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EARNINGS DIFFERENTIALS AND THE CHANGING DISTRIBUTION OF WAGES IN SPAIN, 2005-2010*

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ABSTRACT

Using administrative data from the Social Security and the Tax Administration National Agency, this paper describes the wage distribution in Spain, its evolution in recent years and the implications for increased wage dispersion. We estimate OLS and quantile regression models in order to assess the impact of personal, job and workplace attributes on between- and within-groups wage inequality. Among other things, we find that, although the average wage has been increasing over time, changes have not been uniform across the earnings distribution, making the dispersion to fall during boom years but to rise during downturn years. Furthermore, changes in the impacts of some characteristics (types of contract, skills, region and employer size) contributed to higher wage dispersion, while others (tenure) made the distribution more equal.

Keywords: earnings differentials, wage distribution, quantile regression, administrative data.

JEL Classification: H24, J31, J60.

1. INTRODUCTION

There is no *a priori* reason why the structure of wages should remain stable over time. Technological innovations, changes in the structure of product and/or labour markets and changes in the distribution of workers' education can alter the demand for and the supply of different skill attributes and, thus, the earnings distribution. Some explanations that have been advanced for the somehow general trend towards an increase in wage inequality in the last three decades are a shift in labour demand favouring high-skilled labour at the expense of low-skilled labour, primarily caused by changes in technology; the increase of foreign competition; and different socio-demographic factors, such as the change in the numbers of university graduates among the working population, the secular rise in the labour market participation of women and the increase of migration flows (see *inter alia* Atkinson, 2008; Lemieux, 2008).

These factors were subject to relevant changes in Spain in those years. First, the industrial structure underwent a dramatic transformation which reflected in the labour market, with a declining share of total employment in agriculture and, to a lesser extent, manufacturing and an increasing one in certain service sectors and construction (during the 1996-2007 expansion) and with a continuously rise of the proportion of white-collar high-skilled jobs. Second, foreign competition increased, first because many trade barriers were dismantled and formerly shielded sectors had to face up to competition (particularly just before and after European Union membership in 1986), and later as a consequence of the process of globalisation of the economies. Third, educational levels and female participation rates rose continuously throughout the whole period, especially during the 1980s and 1990s, while the immigration influx increased substantially since the mid-1990s (in relative terms, it was above the average for European countries during the beginning of the XXI century).

In this article we do not examine in detail either the transformations occurred in the labour market or the explanations put forward. Rather our aim is to analyse the evolution of wage inequality in recent years, the effect of the recent crisis on wage dispersion and the factors behind it¹. Therefore, the contribution of the article is twofold. First, it investigates wages differentials for a set of personal, job and workplace attributes not only at the mean but also throughout the conditional earnings distribution, making it possible to assess the impact of these attributes on between- and within-groups wage inequality. Second, it analyses the potential influence of the recent recession on the magnitude of earnings differentials and wage dispersion. In order to do so, it concentrates on a period of time characterized by extremely diverging economic and labour market conditions (from one of rapid economic growth and intense job creation in 2005-2007 to another of sharp crisis and rising unemployment in 2008-2010).

Our hypothesis is that the dramatic changes in the composition of workers and jobs as a consequence of the economic and employment crisis (which concentrated on men, young and low educated individuals, workers holding fixed-term contracts and the ones with low tenure and working in construction, in manual jobs –in particular, those in low-skilled positions– and in small firms) have increased wage inequality and influenced the impact of workers' and jobs' attributes on wage dispersion, rising the impact of some of them (such as labour market experience, skills, labour contracts and employer size).

We characterize the distribution of earnings by using Ordinary Least Squares (OLS) and Quantile Regression (QR). OLS estimates can be interpreted as the average effect that each covariate has on

¹ Although the study of wage dispersion and its determinants has received much attention in the economic literature over the last few decades (Katz and Autor, 1999), these issues have not been investigated extensively in Spain. However, this country stands as one of the few developed countries in which wage inequality has diminished significantly from the mid-1990s to the mid-2000s, in spite of which it exhibits an intermediate level of wage dispersion as compared to the other countries of the European Union (OECD, 2007). Jimeno *et al.* (2001) and Palacio and Simón (2004), using data for the mid-1990s, identify education, contract type and occupation, on the one hand, and wage differentials between firms, on the other hand, as factors having a significant impact on inequality levels in the Spanish labour market. Izquierdo and Lacuesta (2012) focus on the evolution of wage dispersion using information at three points of time (1995, 2002 and 2006), obtaining that it has been decreasing as a result of the opposing effects of changes in the composition of the workforce (in particular, age and schooling which would have increased inequality) and changes in returns (which would have reduced inequality). Carrasco *et al.* (2011) essentially arrive at the same results, with the additional finding that job characteristics also contributed to reduce inequality. This finding had been advanced by Simón (2009), who addressed the relevance of workplaces' attributes on the reduction of wage inequality.

the sample population's wages; in this case, the effect of each category can be represented by a shift of the conditional wages distribution. With QR, in turn, we measure the wage effects of each covariate at different points of the distribution, thus describing changes not only in the location but also in the shape of it. Therefore, we follow a strand of the literature (in labour economics) that has described the distribution of wages and its changes using a set of quantiles in different countries over the last twenty years (Buchinsky, 1994, 1997; Abadie, 1997; Gosling *et al.*, 2000; Machado and Mata, 2001)².

The remainder of this study proceeds as follows. Section two presents the dataset (an administrative dataset, which collects data from the Social Security and the Tax Administration National Agency) and describes the data; at this point, we give an overview of the distribution of wages and the characteristics of the working population in 2005-2010. Section three sets out the econometric techniques to be used later in the empirical analysis. Section four briefly provides the results of the estimation of the wage equation to document earnings differentials across different categories of workers and wage inequality within groups for the period 2005-2010 as a whole, whereas section five examines changes in wage differentials and dispersion over time. Section six investigates the evolution of the conditional wage distribution. Finally, some concluding remarks follow in section seven.

2. DATA DESCRIPTION

2.1. Dataset

This paper uses administrative data from the 'Continuous Sample of Working Life' (*Muestra Continua de Vidas Laborales*, hereinafter MCVL) across the period 2005-2010³. Every year this data source (designed by the Ministry of Employment) provides information on more than one million people. They represent a 4 percent of the population who have had any sort of relationship with the Social Security in a given year (the sampled individuals are selected annually by means of a simple random sampling system). Thus, the population of reference from which the sample is extracted comprises both workers who are registered with the Social Security as working as well as recipients of contributory and non-contributory pensions and unemployment benefits in the year concerned. Jobseekers not receiving benefits and the inactive population (as distinct from pensioners) are not included. The same applies to workers with a social welfare system other than the Social Security system (civil servants receiving pensions) or those with none (such as those working in the informal or submerged economy or some marginal activities)⁴.

This data source has a longitudinal design. From 2004 onwards, an individual who is present in an edition of the sample and subsequently remains registered with the Social Security stays as a sample member. Furthermore, the sample is refreshed with new sample members, remaining representative of the population in each edition⁵.

