# Regional heterogeneity in wage distributions. Evidence from Spain.

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**Abstract:** Regional differences in real wages have been shown to be both large and persistent in the U.S. and the U.K., as well as in the economies of other countries. Empirical evidence suggests that wage differentials adjusted for the cost of living cannot only be explained by the unequal spatial distribution of characteristics determining earnings. Rather, average wage gap decomposition reveals the important contribution made by regional heterogeneity in the price assigned to these characteristics. This paper proposes a method for assessing regional disparities in the entire wage distribution and for decomposing the effect of differences across regions in the endowments and prices of the characteristics. The hypothesis forwarded is that the results from previous studies obtained by comparing average regional wages may be partial and non-robust. Empirical evidence from a matched employer-employee dataset for Spain confirms marked differences in wage distributions between regions, which do not result from worker and firm characteristics but from the increasing role of regional differences in the return to human capital.

**Key words:** Regional Labour Markets, Human Capital, Wage Gap Decomposition, Counterfactual Distributions.

**JEL codes:** J24, J31, R23.

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## 1. INTRODUCTION

A large body of evidence points to the magnitude of regional inequalities in wage levels and the persistence in these differences over time. Thus, according to Gerking and Weirick (1983), "Interregional differences in average wages and earnings have been observed particularly in the North and South of the U.S. ever since the mid-1800s", while a similar type of regional divide in wage levels has been reported for the U.K. (e.g., Blackaby and Manning, 1990). These claims have given rise to a number of studies in both countries aimed at quantifying the magnitude of these regional gaps and identifying their origin. Most of these empirical analyses have been guided by two classical ideas: the fact that regional labour markets are heterogeneous and that there are compensating differentials that offset differences in price levels and non pecuniary attributes across regions. As a result, the real wage paid to each class of worker should be interregionally invariant. Therefore, in the classical paradigm, wage differentials are merely an illusion caused by the failure to distinguish between types of labour. In other words, the competitive model behind these assumptions suggests that the price of the characteristics that determine wages will converge across regions in the absence of imperfect information and persistent stochastic disturbances, and with some mobile factors. In this scenario, identical workers in identical firms will receive wages that differ only in the compensation for the regional attributes (Farber and Newman, 1989).

However, there are other sources of persistent regional premiums in real wages apart from those derived from competitive theories. In their analysis of the U.K., Blackaby and Murphy (1991) identify the role of labour market institutions (unionisation and the bargaining system), the determination of an individual's reservation wage, and variants of efficiency wage theory as possible explanations for the observed persistence of regional wage premiums in the presence of detailed controls on worker characteristics. In the case of efficiency wage models, Farber and Newman (1989) claim that interregional differences in the conditions requiring efficiency wage premiums (turnover, shirking, adverse selection, threats of unionisation, worker's morale, etc.) will cause persistent differences across regions for identical workers. However, as these conditions are assumed to correlate with industry-specific conditions such as firm size, capital intensity and product market power, empirical analyses have focused on the extent to which differences in worker, job and firm characteristics can account for

regional wage differentials, or whether, on the contrary, regions also differ in the prices associated with these characteristics.

Gerking and Weirick (1983), Dickie and Gerking (1987), and Farber and Newman (1989) tested for interregional structural shifts in the wage equations estimated, and concluded that real wages did not differ between macro-regions in the U.S. Rather, differences in average real wages arose from heterogeneous worker characteristics. In sharp contrast, Farber and Newman (1987) obtained results that suggest that differences in returns (prices) may be at least as important in accounting for regional wage differentials as differences in worker characteristics between regions. As pointed out by these authors, the methodology they applied differs from that used in the other studies, and this may account for the contrasting conclusions. Instead of testing equality of coefficients across regional wage equations, they determined the contribution of price and different endowments in accounting for wage differences across regions. Similar conclusions were obtained for the U.K. using analogous decompositions of the regional wage gaps in, for instance, Blackaby and Manning (1990), Reilly (1991), and Blackaby and Murphy (1995).

Less attention has been paid to regional wage differentials in other economies, this despite the fact that they are far from negligible in certain countries. In the case of the EU regions, differences in wages show a rather stable pattern, characterised by stratification and persistence (Webber, 2002). However, the lack of appropriate micro-data at the regional level has impeded the collection of any broad evidence regarding the contribution of differences in returns and endowments. Exceptions to this include Maier and Weiss (1986), who analysed regional earning differentials in Austria, and García and Molina (2002) and Cabral et al. (2005), who conducted similar analyses for Spain and Portugal, respectively. Each of these studies decomposed the regional wage gaps in the contribution of endowments and returns, concluding that differences in the latter are largely responsible for wage differentials.

This paper aims at providing additional evidence on the magnitude and causes of regional wage gaps, by analysing the case of the NUTS II regions in Spain. The wage gap between high- and low-wage regions is decomposed in the contribution of differences in the regional distribution of characteristics, and in the contribution of

regional heterogeneity in their price. In contrast with the evidence provided in previous studies, we do not just focus on the average wage gap or on the amount of dispersion. Instead we report evidence for the entire distribution of wages. This is because it is our belief that there may be significant regional differentials in important characteristics of the wage distribution other than those related to their first moments, and because the contribution of endowments and returns may vary along the wage distribution. In so doing, we propose extending the decomposition proposed in Juhn et al. (1993) to the entire wage distribution, based on the computation of counterfactual distributions obtained under the assumption of the absence of differences across regions in the distribution of observable and unobservable characteristics. In this regard, our approach is in line with Dickey (2007), who states that studies based on the conditional mean and those using inequality measures fail to indicate the region of the wage distribution in which the effects are occurring. There is, however, a notable difference between her and our methodological approaches. While she proposes comparison of estimated returns from quantile regressions for each region, in this paper we assess the effect of differences in returns and characteristics on the entire wage distribution.

Our empirical analysis takes advantage of micro-data from a matched employer-employee dataset, the Spanish 1995 and 2002 waves of the Earnings Structure Survey. It is a large enterprise sample survey providing detailed information on relationships between the level of remuneration, individual characteristics of employees and their employer. This allows us to control for a comprehensive set of wage determinants and to separate the effects of worker human capital from those of job and firm characteristics. This rich information on schooling, tenure and worker experience in the labour market is used to check whether the heterogeneous spatial distribution of skilled workers accounts for most of the differences in wage distributions across regions. If this condition were to be met, convergence in the regional endowment of human capital would lead to a decrease in regional wage disparities. In this regard, the Spanish experience is interesting given the emphasis adopted by regional policy in promoting the accumulation of human capital in less developed regions over recent decades, and may add to the evidence obtained for the U.K. in Duranton and Monastiriotis (2002). Interestingly, after controlling for the set of job and firm characteristics, our results suggest that spatial equalisation of human capital endowments alone would not

automatically remove real wage differentials given that they are, above all, originated by differences across regions in their return.

The rest of this paper is organized as follows. In the second section we briefly describe the dataset and provide evidence on the amount of disparities in regional wage distributions. The methodology proposed to decompose the contribution of characteristics and returns in the entire wage distribution is summarised in the third section, while the results are presented and discussed in section 4. Finally, section 5 concludes.

## 2. DATA AND PRELIMINARY EVIDENCE

We drew our data from the matched employer-employee Spanish Earnings Structure Survey (ESS). The ESS is an extensive survey carried out by the Spanish National Institute of Statistics within the framework of the EU, employing a common methodology and content criteria for all the Member States. It provides information on wages, worker and firm characteristics for a sample of workers in establishments with 10 or more employees in 1995 and 2002. The sample is representative at the level of each of the NUTS II regions in Spain, which makes it possible to perform the proposed analysis. From the original sample available in the ESS we have selected those full-time workers who were under the age of 65, excluding those employed in Ceuta and Melilla.[1] In addition, so as to guarantee comparability between the two years, we removed workers with a training contract in 1995 and workers employed in the health and education sector in 2002, as there is data for only one of the years. The final samples used in the analysis include 120,210 workers for 1995 and 95,232 workers for 2002.

The variable under analysis in this paper is the gross hourly wage, computed as the gross wage (before income tax and the worker's contribution to the public social insurance system) in the month of October divided by the effective number of hours worked during that month. The ESS includes earnings information for both the month of October and the whole year. We used only monthly information because the

[1] Two Spanish cities in the North of Africa, with distinct characteristics. For this reason we have decided to exclude them from the regional analysis performed in this paper.

computation of the yearly salary in the ESS differs between the two years and because the monthly information is more reliable than that for the whole year.[2]

An important feature of the ESS is that it allows us to identify the region in which the employer is located. In conjunction with the fact that the sample of workers for each region in the ESS is representative of its employee population, this enables us to obtain evidence on the size of differences in the wage distribution across the Spanish regions, in 1995 and 2002. Table 1 shows the average nominal hourly wage, its standard deviation, the Gini index, and the number of observations in the sample for each of the regions in the two years. Despite a certain decrease in the number of regional disparities, the marked difference in average regional wages is clear in both years. In Extremadura, the region with the lowest wage level in 1995, the average wage was only 57% of that paid in Madrid, the region with the highest wage level. The distance between the bottom and the top region was lower in 2002, when the average salary in Murcia was 63% of that paid in Madrid. Similar differences are also observed for the groups of regions with the lowest and highest average wages. For instance, the ratio between the top and bottom five regions was 1.44 in 1995 and 1.47 in 2002, while that between the top and bottom three regions was 1.54 in both years. From these figures we can conclude that the degree of regional wage inequality is comparable to that reported for other key economic magnitudes such as income per capita and labour productivity (see among others Goerlich et al., 2002).

For the empirical exercise we used the sample of workers from the three regions with the highest wages (Cataluña, Madrid and País Vasco in both years) —HW— and from the three regions with the lowest wages (Extremadura, Galicia and Murcia in 1995 and Castilla y León, Extremadura and Murcia in 2002) —LW. Although certain alternatives can be considered in the methodology in order to include the whole set of regions in the analysis, we chose to compare the LW and HW groups because the regions within each group have a number of important economic characteristics in common. In short, the HW group is composed of the industrialised and traditionally most dynamic regions in Spain, concentrating the most productive firms, R&D investment and skilled workers,

[2] The main conclusions drawn in this paper are, however, robust to the use of wages based on the yearly information.

while the LW group is composed of lagging regions, despite the recent positive trend in the growth reported by some of them. These characteristics can explain some of the similarities in the wage distribution of the regions within each group and the striking differences across groups. The selection of LW and HW regions was therefore undertaken in such a way so as to intensify similarities within groups and differences across groups. We believe that this selection facilitates the interpretation of our results. In any case, the results are robust to the inclusion of additional regions in each group.

