WAGE INEQUALITY IN SPAIN: RECENT DEVELOPMENTS

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Abstract

This paper analyses wage inequality in Spain from 1995 to 2002. Inequality has decreased slightly in this period although the fall has not been constant over the whole distribution. We use non-parametric techniques to distinguish the effect on inequality of changes in the composition of the labour force and changes in relative returns. We focus mainly on three factors that have varied substantially between 1995 and 2002: female participation, educational attainment and changes in the tenure level. On one hand, changes in the composition of the labour force would have increased inequality had the structure of wages not changed in relation to the 1995 level. Changes in education and especially tenure would have been responsible for most of the higher dispersion. On the other, changes in relative returns between 1995 and 2002 are predominant and are responsible for the lower dispersion observed in the latter year. Changes in the returns to education and age are important factors underlying this decrease in inequality.

JEL Classification: J30, J00.

1 Introduction

This paper analyses wage inequality between 1995 and 2002, and the significance of the different factors underlying this change. Several studies have analysed developments in aggregate income or wage inequality in Spain [Alcaide (1980), Goerlich and Mas (1999), among others]. Some have used different waves of the Household Budget Survey. This survey conducted by INE (the Spanish National Statistics Institute) provides useful information at the household level about earnings and expenditures that enables researchers to compute several inequality indices. With this information, Alcaide found that income inequality in Spain did not change much between 1967 and 1974, but it started to decrease from that moment on. The continuous reduction in inequality is also confirmed by Goerlich and Mas (1999) and ran until the 90s.

Another group of papers reached similar conclusions using the Wage Survey by INE [Garcia-Perea (1991), Jimeno and Toharia (1994)]. One shortcoming of these datasets is the reduced information on either the individual or the firm side in order to study how changes in different factors affect inequality. The recent Wage Structure Survey (hereafter, WSS) provides this previously lacking piece of information. This data set is very rich in terms of wages and characteristics both from the worker and from the firm side. Jimeno et al. (2002) use the initial wave in 1995, analysing the importance of several factors on determining the level of inequality. Among the most important factors they highlight are certain labour force characteristics (mainly educational level and occupational category) and certain *institutional factors* (mainly the type of contract and the level at which the collective agreement was signed).

This paper builds on this previous research to analyse wage inequality between 1995 and 2002. We pool information from the WSS in 1995 and 2002 to analyse which changes in the Spanish labour market were most significant in explaining recent developments in inequality. During this period there have been several changes that may affect the distribution of wages. On one hand, there are changes in the composition of the labour force. For instance, women and workers with a university degree have increased relative to other groups. On the other, in this period several labour market reforms brought about changes in the institutional setting of the labour market. On top of these two types of changes, the value of specific abilities may vary over time[1].

The goal of the paper is to describe how these above-mentioned different changes affected wage inequality between 1995 and 2002. To do that, the rest of the paper is organised as follows. In the second section we briefly describe the data used while in the third section we offer a descriptive analysis of wage inequality between 1995 and 2002. In the fourth and fifth sections we analyse the impact on wage inequality produced by a change in the composition of the labour force, estimating counterfactual wage distributions using non-parametric techniques. In the sixth section we use quantile regressions to describe changes in the wage structure at different points of the distribution and we estimate the relative importance of those changes to characterize the evolution of inequality. Finally, section seven concludes.

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1. There might be changes in the demand for a specific ability and changes in the composition of abilities that one subset of the population has.

The main results show that inequality decreased slightly between 1995 and 2002. This decrease was more significant at the medium section of the distribution, whereas in the upper tail there was an increase in inequality. We also find that changes in the composition of the labour force in respect of educational attainment and tenure would have increased inequality if the wage structure had not varied. Other factors, including female participation, do not appear to have much importance. Finally, we show that the change in the wage structure drove the decrease in inequality. The reduction of the dispersion in relative wages is significant for most of the characteristics in the data set.

2 Data

The data pool the first and the second waves of the WSS. This survey only includes workers who were on the payroll of a firm on 31st October of the corresponding year. The firm should be made up of at least 10 workers[2] and the sample contains only workers whose main source of income is their salary. Thus, this restriction means that the members of the Board of Directors are not considered.

In order to study wage inequality we should previously decide on a wage definition from our data. The information on payments is quite precise in the survey and we include as wages the gross ordinary salary plus the extraordinary payments made by the firm on an annual basis[3]. It does not include non-monetary payments, arrears, indemnifications or other expenses. We will study the worker's hourly wage so we need information about working time. However, the hours of work are measured in the WSS more imprecisely than the salary. We have data about the agreed regular schedule and the hours that someone worked in a non-regular fashion. Since we only have information about non-regular hours of work in October, we extrapolate the number in that particular month to the rest of the year[4]. It is important to note that a large fraction of the sample did not work the whole year in the firm[5]. In order to compute the hourly wage for those workers, we divide the payments by the actual time at work for that person.

Finally, in order to gather the two samples we had to take into account several differences between the two cross-sections. In particular, in 2002 there is some additional information not present in the previous wave[6]. In terms of the sample, in 2002 the coverage of the survey was extended to some non-market services (educational, health and social services sectors) and we dropped these observations in order to obtain a homogeneous sample with 1995. The final sample includes observations for manufacturing, construction and market services in both years.

2. The absence of small firms should be taken into account when we draw conclusions from our analysis.
3. We also convert the 1995 salaries to euro.
4. We must assume that October is a regular month in order to perform the extrapolation correctly.
5. At least one-third of workers did not work the whole year. There are various reasons: either they were hired or fired in the course of the year, injured or required a maternity break.
6. For example it includes the nationality of the worker or the position at the firm.

3 Changes in wage inequality

Traditionally, researchers have measured inequality using different indices. The comparison of these indices over time sheds some light on wage dispersion. Table 1 shows different indices that have been used in the literature. The first two rows present two indices that are independent of the scale: the coefficient of variation and the ratio of percentiles. The two measures show a smaller index in 2002 than in 1995. We may interpret this result as a reduction of inequality in recent years.

However, note that the reduction appears to be quite small. We want to have as many indices as we can in order to see the robustness of this finding. The literature has extensively used the standard deviation of log wages, the Theil and the Gini index. However, neither of them is independent of the scale. In order to homogenise both series, we compute the ratio of means and we multiply each observation in 1995 by this factor[7].

TABLE 1: Wage Inequality Indices

	1995	2002	Change %
Original data			
Coefficient of variation	**1,3780**	1,2861	-6,67%
P90/P10	**3,7527**	3,6446	-2,88%
Re-weighted data*			
SD	**0,5431**	0,5270	-2,96%
SD of log wages	**0,5417**	0,5225	-3,54%
P90/P10	**3,7527**	3,6446	-2,88%
Theil	**0,1770**	0,1763	-0,40%
Gini	**0,3178**	0,3141	-1,16%
P50/P10	**1,6828**	1,6019	-4,81%
P75/P25	**2,0702**	1,9724	-4,72%
P90/P50	2,2301	**2,2752**	2,02%

Source: Wage Structure Survey
The biggest number is bolded
* The reweighted factor takes the 1995 series and multiplies every observation by the ratio of mean wages between 2002 and 1995

The rows in the middle of the table confirm that inequality has decreased between 1995 and 2002. Again, it appears that the reduction has not been very substantial. One problem with these indices is that they do not show the changes in inequality at different points of the distribution. The last three rows in Table 1 cover this shortcoming. We show three ratios of different quantiles. The first represents an inequality measure at the bottom part of the distribution, the second relates to the middle part and the third shows the dispersion at the upper tail. It appears from these measures that inequality decreased at the bottom and the middle part of the distribution, especially at the latter, whereas it increased slightly at the upper part.

The latest evidence suggests that in order to analyse inequality we should consider the whole distribution of wages. We estimate non-parametrically the distribution of log wages

7. The factor is 1.1952, which would mean that hourly wages have increased by approximately 2.8% per year.

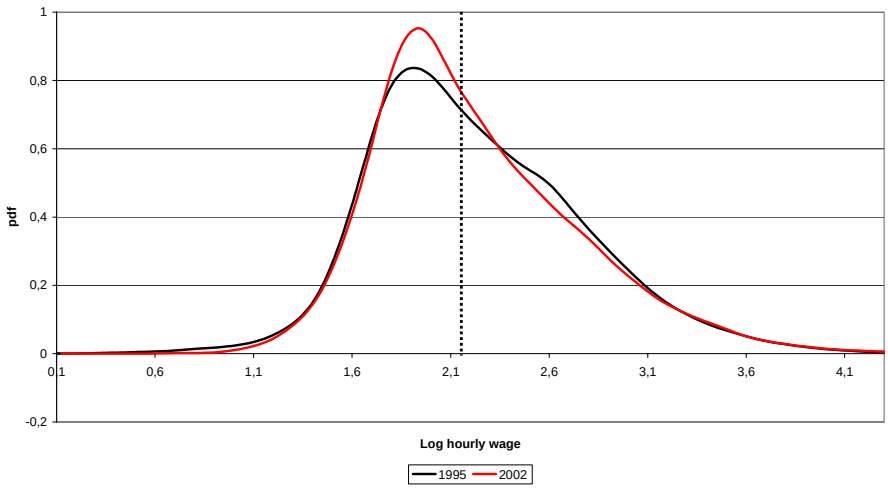
using a Gaussian Kernel[8]. If *K* stands for the density of the normal distribution, *n* for the number of observations, and *h* for the bandwidth, the non-parametric estimation of wages *g(w)* follows from:

$$g(w) = \frac{1}{nh}\sum_i K\left(\frac{w - W_i}{h}\right)$$
$$W_i = \ln(wage_i)$$

Figure 1 shows that the two wage distributions are fairly similar. It is clear from the representation that there are two parts of the wage distribution in 2002 that lose some weight with respect to 1995. First, the lower part of the distribution appears to lose some significance, although this change is not very sizeable. Instead, much clearer is the amount of observations that are lost in the range 2.3-3.2, a range of log-wages which falls above the median and the mean[9]. However, there are two parts of the distribution in 2002 that gain more weight with respect to the 1995 distribution. First, the upper part of the distribution appears to gain some individuals although the increase is very subtle; but second, there is a significant gain in 2002 in the weight of observations around the mode of log-wages.