The MCVL constitutes a rich but complex dataset. It is made up of several files containing diverse information. The files on personal details (coming from Social Security records and the Continuous

² Other works use this method to investigate estimated returns to education (Arias *et al.*, 2001; Martins and Pereira, 2004; Prieto *et al.*, 2008; Budría and Pereira, 2011), to examine the effect of subsidized training on trainee earnings (Abadie *et al.*, 2001) and to analyse unemployment duration data (Koenker and Billias, 2001; Fitzenberger and Wilke, 2010). There is also a large literature dealing with issues related to discrimination and earnings inequality based on QR: García *et al.* (2001), Gardeazábal and Ugidos (2005) and Arulampalam *et al.* (2007) investigate gender wage discrimination; Piketty and Sáez (2006), Autor *et al.* (2006, 2008) and Antonczyk *et al.* (2010) examine wage inequality.

³ We have not considered the year 2004 because it does not contain information on the country of birth of the individuals, being it relevant to build the variable citizenship/place of birth for our estimations (see below).

⁴ In addition, the 'tax module' (see below) lacks income data on workers under the Special Home Regime and self-employed workers in any Social Security regime (with some exceptions).

⁵ The MCVL is therefore only representative of the population related to the Social Security system in the year concerned, and is therefore not representative of the past: although it contains information on previous social security contributions by the individuals selected (dating back several years), it does not include past contributions by individuals who have died or who are no longer actively engaged in the labour market (see Arranz *et al.*, 2012, for an analysis of the impact of using data on a period prior to the years of reference on some key labour market variables).

Municipal Register) provide information on personal characteristics (gender, age, province of residence, citizenship and place of birth⁶, etc.). The files on Social Security contributors contain details for each spell of employment on workplace and job attributes (employer size, location, ownership status, industry affiliation, job category, types of contract and tenure –dates of start and end of employment spells–, etc.). Labour market experience of individuals can also be measured since we know the date of their first labour contract.

A separated ‘tax module’ provided by the Tax Administration National Agency (*Agencia Tributaria*, AEAT) gives annual data on tax earnings. These data allow one to distinguish among different types of income: wages and salaries; pensions; unemployment benefits (in the event a worker is separated from a job and eligible for them); income from economic activities; and others. This module includes everyone receiving income subject to income tax, regardless of their obligation or otherwise to declare it for the purposes of income tax; even the details concern payments below the legal exemption rate, payments with no withholdings, or exempt income.

There are also other files containing the monthly ‘contribution base’ (coming from the Social Security records), which is similar to the salary for most workers (although it does not include overtime and other payments such as dismissal compensations, which are included in the tax data). In principle, this information might be used as a proxy of individuals’ wages (see Hospido and Bonhomme, 2012). However, we have decided to use the wages data contained in the tax module because, as it is well known, tax earnings data do not suffer from measurement errors common in self-reported wages and from top coding common in administrative data like Social Security records, which make them far more reliable⁷. Another fact that reassures us in the use of tax data is that results are fully comparable to the ones obtained with other sources such as the Quarterly Labour Cost Survey (from the National Statistics Institute) in the case of wages and the labour statistics published by the Public Employment Service in the case of the amount of unemployment benefits (see Arranz and García-Serrano, 2011).

One of the main advantages of the MCVL dataset is that the information contained in the personal, contribution and tax files may be matched thanks to the existence of a unique identification number for each person and employer. Nevertheless, this procedure is not easy⁸. Once all the information contained in those files is linked, it is possible to know the number of days spent in each state –employment and non-employment– within the year and to calculate daily amounts received from each types of income. In particular, we obtain daily wages by dividing the amount of wages and salaries by the number of days of work within the year for each worker.

Since the database does not include the number of working hours, we cannot calculate hourly wages, which is a more used measure of earnings in wage inequality studies. However, even when this information is available, many researchers prefer to use monthly or daily earnings rather than hourly wages in order to avoid the measurement error that is typically associated with hours worked (Abadie, 1997). In spite of that, we must mention that using daily wage data involve one sort of distortion that is due to hours differentials in labour supply: daily wages can differ between two, otherwise identical, individuals just because one of them supplies more hours than the other. However, the low flexibility in working hours in the Spanish economy, the small proportion of part-time employment (less than 15 percent) and the fact that the database provides us with a variable on the degree of “partiality” for each contract (for part-timers) minimise that problem.

⁶ The database does not suffer from lack of representativeness of (legal) immigrants. According to the data used in this paper, the share of foreign-born workers was 15 percent in 2010, a figure fully comparable with any other source. However, the fact that some foreign-born people may change visa implies a change of the identification code that might affect the link of files in a panel analysis. In principle, this should not affect our results since we are using cross sections between 2005 and 2010. Nevertheless, we have decided to use a combined variable of place of birth and citizenship, which enriches the analysis, to take account of the fact that a portion of foreign-born people have become Spanish citizens. In addition, it is worth noting that labour market experience and tenure variables are in general shorter for foreigners than for Spanish-born workers because a large proportion of the former entered the country in the last two decades. These potential shortcomings on foreigners’ data have not avoided the use of the MCVL to investigate issues on the longitudinal effects of immigration though (see, for instance, Izquierdo *et al.*, 2009).

⁷ As a matter of example, Hospido and Bonhomme (2012) point out that the proportion of top-coded observations using the ‘contribution base’ information is substantial, so the 90/10 ratio is censored during the whole period of their analysis.

⁸ Arranz and García-Serrano (2011) thoroughly describe this procedure and suggest some recommendations for the mining of the data and its use for the analysis of issues related to the labor market and income distribution.

2.2. Basic descriptives

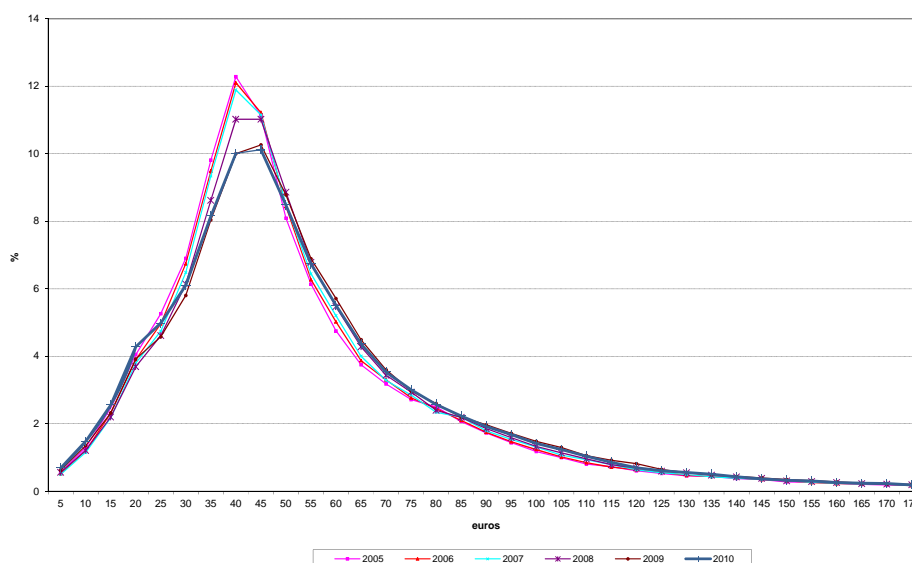
We restrict our analyses to a subsample of wage and salary earners registered with the General System of Social Security, aged between 16 and 59 (to avoid complications associated with early retirement), who are not employed in the agricultural sector. Thus, self-employed individuals have been excluded from the sample. We have also deleted observations with incorrect information on the date of start or end of employment spells. This leaves us with 3,257,535 individuals (524,441 in 2005, 545,541 in 2006, 563,895 in 2007, 563,863 in 2008, 536,466 in 2009 and 523,329 in 2010)⁹.