Table 2 provides a description of wages in these regions. As mentioned above, the ratio between the average wages in the HW and LW groups was 1.54 in both years. It might be argued that part of this difference in nominal wages between the two groups might be caused by the compensation paid for differences in the cost of living. To control for such differences, we used an estimate of relative regional price levels to compute the real hourly wage for the workers in the sample.[3] The average real wage in the LW group increased about 4% in 1995 and 7% in 2002 relative to the nominal wage due to the lower price levels in those regions, whereas the average real wage in the HW group fell as a consequence of their higher cost of living (3% in 1995 and 4% in 2002). Nevertheless, the figures show that differences in relative prices only account for 11 and 16 percentage points of the wage gap between the HW and the LW regions in 1995 and 2002 respectively, and that regional differences in real wages remain important (the ratios in this case being 1.43 in 1995 and 1.38 in 2002). Thus, the regional wage gap in Spain is not mainly attributable to the compensation for differences in the cost of living across regions. The rest of the analysis focuses on wage differentials net of the effect of regional differences in living costs.

Besides the differences in the mean, the wage distributions of these two groups present other interesting variations. The figures reported in Table 2 reveal the existence of differences in the degree of dispersion. The Gini index for the HW regions is higher than that for the LW regions, and the difference in inequality between both groups actually increased in 2002 as a result of the stability in the HW group and the decrease

[3] This information has been kindly provided by the Catalan Institute for Statistics (IDESCAT), which estimates the parity power standards for the 17 Spanish regions from the aggregate Spanish figures used by the Statistical Office of the EU, EUROSTAT, to produce a data net of the cost of living differences across the Member States. Note that given the common currency for the spatial units under analysis, parity power standards only account for differences in the cost of living.

in inequality for the LW regions. This indicates the existence of greater inequality in regions with high average wages. On the other hand, the magnitude of wage differentials does not seem to be the same throughout the distribution. The last set of columns in Table 2 report wages at certain percentiles. In both years, the wage level for the HW group is higher than that for the LW group at all the percentiles, but the gap is not homogeneous. It increases up to the highest percentiles where, particularly in 1995, the ratio of wages for the two groups of regions stabilises. Differences in dispersion and heterogeneity in the gap observed at different percentiles supports our idea of analysing the entire wage distribution in the HW and the LW regions, instead of just comparing their first moments (average wages).

A comparison of the entire wage distribution in the regions under analysis confirms the picture obtained by means of the traditional descriptive analysis outlined above. The estimated density function summarises the most important features of the shape of the wage distribution in each region. The comparison between regions helps to identify particular differences in each of these features.[4] The estimated densities for the individual regions are shown in Figure 1, while Figures 2 and 3 depict the densities associated with the distribution in the HW and LW groups, for 1995 and 2002 respectively. Not only are the modes of the distributions of Cataluña, Madrid, and País Vasco to the right of those calculated for the low-wage regions, but the entire wage distribution is shifted to the right. In fact, the wage level associated with the mode in the latter group of regions corresponds to that for the lowest percentiles in the wage distribution of the HW group. The respective shapes of the wage distributions of the two groups of regions differ markedly, although within their respective groups the shapes of these distributions are largely similar. In agreement with the figures for the Gini index reported above, the wage distribution for the HW regions is much more dispersed than it is in the case of regions with low wage levels. In addition, there is a mass of probability in the right tail of the distribution for the LW regions, indicating that some workers in these regions earn wages that are as high as those earned by some workers in the HW regions. The key point, though, is that the relative number of workers with high wages is much greater in the HW regions than in the LW group. The estimated density functions for the groups of HW and LW regions in Figures 2 and 3 reproduce the

[4] Density functions are estimated non-parametrically using the kernel method.

features observed in the distributions for the individual regions, supporting the existence of marked differences in the characteristics of the wage distributions between both types of regions, in the two periods under analysis.

The J-measure proposed in Kullback and Leibler (1951) can be used to summarize the degree of (dis)similarity between the wage distributions for the two groups of regions.[5] The measure would equal zero if the wage distribution for the two groups of regions was exactly the same and increase as the discrepancy between them grows. The J-measure took a value of 0.58 in 1995, falling to 0.48 in 2002 (row and column labelled Actual in Table 3). This means that despite a certain attenuation in the dissimilarity, the wage distributions for the HW and the LW groups of regions clearly differ. It should be noted that the values for the J-measure for the pairs of regions within each group are much lower (an average of 0.09 for 1995 and 0.14 for 2002 in the case of the HW group, and 0.07 for 1995 and 0.16 for 2002 in the LW group), while for the pairs of regions across the two groups the values are much higher (an average of 0.71 for 1995 and 0.73 for 2002). These figures are thus consistent with the above-mentioned similarity in the wage distributions within the two groups of regions and the discrepancy between regions across the groups.[6]

A visual inspection of the estimated densities and the results for the J-measure confirms the magnitude of regional wage disparities and the fact that they are not only related to the distribution average. Rather, the evidence confirms that regional wage distributions differ strongly in their shape as well. As a consequence, and following for instance Butcher and DiNardo (2002) and Dickey (2007), it can be stated that an analysis based on the first moment of the distributions (the means) would only provide us with partial and non-robust conclusions as to the amount of wage disparities across regions, and their origin. For this reason, we perform here an analysis based on the entire regional wage distribution.

[5] In their seminal paper, DiNardo et al. (1996) suggest the use of this measure to compare wage distributions. Here, we use it in section 4 to summarize the differences between actual and counterfactual wage distributions. A brief description of the J-measure is provided in the Appendix.
[6] The full set of results for the J-measure for each pair of regions is available on request from the authors.

Differences in the wage distributions for the HW and LW groups can be caused by regional heterogeneity in the price or return to worker and firm characteristics, on the one hand, and by differences across regions in the distribution of such characteristics, on the other. In the sections that follow, we assess the contribution of these two sources of regional differentials, but as a prior step we need to verify whether there are differences in the endowment of characteristics between the regions in the HW and the LW groups. For instance, if salary increases with workers' schooling, then regions with higher educational endowments will exhibit higher wages. Table 4 reports a simple description of the observable worker and firm characteristics in the HW and LW groups. It is for instance observed that regions with high wage levels have more skilled workers, employed in relatively larger firms, and hired in a greater proportion by means of permanent contract. Other differences worth mentioning include those related to occupations that demand higher skill levels, to the type of collective bargaining, and to the type of market for the firm's production (national or foreign).[7]

Therefore, there seem to be differences in the characteristics of HW and LW regions that result in differences in regional wage levels. But the fundamental point is whether differences in human capital and firm characteristics can fully account for regional differences in the wage distribution, or if on the contrary part of the gap is caused by differences in returns across regions. In the case that the wage gap could be fully explained by regional differences in the distribution of the observable characteristics, then the conclusion would be that workers in the HW regions are paid a higher wage because they and their employers are endowed with a set of characteristics that make them more productive than their counterparts in the LW regions. Under such circumstances, similar workers employed in similar firms but located in different regions would earn the same wage. By contrast, if part of the wage gap could be explained by differences in returns, this would then point to failures in regional labour markets, as similar workers in comparable firms but in different regions would be earning different wages. In the section that follows we aim to shed more light on this issue.

[7] Conclusions regarding the existence of regional differences in the average of these observed characteristics can be expanded to their entire distribution. Additional results are not reported for reasons of space but are available from the authors upon request.

## 3. METHODOLOGY

In this section we outline the method proposed for assessing the contribution of characteristics and their returns to differences in regional wage distributions. It combines the wage decomposition procedure suggested in Juhn et al. (1993), which allow us to account for both observable and unobservable characteristics, with the principle contained in the analyses in Jenkins (1994), DiNardo et al. (1996) and Butcher and DiNardo (2002) which strongly advocates studying the effects over the entire wage distribution rather than simply focusing on the first moments.

As in traditional decompositions, our starting point is the estimation of a Mincerian-type wage function for workers in each group of regions (HW and LW):

$$w_{iHW} = X_{iHW}\beta_{HW} + \varepsilon_{iHW} \quad (1)$$

$$w_{iLW} = X_{iLW}\beta_{LW} + \varepsilon_{iLW} \quad (2)$$

where $w_{ig}$ denotes the logarithm of real hourly wages for a worker $i$ in the group of regions $g$ ($g$=*HW, LW*), $X_{iq}$ the vector of observable characteristics of worker $i$ in the group $g$, and $\beta_k$ the vector of returns to characteristics. Given the availability of a matched employer-employee dataset, in our case the $X_{ig}$ vector includes information on observable worker and firm characteristics. Worker characteristics include gender, schooling measured by the number of years in the formal education system, and years of experience, both general in the labour market and specific in the firm (tenure). While a gender dummy aims at accounting for the widely reported gender wage gap, the other characteristics are, broadly speaking, related to a worker's human capital. On the other hand, variables used to measure firm characteristics are industry (8 manufacturing and service sectors), type of output market (national or foreign), the type of collective bargaining (within the firm or at some centralized level), the firm's size (measured by the number of workers) and the ownership structure (fully private or public participation). We have also included in this category the type of occupation (grouped in 8 categories of the International Standard Occupation Classification) and the type of contract (fixed-term or permanent) as characteristics of the job and the employer-employee relationship that affect the wage level.