As expected, this figure is consistent with the results in Table 1 in different parts of the distribution. The median for both distributions is therefore around 2.15 (the shaded line in the chart). Wages at the lower part of the distribution are more concentrated towards the median in 2002, whereas wages at the upper part of the distribution are more concentrated towards the median in 1995. In the following section we will explore different mechanisms that might be underlying these changes in wage distribution.

FIGURE 1
Wage distribution in 1995 and 2002



8. We have tried different bandwidths. The optimal bandwidth according to Silverman's rule of thumb produces a very smooth distribution; that is why we finally choose 0.07. We decided to conduct the analysis in log-terms for three reasons. First, the literature has overwhelmingly used log-wages when studying inequality. Second, the distribution of wages is fairly well represented by a log-normal distribution; therefore, log-wages are very suitable for analysing the problem graphically. Finally, it is fairly easy to change from a distribution in logs to the distribution in levels if required.
9. The median is lower than the mean. This indicates that the distribution is skewed to the left.

4 Factorial decomposition of inequality

The Spanish labour market has experienced many changes lately. On one hand there have been significant variations in the composition of the labour force. In particular, females and university degree-holders increased their weight between 1995 and 2002. Moreover, several reforms have been implemented in the labour market affecting both hiring and firing costs. As we have seen in the previous section, the effect on inequality of those changes as a whole has been small. This section presents some preliminary evidence about how each of these changes taken in isolation may have affected inequality between 1995 and 2002.

We can identify significant changes in gender, education and tenure whereas the composition of the labour force in terms of other factors does not change that much[10]. Therefore, we will focus on changes on those three variables[11].The first row of Table 2 shows the proportion of each subset of the population in a particular year. The first column shows that the proportion of female workers within the labour force increased by 7% between 1995 and 2002. At a constant 1995 wage structure, this affects inequality in two different ways: as observed in the second row, the mean wage of females is further away than the mean wage of males from the unconditional mean; therefore, an increase in female participation should increase inequality.

On the other hand, as seen in the third row, women present less wage heterogeneity than males. Thus a higher female participation should reduce aggregate wage inequality. The next section will disentangle which effect has dominated over this period. Table 2 also shows that the wage structure has varied over time. However, there do not appear to be many changes between 1995 and 2002 in the relative wage of females and males and their wage heterogeneity.

The second column shows that the proportion of university degree-holders in 2002 has increased by 4%. At the wage structure of 1995, this alone has a clear effect on inequality. First, this group's mean wage lies fairly far away from the unconditional mean. Second, the group of university degree-holders is the most heterogeneous group in terms of intra-group inequality. These two effects would have increased inequality. On top of the changes on composition, Table 2 shows variations in relative wages between the two years, although it is not clear from it how those changes would have affected inequality.

Finally, the third column presents changes in tenure. It is interesting to see that the proportion of workers with less than 3 years of experience at the same firm increased substantially between 1995 and 2002. The group with more than 7 years of experience is the one that lost most weight. Since the groups that are gaining more weight lie further away from the unconditional mean with respect to other groups, changes in composition should increase inequality. However, individuals with over 4 years' experience are more heterogeneous than individuals with less than 4 years' experience; hence this variation would

10. Appendix A shows the changes in the composition of the labour force in terms of the main variables available in our data.

11. The labour market reforms may have affected tenure. The reforms implemented in 1997 and 2001 changed the type of contracts and firing costs. Therefore, it is likely that the reform had an impact on the proportion of temporary contracts and the number of years that a worker spends in a particular firm (tenure).

decrease inequality. Therefore, it is again an empirical issue which effect will dominate; this will be discussed in the next section.

TABLE 2: Summary Statistics

	Gender		Education				Tenure			
	Males	Females	Primary	1st cycle Secondary	2nd cycle secondary	Tertiary	<1 year	1-3 years	4-7 years	>7 years
Proportion										
1995	0,759	0,241	0,331	0,320	0,166	0,183	0,109	0,238	0,195	0,459
2002	0,688	0,312	0,289	0,316	0,171	0,224	0,234	0,298	0,148	0,321
Relative salary										
1995	1,048	0,915	0,969	0,917	1,074	1,190	0,800	0,901	1,018	1,128
2002	1,041	0,919	0,928	0,930	1,038	1,157	0,854	0,955	1,024	1,160
Inequality within groups										
1995	0,319	0,284	0,246	0,272	0,310	0,350	0,259	0,277	0,301	0,294
2002	0,320	0,283	0,249	0,248	0,311	0,352	0,220	0,266	0,294	0,310

Source: WSS 1995-2002

Relative salary is the ratio between the mean of the particular group and the unconditional mean

Within group inequality is computed using the Gini's index

5 Effect on wage distribution of changes in the proportion of different factors

This section analyses how isolated changes in the proportions of particular subsets of the population affect the distribution of wages. We use the technique of DiNardo et al. (1996). They estimate the counterfactual wage distribution in a particular year assuming that nothing changes with respect to the previous period except the conditional distribution of one factor given the others.

Let us assume that we have information about wages (*w),* one particular factor *(x),* a set of characteristics (*z)* and time (*t).* The density of wages at one point in time *g(w|t)* could be written as the integral of the conditional density of wages given a set of characteristics in a certain period *f(w|x,z,t)* over the distribution of characteristics at that same moment *h(x|z,t)dF(z|t)*:

$$g(w \mid t) = \int_z f(w \mid x, z, t) h(x \mid z, t) dF(z \mid t)$$

The construction of the counterfactual density entails using a different date for different parts of the integral. Therefore, while *g(w|t=95)* represents the actual density of wages in 1995, $g(w|t_{w|x,z}=95, t_{x|z}=02, t_z=95)$ would represent the density of wages that would have occurred keeping the wage structure constant and the composition of the labour force at that of 1995 and changing the factor to its 2002 distribution h*(x|z,t=02)*. DiNardo et al. show that the distribution of wages that would have prevailed if workers had had the characteristics of 2002 and been paid according to the schedule of 1995 is:

$$g(w \mid t_w = 95, t_{x|z} = 02, t_z = 95) = \int f(w \mid x, z, t_{w|x,z} = 95) h(x \mid t_{x|z} = 02) dF(z \mid t_z = 95) =$$

$$\int f(w \mid x, t_w = 95) \theta(x) h(x \mid t_{x|z} = 95) dF(z \mid t_z = 95)$$

$$\text{where} \quad \theta = \frac{h(x \mid z, t_{x|z} = 02)}{h(x \mid z, t_{x|z} = 95)}$$

This means that the counterfactual density could be rewritten as the actual density with the help of a re-weighting function. We will focus on those factors that changed most between 1995 and 2002 in Spain: female participation, educational attainment and tenure[12].

5.1 Change in female participation

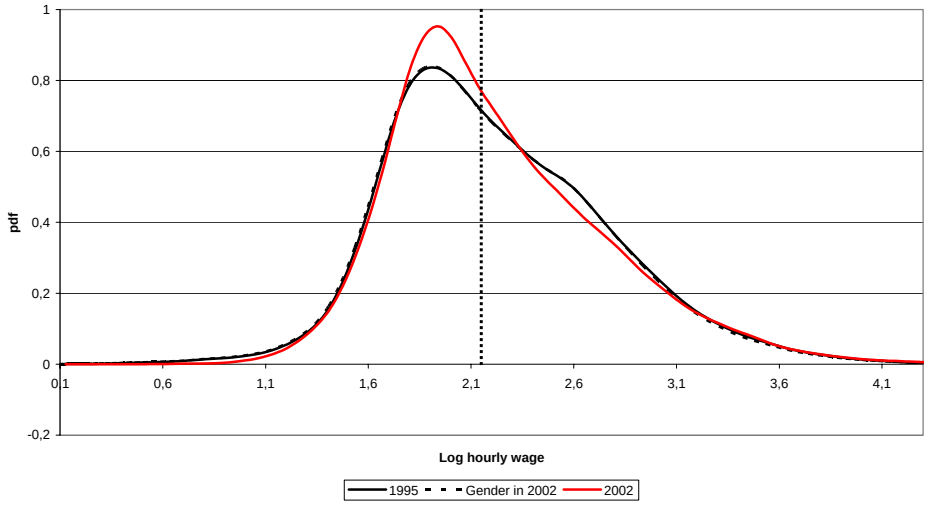
Figure 2 shows the actual distributions of wages in 1995 and 2002 and the counterfactual distribution that would have prevailed in 2002 if only female participation had changed. The counterfactual distribution of wages shows very few changes with respect to the distribution in 1995. Appendix C presents the differences in terms of the probability density function between the counterfactual and the 1995 wage distributions. Wages below the mode increase very slightly in weight, whereas wages above the mode decrease in weight. This was expected because, on average, women earn less than males for identical

12. Appendix B contains a description of how weights are computed depending on the continuity of the regressor and how we estimate the indices of inequality used in Table 1.

characteristics, and because the group of women whose participation increases most (older women) have relatively low wages because they are, on average, less educated[13].

