.38	1.59	1.68	1.34	1.42	1.34	1.37
secondary degree	0.09	0.12	0.096	0.13	0.17	0.22	0.11	0.15	0.13	0.17
university degree	0.017	0.06	0.014	0.06	0.04	0.14	0.01	0.05	0.01	0.05
exp	24.60	24.14	25.73	24.57	25.98	23.35	26.10	24.5	25.48	24.0
exp2	7.49	7.33	8.21	7.68	8.40	7.15	8.52	7.68	8.18	7.40
tenure	9.10	7.87	9.08	7.48	9.74	7.55	8.93	6.99	7.34	5.28
tenure2	1.63	1.38	1.65	1.30	1.88	1.38	1.61	1.19	1.18	0.82
senior officials and managers	0.03	0.03	0.03	0.02	0.06	0.05	0.03	0.02	0.04	0.03
professionals	0.02	0.03	0.02	0.03	0.05	0.08	0.02	0.03	0.01	0.02
technicians and associate professionals	0.09	0.10	0.09	0.10	0.15	0.17	0.10	0.10	0.10	0.09
clerks	0.11	0.10	0.11	0.09	0.14	0.12	0.12	0.10	0.13	0.09
service workers and shop and market sales workers	0.06	0.07	0.06	0.06	0.09	0.09	0.08	0.07	0.18	0.16
skilled agricultural and fishery workers	0.01	0.01	0.02	0.01	0.01	0.004	0.02	0.01	0.03	0.02
craft and related trades workers	0.36	0.37	0.30	0.34	0.21	0.22	0.29	0.33	0.22	0.30
plant and machine operators and assemblers	0.18	0.17	0.22	0.21	0.13	0.13	0.19	0.19	0.12	0.11
elementary occupations	0.14	0.13	0.16	0.15	0.15	0.14	0.17	0.16	0.17	0.19
mining	0.01	0.01	0.01	0.01	0.002	0.001	0.07	0.04	0.01	0.01
manufacture	0.46	0.37	0.46	0.36	0.24	0.18	0.32	0.27	0.13	0.08
electricity, gas and water supply	0.01	0.01	0.02	0.01	0.01	0.01	0.03	0.01	0.02	0.01
construction	0.16	0.22	0.16	0.24	0.13	0.17	0.14	0.26	0.15	0.31
wholesale and retail trade	0.17	0.18	0.18	0.18	0.22	0.20	0.22	0.20	0.21	0.19
hotels and restaurants	0.02	0.03	0.02	0.02	0.05	0.05	0.04	0.03	0.23	0.19
transport, storage and communication	0.06	0.06	0.08	0.08	0.13	0.12	0.07	0.07	0.10	0.07
financial intermediation	0.04	0.03	0.04	0.02	0.09	0.06	0.05	0.03	0.05	0.02
education	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
other services	0.05	0.09	0.03	0.07	0.10	0.20	0.04	0.08	0.07	0.11
lfsize	4.38	3.97	4.31	3.84	5.02	4.68	4.32	3.81	4.20	3.70