Following the proposal made in Juhn et al. (1993), the error term $\varepsilon_{ig}$, which is the component of wages accounted for by the unobservables, can be considered as being formed from two components: an individual's percentile in the residual distribution, $\theta_{ig}$, and the distribution function of the residuals of the wage equation for group $g$, $F_g(\,)$. By definition of the cumulative distribution function:

$$\varepsilon_{ig} = F_g^{-1}\left(\theta_{ig} \mid X_{ig}\right) \tag{3}$$

where $F_g^{-1}\left(\cdot \mid X_{ig}\right)$ is the inverse cumulative residual distribution for workers in group $g$ with characteristics $X_{ig}$. Thus, wages for workers in the two groups of regions can alternatively be expressed as:

$$w_{iHW} = X_{iHW}\beta_{HW} + F_{HW}^{-1}\left(\theta_{iHW} \mid X_{iHW}\right) \tag{4}$$

$$w_{iLW} = X_{iLW}\beta_{LW} + F_{LW}^{-1}\left(\theta_{iLW} \mid X_{iLW}\right) \tag{5}$$

Counterfactual wages can be defined for workers in the LW group under the assumption that the wage structure and the distribution of the residuals (unobservable characteristics and their returns) are the same as those in the HW regions. That is to say, the counterfactual wage is the wage that would be expected (*ceteris paribus*) for the workers in the LW regions if their characteristics were recompensed at the same level as they were in the HW regions, and if there were no differences across regions in the distribution and impact of unobservables:

$$w_{iLW}^{HW,1} = X_{iLW}\beta_{HW} + F_{HW}^{-1}\left(\theta_{iLW} \mid X_{iLW}\right) \tag{6}$$

Similarly, counterfactual wages for workers in the LW group under the assumption that they had the same returns to the observable characteristics as workers in the HW regions, but a different distribution of the unobservables are obtained as:

$$w_{iLW}^{HW,2} = X_{iLW}\hat{\beta}_{HW} + F_{LW}^{-1}\left(\theta_{iLW} \mid X_{iLW}\right) \tag{7}$$

Given an estimate of the wage equations for the two groups of regions, the contribution of differences in characteristics, in returns, and in unobservables to the average regional wage gap can be assessed by comparing the average of actual and counterfactual wages. But the added value of this approach lies in the possibility it affords of measuring the effect of these differences on the entire wage distribution. The joint effect of returns and

unobservables to differences in the wage distributions can be assessed by comparing the density function of $w_{LW}$ with that of $w_{LW}^{HW,1}$. Correspondingly, the effect of regional heterogeneity on returns is obtained by the comparison of $w_{LW}$ and $w_{LW}^{HW,2}$. A shift to the right and a change in the shape of the density of the counterfactual wage distribution suggest that regional heterogeneity in returns and/or in unobservables play a role in explaining differences in the distribution of wages across regions. On the contrary, absence of changes in the counterfactual distribution should be read as evidence in favour of regional differences in the distribution of observable characteristics that are entirely responsible for causing the wage disparities.

Figure 4 helps illustrate these effects. It depicts densities for simulated distributions. The distance between the density labelled *Actual wage in LW group* and that labelled *Counterfactual wage for LW group* can be attributed to regional differentials in returns and unobservables, while the distance between the density of the latter and that of the *Actual wage in HW group* shows differences in the distribution of characteristics between the groups of HW and LW regions. The comparison also sheds some light on the origin of these differences in wage dispersion and in the shape of the wage distributions. In this example, only part of the lower dispersion in the LW group can be attributed to returns. Further, we see that they explain much of the difference at the bottom of the distribution but virtually nothing of the difference for higher wage levels. Results obtained from the visual comparison of the densities are complemented by the J-measure and by results from the decomposition by Juhn et al. (1993) at selected percentiles (JMP).

## 4. RESULTS

To compute the counterfactual wages we need an estimate of the coefficients of the wage equations for the two groups of regions in each of the years. Results of the OLS estimation for the HW and LW groups in 1995 and 2002 are summarised in Table 5.[8]

[8] It might be argued that our OLS estimates are likely to be biased due to the non-exogeneity of education. As in other contributions to the literature that use the same dataset, the lack of appropriate instruments in the ESS prevents us from applying other estimation methods based on instrumental variables. In any case, the large set of controls for firm and job characteristics, such as occupation and the

As expected, there are significant differences in returns between the two groups. In the case of worker characteristics, for example, we see a higher return to schooling in the HW regions. The return of a year of schooling for this group in 1995 was 3.38% *vis a vis* 2.80% in the LW group. The gap in this return increases in 2002 as a result of the sharp fall in return in the LW regions. The return to general experience in the labour market is also lower in the LW group (the return to a year of experience computed in the sample average in 1995 was 2.09% for the HW and 1.24% for the LW, and in 2002 1.50% and 0.73% respectively) although this is not the case for tenure (return to a year in a firm computed in the sample average for 1995 was 0.59% in the HW and 0.84% in the LW, and in 2002 1.40% and 1.32% respectively). Regional heterogeneity in returns is also observed in most of a firm's characteristics. For instance, the return to occupations that require high skill levels is higher in the HW group, and the same is true of being hired by a permanent contract. In contrast, the so-called size-wage effect seems to be of the same magnitude in both groups, or even somewhat greater in the LW group in 2002.

Yet, the heterogeneity in the estimated coefficients of the wage equation for the two groups of regions should be read as an indication that at least part of their wage gap could be due to differences in returns, and not just to the fact that workers, jobs and firms differ across regions.

### 4.1. Effect of regional differences in returns and unobserved characteristics

A comparison of actual wage distributions in the two groups of regions ($w_{LW}$ and $w_{HW}$) and the distribution of counterfactual wages in the LW group with returns and unobservables as in the HW regions ($w_{LW}^{HW,1}$) can be made from the densities depicted in Figure 5.[9] In addition, the second column of results in Table 3 shows the J-measure for this counterfactual distribution and the two real distributions, while results for the JMP decomposition at selected quantiles are reported in Table 6. The estimated density for $w_{LW}^{HW,1}$ clearly reveals that the counterfactual distribution shifted to the right, towards

type of contract, should capture the effect of worker omitted variables, such as ability, that might be biasing the estimates of the return to education.

[9] It should be mentioned that as the wage equations used to compute the counterfactual wages include a number of dummy variables as regressors, the identification constraints suggested in Gardeazabal and Ugidos (2004) were imposed to guarantee that results were invariant to the omitted categories.

higher wage levels, particularly in 2002. We also observe a change in the shape of the counterfactual distribution, which is more similar to the actual distribution for the HW regions than it is for the LW group. As a consequence, this evidence suggests that a large proportion of the differences in wages across regions were caused by regional heterogeneity in returns and by differences in the distribution of unobserved characteristics. This is confirmed by the results of the (dis)similarity measure. The J-coefficient obtained when comparing the counterfactual distribution for the LW group with the actual distribution in the HW takes a much lower value than that obtained when contrasting the two actual distributions (0.1236 versus 0.5804 in 1995 and 0.0987 versus 0.4851 in 2002). This means that when valuing the observed characteristics with the same returns and equalising the distribution of the unobserved characteristics, most differences in the wage distributions for the two groups of regions disappear.

A detailed analysis of the densities also reveals that the effect of differences in these two factors were not homogeneous throughout the distribution. They do seem to be fully responsible for the lower wage levels at the bottom of the distribution. In fact, the left tail of the counterfactual density of the LW regions is to the right of that for the actual distribution in the HW group in 2002, indicating that had returns and unobservables been the same across regions, wages for workers at the bottom of the distribution in the LW group would have been higher than those for workers with the lowest wages in the HW group. Differences in returns and unobservables almost fully explain differences among the top wage levels in 2002 as well. At other parts of the distribution their effect is not so marked, although it is still greater than that attributable to differences in observed characteristics. This is confirmed by the figures obtained from the JMP decomposition (summarised in Table 6) for some selected quantiles. For the first decile in both years and even for the lower quartile in 2002, differences in returns alone caused a gap that would have been even greater than that observed in the data. For these wage levels, the regional distribution of observed characteristics and the effect of unobservables partially balance out the effect of regional differences in returns (negative contribution to the wage gap). For the median and upper percentiles there is a significant difference between the two years under analysis. Although in both cases the most intense contribution is that of returns, in 1995 the effect of observable characteristics is non-negligible whereas it diminished significantly in 2002.

Our results so far suggest that the main discrepancy in wage distributions between the HW and LW groups of regions cannot be explained by regional differences in observed worker and firm characteristics. On the contrary, above all in 2002, they seem to be associated with spatial heterogeneity in returns and unobservables. In addition, the limited effect attributable to the unobserved characteristics in the JMP decomposition combined with figures for the effect of differences in returns point to the latter as the main contributor to the gap in wage distributions. The distribution of counterfactual wages for the LW group resulting from assigning the returns of the HW group but keeping its observed characteristics and the distribution of residuals unaltered, $w_{LW}^{HW,2}$, is quite similar to that of $w_{LW}^{HW,1}$, which confirms that most of the changes discussed above correspond to differences in returns (Figure 6). The J-measure for both counterfactual distributions is as low as 0.0161 in 1995 and 0.0318 in 2002. The main difference between them is concerned with with dispersion around the mode, as the counterfactual distribution is less dispersed when we only modify returns. Then, the basic role of unobservables might be concerned with the difference in the degree of dispersion of wages between the two groups of regions.

### 4.2. The effect of regional differences in the return to human capital

As mentioned in section 2, the use of a matched employer-employee dataset allows us to control for worker and firm characteristics in our analysis. The availability of this information is now crucial to study the separate contribution of differences in returns to each of these sets of characteristics. We can compute counterfactual wages in the LW group as if its workers had been paid for their individual characteristics as workers were in the HW group. As this set of characteristics comprises gender and human capital proxies, and given our interest in the effect of returns to the latter, counterfactual wages in this case are computed modifying only returns to human capital ( $w_{LW}^{HW,HK}$ ):[10]

$$w_{iLW}^{HW,HK} = HK_{iLW}\beta_{HW}^{HK} + X_{iLW}^{*}\beta_{LW}^{*} + F_{LW}^{-1}\left(\theta_{iLW} \mid X_{iLW}\right) \qquad (8)$$

where $HK_{iLW}$ is the vector of observations for schooling, experience and tenure for worker *i* in the LW group, $\beta_{HW}^{HK}$ is the vector of returns to the human capital variables in the HW group, and the star denotes all the other characteristics.

[10] Results, available upon request, are unaffected when modifying returns to gender as well.