As a consequence of the economic crisis starting at the end of 2007, which hit hard construction and, to a lesser extent, manufacturing, there were important changes in the composition of salaried employment. The shares of men, individuals aged 16-30, workers holding fixed-term contracts and the ones working in manual jobs (in particular, those in low-skilled positions) were lower in 2010 compared with 2005. Moreover, average labour market experience and job tenure increased since employment destruction concentrated in positions occupied by workers with less experience and seniority. This was essentially the opposite to what happened during the last expansion, when the shares of young men (and women) and jobs in construction increased. The number of workers with temporary contracts and in low-skilled jobs also increased, although the shares of temporary employment and low-skilled positions did not change dramatically.

The mean daily wage was 58.0 euros in 2005 and 61.8 euros in 2010 (in constant euros of 2006). However, these averages hide quite a lot of diversity. Wages are higher for male, older and native-born individuals; workers holding open-ended contracts and having longer labour market experience and seniority; and the ones working in certain industries (manufacturing and energy, transport and collective services) and workplaces (large companies, corporations and public firms).

To capture changes in the wages distribution apart from shifts in the mean wages, Figure 1 displays the distribution for each year of the period 2005-2010. They show the usual bell shape with a long tail to the right. The mode is located around 40 euros (in 2004-2007) and 45 euros (in 2008-2010), with approximately 10-12 percent of employees obtaining that amount and around 40 percent obtaining between 35 and 50 euro. The yearly distributions for the period 2005-2007 almost entirely overlap, while the ones corresponding to 2008 and, above all, 2009-2010 have less mass below the mode (in particular, in the lower-middle part of the distribution) and seem to have shifted to the right. These findings indicate that the impact of the employment crisis has affected relatively more those workers in jobs with lower wage levels and suggest an increase in wage inequality.

Figure 1
REAL DAILY WAGE DISTRIBUTIONS. SPAIN (MCVL, 2005-2010)



⁹ Descriptive statistics used in this subsection are available from the authors upon request.

This is confirmed by Table 1, which reports basic indicators characterising the wages distribution. In the literature, wage inequality is usually discussed with respect to the ratios of the 10th, the 50th and the 90th deciles (d10, d50 and d90), respectively. These are given in the table together with the ten deciles. Increases of the real wages seemed to be higher in the upper half of the distribution, at least since the beginning of the crisis: the d90/d10 ratio, which declined in 2005-2007, rose from 5.34 in 2007 to 6.07 in 2010 (a 12 percent). Moreover, the increase in overall inequality occurred rather at the lower half of the distribution: the d90/d50 measure did not change throughout all the period, whereas the d50/d10 ratio declined a bit until 2007 and then increased from 2.70 to 3.05 (a 13 percent). This is further confirmed by the changes of the d70/d30 and the d100/d10 ratios.

Table 1
BASIC INDICATORS OF THE WAGE DISTRIBUTION (constant euros of 2006).
SPAIN (MCVL, 2005-2010)

	2005-2010		2005		2006		2007		2008		2009		2010	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Real daily wage (€)	61.4	322.8	58.0	221.5	60.6	361.4	62.6	431.9	61.6	295.7	63.4	304.3	61.8	270.5
Deciles (€)														
d10	15.0	5.2	14.8	5.1	15.3	5.2	15.6	5.3	15.4	5.4	14.9	5.3	14.2	5.1
d20	26.6	2.4	25.9	2.3	26.5	2.3	27.0	2.3	27.2	2.4	26.9	2.6	25.8	2.6
d30	33.3	1.5	32.4	1.5	33.0	1.5	33.4	1.5	33.9	1.5	34.0	1.7	33.1	1.7
d40	38.0	1.3	36.9	1.2	37.5	1.2	37.9	1.2	38.7	1.3	39.2	1.4	38.4	1.4
d50	42.5	1.3	41.0	1.2	41.6	1.2	42.1	1.3	43.1	1.3	44.1	1.4	43.3	1.4
d60	47.7	1.7	45.7	1.6	46.4	1.6	47.1	1.7	48.3	1.7	49.7	1.9	48.9	1.8
d70	54.8	2.4	52.5	2.4	53.3	2.4	54.1	2.4	55.3	2.4	57.1	2.5	56.3	2.5
d80	65.6	4.0	63.2	3.9	63.8	3.9	64.8	4.0	66.0	4.0	68.3	4.2	67.4	4.1
d90	84.1	7.2	81.0	6.7	81.7	6.8	83.2	7.1	84.7	7.3	87.9	7.5	86.3	7.3
d100	205.9	1007.7	186.1	685.0	207.3	1131.0	220.8	1354.4	203.3	921.1	211.7	947.6	204.3	839.7
Dispersion indicators														
d90/d10	5.60		5.46		5.36		5.34		5.49		5.90		6.07	
d90/d50	1.98		1.98		1.96		1.98		1.96		1.99		1.99	
d50/d10	2.83		2.76		2.73		2.70		2.80		2.96		3.05	
d70/d30	1.65		1.62		1.62		1.62		1.63		1.68		1.70	
d100/d10	13.69		12.53		13.58		14.16		13.18		14.21		14.38	
Observations	3,257,535		524,441		545,541		563,895		563,863		536,466		523,329	

Furthermore, Table 2 reports yearly real growth rates of earnings distinguishing by deciles. While wages at the bottom of the distribution (d10 and d20) fell over the whole period, the salaries above the median rose by more than 6 percent. This overall change hides the existence of a certain relationship between the growth rates of wages by deciles and the business cycle though: wage earnings rose more rapidly during the upswing and fell during the downturn for the lower deciles, whereas they grew less during the expansion and more during the recession for the upper deciles. However, in 2010 wage earnings fell for all the deciles, in particular for those at the bottom of the distribution.

Table 2
YEARLY GROWTH RATE OF REAL DAILY WAGES BY DECILES. SPAIN (MCVL, 2005-2010).

	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	2005-2010
d10	2.8	2.1	-1.1	-3.4	-4.6	-4.3
d20	2.3	1.9	0.7	-1.2	-4.1	-0.6
d30	1.7	1.3	1.4	0.5	-2.8	2.1
d40	1.5	1.2	2.0	1.4	-2.1	4.0
d50	1.5	1.2	2.4	2.2	-1.7	5.6
d60	1.5	1.5	2.5	2.8	-1.6	6.8
d70	1.3	1.6	2.3	3.3	-1.5	7.1
d80	1.0	1.5	1.9	3.5	-1.4	6.6
d90	0.9	1.8	1.8	3.8	-1.8	6.5
d100	11.3	6.9	-8.3	4.2	-3.5	9.7
Total	4.6	3.4	-1.8	2.9	-2.5	6.5

3. ECONOMETRIC METHODS

As we are interested in analysing the magnitude of wage differentials across individuals over time, our strategy rests upon the estimation of extended wage equations (Mincer, 1974) for each year of the period 2005-2010:

$$Y_i = \alpha + x_i\beta + \varepsilon_i \quad (1)$$

where Y_i represents the logarithm of the gross real daily wages (deflated to 2006 prices by the consumer prices index) of individual i ; X_i stands for a vector of personal, job and workplace characteristics (gender, citizenship/place of birth, labour market experience, type of contract, occupational category, job tenure, working time, region, firm size, industry affiliation and type of employer); β is a vector of parameters to be estimated; and ε_i is a random disturbance term.