However, it is not very clear how inequality would have changed due to the increase in women's participation. On one hand, females' wages are much further away than males' from the mean, which would tend to increase inequality. On the other hand, women are more homogeneous. Graphically it is also difficult to see the direction of inequality from inspection of Figure 2: the hump goes slightly up which would indicate a decrease in inequality if the mean is kept. However, the skewness of the distribution slightly increases which would produce higher inequality[14].

FIGURE 2
Wage distribution with changes in female participation



To shed some light on this issue, Table 3 shows different inequality measures. The standard deviation, the Theil and the Gini index present a small decrease in dispersion. However, as was stated in the third section, those indices depend to a limited extent on the scale of the series and the mean of the distribution is decreasing too. Very interestingly, the ratio of percentiles, which is free of scale, shows an increase in inequality[15]. This increase is concentrated in the lowest part of the distribution and it is due to the fact that below the median, the distribution is more concentrated towards it. This would mean that the increase in inequality stemming from the fact that females are far away from the mean was more important than the fact that women were more homogeneous than men.

13. Notice that the methodology takes into account the fact that female participation has increased more for older women, because the counterfactual distribution uses the conditional distribution of female participation given other characteristics.
14. The median of the distribution is located to the left of the mean. If we increase the skewness, the median will be further away from the mean, which would increase inequality.
15. This is also confirmed by the change in the coefficient of variation of the two series.

TABLE 3: Wage inequality if female participation changed

	1995	1995 + Change in Female Part.	Change respect to 1995 %	2002
SD of log wages	**0,5417**	0,5382	-0,65%	0,5225
P90/P10	**3,7527**	3,7686	0,42%	3,6446
Theil	**0,1770**	0,1737	-1,86%	0,1763
Gini	**0,3178**	0,3149	-0,91%	0,3141
P50/P10	1,6828	**1,7037**	1,24%	1,6019
P75/P25	**2,0702**	2,0685	-0,08%	1,9724
P90/P50	**2,2301**	2,2120	-0,81%	2,2752

Source: Wage Structure Survey
The biggest number is bolded
Percentiles from the log distribution

5.2 Change in educational attainment

Figure 3 shows the counterfactual wage distribution when educational attainment of the labour force is the only factor that increases between 1995 and 2002. The distribution again does not change much. The part of the counterfactual distribution above the mode increases its weight with respect to the 1995 level. The change is more important for the middle part of the distribution, but the upper part of the distribution increases its weight for a big part of the distribution. This result was expected since university degree-holders are the group which most increases and which earns higher wages.

In the previous section it was suggested that this change should increase wage dispersion. Table 4 confirms this prior since all indicators show higher inequality. However, the increase is not very significant. An explanation for this fact is the way it is constructed the counterfactual distribution. Notice that the analysis considers changes in the distribution of education conditional on many other characteristics (gender and experience but also sector, size of the firm, type of contract or bargaining system). Although, as it was shown in table 2, the proportion of university degree holders has increased, this increase has been concentrated in specific sectors, occupations and firms, where university degree holders were already working before. Therefore, the conditional distribution of education on all the other factors has not changed as much as the unconditional proportion of university degree holders. That is the reason why the shock is not very significant in conditional terms but it is fairly big in unconditional terms. Instead, female participation and low-experienced workers have increased in almost all sectors, firms and types of jobs, making the distinction between unconditional or conditional shocks of no interest. If we redo the exercise only conditioning to gender, age and tenure we get a much bigger impact of increasing education around 3% in terms of the standard deviation. Instead, the effect of the other two factors does not change much respect to the effect presented here.

The impact of education is concentrated at the bottom part of the distribution. This is the case because the mode is shifted to the right due to an increase in the level of educational attainment while there is a concentration of individuals above the mode. The middle part of the distribution does not change inequality much because the shock affects more or less symmetrically above and below the mode.

FIGURE 3
Wage distribution with changes in the educational achievement

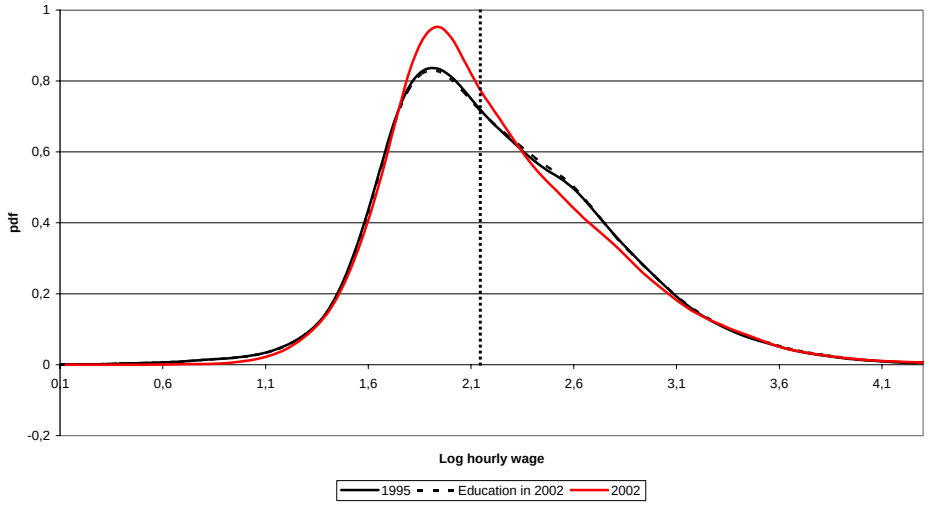


TABLE 4: Wage inequality if education changed

	1995	1995 + Change in Educational Attaintment	Change respect to 1995 %	2002
SD of log wages	0,5417	**0,5439**	0,41%	0,5225
P90/P10	3,7527	**3,8313**	2,09%	3,6446
Theil	0,1770	**0,1791**	1,19%	0,1763
Gini	0,3178	**0,3275**	3,05%	0,3141
P50/P10	1,6828	**1,7116**	1,71%	1,6019
P75/P25	**2,0702**	2,0784	0,40%	1,9724
P90/P50	**2,2301**	2,2385	0,38%	2,2752

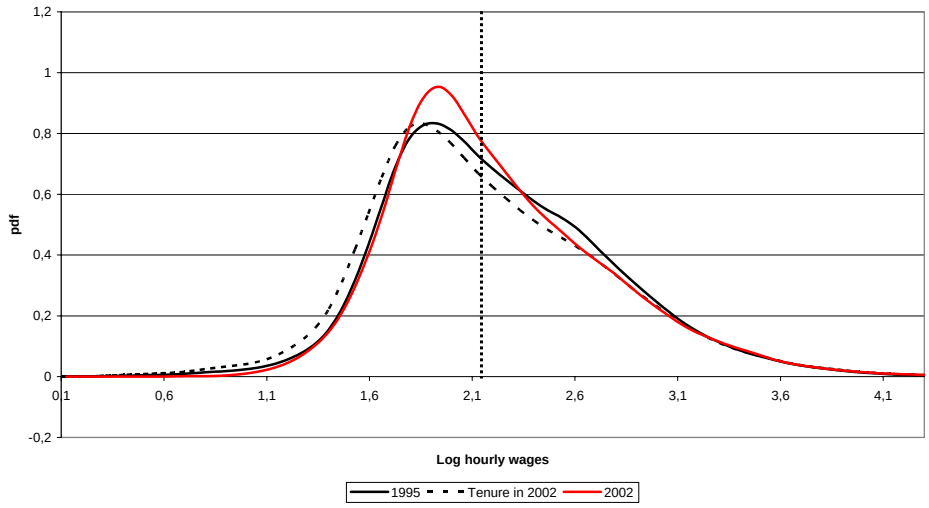
Source: Wage Structure Survey
The biggest number is bolded
Percentiles from the log distribution

5.3 Change in the tenure distribution

Figure 4 shows how wages would have varied if tenure had been the only factor changing between 1995 and 2002[16]. The effect obtained is qualitatively similar to that observed with female participation although it is quantitatively more significant. With respect to the 1995 distribution, the counterfactual distribution shows a higher weight at the lower part of the distribution, whereas there is a decrease in the upper-middle part. The reason behind this is that the group that increases the most is the group of individuals with less than one year of experience in the firm who are concentrated in the lower part of the distribution of wages.