Alternatively, counterfactual wages in the case of balancing out only differences in returns to firm characteristics ( $w_{LW}^{HW,F}$ ) are computed as:

$$w_{iLW}^{HW,F} = F_{iLW}\beta_{HW}^{F} + X_{iLW}^{\#}\beta_{LW}^{\#} + F_{LW}^{-1}\left(\theta_{iLW} \mid X_{iLW}\right) \quad (9)$$

where $F_{iLW}$ is the vector of observations for firm characteristics of worker *i* in the LW group, $\beta_{HW}^{F}$ is the vector of returns to these characteristics in the HW group, and # denotes worker characteristics.

The estimated density function for $w_{LW}^{HW,HK}$ is depicted in Figure 7, together with those for actual wages. The shift to the right and the change in the shape is of the same magnitude as that obtained for $w_{LW}^{HW,2}$, that is the counterfactual, when returns to all the characteristics were changed (Figure 6). The only difference of note is that related to the reduction in the intensity of change in the shape of the counterfactural distribution for 1995 when only the returns to human capital are modified. Evidence from the visual inspection of the densities is confirmed by the values of the J-measure in the fourth column of results in Table 3. Its value when comparing the two counterfactuals is 0.0181 for 1995, but it falls even lower for 2002 (0.0072). Correspondingly, the J-measure for the comparison between the distribution of $w_{LW}^{HW,HK}$ and that of $w_{HW}$ provides much lower values than those obtained for the comparison between the two actual distributions, $w_{LW}$ and $w_{HW}$.

The evidence points to differences in returns to human capital as being the main source of regional variation in wage distributions. If it were in fact the case, the contribution of returns to firm characteristics should be only marginal in explaining differences in wage distributions across regions. This result is confirmed by Figure 8, which compares the estimated densities for real wages and counterfactual wages $w_{LW}^{HW,F}$. In 1995, the latter density accumulates less mass of probability around the mode than the density for the LW regions, and this represents the single significant difference between the two distributions. This discrepancy is even lower for 2002. The last column of results in Table 3 for the J-measure also confirms in this case the evidence obtained from a visual inspection of the densities. The values obtained when comparing the counterfactual distribution with the actual distribution for the HW group are quite similar to those

obtained when comparing the real distribution for the two groups, especially in 2002. Correspondingly, the J-measure takes values close to zero when the counterfactual and the actual distributions for the LW group are compared (0.0189 in 1995 and 0.0101 in 2002). Therefore, the evidence strongly supports our claim that differences in returns to firm characteristics only played a minor role in explaining the discrepancy in the wage distribution between the two groups of regions, and that most of the differences were caused by regional heterogeneity in returns to human capital. In addition, these effects would seem to be increasing over time.

## 5. CONCLUDING COMMENTS

Evidence from a comprehensive wage survey has confirmed the existence of differences not only in average regional wages but also in other key features of the wage distribution. Applying standard practices from the regional science literature for the decomposition of average wage gaps would have provided only partial and, in all likelihood, non-robust results regarding the origin of these spatial differentials. Rather, by adhering to developments in the labour economics literature, here we have proposed a method for assessing the contributions of regional differences in characteristics and of spatial heterogeneity in their price, to the discrepancy between entire regional wage distributions.

The results of the decomposition for Spain have revealed that most of the differences in the regional distributions are not associated with compensating differentials and structural variation. In other words, the evidence we have obtained suggests that identical workers in identical jobs and identical firms receive different wages depending on the region in which they are located. This holds true for all wage levels, albeit that our analysis of the entire distribution indicates that the gap is not homogeneous. The relative contribution of returns is greatest for workers with the lowest wage levels, while the effects of worker and firm characteristics seem to be constrained to medium wage levels.

The availability of information for a rich set of worker and job and firm characteristics has allowed us to demonstrate that regional heterogeneity in the returns to human

capital (lower in the case of the less developed regions) was the main factor explaining wage disparities across regions. Had human capital in the less developed regions been recompensed at the same level as in the more advanced regions, the bulk of the differences observed in the wage distributions would have disappeared. This result has interesting implications from a policy point of view. In brief, it questions the effectiveness of policies that promote human capital accumulation in the less developed regions as a means of fostering regional convergence. Firstly, if we assume the existence of a link between wages and productivity, increasing the skills of workers in these regions will not lead to productivity improvements of the same magnitude as those in the advanced regions and, secondly, and related to this point, more highly skilled workers will have the incentive to migrate to those regions in which they can obtain a greater reward for their human capital. Recent evidence regarding differences in the propensity of interregional migration for individuals with different levels of schooling and the direction of migration flows in Spain supports this claim. The key point remains then as to why returns to human capital differ across regions. Based on recently published findings in Head and Mayer (2006), López-Rodríguez et al. (2007) and Combes et al. (2008), we hypothesize that such returns may be related to economies of density and market potential, although further research is clearly required on this issue.

We should stress that our conclusions are derived from a partial equilibrium exercise. As is usual in a counterfactual analysis of this type, it is difficult to predict the reaction of workers and firms, for instance, to the regional equalization of returns to human capital. Further, counterfactual wages were computed here on the basis of estimated returns from the conditional mean regression of wage equations, which is likely to be a shortcoming if returns are not homogeneous for all wage levels, as in the case reported by Dickey (2007) for the regions in Great Britain. The use of returns estimated from quantile regressions should be explored in greater depth, although this would probably cause the derivation of counterfactual wages to be more cumbersome. Finally, this paper has only provided a static analysis of regional wage differentials, since our objective here was to examine the roots of these differentials and not their changes over time. However, as extending this methodology to incorporate a non-static analysis is quite straightforward, it is in our future research agenda.

**APPENDIX**

The J-measure of Kullback and Leibler (1951) can be used to summarise the amount of discrepancy between any two distributions. Given two estimated densities $\hat{g}_1(w)$ and $\hat{g}_2(w)$ it is obtained as:

$$J_{12}(w) = \int_0^{\infty} [\hat{g}_1(w) - \hat{g}_2(w)] \ln \frac{\hat{g}_1(w)}{\hat{g}_2(w)} dw$$

It will equal zero for identical distributions while values close to zero indicate that the distributions do not differ greatly. Correspondingly, the higher the value for the J-measure becomes, the larger the discrepancy between the distributions.

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**Table 1. Descriptive of regional nominal wages in Spain**

| | 1995 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|
| | **Average*** | **Std. Dev.** | **Gini** | **N. Obs.** | **Average*** | **Std. Dev.** | **Gini** | **N. Obs.** |
| Andalucía | 6.276 | 3.585 | 0.2802 | 10808 | 7.609 | 5.099 | 0.282 | 8076 |
| Aragón | 5.992 | 3.371 | 0.2602 | 5937 | 7.627 | 4.125 | 0.242 | 4549 |
| Asturias | 6.042 | 3.547 | 0.2649 | 4117 | 7.074 | 3.627 | 0.228 | 2985 |
| Baleares | 5.294 | 2.857 | 0.2350 | 3551 | 6.670 | 4.088 | 0.222 | 2645 |
| Canarias | 5.266 | 3.528 | 0.2993 | 5572 | 6.355 | 3.606 | 0.258 | 3712 |
| Cantabria | 5.256 | 2.690 | 0.2313 | 2751 | 6.459 | 3.004 | 0.214 | 2110 |
| Castilla y León | 5.117 | 2.737 | 0.2539 | 5498 | 6.337 | 3.452 | 0.235 | 4420 |
| Castilla La Mancha | 6.226 | 3.765 | 0.2868 | 7389 | 7.320 | 4.043 | 0.257 | 5441 |
| Cataluña | 7.094 | 4.488 | 0.2852 | 19230 | 9.067 | 5.781 | 0.283 | 15969 |
| Com. Valenciana | 5.725 | 3.254 | 0.2620 | 10604 | 7.073 | 3.974 | 0.242 | 9809 |
| Extremadura | 4.502 | 2.675 | 0.2500 | 2381 | 5.365 | 2.775 | 0.203 | 1567 |
| Galicia | 5.047 | 2.980 | 0.2529 | 7187 | 6.628 | 4.051 | 0.261 | 5820 |
| Madrid | 7.846 | 5.918 | 0.3310 | 15794 | 9.532 | 7.466 | 0.332 | 12995 |
| Murcia | 4.639 | 2.279 | 0.2150 | 4062 | 5.975 | 3.097 | 0.205 | 3546 |
| Navarra | 6.187 | 3.272 | 0.2373 | 3695 | 8.258 | 3.602 | 0.205 | 3095 |
| País Vasco | 7.470 | 3.937 | 0.2488 | 8902 | 9.480 | 4.447 | 0.229 | 6507 |
| La Rioja | 5.097 | 2.621 | 0.2134 | 2732 | 6.652 | 3.378 | 0.200 | 1986 |
| Total | 6.282 | 4.073 | 0.2901 | 120210 | 7.836 | 5.098 | 0.279 | 95232 |