However, mean (least squares) regression does not allow one to document the heterogeneity in the way wages respond to variations in the variables which are expected to affect them, since they estimate the conditional mean of wages given the explanatory variables. Therefore, if we want to study the effect of each covariate along the whole distribution and, consequently, estimate the influence of workers and employers heterogeneity on wages, we need a different technique. Quantile Regression (QR) provides a suitable framework in this context, since it allows the impact of a regressor on particular points (at the bottom, median and top) of the conditional distribution of wages to be estimated. With this technique we can describe how the wages of those who are low earners or high earners within their groups of population vary with changes in the covariates that define those groups.

In this sense, by combining OLS with QR we can assess the impact of a set of personal, job and workplace attributes on wage inequality between and within groups (Buchinsky, 1994; Budría and Pereira, 2011): while OLS estimates measure the average wage differential between groups (conditional on observable characteristics), differences in quantile coefficients represent the (within) wage differential induced by each attribute between individuals that are in the same group but located at different quantiles.

Following the model proposed by Koenker and Bassett (1978), the QR model can be expressed as:

$$Y_i = x_i\beta_q + \varepsilon_{qi}, \quad \text{with } Q_q(Y_i | X_i) = x_i\beta_q \quad (2)$$

where $Q_q(Y_i | X_i)$ denotes the quantile q of the outcome Y conditional on the vector of covariates X .

The q_{th} QR estimator $\hat{\beta}_q$ minimizes over β_q the objective function (Cameron and Trivedi, 2005, 2010):

$$Q(\beta_q) = \sum_{i:y_i \geq x_i\beta} q |y_i - x_i\beta_q| + \sum_{i:y_i < x_i\beta} (1-q) |y_i - x_i\beta_q| \quad (3)$$

where $0 < q < 1$, and different choices of q estimate different values of β . The objective function (3) is not differentiable, so the usual gradient optimization cannot be applied. This problem is solved using linear programming methods. The estimator that minimizes $Q(\beta_q)$ is one with well-established asymptotic properties. The QR estimator is asymptotically normal under general conditions (Cameron and Trivedi, 2005).

4. WAGE DIFFERENTIALS AND DISPERSION

Table 3 reports OLS and QR estimates of the effects of individual, job and firm characteristics on mean wages (equation (1)) and on wages deciles (equation (2)), respectively, using pool data for the period 2005-2010. While the estimated coefficients of the latter measure the impact of each covariate on different points of the wage distribution, the former are presented to allow a comparison with the effects upon the mean. This table also reports the 90th-10th spread for each covariate.

Table 3
POOL OLS AND QR ESTIMATES OF LOG REAL DAILY WAGES. SPAIN (MCVL, 2005-2010)

	OLS	Percentiles									90 th -10 th
		10th	20th	30th	40th	50th	60th	70th	80th	90th	
Gender											
Men (&)	—	—	—	—	—	—	—	—	—	—	—
Women	-0.171	-0.114	-0.120	-0.130	-0.140	-0.153	-0.168	-0.184	-0.202	-0.227	-0.114
Citizenship/Place of birth											
Spanish born in Spain (&)	—	—	—	—	—	—	—	—	—	—	—
Spanish not born in Spain and double citizenship	0.001	-0.009	-0.005	-0.003	-0.003	0.000	0.001	0.004	0.009	0.014	0.023
UE and developed countries	0.063	0.052	0.060	0.062	0.063	0.065	0.064	0.066	0.068	0.064	0.013
Developing countries	0.017	0.011	0.026	0.032	0.036	0.037	0.036	0.035	0.030	0.013	0.002
Labour market experience											
<4 years (&)	—	—	—	—	—	—	—	—	—	—	—
4-10 years	0.075	0.109	0.093	0.080	0.072	0.067	0.062	0.057	0.051	0.039	-0.070
>10 years	0.163	0.168	0.152	0.141	0.137	0.136	0.137	0.140	0.143	0.144	-0.024
Job tenure											
< 6 months (&)	—	—	—	—	—	—	—	—	—	—	—
≥6 months and <1 year	0.044	0.056	0.045	0.041	0.038	0.037	0.036	0.036	0.036	0.032	-0.024
≥1 year and <3 year	0.073	0.077	0.063	0.059	0.056	0.056	0.058	0.061	0.064	0.062	-0.015
≥3 years and <6 years	0.120	0.104	0.094	0.094	0.096	0.099	0.104	0.110	0.114	0.111	0.007
≥6 years	0.207	0.171	0.165	0.169	0.175	0.183	0.193	0.202	0.209	0.204	0.033
Job category											
WCHS	0.809	0.629	0.652	0.676	0.702	0.734	0.775	0.833	0.916	1.047	0.418
WCMS	0.518	0.356	0.378	0.412	0.447	0.483	0.521	0.562	0.614	0.708	0.352
WCLS	0.216	0.167	0.156	0.159	0.166	0.179	0.196	0.218	0.250	0.310	0.143

(*Sigue*)

(Continuación)

	OLS	Percentiles									90 th -10 th
		10th	20th	30th	40th	50th	60th	70th	80th	90th	
BCHS	0.134	0.157	0.132	0.122	0.117	0.115	0.116	0.119	0.129	0.149	-0.007
BCMS	0.079	0.100	0.079	0.071	0.066	0.064	0.064	0.066	0.070	0.078	-0.022
BCLS(&)	—	—	—	—	—	—	—	—	—	—	—
Contract type											
Open-ended (&)	—	—	—	—	—	—	—	—	—	—	—
Temporary per task / Others	-0.031	-0.052	-0.045	-0.041	-0.037	-0.035	-0.032	-0.030	-0.029	-0.021	0.032
Casual	0.024	0.021	0.015	0.013	0.008	0.005	0.004	0.001	0.002	0.010	-0.011
Working time											
Full-time (&)	—	—	—	—	—	—	—	—	—	—	—
Part-time (>1/2 working time)	-0.382	-0.434	-0.422	-0.408	-0.397	-0.387	-0.376	-0.365	-0.358	-0.353	0.081
Part-time (1/2 working time)	-0.597	-0.673	-0.666	-0.658	-0.648	-0.635	-0.619	-0.598	-0.565	-0.503	0.170
Part-time (<1/2 working time)	-1.003	-1.529	-1.299	-1.174	-1.078	-0.986	-0.894	-0.785	-0.655	-0.490	1.039
Firm size											
0	0.091	0.021	0.050	0.064	0.075	0.083	0.090	0.097	0.109	0.129	0.108
1-4 workers (&)	—	—	—	—	—	—	—	—	—	—	—
5-9 workers	0.046	0.054	0.043	0.037	0.035	0.034	0.033	0.033	0.034	0.040	-0.014
10-19 workers	0.075	0.075	0.065	0.060	0.058	0.058	0.058	0.060	0.065	0.076	0.001
20-49 workers	0.111	0.104	0.095	0.092	0.091	0.091	0.094	0.097	0.104	0.116	0.012
50-99 workers	0.161	0.149	0.141	0.139	0.141	0.145	0.150	0.154	0.161	0.170	0.021
100-499 workers	0.218	0.212	0.205	0.204	0.207	0.212	0.216	0.219	0.226	0.230	0.017
+500 workers	0.275	0.293	0.278	0.271	0.269	0.267	0.266	0.265	0.268	0.260	-0.033
Ownership											
Natural person (&)	—	—	—	—	—	—	—	—	—	—	—
Corporation	0.145	0.112	0.115	0.122	0.127	0.132	0.138	0.145	0.154	0.169	0.056
Other types of company	0.043	0.034	0.032	0.033	0.034	0.035	0.038	0.041	0.046	0.051	0.017
Workers' cooperatives and similar	0.121	0.063	0.090	0.109	0.121	0.133	0.145	0.157	0.167	0.170	0.107
Public sector	0.201	0.249	0.244	0.232	0.218	0.208	0.198	0.188	0.176	0.150	-0.099
Years											
2005 (&)	—	—	—	—	—	—	—	—	—	—	—
2006	0.019	0.020	0.018	0.018	0.017	0.017	0.017	0.017	0.018	0.018	-0.002
2007	0.033	0.034	0.032	0.031	0.031	0.031	0.029	0.029	0.028	0.029	-0.004
2008	0.052	0.051	0.051	0.051	0.052	0.053	0.052	0.053	0.054	0.056	0.005
2009	0.059	0.058	0.061	0.064	0.065	0.065	0.064	0.063	0.063	0.065	0.007
2010	0.040	0.043	0.045	0.047	0.048	0.047	0.047	0.046	0.045	0.046	0.003
Intercept	3.398	3.144	3.283	3.362	3.419	3.465	3.507	3.549	3.598	3.679	0.535
Observations	3,257,535	3,257,535									