16. We do not considering experience in general because the age distribution of the labour workforce has not changed much between 1995 and 2002. The effect on inequality of changes in the age of the workforce is qualitatively similar to the one obtained in this sub-section although the magnitude is fairly small.

FIGURE 4
Wage distribution with changes in tenure



All inequality indices calculated in Table 5 show an increase in inequality. The effect arising from homogeneity is smaller than the effect from a bigger distance of wages relating to low tenure with respect to the mean. However, in contrast to what was found with female participation, different parts of the distribution do not behave the same way. The lower part of the distribution decreases its concentration while the others increase.

TABLE 5: Wage inequality if tenure changed

	1995	1995 + Change in Tenure	Change respect to 1995 %	2002
SD of log wages	0,5417	**0,5719**	5,58%	0,5225
P90/P10	3,7527	**4,1017**	9,30%	3,6446
Theil	0,1770	**0,1977**	11,69%	0,1763
Gini	0,3178	**0,3351**	5,44%	0,3141
P50/P10	1,6828	**1,7313**	2,89%	1,6019
P75/P25	2,0702	**2,1406**	3,40%	1,9724
P90/P50	2,2301	**2,3691**	6,23%	2,2752

Source: Wage Structure Survey
The biggest number is bolded
Percentiles from the log distribution

5.4 Importance of changes in the labour force composition

Changes of factors do not occur in isolation. The previous three changes interact with each other. In isolation each of them produced an increase in inequality, however; the overall effect might be different. Moreover, as we saw in Appendix A other factors changed at the same time. For instance, in 2002 we find a higher proportion of large firms which usually have high wages compared to smaller firms. We also find less bargaining agreements at the firm level and, as Izquierdo et al. (2005) shows, these types of agreements tend to result in lower wage growth for the worker.

Figure 5 shows how the counterfactual distribution of wages varies when adding the three changes[17]. It is clear that tenure and female participation increase the importance of the left tail, while educational attainment increases the weight in the right tail. These two facts together generate an increase in the overall inequality but smaller than the one produced by tenure alone. This is confirmed in Table 6.

Going back to Figure 5, we observe how the distribution varies when all observed variables change according to their levels in 2002. We can see that the small changes that in aggregate terms distribution of wages shifted to the right mainly thanks to the improvement of the number of big firms. In terms of inequality we get a higher inequality derived from the changes in the upper part of the distribution. However, the three factors previously considered account for a big part of the variation in the standard deviation.

Concluding, changes in female participation, educational attainment and tenure may have affected inequality importantly respect to the way other factors have done it. Actually, tenure and educational attainment are the two factors that move inequality the most. However, the actual change in their proportions would have lead to an increase in inequality between 1995 and 2002 instead of the observed decrease. In order to understand this lower dispersion we should incorporate in the analysis changes in the wage structure. This is done in next section.

FIGURE 5
Wage distribution with cumulative changes and all regressors

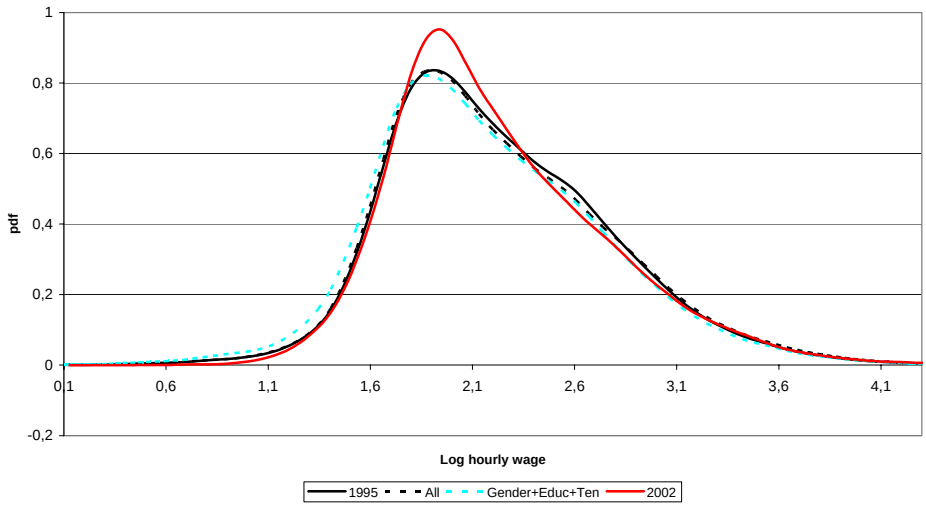


TABLE 6: Wage inequality if some and all factors changed together

	1995	1995 + Cumulative Effects	Change respect to 1995 %	1995 + Changes in all regressors	Change respect to 1995 %	2002
SD of log wages	0,5417	**0,5578**	2,97%	**0,5531**	2,10%	0,5225
P90/P10	3,7527	**3,9318**	4,77%	**3,9310**	4,75%	3,6446
Theil	0,1770	**0,1861**	5,14%	**0,1866**	5,42%	0,1763
Gini	0,3178	**0,3250**	2,27%	**0,3258**	2,52%	0,3141
P50/P10	1,6828	**1,7395**	3,37%	**1,7042**	1,27%	1,6019
P75/P25	2,0702	**2,0947**	1,18%	**2,1064**	1,75%	1,9724
P90/P50	2,2301	**2,2603**	1,36%	**2,3067**	3,43%	2,2752

Source: Wage Structure Survey
The biggest number is bolded
Percentiles from the log distribution

17. The methodology for this exercise is described in Appendix B.

6 Effects on inequality of changes in the wage structure

In the previous section we saw that changes in the composition of the labour force keeping constant the 1995 wage structure would have led to an increase in inequality. This is the reason why the observed lower dispersion in 2002 should be driven by significant changes in the wage structure[18].

In this section we analyse these changes using multivariate regression analysis. The coefficient of one variable in a regression identifies the way this particular factor affects the conditional mean wage. By comparing the coefficients of two different points in time, we shed some light on how one characteristic changes its correlation with the conditional mean wage over time. Notice that the interpretation of the coefficient should not be causal. In fact, if we observe that university degree-holders earn relatively less in 2002 than in 1995, it could be due to a decrease in the value of the services that this group supplies, to a change in the relative abilities of this type of worker or to the impact of institutional factors on the relative returns of this group.

If we want to analyse changes in the whole distribution of conditional wages, we should use quantile regressions. Quantile regressions have been widely used to analyse the conditional wage distribution in Chamberlain (1994), Buchinsky (1994 and 1995) and Abadie (1997). In a quantile regression model $Q_T(y|x)$ is the T-th quantile of the conditional distribution of wages (y) given certain characteristics (x). Then we specify a functional form for the quantile such as:

$$Q_T(y \mid x) = X\beta_T$$

The goal of the exercise is to estimate the parameters β_T that define the conditional quantile function[19]. Table 7 shows the results for the empirical specification. In the first two columns the changes in the mean of the conditional distribution are shown. In the following columns are the results for the 10th, 25th, 50th, 75th and 90th quantiles.

In order to organise the information better, we are going to analyse different factors one by one. We will start by considering the wage gap by gender, education level and tenure, as these were the three factors that changed most in the composition of the labour force. We will then continue by considering changes in the wage structure according to the rest of the characteristics that are observed in the data set: age, type of contract, size of the firm, public or private ownership and bargaining system.

6.1 The gender wage gap

The first row of Table 7 in Appendix D shows the wage differential between males and females, revealing that women earned 22% less than men in 1995. In a particular year, the wage gap is increasing over quantiles. This evidence was also found in Gardeazabal and Ugidos (2005) and Garcia (2001)[20]. The difference between men and women has practically

18. It is beyond the scope of this paper to identify whether the observed changes in wages are attributed to the above-mentioned movements in supply or to additional movements in demand.

19. To see different solving strategies see Manski (1988) and Chamberlain (1994).

20. De la Rica et al. (2005) challenged this idea by considering different types of jobs. We will discuss this possibility later.

not varied between 1995 and 2002. This result is different compared to other studies in other countries, where a declining segregation is observed [Dolado et al. (2002) and Mulligan (2005)]. Moreover, the quantile regressions show that the change is very small for all parts of the conditional distribution. The increase in inequality is slightly bigger in the middle part of the distribution (median and 75th quantile), although the variation is also very small.

De la Rica et al. (2005) show the importance of considering the type of job when analysing the wage gap between males and females. They found that the wage gap increases along quantiles only when considering highly skilled activities. The data set allows a simple test for the previous hypothesis. We analyse the wage gap over the distribution of skilled non-manual jobs vs. unskilled manual jobs. Table 8 shows the gender wage gap by occupation using the same regressions as in Table 7 and including interaction terms between gender and occupation. It is clear from that Table that, as de la Rica et al. pointed out, the gender wage gap behaves differently depending on the type of job held. The wage gap for skilled non-manual jobs increases along the distribution whereas for unskilled manual jobs decreases[21].