Table A2: Descriptive statistics, Women

	Norte		Centro		Lisboa		Alentejo		Algarve	
	1995	2002	1995	2002	1995	2002	1995	2002	1995	2002
ln hourly wage	0.98	1.15	0.99	1.15	1.34	1.46	1.02	1.20	1.12	1.23
secondary degree	0.11	0.16	0.13	0.18	0.25	0.27	0.18	0.22	0.20	0.24
university degree	0.013	0.08	0.014	0.09	0.04	0.17	0.013	0.08	0.01	0.07
exp	21.13	21.67	22.08	22.29	23.37	21.50	23.94	22.84	23.69	22.76
exp2	5.66	6.08	6.22	6.52	7.04	6.33	7.36	6.95	7.18	6.85
tenure	8.40	7.50	7.83	7.08	8.22	6.84	7.11	6.14	5.86	5.13
tenure2	1.35	1.22	1.22	1.09	1.39	1.14	1.06	0.90	0.80	0.70
senior officials and managers	0.01	0.01	0.01	0.01	0.03	0.03	0.02	0.01	0.02	0.01
professionals	0.02	0.04	0.02	0.04	0.05	0.08	0.02	0.04	0.01	0.03
technicians and associate professionals	0.05	0.06	0.04	0.06	0.12	0.12	0.06	0.07	0.07	0.07
clerks	0.16	0.18	0.17	0.19	0.28	0.27	0.19	0.20	0.23	0.21
service workers and shop and market sales workers	0.11	0.18	0.16	0.25	0.21	0.24	0.28	0.32	0.29	0.36
skilled agricultural and fishery workers	0.01	0.004	0.01	0.004	0.003	0.002	0.01	0.02	0.01	0.01
craft and related trades workers	0.35	0.28	0.24	0.16	0.07	0.04	0.13	0.09	0.05	0.03
plant and machine operators and assemblers	0.11	0.08	0.11	0.08	0.05	0.02	0.07	0.05	0.01	0.01
elementary occupations	0.18	0.16	0.23	0.20	0.21	0.19	0.23	0.21	0.32	0.27
mining	0.0008	0.0007	0.002	0.001	0.0009	0.0006	0.01	0.004	0.002	0.001
manufacture	0.66	0.50	0.56	0.39	0.20	0.12	0.31	0.22	0.08	0.05
electricity, gas and water supply	0.002	0.002	0.003	0.001	0.01	0.003	0.01	0.002	0.003	0.001
construction	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.03
wholesale and retail trade	0.13	0.17	0.17	0.21	0.24	0.24	0.25	0.25	0.23	0.26
hotels and restaurants	0.04	0.06	0.07	0.08	0.10	0.10	0.12	0.12	0.37	0.32
transport, storage and communication	0.02	0.02	0.02	0.02	0.07	0.06	0.03	0.02	0.05	0.04
financial intermediation	0.02	0.02	0.02	0.02	0.07	0.06	0.03	0.02	0.03	0.02
education	0.02	0.03	0.04	0.04	0.06	0.05	0.04	0.03	0.04	0.03
other services	0.09	0.18	0.11	0.19	0.24	0.35	0.19	0.30	0.17	0.25
lfsize	4.43	4.13	4.29	4.06	4.66	4.65	3.88	3.87	3.72	3.81