* In current €

**Table 2. Descriptive of wages in the groups of low- and high-wage regions**

| | Nominal Gross Hourly Wage | | | Real Gross Hourly Wage | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Percentiles | | | | |
| | Average | Std. Dev. | Gini | Average | Std Dev. | Gini | 10% | 25% | 50% | 75% | 90% |
| **1995** | | | | | | | | | | | |
| Cataluña | 7.09 | 4.49 | 0.285 | 6.77 | 4.28 | 0.285 | 3.30 | 4.21 | 5.77 | 7.91 | 11.06 |
| Madrid | 7.85 | 5.92 | 0.331 | 7.78 | 5.86 | 0.331 | 3.37 | 4.28 | 6.24 | 9.10 | 13.79 |
| País Vasco | 7.47 | 3.94 | 0.249 | 7.20 | 3.79 | 0.249 | 3.80 | 4.91 | 6.41 | 8.28 | 11.08 |
| ***High-Wage regions*** | **7.44** | **4.97** | **0.297** | **7.22** | **4.85** | **0.298** | **3.40** | **4.36** | **6.08** | **8.37** | **11.99** |
| Extremadura | 4.50 | 2.67 | 0.250 | 5.12 | 3.04 | 0.250 | 3.14 | 3.57 | 4.07 | 5.43 | 8.29 |
| Galicia | 5.05 | 2.98 | 0.253 | 5.12 | 3.03 | 0.253 | 3.01 | 3.46 | 4.12 | 5.84 | 8.25 |
| Murcia | 4.64 | 2.28 | 0.215 | 4.83 | 2.37 | 0.215 | 3.08 | 3.54 | 4.21 | 5.26 | 7.31 |
| ***Low-Wage regions*** | **4.83** | **2.74** | **0.243** | **5.04** | **2.85** | **0.242** | **3.07** | **3.49** | **4.13** | **5.58** | **8.00** |
| **2002** | | | | | | | | | | | |
| Cataluña | 9.07 | 5.78 | 0.283 | 8.51 | 5.43 | 0.283 | 4.31 | 5.33 | 7.05 | 9.83 | 14.06 |
| Madrid | 9.53 | 7.47 | 0.332 | 9.54 | 7.47 | 0.332 | 4.33 | 5.23 | 7.44 | 11.13 | 16.90 |
| País Vasco | 9.48 | 4.45 | 0.229 | 8.95 | 4.20 | 0.229 | 5.12 | 6.21 | 8.05 | 10.45 | 13.62 |
| ***High-Wage regions*** | **9.31** | **6.26** | **0.293** | **8.97** | **6.10** | **0.294** | **4.42** | **5.44** | **7.39** | **10.38** | **14.92** |
| Castilla y León | 6.34 | 3.45 | 0.235 | 6.87 | 3.74 | 0.235 | 4.17 | 4.91 | 5.69 | 7.47 | 10.71 |
| Extremadura | 5.37 | 2.77 | 0.203 | 6.22 | 3.22 | 0.203 | 4.26 | 4.67 | 5.29 | 6.35 | 8.89 |
| Murcia | 5.98 | 3.10 | 0.205 | 6.08 | 3.15 | 0.205 | 4.09 | 4.57 | 5.23 | 6.56 | 8.78 |
| ***Low-Wage regions*** | **6.04** | **3.24** | **0.222** | **6.47** | **3.47** | **0.221** | **3.88** | **4.40** | **5.09** | **6.51** | **9.13** |

**Table 3. J-Measure of (dis)similarity of distributions.**

| | | Actual | | Counterfactual | | |
|---|---|---|---|---|---|---|
| | | Low-Wage | All returns and unobservables | All returns | Returns to human capital | Returns to firms characteristics |
| **Actual** | | | | | | |
| High-Wage | | | | | | |
| | 1995 | 0.5804 | 0.1236 | 0.1741 | 0.2676 | 0.4648 |
| | 2002 | 0.4851 | 0.0987 | 0.1910 | 0.2289 | 0.4587 |
| Low-Wage | | | | | | |
| | 1995 | | 0.3177 | 0.3661 | 0.3530 | 0.0189 |
| | 2002 | | 0.5918 | 0.7465 | 0.7659 | 0.0101 |
| **Counterfactual** | | | | | | |
| All returns and unobservables | | | | | | |
| | 1995 | | | 0.0161 | 0.0428 | 0.2196 |
| | 2002 | | | 0.0318 | 0.0365 | 0.5455 |
| All returns | | | | | | |
| | 1995 | | | | 0.0181 | 0.2701 |
| | 2002 | | | | 0.0072 | 0.6950 |
| Returns to human capital | | | | | | |
| | 1995 | | | | | 0.2672 |
| | 2002 | | | | | 0.7157 |

## Table 4. Descriptive of observable worker and firm characteristics

| | 1995 | | 2002 | |
|---|---|---|---|---|
| | **HW reg.** | **LW reg.** | **HW reg.** | **LW reg.** |
| | **Continuous variables (average and std. desv.)** | | | |
| Schooling (*in years*) | 9.367 | 8.099 | 10.128 | 8.502 |
| | (4.045) | (3.493) | (4.117) | (3.427) |
| Experience (*in years*) | 22.796 | 22.806 | 20.929 | 19.738 |
| | (11.711) | (11.439) | (12.056) | (11.552) |
| Tenure (*in years*) | 11.849 | 9.306 | 9.080 | 6.116 |
| | (10.230) | (9.274) | (10.431) | (8.257) |
| Firm size (*in number of employees*) | 281.982 | 90.383 | 349.993 | 62.197 |
| | (897.870) | (417.224) | (854.437) | (74.917) |
| | **Discrete Variables (share)** | | | |
| Gender | | | | |
| Male | 74.92% | 80.80% | 70.70% | 78.53% |
| Female | 25.08% | 19.20% | 29.30% | 21.47% |
| Occupation | | | | |
| Direction and management | 5.24% | 3.61% | 3.06% | 1.57% |
| 2nd and 3rd cycle university | 4.50% | 1.49% | 5.04% | 1.48% |
| 1rst cycle university | 2.70% | 1.20% | 2.72% | 1.66% |
| Technicians and administrative workers | 30.55% | 21.78% | 31.78% | 19.58% |
| Restoration and Shopping | 6.30% | 6.65% | 6.32% | 4.94% |
| Skilled workers | 17.96% | 26.23% | 17.74% | 28.70% |
| Manufacturing operators | 23.66% | 25.66% | 25.93% | 28.41% |
| Non-skilled workers | 9.09% | 13.39% | 7.41% | 13.66% |
| Type of Contract | | | | |
| Indefinite duration | 80.47% | 67.59% | 83.27% | 70.28% |
| Fixed-term | 19.53% | 32.41% | 16.73% | 29.72% |
| Product Market Orientation | | | | |
| National market | 2.54% | 0.43% | 78.90% | 96.15% |
| Foreign market | 97.46% | 99.57% | 21.10% | 3.85% |
| Collective agreement | | | | |
| National sector | 35.57% | 33.85% | 39.92% | 45.06% |
| Provincial or lower territory | 33.30% | 51.47% | 41.65% | 51.80% |
| Firm or establishment | 31.13% | 14.67% | 18.42% | 3.14% |
| Industry | | | | |
| Mining | 4.69% | 8.69% | 0.64% | 0.43% |
| Manufacturing | 52.28% | 46.35% | 61.88% | 64.22% |
| Energy and Water | 3.43% | 2.14% | 0.47% | 0.86% |
| Construction | 6.80% | 9.49% | 6.96% | 13.30% |
| Shopping and Restoration | 4.56% | 6.26% | 12.07% | 12.63% |
| Transportation and Communication | 14.35% | 16.64% | 3.28% | 2.94% |
| Financial activities | 6.47% | 5.76% | 5.04% | 2.74% |
| Real estate and Business services | 7.42% | 4.68% | 9.65% | 2.88% |
| Observations | 43926 | 13630 | 35471 | 9533 |

**Table 5. Estimation of wage equations for the low- and high-wage regions**

| | 1995 | | | | 2002 | | | |
|---|---|---|---|---|---|---|---|---|
| | HW reg. | | LW reg. | | HW reg. | | LW reg. | |
| | Coefficient | Sig. | Coefficient | Sig. | Coefficient | Sig. | Coefficient | Sig. |
| Schooling | 0.0338 | *** | 0.0280 | *** | 0.0311 | *** | 0.0167 | *** |
| Experience | 0.0300 | *** | 0.0193 | *** | 0.0192 | *** | 0.0093 | *** |
| Experience² | -0.0004 | *** | -0.0003 | *** | -0.0002 | *** | -0.0001 | *** |
| Tenure | 0.0059 | *** | 0.0084 | *** | 0.0168 | *** | 0.0138 | *** |
| Tenure² | 0.0000 | | 0.0000 | | -0.0003 | *** | -0.0001 | *** |
| Gender (Female) | | | | | | | | |
| Male | 0.2159 | *** | 0.1866 | *** | 0.2341 | *** | 0.2042 | *** |
| Firm size –in logs– | 0.0467 | *** | 0.0498 | *** | 0.0421 | *** | 0.0624 | *** |
| Occupation (Non-skilled workers) | | | | | | | | |
| Direction and management | 0.7194 | *** | 0.5807 | *** | 0.8189 | *** | 0.6623 | *** |
| 2nd and 3rd cycle university | 0.5917 | *** | 0.4582 | *** | 0.6423 | *** | 0.5427 | *** |
| 1st cycle university | 0.3865 | *** | 0.4468 | *** | 0.4735 | *** | 0.3701 | *** |
| Technicians and administrative workers | 0.2165 | *** | 0.1544 | *** | 0.2366 | *** | 0.1819 | *** |
| Restoration and Shopping | 0.0247 | *** | 0.0568 | *** | 0.0362 | *** | 0.0675 | *** |
| Skilled workers | 0.0956 | *** | 0.0704 | *** | 0.1087 | *** | 0.0727 | *** |
| Manufacturing operators | 0.0960 | *** | 0.0687 | *** | 0.1017 | *** | 0.0389 | *** |
| Type of Contract (Fixed-Term) | | | | | | | | |
| Indefinite duration | 0.1510 | *** | 0.0590 | *** | 0.0815 | *** | 0.0517 | *** |
| Product Market Orientation (Foreign market) | | | | | | | | |
| National market | -0.0295 | *** | -0.0269 | *** | -0.0460 | *** | -0.0542 | *** |
| Collective agreement (Firm or establishment) | | | | | | | | |
| National sector | -0.1167 | *** | -0.0761 | *** | -0.1255 | *** | -0.1108 | *** |
| Provincial or lower territory | -0.0600 | *** | -0.0959 | *** | -0.0953 | *** | -0.1326 | *** |
| Industry (Real state and Business services) | | | | | | | | |
| Mining | 0.1006 | *** | 0.0744 | *** | 0.3050 | *** | 0.1655 | *** |
| Manufacturing | 0.0255 | *** | 0.0296 | ** | 0.1534 | *** | -0.0215 | |
| Energy and Water | 0.1759 | *** | 0.2093 | *** | 0.3331 | *** | 0.4427 | *** |
| Construction | 0.0744 | *** | 0.0982 | *** | 0.2297 | *** | 0.0554 | *** |
| Shopping and Restoration | 0.0328 | *** | 0.0528 | *** | 0.1147 | *** | -0.0672 | *** |
| Transportation and Communication | 0.0008 | | -0.0176 | | 0.1355 | *** | 0.0214 | |
| Financial activities | 0.0626 | *** | 0.2865 | *** | 0.1970 | *** | 0.2033 | *** |
| Intercept | 0.4163 | *** | 0.5258 | *** | 0.7371 | *** | 1.1085 | *** |
| Observations | 43926 | | 13630 | | 35471 | | 9533 | |
| Test F | 1938.300 | | 597.960 | | 1861.930 | | 392.080 | |
| Prob > F | 0.0000 | | 0.0000 | | 0.0000 | | 0.0000 | |
| $R^2$ | 0.5247 | | 0.5236 | | 0.5677 | | 0.5076 | |
| $R^2$ (adj) | 0.5244 | | 0.5227 | | 0.5674 | | 0.5063 | |
| Root MSE | 0.3544 | | 0.2789 | | 0.3234 | | 0.2604 | |