TABLE 8: Levels and changes in Female coefficient by Ocupation

	Mean		10th Quantile		25th Quantile	
	Non qualified manual	Qualified non-manual	Non qualified manual	Qualified non-manual	Non qualified manual	Qualified non-manual
1995	-0,2359	-0,1965	-0,1689	-0,2262	-0,1884	-0,1929
2002	-0,2569	-0,1736	-0,1929	-0,1719	-0,2125	-0,1568
Change	-0,021	0,0229	-0,024	0,0543	-0,0241	0,0361

	50th Quantile		75th Quantile		90th Quantile	
	Non qualified manual	Qualified non-manual	Non qualified manual	Qualified non-manual	Non qualified manual	Qualified non-manual
1995	-0,2297	-0,1679	-0,2682	-0,1711	-0,3063	-0,2068
2002	-0,2484	-0,1562	-0,2775	-0,1837	-0,3013	-0,212
Change	-0,0187	0,0117	-0,0093	-0,0126	0,005	-0,0052

Moreover, the pattern between 1995 and 2002 is also different depending on the job held. Whereas the gender wage gap slightly increased for skilled non-manual jobs, it slightly decreased for unskilled manual jobs (especially at the bottom part of the distribution). This would generate lower inequality at the bottom part of the distribution of wages and higher inequality at the top.

The different evolution of the gender wage gap by occupation is related to the cohort of the female worker. This could be seen with an interaction between age and gender. In Table 9 is evident that the gender wage gap increases the most for old women at the higher quantiles (this is the group that increased the participation the most). Instead, young women of different quantiles kept the wage gap that was observed in 1995.

21. This is not true for the very top quintiles of non-qualified manual.

In sum, the gender wage gap did not change much in mean between 1995 and 2002. If anything, it slightly decreased at the bottom part of the distribution and it slightly increased at the upper part.

TABLE 9: Changes in the Female coefficient by cohort

	Mean			10th Quantile			25th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
Female	0,0091	-0,0031	-0,023	0,0148	-0,0025	-0,0007	0,008	-0,0058	-0,0207

	50th Quantile			75th Quantile			90th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
Female	0,0073	-0,0051	-0,0341	0,0126	-0,01	-0,0441	0,0123	0,0076	-0,0455

6.2 Returns to education

The second, third and fourth row of table 7 in Appendix D show the results for different levels of education. The coefficient of each variable represents the wage differential of a worker with a particular educational level with respect to a worker who studied up to primary level. As was expected, the more educated someone is, the higher his/her wage. Moreover, this difference is increasing as long as we move toward the upper part of the distribution. This regularity has been found in other studies and is explained by heterogeneity and the complementarities between the ability and the characteristics of the job [Buchinsky (1994), Martins and Pereira (2004)].

Interestingly, the wage differential across educational levels decreases by 5% between 1995 and 2002. This phenomenon has been observed since the 80s by Del Rio and Ruiz-Castillo (2001), Abadie (2002), and Febrer and Mora (2005). All of them argue that the increase in the supply of university degree-holders has not been offset by increases in demand. This idea appears to fit very well into our findings for the period 1995-2002. Moreover, the quantile regressions show that the reduction of the differential is similar for all parts of the distribution of wages. Nevertheless, it appears that the evolution of returns to schooling over the distribution hides some composition effects.

TABLE 10: Changes in education coefficients respect to primary by gender

	Mean		10th Quantile		25th Quantile	
	Male	Female	Male	Female	Male	Female
1st Cycle of Secondary	-0,0172	-0,02	-0,0038	0,0018	-0,0072	-0,0101
2nd Cycle of Secondary	-0,0368	-0,0572	-0,0222	-0,0233	-0,0224	-0,0364
University or more	-0,0545	-0,0075	-0,0239	0,0141	-0,0466	0,0097

	50th Quantile		75th Quantile		90th Quantile	
	Male	Female	Male	Female	Male	Female
1st Cycle of Secondary	-0,0154	-0,0101	-0,0156	-0,0213	-0,0246	-0,0133
2nd Cycle of Secondary	-0,0384	-0,0354	-0,0393	-0,0486	-0,0505	-0,0542
University or more	-0,0648	-0,0098	-0,0743	-0,0174	-0,0791	0,0206

Actually, there are statistical differences between the evolution of the wage gap for men and women. When we interact education with gender (table 10) it is evident that the wage gap decreased for male but not for female workers. This was already found in Amuedo-Dorantes and de la Rica (2006)[22].

TABLE 11: Changes in the education coefficients respect to primary by cohort

	Mean			10th Quantile			25th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
1st Cycle of Secondary	0,0176	0,011	-0,0432	0,0245	0,0243	-0,0363	0,0226	0,018	-0,035
2nd Cycle of Secondary	-0,0154	-0,0285	-0,083	-0,0074	-0,0076	-0,0451	-0,0042	-0,0123	-0,0622
University or more	0,0074	-0,021	-0,0782	0,0155	0,0072	-0,0673	0,0125	-0,0095	-0,1037

	50th Quantile			75th Quantile			90th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
1st Cycle of Secondary	0,0199	0,0118	-0,0458	0,0228	0,006	-0,0469	0,0305	-0,0065	-0,0529
2nd Cycle of Secondary	-0,0064	-0,0229	-0,0864	-0,0149	-0,0337	-0,0978	-0,0185	-0,0467	-0,0987
University or more	0,0131	-0,0328	-0,0952	0,0034	-0,0366	-0,096	0,0041	-0,0387	-0,0487

Something similar happens in table 11 where it is shown the changes in the educational premium between 1995 and 2002 by different age cohorts. The loss is much higher for old than for young cohorts. Abadie also found big losses for old university degree-holders at the top quantiles.

The empirical evidence for other countries has found a recent increase in the wage premium for university degree holders instead of the loss that is found in Spain [see, for instance Katz and Murphy (1992) for the US]. This increase is actually concentrated at the top part of the distribution [Lemieux (2006)] whereas in Spain there is a loss even in the top quantiles. The big increase in the participation of university degree holders makes the Spanish case a singular one and indicates the possibility that the demand of skilled labor (that could have increased in Spain as in other countries increased) has not been able to absorb the supply.

Summarizing, the concentration of the wage structure regarding educational attainment has been intense in the period of study and compensates, at least partially, the increase in inequality produced by more university degree holders in the Spanish labor market.

6.3 Returns to age and tenure

Rows 5 to 6 in table 7 in Appendix D are devoted to age and rows 7 to 9 to tenure. In section 4 we pointed out that the age of the labor force almost did not suffered any change, while tenure decreased enormously. That is the reason why section 5 analyzed the effects of changes in the tenure composition instead of the age composition. However as we will see below there are important changes on the returns of age and that is why we will study both variables together.

22. They considered a different definition of wages and they actually saw that women's returns to schooling increased.

Age accounts for general experience in the labour market whereas tenure stands for specific experience within the firm. As expected, the higher someone's experience of any kind, the higher his wage. However, the effect of each type of experience is different at different parts of the distribution. Whereas returns to general experience (age) increased along quantiles, tenure is seen to be more valuable at the bottom part of the distribution than at the top. This result means that firm-specific knowledge is a better asset for workers at the bottom part of the distribution whereas general experience appears to be more valuable at the top part of it.

Between 1995 and 2002, the wage differential between workers of different ages has decreased. This decrease has been similarly distributed along different quantiles. The fact that the quality of young workers may have increased between 1995 and 2002 could help to explain the depreciation of the differentials at every part of the distribution. At the same time, returns to tenure increased over time. This is consistent with the high supply of workers with no specific experience at all. More specifically, tenure increased its value especially at the top part of the distribution.

A part of this behaviour could be explained by cohort effects. Tenure loses importance for young workers, whereas it increases its importance for old workers. However, within each particular age there is still a different behaviour according to different quantiles.

TABLE 12: Changes in tenure coefficient respect to less than 1 year by cohort

	Mean			10th Quantile			25th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
Tenure 1-3 years	-0,0226	-0,0036	-0,0019	-0,115	-0,0661	-0,0271	-0,0463	-0,0102	-0,0128
Tenure 4-7 years	-0,04	0,0131	0,0612	-0,1586	-0,1003	-0,0074	-0,0731	-0,0305	0,017
Tenure > 7 years	-0,0474	0,0329	0,0923	-0,2329	-0,0974	-0,0094	-0,0934	-0,0172	0,0274

	50th Quantile			75th Quantile			90th Quantile		
	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64	Age <30	Age 30-45	Age 46-64
Tenure 1-3 years	-0,0117	-0,0008	-0,0226	0,0059	0,0189	0,0007	0,0431	0,083	0,0538
Tenure 4-7 years	-0,0305	0,0071	0,0134	0,0031	0,061	0,0596	0,0697	0,1447	0,1548
Tenure > 7 years	-0,028	0,0274	0,0454	0,024	0,0906	0,1047	0,1087	0,1837	0,2142

6.4 The wage structure of alternative factors

The wage structure has changed significantly in other dimensions apart from gender, education, age and tenure, as opposed to what happened with the labour force structure. In particular, Table 7 presents evidence on changes in the wage structure with respect to type of contract, public ownership, type of collective agreement and size of the firm. This subsection presents a brief description of the results, paying particular attention to the changes in differentials[23].