Table A3: Wage equations 1995, Men

	Norte	Centro	Lisboa	Alentejo	Algarve
constant	0.42	0.44	0.50	0.40	0.38
	(53.18)	(38.10)	(64.47)	(17.73)	(20.10)
secondary degree	0.22	0.16	0.23	0.15	0.17
	(71.53)	(43.78)	(81.14)	(20.42)	(19.18)
university degree	0.57	0.49	0.56	0.58	0.40
	(56.86)	(34.70)	(78.14)	(18.16)	(9.95)
exp	0.02	0.02	0.03	0.02	0.02
	(83.36)	(60.71)	(88.91)	(32.36)	(24.84)
exp2	-0.03	-0.03	-0.04	-0.03	-0.03
	(-70.57)	(-56.85)	(-81.89)	(-30.48)	(-22.33)
tenure	0.004	0.006	0.007	0.01	0.01
	(14.78)	(17.49)	(21.71)	(16.92)	(9.06)
tenure2	0.0009	-0.006	-0.004	-0.02	-0.01
	(1.27)	(-6.22)	(-3.98)	(-10.83)	(-4.39)
senior officials and managers	0.80	0.70	0.83	0.60	0.72
	(104.17)	(68.69)	(122.53)	(32.72)	(32.99)
professionals	0.69	0.69	0.73	0.61	0.68
	(61.33)	(43.54)	(96.94)	(17.49)	(14.13)
technicians and associate professionals	0.49	0.41	0.50	0.44	0.39
	(142.21)	(95.76)	(144.20)	(50.99)	(36.60)
clerks	0.24	0.21	0.22	0.19	0.18
	(89.64)	(59.50)	(71.0)	(23.37)	(20.65)
service workers and shop and market sales workers	0.14	0.15	0.094	0.14	0.17
	(42.28)	(34.62)	(25.59)	(15.96)	(22.09)
skilled agricultural and fishery workers	-0.11	-0.07	-0.08	-0.02	0.07
	(-7.62)	(-3.52)	(-3.01)	(-0.89)	(4.75)
craft and related trades workers	0.14	0.19	0.16	017	0.17
	(74.20)	(71.47)	(60.57)	(29.57)	(22.09)
plant and machine operators and assemblers	0.12	0.16	0.18	0.16	0.16
	(56.69)	(58.06)	(59.69)	(26.56)	(18.25)
mining	-0.10	0.12	0.09	0.23	0.19
	(-10.96)	(9.03)	(6.25)	(11.15)	(9.15)
manufacture	-0.08	-0.003	-0.02	0.07	0.05
	(-11.14)	(-0.24)	(-3.72)	(3.72)	(3.03)
electricity, gas and water supply	0.28	0.33	0.01	0.33	0.26
	(33.00)	(28.39)	(1.02)	(15.64)	(15.20)
construction	-0.05	-0.07	-0.15	-0.01	0.04
	(-6.56)	(-6.50)	(-23.14)	(-0.67)	(2.51)
wholesale and retail trade	-0.004	-0.03	-0.03	-0.01	0.04
	(-0.50)	(-2.71)	(-4.42)	(-0.52)	(2.87)
hotels and restaurants	-0.22	-0.23	-0.29	-0.20	0.02
	(-26.70)	(-18.73)	(-39.51)	(-9.20)	(1.32)
transport, storage and communication	0.03	0.03	-0.14	-0.04	-0.001
	(3.54)	(2.40)	(-20.62)	(-1.70)	(-0.05)
financial intermediation	0.44	0.52	0.26	0.51	0.49
	(56.46)	(45.99)	(39.32)	(24.89)	(29.46)
education	0.07	0.08	0.07	0.04	0.17
	(6.07)	(5.17)	(5.29)	(1.28)	(4.13)
lfsize	0.07	0.07	0.07	0.07	0.08
	(192.0)	(129.67)	(161.71)	(66.23)	(62.84)