Notes: 'Job category' is classified as: White-collar high-skilled occupations, WCHS (managers, workers with university degree, technical engineers and qualified assistants); White-collar medium-skilled occupations, WCMS (clerical and workshop heads and assistants); White-collar low-skilled occupations, WCLS (administrative officials and other clerical workers); Blue-collar high-skilled occupations, BCHS (first and second class officials); Blue-collar medium-skilled occupations, BCMS (third class officials and specialists); and Blue-collar low-skilled occupations, BCLS (labourers).

- '&' indicates the characteristics of reference; All models include a set of dummies on region (7) and industry affiliation (8);

All covariates are statistically significant at 1 percent except those parameters with ***.

Women earn less than otherwise comparable men on average. However, OLS overestimates the gender gap at the bottom and the median of the distribution and underestimates it at the top. At the same time, the within-groups dispersion is lower for women than for men. These findings are a bit different from those obtained previously by De la Rica *et al.* (2008) and Del Río *et al.* (2011) using Spanish data and Arulampalam *et al.* (2007) using the European Community Household Panel. In the latter case, the results for Spain show a sort of U-shaped gender pay gap; our results suggest that the Spanish case would be similar to other countries showing a different profile: in Denmark, Finland, France, Italy, the Netherlands and Germany the wage gap is higher in the 90th and 75th quantiles than in other parts of the wages distribution.

Although raw data show that foreigners (in particular, those coming from developing countries) earn less than Spaniards born in Spain, this wage differential vanishes once we control properly for personal, job and workplace attributes (in fact, it becomes positive for individuals from developed countries). Moreover, this happens throughout all percentiles of the conditional wages distribution. Two features of this result that are somehow at odds with much of the existing literature are worth noting. First, the mean immigrant-native wage differentials found in the empirical studies are usually negative (not positive) for non-native workers, although the penalty varies by gender and country of origin; but in some cases the penalty does not exist after taking account of their different observed characteristics (see Simón *et al.*, 2008; Billger and Lamarche, 2010). Second, the usual finding is that the negative effect of being an immigrant on earnings is not constant across the conditional wages distribution but tends either to increase (Chiswick *et al.*, 2008) or to diminish (Billger and Lamarche, 2010) monotonically in magnitude as wages rise.

Earnings rise monotonically with job tenure and labour market experience. However, the profile of the seniority pay gap differs across groups: earnings differentials diminish throughout the percentiles of the conditional wages distribution for less-tenured workers while they rise for more-tenured workers. This means that seniority is more valued in high-paid jobs, making within-groups dispersion higher for more-tenured workers (see the 90th-10th spread) and the wages distribution less compressed across seniority groups at the top than at the bottom and the median. In the case of labour market experience, however, the pattern of the pay gap is decreasing for all categories, which makes the wage spread lower for more-experienced workers.

Earnings also increase as we move up the occupational ladder¹⁰. Workers in non-manual jobs command higher wages than workers in manual jobs and those performing high-skilled tasks earn more than those performing low-skilled tasks. It is worth noting that occupational earnings differentials (compared with workers in blue-collar low-skilled jobs) exhibit a clear profile throughout the percentiles of the conditional wages distribution: they are increasing for non-manual occupations and show a U shape in the case of manual occupations.

Raw data suggest that wages of workers holding fixed-term contracts are lower than earnings of workers holding open-ended contracts and part-timers earn less than their full-time counterparts¹¹. Our results show that the differentials between temporary and permanent workers (documented by Jimeno and Toharia, 1993; Davia and Hernanz, 2004; and De la Rica *et al.*, 2004) tend to diminish substantially (or even to reverse, in the case of workers with casual contracts) after controlling for personal, job and workplace characteristics. Moreover, for those workers having temporary per-task or

¹⁰ 'Job category' is an administrative definition of the individual's occupation, but it also relates to education since it indicates a position in a ranking determined by the worker's contribution to the Social Security system, which depends partially on the individual's level of education. We have grouped it into six categories according to the type of tasks, skills and qualifications the job supposedly requires to properly perform it (see note to Table 3). Although this variable is not a perfect proxy for human capital, it has been previously used in other studies when no information on educational attainment is available in administrative datasets (Jenkins and García-Serrano, 2004; Alba *et al.*, 2007). The problem with the variable on educational attainment in the MCVL database is that it is only infrequently updated.

¹¹ There are various types of temporary contracts that firms may use: casual contracts (for sudden increases in the demand for goods and services), per-task or service contracts (for specific activities of limited duration not related to the 'usual' activity of the firm), training contracts (aimed at people under the age of 25 with low skills levels), work experience (practice) contracts (designed for people who have recently graduated from various educational programmes) and interim contracts (to substitute for workers having the right to return to the same job with the same employer).

other types of fixed-term contracts, the pay gap is somewhat decreasing throughout all percentiles of the conditional wages distribution. In the case of part-timers, not only their wages are lower than those of full-timers but also their within-groups dispersion is substantially larger (especially for those who work less hours).

Earnings tend to rise with employer size (Oi and Idson, 1999). Moreover, the profile of the size pay gap is roughly similar for nearly all groups of workers: the gap starts out higher than the average at the bottom of the distribution, decreasing up to the 50th percentile and increasing after it. The only difference corresponds to the workers in the largest firms: differentials decrease at the beginning of the distribution and remain nearly constant from the median to the top. As a consequence, larger firms tend to have a lower wage spread. Regarding the type of firms, workers in public firms earn more on average, but the effect of public ownership is much more relevant at the lower tail of the wage distribution: relatively low-paid workers earn more in public owned firms but the impact of this attribute dies out as we move along the wage distribution. This makes the wage spread to compress¹².

Finally, the coefficients of the yearly dummies indicate that the wage distribution has suffered a location shift (OLS estimates suggest that the average wage has been increasing over time, at least until 2009) but, at the same time, changes have not been uniform across the distribution (the wage dispersion declined in boom years but tended to increase in recession years)¹³.