Notes: Excluded category for the dummy variables in brackets. ***, ** , * means significant at 1%, 5% and 10%, respectively

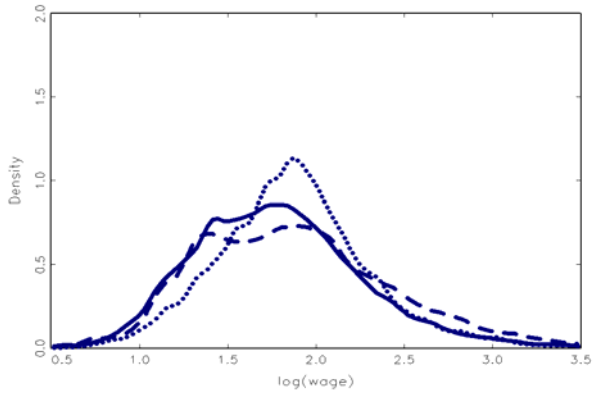
**Table 6. Regional wage gap decomposition at selected quantiles.**

| | Total Difference | Observed Quantities | Observed Returns | Unobserved Quantities and Returns |
|---|---|---|---|---|
| **1995** | | | | |
| **10%** | 0.1033 | -0.0047 | 0.1577 | -0.0498 |
| **25%** | 0.2219 | 0.0577 | 0.1859 | -0.0217 |
| **50%** | 0.3854 | 0.1654 | 0.2091 | 0.0110 |
| **75%** | 0.4058 | 0.1661 | 0.2039 | 0.0358 |
| **90%** | 0.4049 | 0.1428 | 0.2080 | 0.0540 |
| **2002** | | | | |
| **10%** | 0.0637 | -0.1000 | 0.2249 | -0.0612 |
| **25%** | 0.1398 | -0.0677 | 0.2460 | -0.0385 |
| **50%** | 0.3070 | 0.0320 | 0.2723 | 0.0026 |
| **75%** | 0.4078 | 0.0833 | 0.2851 | 0.0394 |
| **90%** | 0.4218 | 0.0553 | 0.3019 | 0.0646 |

**Figure 1. Density functions for real hourly wages in the regions under analysis**

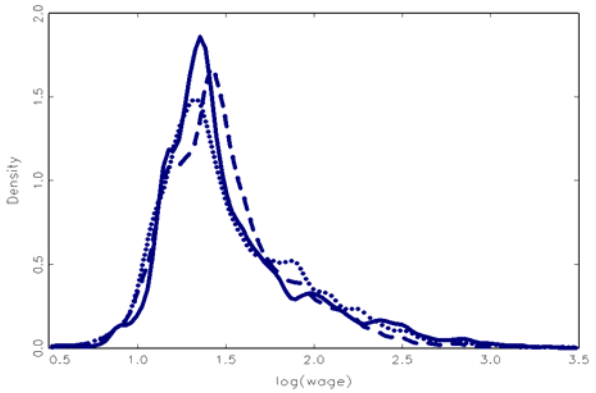
**1995**

**High-wage regions**




— Cataluña -- Madrid … País Vasco

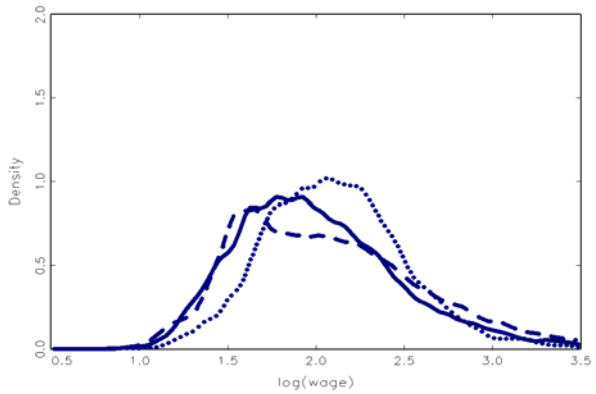
**Low-wage regions**




— Extremadura -- Murcia … Galicia

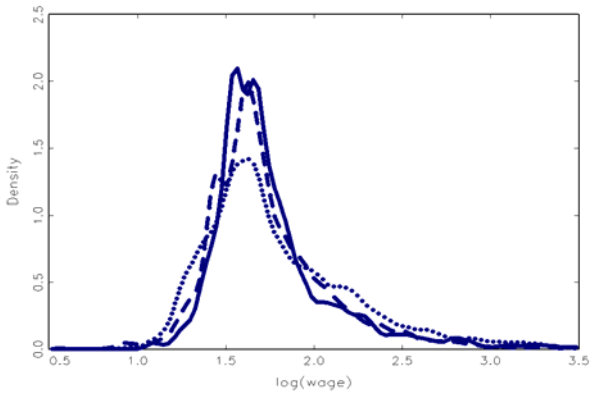
**2002**

**High-wage regions**



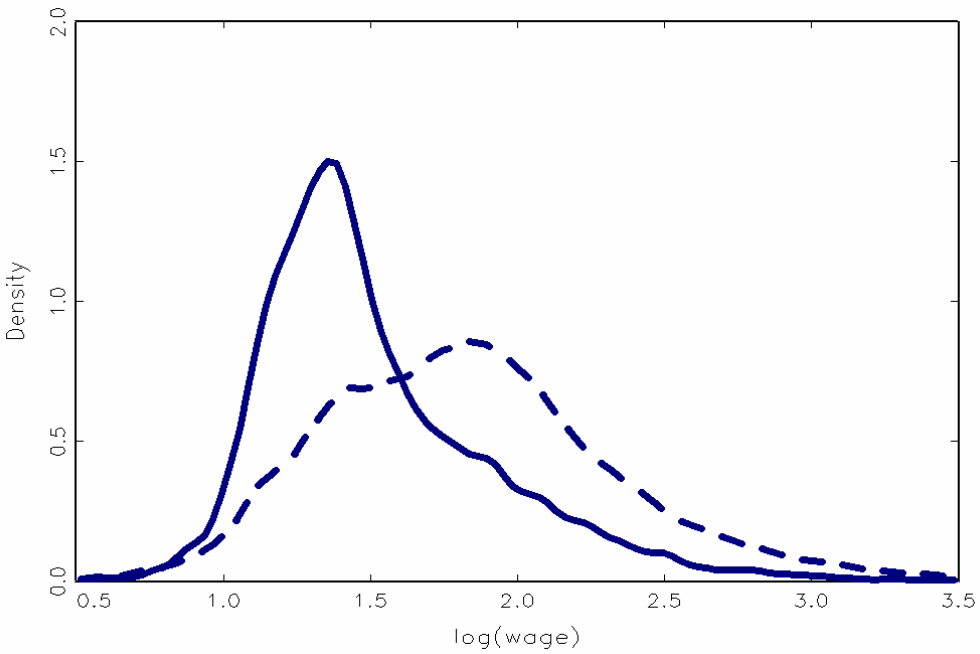

— Cataluña -- Madrid … País Vasco

**Low-wage regions**



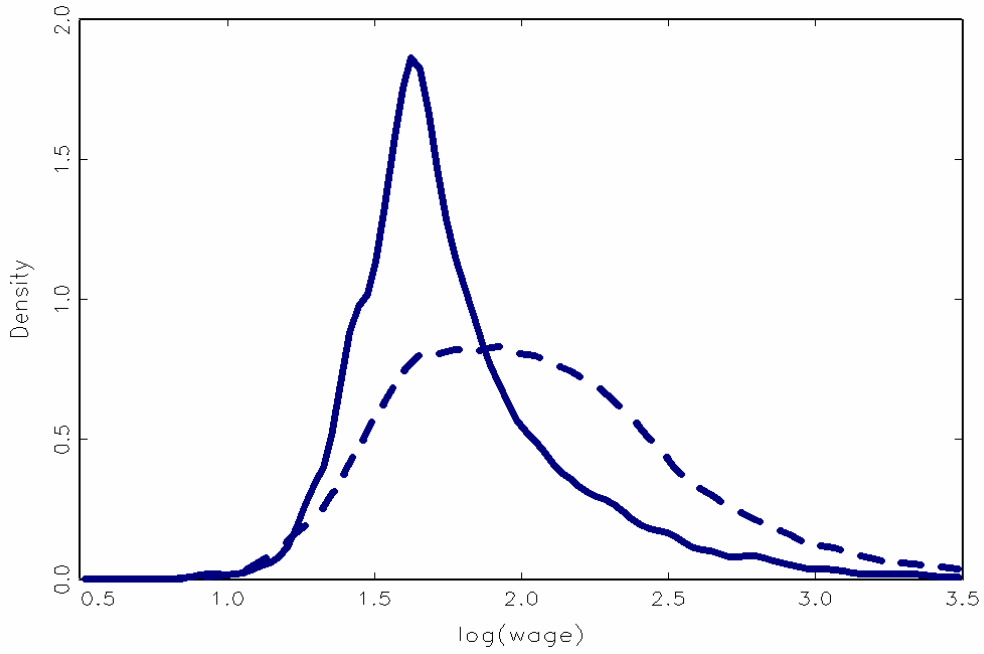

— Extremadura -- Murcia … Castilla León

**Figure 2. Density functions for real hourly wage in the LW and HW groups of regions, 1995**




—— LW group --- HW group

**Figure 3. Density functions for real hourly wage in the LW and HW groups of regions, 2002**




—— LW group --- HW group

**Figure 4. Interpretation of the contribution of characteristics and returns to regional differences in wage distributions (densities for simulated wage distributions).**