Table A4: Wage equations 2002, Men

	Norte	Centro	Lisboa	Alentejo	Algarve
constant	0.53	0.59	0.55	0.58	0.66
	(112.63)	(100.87)	(105.19)	(59.52)	(53.29)
secondary degree	0.18	0.13	0.20	0.11	0.12
	(79.71)	(49.74)	(89.57)	(22.61)	(21.90)
university degree	0.50	0.42	0.52	0.47	0.39
	(101.46)	(69.76)	(130.75)	(38.06)	(27.11)
exp	0.02	0.02	0.02	0.02	0.02
	(93.94)	(75.86)	(100.64)	(38.13)	(29.32)
exp2	-0.03	-0.03	-0.04	-0.03	-0.03
	(-77.22)	(-71.14)	(-87.53)	(-35.05)	(-26.21)
tenure	0.01	0.01	0.02	0.02	0.02
	(55.76)	(53.66)	(77.89)	(34.29)	(27.50)
tenure2	-0.01	-0.02	-0.03	-0.03	-0.03
	(-23.36)	(-25.75)	(-42.62)	(-18.73)	(-14.49)
senior officials and managers	0.84	0.77	0.97	0.72	0.70
	(124.94)	(88.45)	(160.15)	(39.09)	(36.64)
professionals	0.64	0.63	0.72	0.61	0.57
	(101.93)	(78.72)	(145.83)	(38.10)	(26.50)
technicians and associate professionals	0.47	0.42	0.54	0.42	0.42
	(167.30)	(123.78)	(178.66)	(61.48)	(49.46)
clerks	0.20	0.19	0.22	0.19	0.15
	(90.41)	(65.15)	(80.37)	(31.51)	(22.94)
service workers and shop and market sales workers	0.11	0.11	0.08	0.11	0.10
	(41.40)	(31.57)	(27.43)	(16.41)	(16.52)
skilled agricultural and fishery workers	-0.06	-0.03	-0.01	0.01	0.06
	(-6.58)	(-2.25)	(-1.06)	(0.81)	(4.65)
craft and related trades workers	0.14	0.18	0.19	0.16	0.16
	(94.93)	(94.67)	(87.04)	(43.74)	(41.58)
plant and machine operators and assemblers	0.12	0.18	0.20	0.17	0.16
	(70.00)	(82.58)	(81.52)	(35.96)	(29.24)
mining	-0.03	0.09	0.08	0.28	0.11
	(-4.27)	(12.65)	(5.87)	(30.68)	(6.82)
manufacture	-0.05	0.04	-0.005	0.09	-0.03
	(-11.34)	(8.22)	(-1.24)	(11.66)	(-2.66)
electricity, gas and water supply	0.32	0.40	0.09	0.39	0.23
	(52.38)	(53.16)	(12.83)	(30.60)	(12.71)
construction	-0.05	-0.03	-0.12	-0.02	-0.09
	(-11.87)	(-6.83)	(-29.74)	(-3.04)	(-8.86)
wholesale and retail trade	-.0006	0.01	-0.01	0.03	-0.04
	(-0.14)	(2.71)	(-1.48)	(4.14)	(-3.55)
hotels and restaurants	-0.15	-0.13	-0.18	-0.11	-0.05
	(-29.79)	(-20.41)	(-36.19)	(10.58)	(-4.73)
transport, storage and communication	0.12	0.13	0.001	0.07	0.02
	(27.07)	(23.82)	(0.34)	(7.32)	(1.51)
financial intermediation	0.32	0.42	0.17	0.40	0.27
	(62.74)	(65.08)	(39.22)	(36.66)	(20.15)
education	0.07	0.23	0.02	0.17	0.21
	(8.16)	(21.91)	(2.04)	(8.17)	(7.33)
lfsize	0.07	0.06	0.07	0.07	0.07
	(230.23)	(144.16)	(178.53)	(87.32)	(76.71)