23. There are many interactions between those variables and the previous ones that could be analyzed. For example Card and de la Rica (2005) found that the level of bargaining affected inequality for female more than for male. Since in this paper we focus on female participation, education and tenure we are not going to go more deeply in those interactions.

The 10th row shows the wage differences between indefinite and temporary contracts. Temporary workers earn 10% less than indefinite workers on average. This gap is equal to the results obtained in de la Rica (2005). The differential is higher at the upper tail of the distribution. Comparing the two cross-sections, the wage differential between temporary and indefinite contracts has decreased over time by almost 5%. This decrease has mainly come about at the top part of the distribution. One possible explanation for this fact is the increasing use of temporary contracts for older workers. Indeed, when interacting age and type of contract, we do not observe substantial changes in the wage gap for young workers.

The next variable we consider is public ownership of the firm. According to the results in Table 8 there are no statistical differences between public and private firms once we control for the previous characteristics. We are just considering public firms and not the public sector as a whole [Jimeno (2005)[24])]. When we allow variations in the wage differential depending on the quantile, we find a small wage premium of the public firm at the lower part of the distribution. Instead, private firms pay more than public firms at the upper tail. There are not many changes in this dimension between 1995 and 2002. If anything, it appears that the differential has been reduced. However, the reduction is very small.

Another interesting variable that may affect the wage level is the level under which the collective agreement is negotiated in the firm. Our results show a wage differential between agreements signed at the firm-level and those signed at a sectoral level. In particular, in the first type of contract, wages are 12% higher than in the second. This is qualitatively similar to the results in Izquierdo et al. (2003), although they use a different dataset. Moreover, the differential is evident in all parts of the distribution. Over time it appears that the differential slightly decreases for all quantiles.

Finally, we observe higher wages in bigger firms. The differential is similar in all parts of the distribution. With respect to this differential over time, bigger firms decreased the premium respect to small firms.

In summary, results for this subsection indicate that there is a squeeze on wages in several dimensions apart from females, educational levels and age. This fact also helps to drive the lower dispersion in 2002 and the next sub-section will quantify the importance of each factor.

6.5 Importance of changes in returns

In order to capture how the previous changes in returns affect the variance of wages we use the formula of the variance decomposition:

$$Var(\ln W) = \text{var}\left[E(\ln W \mid X, \beta)\right] + E\left[\text{var}(\ln W \mid X, \beta)\right]$$

The first part of the equation is the way the variance varies between different groups. The second part of the equation is the way inequality varies within each group. We are going to assume that returns only affect the between component while it does not affect the within component. This is not an innocuous assumption, actually Lemieux (2006) estimates a model

24. They found that the public sector paid a positive premium.

where returns to education and age affect both the between and the within components[25]. In a world with heterogeneous returns, if the price of the factor increases, the variance within a specific category also increases. Therefore, in this case where most of returns went down it is likely that the within component also decreased. Consequently, the estimated effect would be a lower bound for the real one.

The between component is approximated by the variance of the predicted wages once returns are changed (using an OLS regression).

$$E(\ln W \mid X_{1995}, \beta_{1995}) = X_i^{1995} \beta^{1995}$$
$$E(\ln W \mid X_{2002}, \beta_{2002}) = X_i^{2002} \beta^{2002}$$

$$E(\ln W \mid X_{1995}, \beta_{1995}(k-1), \beta_{2002}(k)) = X_i^{1995}(k-1)\beta^{1995}(k-1) + X_i^{1995}(k)\beta^{2002}(k)$$

Notice that using the previous results and the formula we may also estimate the components of the total change in the variance as a consequence of changes in the composition. In the previous section it was computed the counterfactual standard deviation when returns where kept constant[26]. Moreover, the between component could be computed using:

$$E(\ln W \mid X_{2002}, \beta_{1995}) = X_i^{2002} \beta^{1995}$$

Therefore the within component will be the residual.

Table 13 shows that the between component experiences a great decline due to changes in all returns. This decline is much bigger than the increase produced in the between component due to changes in the labour force composition. Even in the case when we allow the within component to vary with the labour force composition, the total change in variance will be higher when changing the returns. Notice that the total change in the variance is not the sum of these two components since there are interactions between the two that are not taken into account.

Table 13: Variance decomposition

	1995	Changing all returns	Change respect to 1995 %	Changing in composition	Change respect to 1995 %	2000
Between	0,1768	0,1531	-13,41%	0,18558	4,95%	0,1636
Within	0,1166	0,1166	0%	0,12034	3,20%	0,1094
Total	0,2934	**0,2697**	-8,08%	**0,3059**	4,25%	0,2730
Total Standard Deviation	0,5417	0,5193	-4,13%	0,5531	2,10%	0,5225

Table 14 shows the relative importance of each return in isolation. Most of the returns have an impact decreasing the variance. Only returns to tenure appear to have a sizeable positive effect in the variance (gender and property do not produce any important increase). Among the returns that reduce the variance the most we should highlight the

25. The justification was the different behaviour of returns to schooling at different parts of the distribution. Actually his model is based in heterogeneity of returns over the population.
26. he counterfactual variance will be the square of the standard deviation.

change in the wage gap between different types of contract and the changes in returns to education and general experience.

Table 14: Effect on Standard Deviation

	Standard Deviation	Change respect to 1995 %
1995	0,5417	-
2002	0,5225	**-0,0354**
Gender	0,5427	0,19%
Education	0,5364	**-0,98%**
Tenure	0,5495	1,45%
Age	0,5330	**-1,61%**
Ocupation	0,5376	**-0,76%**
Type of contract	0,5332	**-1,57%**
Size	0,5389	**-0,52%**
Property	0,5417	0,00%
Bargaining	0,5398	**-0,34%**
Total Standard Deviation	0,5193	**-4,14%**

7 Conclusions

The paper has shown that wage inequality in Spain has decreased slightly between 1995 and 2002. This change is mainly attributed to a higher concentration of wages in the middle part of the distribution and, to a lesser extent, to a smaller dispersion in the lower tail. On the other hand, there is an increase in inequality in the upper tail.

Many factors have changed in the Spanish labour market between 1995 and 2002 that have affected inequality in different ways. Regarding changes in the composition of the labour force, we have carefully analysed three of them: the increase in female participation, the increase in university degree-holders and the reduction in the tenure level. We have estimated non-parametrically the counterfactual wage distribution had only one of these factors changed to the corresponding level in 2002. According to this methodology, we have found that the labour force is more heterogeneous in 2002 than in 1995, especially in the upper part of the distribution. In other words, the observed changes in the composition of the labour force would have generated a significant increase in wage inequality. In particular, changes in education and mainly tenure have a large impact increasing inequality. Conversely, changes in female participation have almost no impact on the aggregate dispersion of wages.

Regarding changes in the wage structure, we use quantile regressions to estimate the change in the price of different factors at different parts of the distribution, holding everything else constant. According to this methodology, we find that in many dimensions there is a reduction in wage dispersion which has offset the higher inequality derived from the changes in the composition of the labour force. It is beyond the scope of this paper to conclude whether the changes in prices stem from changes in supply, demand or other institutional factors. However, it is evident from the paper that the change in the wage structure finally dominates the potential effect produced by changes in the composition of the labour force.

In particular, our empirical analysis shows that in this period there has been a significant decrease in the returns to education. This phenomenon has been observed in the Spanish economy since the 80s and would be consistent with a situation where the intense increase in the supply of university degree-holders has not been offset by similar increases in demand. Those results contrast with the available empirical evidence for other countries, where an increase in the wage premium for university degree-holders has been found for the recent period. Future research could be devoted to analysing this phenomenon in depth in order to look at alternative explanations. For instance, institutional factors such as the bargaining mechanism, which in Spain has been producing a high homogeneity of wage increases [Izquierdo et al. (2003)], would also have played a role in this decrease in the returns to education.

APPENDIX A

LOGARITHM OF HOURLY WAGE DEMEANED	1995			2002		
	Proportion	Relative Wage	Within inequality	Proportion	Relative Wage	Within inequality
TOTAL		2,23			2,24	
SEX						
Males	0,76	1,05	0,32	0,69	1,04	0,32
Females	0,24	0,92	0,28	0,31	0,92	0,28
AGE						
16-29	0,26	0,86	0,23	0,28	0,89	0,22
30-45	0,47	1,04	0,30	0,47	1,02	0,31
>46	0,27	1,12	0,32	0,25	1,10	0,34
EDUCATION						
At most primary	0,33	0,97	0,25	0,29	0,93	0,25
1st cycle of Secondary	0,32	0,92	0,27	0,32	0,93	0,25
2nd cycle Secondary and VT	0,17	1,07	0,31	0,17	1,04	0,31
Tertiary	0,18	1,19	0,35	0,22	1,16	0,35
SIZE OF THE FIRM						
10-49 workers	0,49	0,94	0,29	0,40	0,94	0,27
50-200 workers	0,29	1,02	0,31	0,31	1,01	0,31
More than 200 workers	0,22	1,15	0,31	0,29	1,09	0,34
SECTOR						
Mining	0,01	1,03	0,29	0,01	1,01	0,27
Manufactures	0,52	1,01	0,30	0,45	1,03	0,30
Energy and water	0,02	1,28	0,28	0,02	1,25	0,31
Construction	0,08	0,96	0,29	0,09	0,95	0,26
Commerce, reparation	0,11	0,95	0,31	0,12	0,96	0,30
Hotels and restaurants	0,06	0,88	0,24	0,07	0,88	0,22
Transportation	0,06	1,11	0,28	0,07	1,09	0,32
Financial intermediation	0,08	1,29	0,26	0,06	1,32	0,28
Real estate agencies	0,06	1,01	0,36	0,11	0,94	0,31