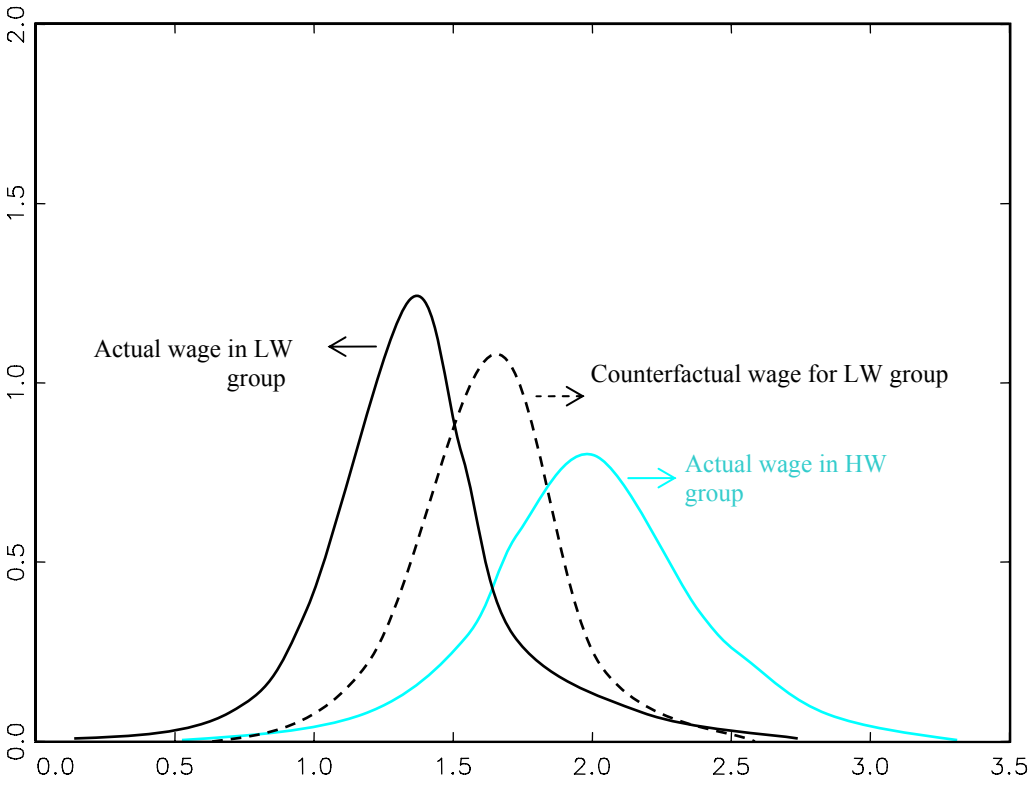
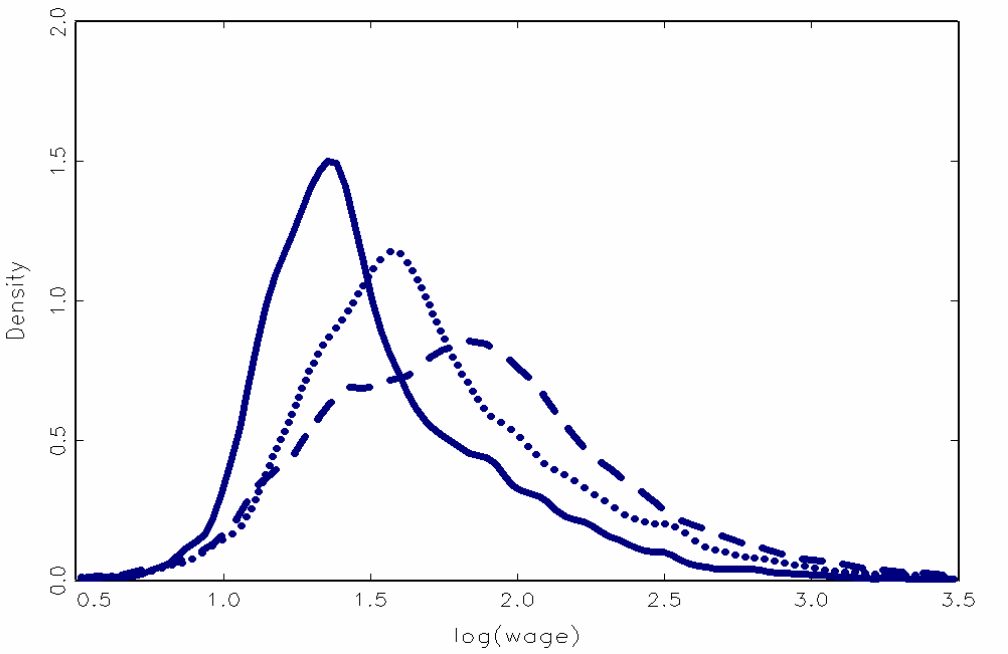
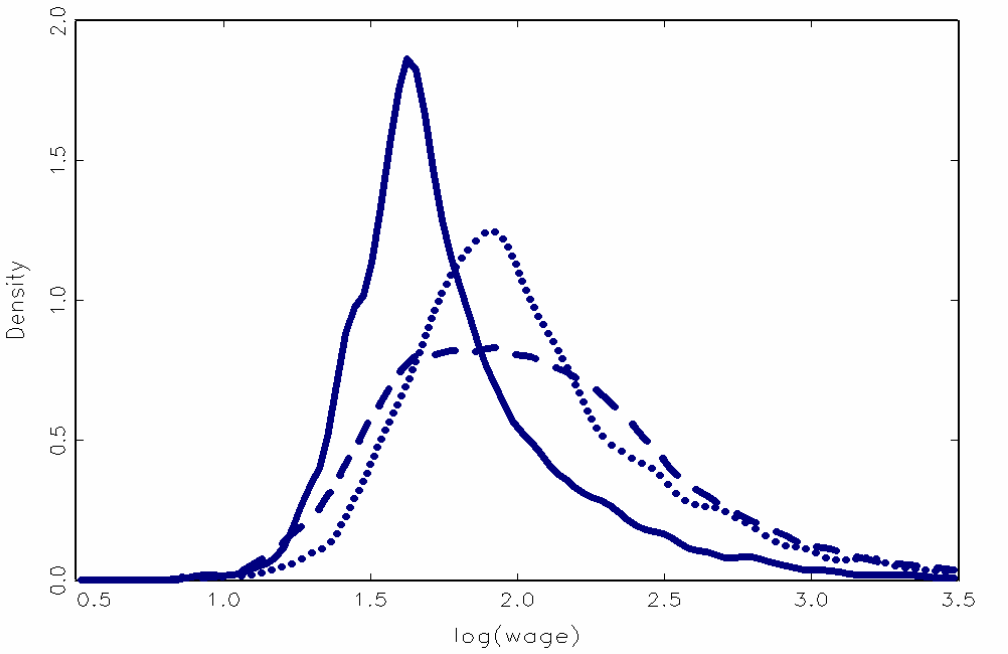