Table A5: Wage equations 1995, Women

	Norte	Centro	Lisboa	Alentejo	Algarve
constant	0.45	0.43	0.38	0.42	0.45
	(91.78)	(59.61)	(66.86)	(33.12)	(29.53)
secondary degree	0.19	0.13	0.18	0.11	0.14
	(59.04)	(33.83)	(62.99)	(15.74)	(16.76)
university degree	0.48	0.51	0.52	0.55	0.53
	(43.15)	(30.02)	(66.38)	(17.39)	(13.49)
exp	0.01	0.01	0.019	0.01	0.02
	(37.70)	(22.03)	(54.04)	(12.71)	(17.96)
exp2	-.017	-0.014	-0.032	-0.02	-0.03
	(-29.68)	(-19.03)	(-50.83)	(-13.73)	(-17.79)
tenure	0.01	0.01	0.01	0.02	0.01
	(16.72)	(21.02)	(36.29)	(17.55)	(8.86)
tenure2	-0.01	-0.02	-.018	-0.03	-0.01
	(-9.69)	(-13.70)	(-13.96)	(-8.77)	(-3.56)
senior officials and managers	0.70	0.52	0.74	0.41	0.48
	(53.39)	(29.86)	(66.96)	(14.62)	(14.41)
professionals	0.81	0.81	0.76	0.51	0.66
	(63.87)	(40.93)	(82.35)	(14.78)	(17.19)
technicians and associate professionals	0.53	0.44	0.55	0.45	0.44
	(100.45)	(58.27)	(124.96)	(33.01)	(29.72)
clerks	0.27	0.24	0.30	0.27	0.22
	(94.84)	(62.68)	(88.72)	(32.90)	(25.64)
service workers and shop and market sales workers	0.08	0.06	0.04	0.06	0.07
	(25.09)	(16.34)	(13.01)	(8.58)	(10.23)
skilled agricultural and fishery workers	-0.13	-0.09	-0.08	0.04	0.02
	(-7.08)	(-3.32)	(-2.02)	(0.74)	(0.33)
craft and related trades workers	0.02	-0.03	-0.02	-.002	0.004
	(8.49)	(-9.42)	(-4.99)	(-0.29)	(0.28)
plant and machine operators and assemblers	0.07	0.06	0.10	0.18	0.11
	(27.67)	(15.40)	(20.45)	(17.93)	(5.17)
mining	0.01	0.10	0.23	0.24	0.23
	(0.42)	(4.18)	(20.45)	(9.87)	(5.25)
manufacture	-0.07	-0.03	0.01	0.02	-0.07
	(-18.23)	(-4.88)	(1.55)	(1.79)	(-5.23)
electricity, gas and water supply	0.46	0.47	0.12	0.44	0.42
	(45.41)	(30.74)	(13.42)	(26.98)	(13.94)
construction	-0.02	-0.02	-0.002	0.02	0.10
	(-2.85)	(-2.39)	(-0.36)	(1.00)	(4.84)
wholesale and retail trade	0.05	0.01	0.06	0.03	0.02
	(11.87)	(1.56)	(16.30)	(3.92)	(1.88)
hotels and restaurants	-0.10	-0.08	-0.12	-0.05	0.08
	(-22.10)	(-15.50)	(-32.45)	(-6.21)	(8.05)
transport, storage and communication	0.26	0.13	0.10	0.18	0.20
	(40.35)	(15.33)	(19.64)	(11.47)	(13.49)
financial intermediation	0.55	0.56	0.38	0.59	0.53
	(95.78)	(68.31)	(83.17)	(45.22)	(33.39)
education	0.14	0.15	0.10	0.12	0.08
	(19.03)	(16.49)	(16.38)	(8.75)	(4.66)
lfsize	0.05	0.06	0.06	0.05	0.06
	(140.59)	(103.18)	(142.48)	(49.73)	(48.74)

Table A6: Wage equations 2002, Women

	Norte	Centro	Lisboa	Alentejo	Algarve
constant	0.53	0.54	0.49	0.62	0.62
	(170.63)	(136.53)	(123.85)	(82.69)	(71.97)
secondary degree	0.15	0.12	0.19	0.11	0.12
	(74.56)	(52.48)	(87.99)	(25.89)	(25.82)
university degree	0.44	0.40	0.50	0.44	0.40
	(101.30)	(75.90)	(137.89)	(40.41)	(34.37)
exp	0.01	0.01	0.02	0.01	0.01
	(64.11)	(41.56)	(84.00)	(21.36)	(24.10)
exp2	-0.02	-0.02	-0.03	-0.02	-0.02
	(-50.29)	(-37.36)	(-75.25)	(-20.40)	(-22.48)
tenure	0.01	0.01	0.02	0.02	0.02
	(57.60)	(55.29)	(71.07)	(27.16)	(23.41)
tenure2	-0.02	-0.03	-0.03	-0.02	-0.02
	(-32.05)	(-27.32)	(-30.57)	(-8.78)	(-7.99)
senior officials and managers	0.77	0.67	0.84	0.67	0.58
	(75.52)	(54.67)	(104.83)	(25.58)	(19.75)
professionals	0.74	0.77	0.75	0.68	0.69
	(118.35)	(101.73)	(157.05)	(44.71)	(36.79)
technicians and associate professionals	0.49	0.45	0.53	0.46	0.45
	(135.85)	(97.75)	(158.30)	(53.34)	(47.38)
clerks	0.25	0.23	0.27	0.22	0.22
	(117.79)	(93.38)	(109.45)	(45.45)	(42.09)
service workers and shop and market sales workers	0.09	0.08	0.05	0.07	0.06
	(48.56)	(39.68)	(25.77)	(22.00)	(16.65)
skilled agricultural and fishery workers	-0.04	-0.02	0.03	0.07	0.05
	(-3.64)	(-1.97)	(1.81)	(4.65)	(3.14)
craft and related trades workers	-0.004	-0.03	0.003	0.01	0.02
	(-2.63)	(-15.52)	(0.90)	(2.23)	(2.10)
plant and machine operators and assemblers	0.07	0.04	0.06	0.06	0.09
	(35.30)	(15.31)	(14.93)	(8.39)	(7.19)
mining	-0.02	0.06	0.15	0.20	0.08
	(-1.17)	(3.31)	(5.10)	(9.88)	(1.55)
manufacture	-0.03	-0.00	0.02	0.002	-0.06
	(-15.61)	(-0.08)	(6.92)	(0.33)	(-7.11)
electricity, gas and water supply	0.42	0.40	0.20	0.45	0.37
	(35.66)	(24.08)	(21.28)	(20.81)	(10.22)
construction	-0.03	-0.02	-0.01	0.01	0.02
	(-6.66)	(-3.94)	(-2.85)	(1.03)	(1.47)
wholesale and retail trade	0.02	0.02	0.04	0.01	0.01
	(9.15)	(7.06)	(16.40)	(3.55)	(1.96)
hotels and restaurants	-0.07	-0.03	-0.07	-0.05	0.06
	(-27.96)	(-13.08)	(-30.06)	(-13.77)	(13.78)
transport, storage and communication	0.22	0.13	0.15	0.14	0.18
	(43.45)	(22.21)	(42.82)	(13.67)	(16.83)
financial intermediation	0.45	0.48	0.32	0.49	0.42
	(103.62)	(84.83)	(97.70)	(51.17)	(37.84)
education	0.13	0.22	0.03	0.12	0.18
	(26.71)	(42.46)	(7.48)	(12.98)	(15.49)
lfsize	0.05	0.05	0.05	0.04	0.04
	(183.63)	(151.15)	(166.68)	(71.38)	(65.22)