Relative salary is the ratio between the mean of the particular group and the unconditional mean

Within group inequality is computed using the Gini's index

LOGARITHM OF HOURLY WAGE DEMEANED (Cont)	1995			2002		
	Proportion	Relative Wage	Within inequality	Proportion	Relative Wage	Within inequality
Region						
Andalucía	0,09	0,99	0,31	0,09	0,95	0,32
Aragón	0,05	1,01	0,29	0,05	1,00	0,29
Asturias	0,03	0,99	0,29	0,04	1,00	0,29
Baleares	0,03	0,94	0,28	0,04	0,97	0,32
Canarias	0,05	0,92	0,34	0,05	0,92	0,34
Cantabria	0,02	0,93	0,26	0,02	0,96	0,26
Castilla león	0,05	0,90	0,30	0,05	0,91	0,29
Castilla La Mancha	0,06	0,99	0,31	0,06	0,97	0,30
Cataluña	0,16	1,05	0,32	0,15	1,04	0,31
Comunidad Valenciana	0,09	0,95	0,29	0,10	0,96	0,29
Extremadura	0,02	0,88	0,30	0,02	0,89	0,28
Galica	0,06	0,93	0,30	0,06	0,93	0,31
Madrid	0,13	1,10	0,35	0,13	1,06	0,37
Murcia	0,04	0,87	0,27	0,04	0,92	0,26
Navarra	0,03	1,02	0,25	0,03	1,06	0,24
País Vasco	0,07	1,09	0,27	0,06	1,09	0,27
La Rioja	0,02	0,92	0,24	0,02	0,95	0,25
TYPE OF FIRM						
Public	0,01	1,21	0,24	0,02	1,20	0,32
Private	0,99	1,01	0,32	0,98	1,00	0,32
OCUPATION CATEGORIES						
Qualified Non-manual	0,19	1,26	0,31	0,22	1,23	0,33
Non Qualified-Non Manual	0,24	0,97	0,27	0,22	0,93	0,27
Qualified Manual	0,38	0,98	0,25	0,36	0,97	0,23
Non Qualified-Manual	0,19	0,87	0,22	0,20	0,87	0,21
BARGAINING WAGE STETING						
Sector nationwide or region	0,80	0,98	0,31	0,84	0,98	0,31
Firm	0,20	1,15	0,28	0,16	1,12	0,31
TYPE OF CONTRACT						
Long term	0,73	1,08	0,31	0,74	1,05	0,32
Fixed term	0,27	0,84	0,22	0,26	0,86	0,21
TENURE						
<1 year	0,11	0,80	0,26	0,23	0,85	0,22
1-3 years	0,24	0,90	0,28	0,30	0,95	0,26
4-7 years	0,20	1,02	0,30	0,15	1,02	0,29
>7 years	0,46	1,13	0,29	0,32	1,16	0,31

Relative salary is the ratio between the mean of the particular group and the unconditional mean

Within group inequality is computed using the Gini's index

APPENDIX B. Mathematical Appendix

B.1) Methodology

Let's assume there is one continuous variable *z* and one discrete variable *x* and we want to change the distribution of *x.* Hence, using non-parametric techniques and Bayes' rule the counterfactual density may be estimated by:

$$\hat{\theta}_i = 1(x=0)\frac{\Pr(x=0 \mid z, t_{x|z}=02)}{\Pr(x=0 \mid z, t_{x|z}=95)} + \left(1-1(x=0)\right)\frac{\Pr(x=1 \mid z, t_{x|z}=02)}{\Pr(x=1 \mid z, t_{x|z}=95)}$$

B.2) Indexes

The formulas for the indexes are[27]:

$$sd\_\log\_wage = \int_{-\infty}^{\infty} (w-\overline{w})^2 f(w)dw \quad \text{where } \overline{w} = \int_{-\infty}^{\infty} wf(w)dw$$

$$\text{quintile(x) is } \exp(w^*) \text{ that solves } \int_{-\infty}^{w^*} f(w)dw = x$$

$$Theil = \int_0^{\infty} \ln\left(\frac{v}{\overline{v}}\right)\frac{v}{\overline{v}} f(v)dv \quad \text{where } v = \exp(w) \text{ and } f(v) = \frac{f_w(v^{-1})}{v} \overline{w} = \int_{-\infty}^{\infty} wf(w)dw$$

$$Gini = 1 - 2\int_0^{\infty} F_1(v) f(v)dv \quad \text{where } F_1(v) = \frac{\int_0^{v} yf(y)dy}{\int_{-\infty}^{\infty} vf(v)dv}$$

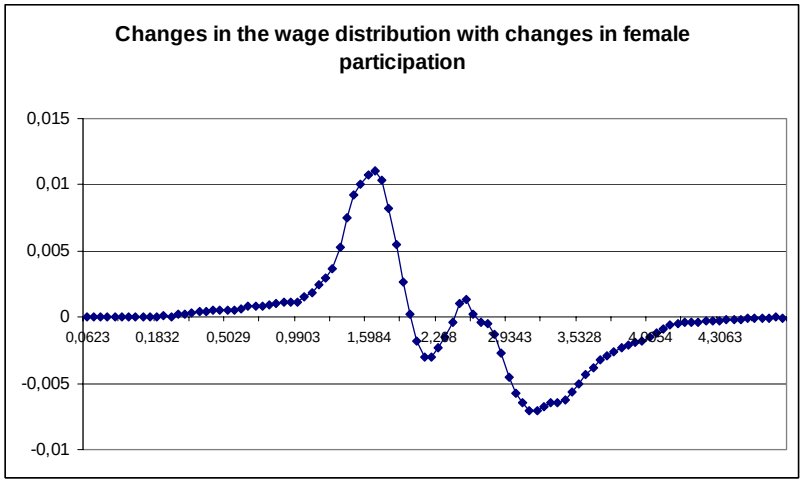
B.3) All changes together

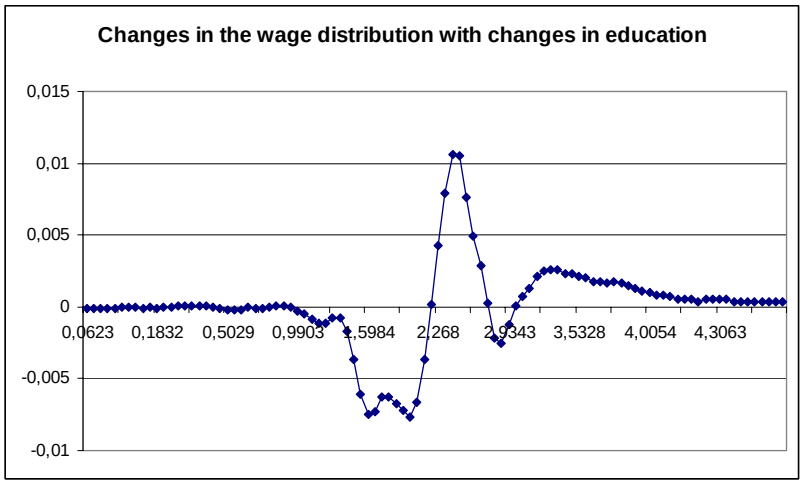
In order to account for all changes:

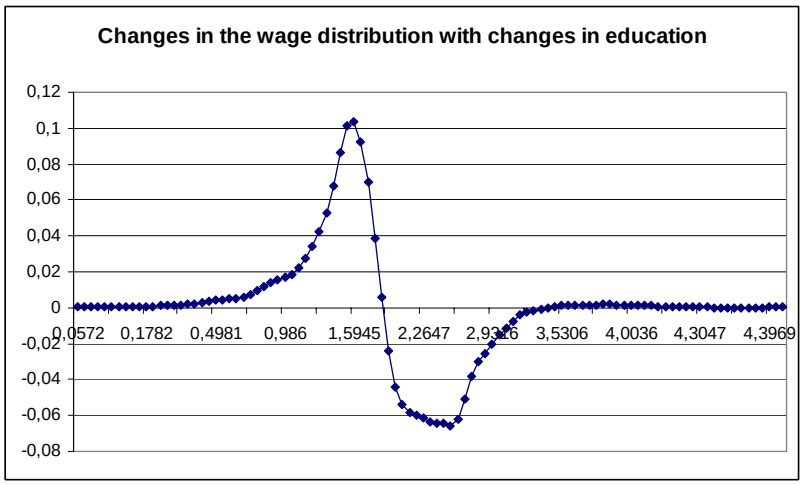
$$\hat{g}(w \mid t_w = 1995, t_z = 2002) = \int f(w \mid z, t_{w|z} = 95)dF(z \mid t_z = 02)$$
$$= \sum_{i=1}^{n} \frac{\hat{\theta}_i}{h} K\left(\frac{w - W^{95}{}_i}{h}\right)$$
$$\hat{\theta}_i = \frac{dF(z \mid t_z = 02)}{dF(z \mid t_z = 95)} \propto \frac{\Pr(t = 02 \mid z_i)}{\Pr(t = 95 \mid z_i)}$$