**Figure 5. Effect of differences in returns to all characteristics and unobservables**

**1995**



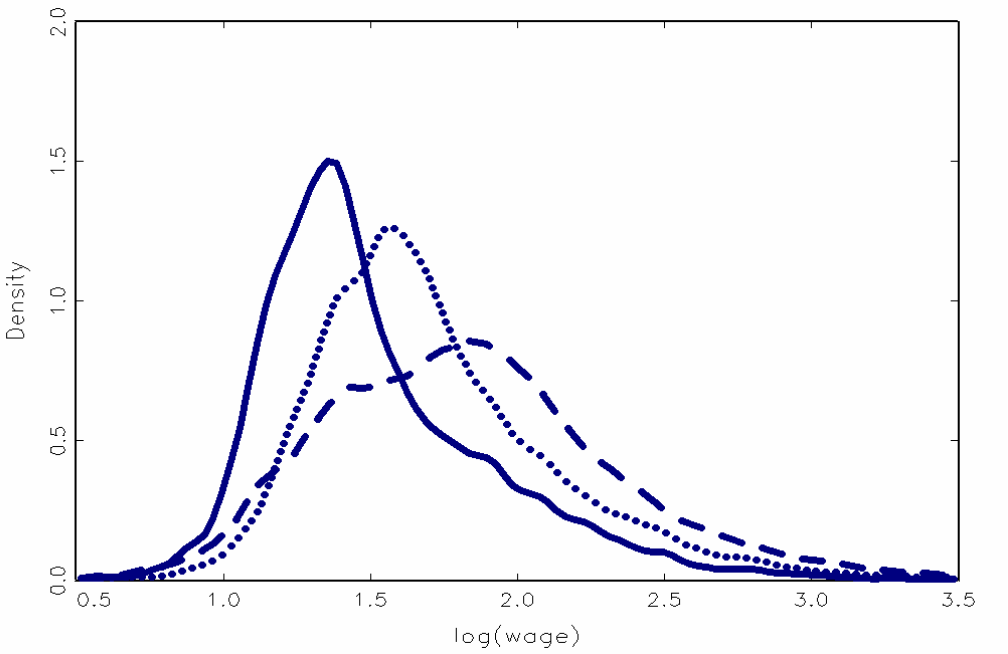

**2002**



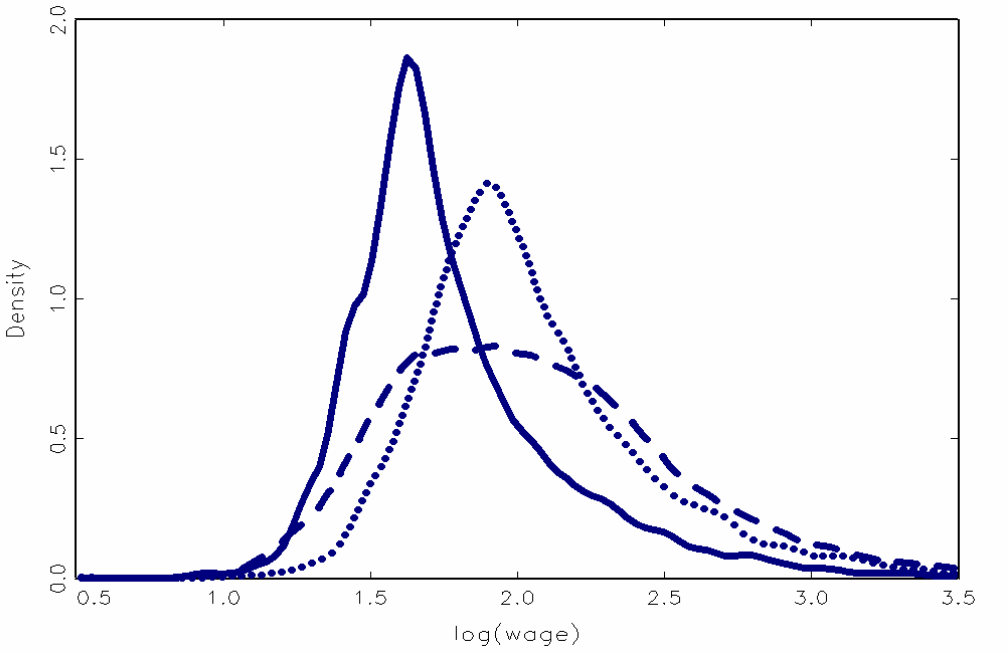

—— actual LW group --- actual HW group ··· counterfactual LW group

**Figure 6. Effect of differences in returns to all characteristics**

**1995**



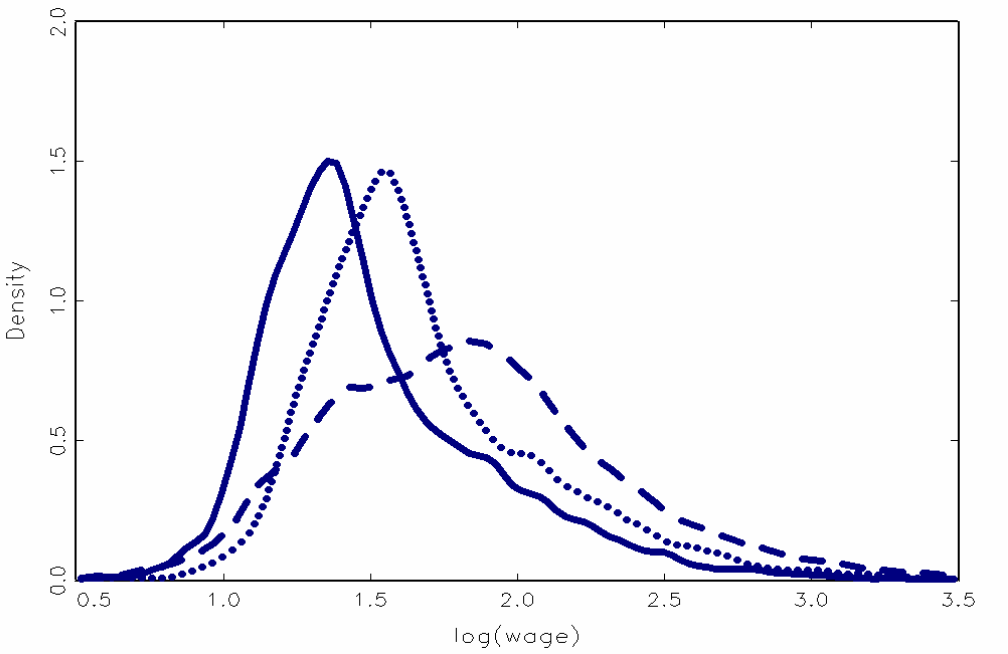

**2002**



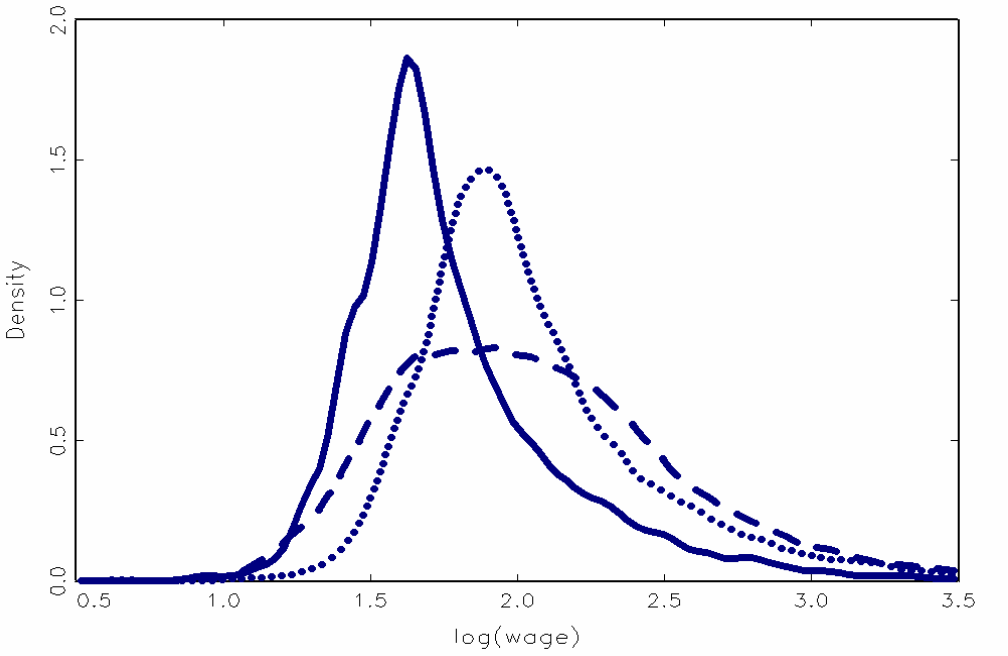

—— actual LW group --- actual HW group ··· counterfactual LW group

**Figure 7. Effect of differences in returns to human capital**

**1995**



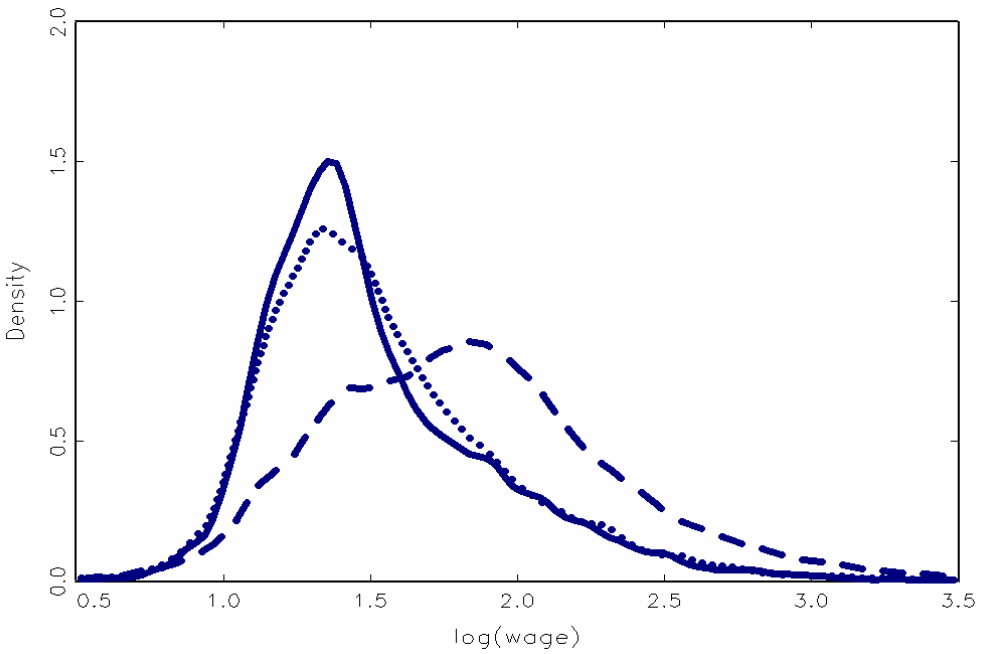

**2002**



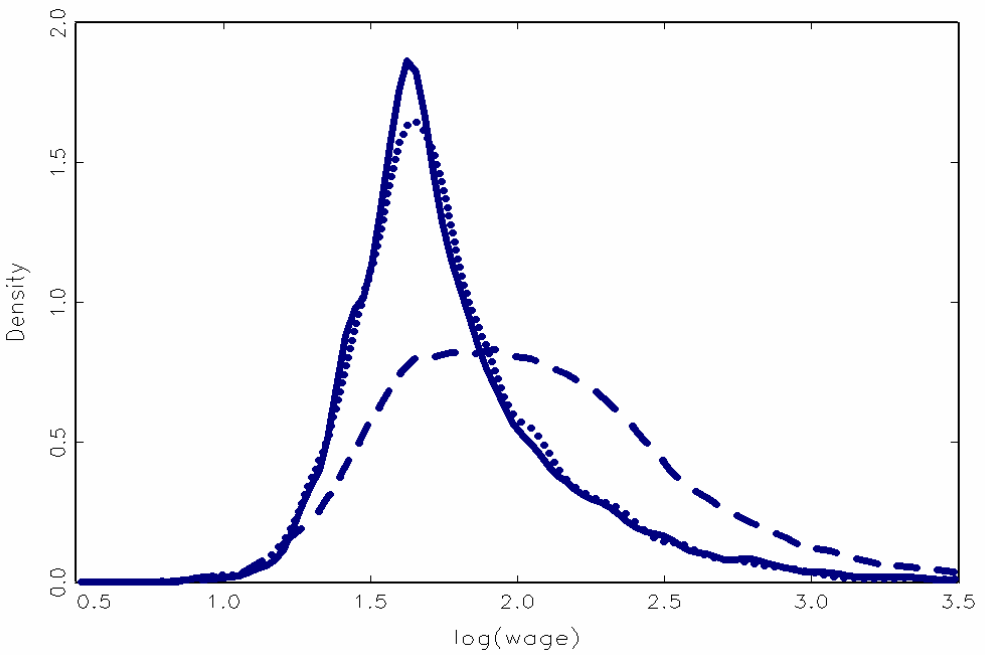

—— actual LW group --- actual HW group ··· counterfactual LW group

**Figure 8. Effect of differences in returns to firm characteristics**

**1995**




**2002**




—— actual LW group --- actual HW group ··· counterfactual LW group