5. EVOLUTION OF WAGE DIFFERENTIALS AND DISPERSION

Table A.1 and A.2 of the Appendix provide the results of the impact of the set of individual, job and firm characteristics on wages percentiles using 2005 (an expansion year) and 2010 (a recession year) data, respectively (OLS estimates of the effects of the explanatory variables on mean wages for each year of the period 2005-2010 are not provided but are available from the authors upon request)¹⁴. Moreover, Table 4 summarises the changes that have taken place in this period of time, making use of the estimates of QR to provide some measures of the marginal effect of the covariates on the dispersion of the wage distribution: it reports the changes in OLS coefficients (column (1)) and in the 90th-10th spread (column (2)), together with the changes at the two extreme deciles (columns (3) and (4)) and the difference in log wages at these deciles in both years (columns (5) and (6)). Our estimates of the marginal impact of the covariates on these measures are obtained simply by computing the differences of the QR coefficients at the relevant deciles. Column (2) can be obtained as the difference of either columns (3) and (4) or columns (5) and (6)¹⁵.

We have performed (results not shown but available upon request) a joint test of equality of coefficients at all quantiles and an F-test for the equality of coefficients at d90 and d10. Both hypotheses of equality are rejected with some minor exceptions. These results indicate that the quantile coefficients are not equal and the measure of dispersion is significant for most variables with the exception of some categories.

¹² Some authors (Simón, 2005) have found that there is a close correspondence across countries between inter-firm wage variability and the overall wage dispersion and that some countries (for instance, Spain) exhibit more dispersed employer wage differentials than other European countries despite having roughly similar wage-setting institutions.

¹³ The estimation of the models also includes a set of regional dummies. The results show the existence of relevant between- and within-groups differences: the regions with higher wages (Madrid and those in the northeast –Catalonia, Aragon and La Rioja) are, at the same time, the only ones where the 90th-10th spread is positive.

¹⁴ We have selected 2005 and 2010 as representative of the latest expansion and recession, respectively. GDP and employment growth remained high until 2007 but plunged rapidly in 2008. As a consequence, the unemployment rate, which had declined below 9 percent in 2005-2007, increased sharply to 18 percent at the beginning of 2009 and above 20 percent at the end of 2010.

¹⁵ The intercept of the model can be interpreted as the estimated conditional quantile function of the wage distribution of an individual with the reference attributes. The coefficients of the intercept shown in Tables A.1, A.2 and 4 suggest that the dispersion (measured by the difference between d90 and d10) of the reference group has remained quite stable during the period of analysis. Therefore, the comparison of the evolution of the dispersion of the other groups with respect to that of the reference group makes sense. We thank an anonymous referee for the suggestion on this point.

Table 4
CHANGES IN OLS AND QR EFFECTS. SPAIN, 2005 AND 2010

	Δ OLS	$\Delta(90d-10d)$	$\Delta(90d)$	$\Delta(10d)$	(90d-10d) en 2010	(90d-10d) en 2005
	(1)	(2)	(3)	(4)	(5)	(6)
Gender						
Men (&)	—	—	—	—	—	—
Women	0.030	-0.022	0.009	0.031	-0.118	-0.096
Citizenship/Place of birth						
Spanish born in Spain (&)	—	—	—	—	—	—
Spanish not born in Spain and double citizenship	0.012	0.034	0.031	-0.003	0.049	0.015
UE and developed countries	-0.029	-0.037	-0.041	-0.004	-0.005	0.032
Developing countries	-0.016	0.009	-0.020	-0.029	0.006	-0.003
Labour market experience						
<4 years (&)	—	—	—	—	—	—
4-10 years	-0.001	0.023	0.006	-0.017	-0.067	-0.09
>10 years	0.010	0.011	0.010	-0.001	-0.03	-0.041
Job tenure						
< 6 months (&)	—	—	—	—	—	—
\geq 6 months and <1 year	0.029	0.012	0.030	0.018	-0.013	-0.025
\geq 1 year and <3 year	-0.018	-0.011	-0.022	-0.011	-0.026	-0.015
\geq 3 years and <6 years	-0.018	-0.034	-0.041	-0.007	-0.015	0.019
\geq 6 years	-0.020	-0.039	-0.050	-0.011	0.005	0.044
Job category						
WCHS	-0.018	0.012	0.006	-0.006	0.418	0.406
WCMS	-0.039	-0.013	-0.031	-0.018	0.336	0.349
WCLS	-0.006	0.001	0.001	0.000	0.136	0.135
BCHS	0.010	-0.020	-0.004	0.016	-0.023	-0.003
BCMS	-0.001	-0.018	-0.006	0.012	-0.034	-0.016
BCLS(&)	—	—	—	—	—	—
Contract type						
Open-ended (&)	—	—	—	—	—	—
Temporary per task / Others	0.022	0.029	0.025	-0.004	0.041	0.012
Casual	0.030	0.042	0.050	0.008	0.014	-0.028
Working time						
Full-time (&)	—	—	—	—	—	—
Part- time (>1/2 working time)	0.001	0.000	0.002	0.002	0.08	0.08
Part- time (1/2 working time)	-0.043	-0.038	-0.055	-0.017	0.136	0.174
Part- time (<1/2 working time)	-0.100	-0.017	-0.115	-0.098	1.022	1.039
Firm size						
0	0.032	0.016	0.039	0.023	0.117	0.101
1-4 workers (&)	—	—	—	—	—	—

(*Sigue*)

(Continuación)

	Δ OLS (1)	Δ (90d-10d) (2)	Δ (90d) (3)	Δ (10d) (4)	(90d-10d) en 2010 (5)	(90d-10d) en 2005 (6)
5-9 workers	-0.004	0.019	0.006	-0.013	-0.004	-0.023
10-19 workers	-0.010	0.028	0.008	-0.02	0.011	-0.017
20-49 workers	-0.016	0.023	0.001	-0.022	0.017	-0.006
50-99 workers	-0.027	0.002	-0.021	-0.023	0.016	0.014
100-499 workers	-0.048	0.017	-0.036	-0.053	0.016	-0.001
+500 workers	-0.038	0.001	-0.037	-0.038	-0.041	-0.042
Ownership						
Natural person (&)	—	—	—	—	—	—
Corporation	-0.076	-0.055	-0.105	-0.05	0.032	0.087
Other types of company	-0.060	-0.048	-0.084	-0.036	-0.01	0.038
Workers' cooperatives and similar	-0.038	-0.037	-0.062	-0.025	0.099	0.136
Public sector	-0.031	-0.035	-0.049	-0.014	-0.063	-0.028
Intercept	0.088	0.022	0.114	0.092	0.583	0.561

Note: figures in this table are based on the results provided in Tables A.1 and A.2 of the Appendix.

Although women receive lower wages than men, the average gender wage gap has experienced a decrease between 2005 and 2010: from 18 percent to 15 percent. Moreover, the impact of gender on the wage distribution has not had a uniform evolution over the period of study, with gender differentials having diminished a bit for individuals earning wages at the bottom and the middle of the distribution but not for those at the top of the pay scale. As a consequence, the 90th-10th spread has fallen. Therefore, not only the gender wage gap has declined on average but the within-groups inequality among women has experienced a fall. Something similar has occurred with immigrant-native wage differentials and dispersion for the group of individuals coming from less developed countries: we have found that average pay gap and within-groups dispersion has declined. On the contrary, dispersion has increased for the other two groups of non-native workers.