APPENDIX B: VARIABLES DEFINITION

ln hourly wage	logarithm of the hourly wage rate (calculated with the monthly net wage) Wages were deflated by the regional consumer price index from INE and are at 2002 prices.
exp	number of potential years of experience in the labour market.= (age - years of education-6)
exp2	$exp^2/100$
tenure	number of years of tenure in the current job
tenure2	$tenure^2/100$
secondary education	dummy variable; equals one if individual has a secondary degree (twelve years).
university degree	dummy variable; equals one if individual has a University degree.
senior officials and managers	dummy variable; equals one if the individual's occupation is senior official or manager.
professionals	dummy variable; equals one if the individual's occupation is professional.
technicians and associate professionals	dummy variable; equals one if the individual's occupation is technician or associate professional.
clerks	dummy variable; equals one if the individual's occupation is clerk.
service workers and shop and market sales workers	dummy variable; equals one for service workers, shop and market sales workers.
skilled agricultural and fishery workers	dummy variable: equals one for skilled workers from agricultural or fishery.
craft and related trades workers	dummy variable: equals one for craft and related trade workers.
plant and machine operators and assemblers	dummy variable: equals one if the individual's occupation is plant or machine operator and assemblers.
elementary occupations	dummy variable: equals one if the individual's occupation is elementary.
mining	dummy variable: equals one if the individual' works in mining.
manufacture	dummy variable: equals one if the individual works in manufacture.
electricity, gas and water supply	dummy variable: equals one if the individual works in electricity, gas or water.
construction	dummy variable: equals one if the individual works is in construction.
wholesale and retail trade	dummy variable: equals one if the individual works in wholesale and retail trade.
hotels and restaurants	dummy variable: equals one if the individual works in hotels and restaurants.
transport, storage and communication	dummy variable: equals one if the individual works in transport, storage and communication.
financial intermediation	dummy variable: equals one if the individual works in financial intermediation.
public administration and defence; compulsory social security	dummy variable: equals one if the individual works in public administration and defence; compulsory social security.
education	dummy variable: equals one if the individual works in education.
other services	dummy variable: equals one if the individual works in health, social work, compulsory social security and personal service activities.
lfsize	The logarithm of the firm size