27. All the integrals are computed using a Gauss Legender algorithm.

APPENDIX C


Changes in the wage distribution with changes in female participation
0,015
0,01
0,005
0
-0,005
-0,01
0,0623
0,1832
0,5029
0,9903
1,5984
2,268
2,9343
3,5328
4,0054
4,3063


Changes in the wage distribution with changes in education
0,015
0,01
0,005
0
-0,005
-0,01
0,0623
0,1832
0,5029
0,9903
1,5984
2,268
2,9343
3,5328
4,0054
4,3063


Changes in the wage distribution with changes in education
0,12
0,1
0,08
0,06
0,04
0,02
0
-0,02
-0,04
-0,06
-0,08
0,0572
0,1782
0,4981
0,986
1,5945
2,2647
2,9326
3,5306
4,0036
4,3047
4,3969

APPENDIX D

TABLE 7: Quantile regression (First Column)

	Mean		Quantile 10%	
	1995	2002	1995	2002
Sex (1=Female)	-0,2202	-0,2303	-0,2045	-0,2045
	(0.0023)**	(0.0020)**	(0.0034)**	(0.0029)**
1st Cycle of Secondary	0,0272	0,0078	0,0167	0,0105
	(0.0023)**	(0.0020)**	(0.0034)**	(0.0031)**
2nd Cycle of Secondary	0,1271	0,0791	0,093	0,066
	(0.0033)**	(0.0027)**	(0.0045)**	(0.0039)**
University or more	0,24	0,1938	0,1606	0,1383
	(0.0035)**	(0.0031)**	(0.0047)**	(0.0042)**
Age 30-45	0,1563	0,1042	0,1278	0,0687
	(0.0026)**	(0.0021)**	(0.0036)**	(0.0030)**
Age 46-64	0,2551	0,1955	0,1985	0,1298
	(0.0033)**	(0.0028)**	(0.0045)**	(0.0040)**
Tenure 1-3 years	0,1121	0,0957	0,2149	0,1316
	(0.0040)**	(0.0026)**	(0.0050)**	(0.0038)**
Tenure 4-7 years	0,1827	0,1758	0,3153	0,1979
	(0.0050)**	(0.0034)**	(0.0064)**	(0.0048)**
Tenure > 7 years	0,2883	0,3184	0,43	0,326
	(0.0052)**	(0.0034)**	(0.0065)**	(0.0048)**
Type of contract (1=Temporal)	-0,1023	-0,0545	-0,0593	-0,0522
	(0.0036)**	(0.0026)**	(0.0049)**	(0.0039)**
Size between 50-200 workers	0,119	0,1212	0,1034	0,0962
	(0.0023)**	(0.0021)**	(0.0032)**	(0.0029)**
Size >200 workers	0,2018	0,1766	0,2081	0,17
	(0.0030)**	(0.0025)**	(0.0040)**	(0.0033)**
Public property (1=public)	-0,0106	-0,0087	0,0346	0,0032
	(0,0084)	(0,0077)	(0.0121)**	(0,009)
Bargaining system (1=sector)	-0,1151	-0,0982	-0,0939	-0,0666
	(0.0029)**	(0.0029)**	(0.0040)**	(0.0038)**
Constant	7,3588	2,48	6,678	1,9324
	(0.0115)**	(0.0096)**	(0.0148)**	(0.0126)**
Observations	133619	156966	133619	156966
R-squared	0,6	0,59		

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Source: Wage Structure Survey
The regressions include dummies for Type of work, region of firm and sector

TABLE 7: Quantile regression (Cont)

	Quantile 25%		Quantile 50%	
	1995	2002	1995	2002
Sex (1=Female)	-0,2004	-0,2079	-0,2058	-0,2195
	(0.0026)**	(0.0022)**	(0.0024)**	(0.0021)**
1st Cycle of Secondary	0,0174	0,0075	0,0215	0,0048
	(0.0027)**	(0.0024)**	(0.0025)**	(0.0023)*
2nd Cycle of Secondary	0,0996	0,0678	0,1161	0,0739
	(0.0035)**	(0.0030)**	(0.0033)**	(0.0029)**
University or more	0,1837	0,1488	0,2214	0,1675
	(0.0036)**	(0.0032)**	(0.0034)**	(0.0031)**
Age 30-45	0,1159	0,0687	0,1284	0,0755
	(0.0029)**	(0.0023)**	(0.0027)**	(0.0023)**
Age 46-64	0,1918	0,1358	0,2103	0,1561
	(0.0036)**	(0.0030)**	(0.0033)**	(0.0029)**
Tenure 1-3 years	0,1468	0,1131	0,1041	0,0942
	(0.0039)**	(0.0029)**	(0.0036)**	(0.0028)**
Tenure 4-7 years	0,2329	0,1802	0,1733	0,1623
	(0.0050)**	(0.0037)**	(0.0046)**	(0.0036)**
Tenure > 7 years	0,3428	0,3168	0,2824	0,3126
	(0.0051)**	(0.0036)**	(0.0047)**	(0.0034)**
Type of contract (1=Temporal)	-0,0604	-0,0425	-0,083	-0,0437
	(0.0038)**	(0.0030)**	(0.0035)**	(0.0028)**
Size between 50-200 workers	0,1103	0,1054	0,12	0,1211
	(0.0025)**	(0.0022)**	(0.0023)**	(0.0022)**
Size >200 workers	0,2052	0,1748	0,2029	0,1803
	(0.0031)**	(0.0025)**	(0.0029)**	(0.0025)**
Public property (1=public)	0,0178	-0,0151	-0,0139	-0,0181
	(0,0094)	(0.0070)*	(0,0087)	(0.0069)**
Bargaining system (1=sector)	-0,1245	-0,1048	-0,1457	-0,1238
	(0.0031)**	(0.0029)**	(0.0028)**	(0.0027)**
Constant	7,0183	2,1708	7,3671	2,465
	(0.0115)**	(0.0098)**	(0.0106)**	(0.0094)**
Observations	133619	156966	133619	156966
R-squared				

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Source: Wage Structure Survey
The regressions include dummies for Type of work, region of firm and sector

TABLE 7: Quantile regression (Final Columns)

	Quantile 75%		Quantile 90%	
	1995	2002	1995	2002
Sex (1=Female)	-0,2252	-0,2366	-0,2537	-0,2588
	(0.0033)**	(0.0026)**	(0.0042)**	(0.0038)**
1st Cycle of Secondary	0,0244	0,0071	0,0242	0,0016
	(0.0035)**	(0.0030)*	(0.0046)**	-0,0044
2nd Cycle of Secondary	0,1366	0,0886	0,1526	0,0903
	(0.0046)**	(0.0038)**	(0.0060)**	(0.0055)**
University or more	0,2553	0,1966	0,28	0,2226
	(0.0047)**	(0.0039)**	(0.0061)**	(0.0056)**
Age 30-45	0,1524	0,102	0,1802	0,1291
	(0.0037)**	(0.0029)**	(0.0048)**	(0.0042)**
Age 46-64	0,2536	0,1973	0,3063	0,2401
	(0.0046)**	(0.0036)**	(0.0060)**	(0.0053)**
Tenure 1-3 years	0,0726	0,0813	0,0179	0,0577
	(0.0050)**	(0.0035)**	(0.0065)**	(0.0051)**
Tenure 4-7 years	0,1278	0,1584	0,0552	0,1432
	(0.0065)**	(0.0045)**	(0.0084)**	(0.0066)**
Tenure > 7 years	0,2291	0,3069	0,1501	0,2891
	(0.0066)**	(0.0043)**	(0.0086)**	(0.0062)**
Type of contract (1=Temporal)	-0,1123	-0,0484	-0,1293	-0,0585
	(0.0048)**	(0.0035)**	(0.0062)**	(0.0051)**
Size between 50-200 workers	0,127	0,1298	0,1222	0,1356
	(0.0032)**	(0.0028)**	(0.0042)**	(0.0040)**
Size >200 workers	0,199	0,1818	0,1846	0,1773
	(0.0041)**	(0.0032)**	(0.0054)**	(0.0047)**
Public property (1=public)	-0,0355	-0,0229	-0,0489	-0,0091
	(0.0121)**	(0.0088)**	(0.0156)**	(0,0129)
Bargaining system (1=sector)	-0,1395	-0,1226	-0,1252	-0,1119
	(0.0038)**	(0.0035)**	(0.0050)**	(0.0051)**
Constant	7,7384	2,7751	8,1045	3,1429
	(0.0147)**	(0.0119)**	(0.0191)**	(0.0173)**
Observations	133619	156966	133619	156966
R-squared				

Robust standard errors in parentheses
* significant at 5%; ** significant at 1%

Source: Wage Structure Survey
The regressions include dummies for Type of work, region of firm and sector

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