The pay gaps associated with experience (evaluated at its average level) did not change much from 2005 to 2010, as it is apparent from OLS estimates. Therefore, its impact upon between-groups inequality only increased marginally. However, while wage differentials remained roughly constant on the mid-part of the distribution, they declined at the lower deciles and rose at the upper deciles, bringing about an increase of wage dispersion within all groups of workers classified according to their labour market experience. In the case of tenure, the results are basically the opposite. Although earnings rise with length of service, the pay gaps associated with tenure were lower in 2010 than in 2005: the mean earnings differential increased for workers at the bottom of the tenure distribution (less than 1 year) and declined for the rest. Moreover, earning differentials have declined substantially at the top of the distribution for nearly all seniority categories. This implies that there has been a significant fall of the return to tenure at the upper deciles, reducing the 90th-10th spread and the within-groups dispersion¹⁶.

The average occupational wage gap has remained nearly constant for all the job categories. However, the impact of qualification on the wages distribution has not had a uniform evolution over the period of study: while occupational differentials appear to have increased for individuals earning wages in the top of the distribution, they have fallen at the bottom. These patterns of change have resulted in a decline of the 90th-10th spread for all groups of workers classified according to their job category as compared with those in the bottom of the occupational ladder with the exception of

¹⁶ Simón (2009) essentially obtains the opposite effects of experience and tenure on average wage inequality when comparing a recession year (1995) and an expansion year (2002).

the white-collar high-skilled workers, suggesting a reduction of within-groups inequality for all of them and a rise for the latter. These results might be interpreted as if the incremental returns to having higher qualifications/education would have increased for the upper segments of the distribution. This is what Machado and Mata (2001) find for Portugal when comparing two years (1982 and 1994). Budría and Pereira (2011) also document a rise of the dispersion of earnings among high-educated workers for several European countries (Germany, Greece, France, Norway and Italy) during the 1990s.

If we consider the differences regarding labour contracts, the average wage gap declined for workers holding temporary per-task and other types of fixed-term contracts but increased for those having casual contracts. However, the pay gap increased at the top of the wage distribution from 2005 to 2010 for both groups of workers, making the 90th-10th spread and, therefore, the within-groups wage dispersion to rise. In the case of part-timers, the wage spread hardly changed but the mean wage gap increased substantially for those working less hours.

Regarding the effect of employer size, OLS estimates show that increases in the coefficients of the smallest firms (at least, until 2008) were accompanied by bigger decreases in the coefficients of the largest firms. Therefore, these changes in average employer-size pay gaps point out to a reduction of between-groups wage inequality until 2008 and an increase afterwards. However, changes within firm-size categories followed the opposite direction: the 90th-10th spread increased for all groups (it was only zero for the largest category). These changes were mainly due to an increase of the pay gap at the top of the distribution in the smallest categories and a higher reduction of the pay gap at the bottom than at the top of the distribution in the largest categories. These results suggest that wage dispersion rose within nearly all employer-size groups. As for the type of firms, the effect of working in private owned firms lowered substantially on average (the reduction concentrated in 2008-2010) but also relatively more at the lower tail of the wage distribution than at the top, making the wage spread to compress from 2005 to 2010¹⁷.

6. CHANGES IN THE WAGE DISTRIBUTION

After having presented the influence of various personal, job and employer attributes on wages at different points of the earnings distribution and the changes of their effects over time, we move on to analyse the conditional wage distribution and its evolution over the period of study. Accordingly, we pursue two exercises (see Machado and Mata, 2001).

The first one consists of comparing the wage distribution of a sample of individuals which are all identical with respect to the attributes considered in the models we have estimated previously. The first two columns of Table 5 report the results of this exercise. The estimates in each column were obtained using the regression coefficients and the regressors sample averages for the corresponding year (2005 and 2010, respectively). In addition, Table 6 displays the growth rate of wages (between 2005 and 2010) at different points of the conditional distribution in the second column; the corresponding figures for the empirical distribution are also shown for the sake of comparison in the first column.

In the second exercise, we try to provide a counterfactual depiction of what the wage distribution in a recession year (2010) would look like if the covariates would have remained constant at the average values of an expansion year (2005). Therefore, the last column of Table 5 presents the estimates obtained using the coefficients from the 2010 regressions but the 2005 average values of the covariates. Accordingly, the last column of Table 6 offers the estimates of the growth rate of wages at different points of the conditional distribution in this case.

¹⁷ As for the effect of the regional variable, we have obtained that the employment crisis has resulted in a rise of average earnings in the regions with higher wages (Madrid and the Northeast) and that the 90th-10th spread has increased in all of the regions but especially in those of higher wages.

Table 5
THE CONDITIONAL WAGE DISTRIBUTION (euros per day). SPAIN, 2005 AND 2010 (MCVL, 2005-2010)

	2005	2010	2010 at 2005 averages
Deciles			
d10	32.55	33.77	33.91
d20	37.35	38.86	38.84
d30	41.02	42.87	42.68
d40	44.52	46.66	46.27
d50	48.25	50.66	50.07
d60	52.65	55.30	54.45
d70	58.27	61.14	59.95
d80	66.12	69.64	67.91
d90	80.31	85.19	82.66
Dispersion			
d90/d10	2.47	2.52	2.44
d90/d50	1.66	1.68	1.65
d50/d10	1.48	1.50	1.48
d70/d30	1.42	1.43	1.40
Observations	524,441	523,329	523,329

Table 6
GROWTH RATES OF REAL WAGES BY DECILES (%). SPAIN, 2005 AND 2010 (MCVL, 2005-2010)

	Empirical	Conditional	Conditional at 2005 averages
d10	-4.31	3.76	4.19
d20	-0.58	4.05	3.99
d30	2.13	4.52	4.05
d40	4.04	4.80	3.93
d50	5.61	5.01	3.78
d60	6.89	5.05	3.42
d70	7.14	4.93	2.88
d80	6.66	5.32	2.71
d90	6.50	6.07	2.92

The first finding that merits a comment is that the conditional distributions are less dispersed than their empirical counterparts (compare Tables 1 and 5). This is unsurprising since part of the dispersion in the empirical distribution comes from the dispersion in workers' attributes across the sample.

Secondly, as we have already observed with the empirical distribution, the conditional distribution of wages has shifted to the right between both years. However, this shift has been somewhat more pronounced in the right than in the left tail: while the wages above the median were more than 5 percent higher in 2010 than in 2005, they were less than 4 percent higher in the first and second deciles. This led to a slight increase in earnings inequality, which was smaller than the one observed in the empirical distribution. In fact, the dispersion of the growth rates in the conditional distribution is far smaller than the corresponding dispersion in the empirical distribution, especially in the lower part of the distribution.

Finally, by comparing the two last columns of Tables 5 and 6, we will try to disentangle two types of factors that may have caused the estimated shifts in the conditional wage distribution: changes in the level of covariates and changes in the impacts of (or returns to) these characteristics. The information provided by the inequality indexes and the growth rates reveal that, although both changes contributed towards increased inequality, most of the estimated variation in the wage inequality was due to changes in the distribution of workers' and jobs' attributes rather than to an increased inequality within workers and jobs with the same characteristics. This means that the overall contribution of changes in returns is relatively modest as compared with changes in the way the average level of the covariates evolved. This result fits nicely with new evidence for the recession period (Hospido and Bonhomme, 2012, document that most of the inequality increase in 2007-2010 is explained by changes in labour force composition –by age and skills–)¹⁸.

Summing up, the impact of heterogeneity of workers and jobs in wage inequality is clearly documented with our results. If workers and jobs had been the same, wages would have increased more than they did at the bottom of the wage distribution and less at the top. Furthermore, if their attributes had remained constant from 2005 to 2010, the dispersion in wage growth between the bottom and the top would have been even smaller. In this case, dispersion would have not altered due to changes in the structure of pay.

7. CONCLUSIONS

This paper has analysed the changes in earnings inequality and the wage distribution that have taken place across the period 2005-2010 in Spain. We have made use of a large administrative data source (the 'Continuous Sample of Working Life'), one of whose main advantages is the possibility of matching individual records with jobs and earnings information: while the Social Security provides information on personal, job and workplace attributes, earnings data come from the Tax Administration National Agency. OLS and QR models have been estimated to measure wages differentials for a set of covariates and to examine the evolution of the effect of the regressors at different points of the wages distribution over time. Our results are as follows.

First, we have found the existence of substantial wages differentials across groups of workers, even after controlling for various characteristics: men, high-tenured and experienced individuals, workers in public and large firms and those working in white-collar high-skilled occupations (requiring more education and qualifications) earn more than otherwise similar workers. In general, wage differentials are more strongly associated with job and workplace attributes, so that workforce characteristics play a less influential part, a finding which agrees with previous evidence for several European countries including Spain (Simón, 2010). Moreover, our results suggest that certain categories of individuals (men, high-tenured workers, part-timers, those working in white-collar (high- and medium-skilled) jobs and in medium-sized privately-owned firms) show much larger wage dispersion than others.

Second, the effects of the covariates have not remained constant over time, having affected the between-groups but also the within-groups wage inequality. On the one hand, average earnings differentials have declined for much of the variables considered in our analysis: gender, citizenship, job category, seniority, employer size and type of firm. However, they increased (although not much) in the case of labour market experience and region. On the other hand, changes in the impacts of some job and workplace characteristics (labour contracts, region and employer size) contributed to higher wage dispersion, while others (tenure) made the distribution more equal.

Third, since the job category variable we use contains elements related to the education possessed by the individual and the skills required by the job, our results may be related to those of the literature on qualifications and wage inequality. What we have found is that skills bring about important between-groups wage differences and a positive impact on within-groups dispersion, since returns are higher at the upper segments of the distribution (as in Machado and Mata, 2001; Budría and Pereira, 2011).

¹⁸ Evidence for the upturn period seems controversial. While Simón (2009) finds that the biggest part of the reduction in wage inequality between 1995 and 2002 can safely be attributed to changes in the composition of the workforce and, above all, firms, Izquierdo and Lacuesta (2012) and Carrasco *et al.* (2011) contend that for the whole period 1995-2006 (and, in particular, for 2002-2006) that was not the case.



Moreover, the incremental returns to having higher qualifications have increased for the top deciles as a consequence of the impact of the economic and employment crisis. These results are roughly similar to the ones obtained for the regional dummies, in which case the workers in regions of higher wages substitute for the high-educated/qualified individuals.

Finally, with respect to the evolution of the wage distribution, we have found that between 2005 and 2010 increases of the real wages were higher in the upper half of the observed distribution (they were more intense during the downturn than during the upswing) than in the bottom (they have even declined in the recession) and that the increase in overall inequality occurred rather at the lower half of the distribution. These findings are corroborated by OLS estimates which suggest that, while the average wage has been increasing over time (at least, until 2009), changes have not been uniform across the earnings distribution, making the dispersion to fall during the boom but to rise during the downturn. Furthermore, although both the changes in the level of covariates and the changes in the impact of these characteristics contributed towards increased inequality, most of the estimated variation in the wage inequality was due to changes in the distribution of workers' and jobs' attributes rather than to an increased inequality within workers and jobs with the same characteristics.

APPENDIX

Table A.1
QUANTILE REGRESSION ESTIMATES OF LOG REAL DAILY WAGES. SPAIN (MCVL, 2005)

	OLS	Percentiles								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Gender										
Men (&)	—	—	—	—	—	—	—	—	—	—
Women	-0.180	-0.126	-0.131	-0.138	-0.148	-0.160	-0.172	-0.186	-0.200	-0.222
Citizenship/Place of birth										
Spanish born in Spain (&)	—	—	—	—	—	—	—	—	—	—
Spanish not born in Spain and double citizenship	-0.002	-0.009	-0.004	-0.002*	-0.002*	0.001*	0.001*	0.004	0.006	0.006
UE and developed countries	0.086	0.058	0.069	0.073	0.076	0.074	0.077	0.078	0.083	0.090
Developing countries	0.022	0.024	0.041	0.045	0.047	0.046	0.044	0.041	0.035	0.021
Labour market experience										
<4 years (&)	-	-	-	-	-	-	-	-	-	-
4-10 years	0.076	0.121	0.102	0.089	0.081	0.073	0.064	0.056	0.048	0.031
>10 years	0.163	0.178	0.159	0.149	0.143	0.138	0.137	0.134	0.136	0.137
Job tenure										
< 6 months (&)	—	—	—	—	—	—	—	—	—	—
≥6 months and <1 year	0.028	0.043	0.033	0.029	0.026	0.024	0.023	0.023	0.022	0.018
≥1 year and <3 year	0.088	0.092	0.079	0.074	0.071	0.072	0.075	0.079	0.083	0.077
≥3 years and <6 years	0.119	0.104	0.091	0.090	0.089	0.093	0.099	0.108	0.118	0.123
≥6 years	0.220	0.186	0.177	0.179	0.184	0.192	0.202	0.216	0.225	0.230
Job category										
WCHS	0.812	0.631	0.653	0.677	0.701	0.732	0.778	0.835	0.913	1.037
WCMS	0.538	0.368	0.392	0.428	0.465	0.501	0.539	0.580	0.630	0.717
WCLS	0.215	0.167	0.155	0.157	0.165	0.176	0.193	0.216	0.244	0.302
BCHS	0.130	0.154	0.127	0.115	0.109	0.106	0.109	0.117	0.126	0.151
BCMS	0.081	0.098	0.079	0.071	0.066	0.064	0.065	0.071	0.074	0.082
BCLS(&)	—	—	—	—	—	—	—	—	—	—
Contract type										
Open-ended (&)	—	—	—	—	—	—	—	—	—	—
Temporary per task / Others	-0.046	-0.051	-0.050	-0.050	-0.050	-0.052	-0.052	-0.050	-0.047	-0.039
Casual	0.009	0.017	0.009	0.006	-0.001*	-0.006	-0.011	-0.015	-0.017	-0.011
Working time										
Full-time (&)	—	—	—	—	—	—	—	—	—	—
Part-time (>1/2 working time)	-0.382	-0.434	-0.424	-0.412	-0.400	-0.390	-0.376	-0.365	-0.356	-0.354
Part-time (1/2 working time)	-0.578	-0.658	-0.656	-0.647	-0.632	-0.618	-0.599	-0.579	-0.544	-0.484
Part-time (<1/2 working time)	-0.961	-1.485	-1.259	-1.137	-1.045	-0.952	-0.864	-0.754	-0.618	-0.446

(*Sigue*)

(Continuación)

	OLS	Percentiles								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Firm size										
0	0.064	0.003*	0.032	0.044	0.054	0.062	0.069	0.073	0.086	0.104
1-4 workers (&)	—	—	—	—	—	—	—	—	—	—
5-9 workers	0.042	0.056	0.047	0.039	0.035	0.033	0.032	0.028	0.029	0.033
10-19 workers	0.072	0.081	0.071	0.064	0.060	0.058	0.057	0.056	0.058	0.064
20-49 workers	0.110	0.111	0.102	0.097	0.095	0.094	0.095	0.094	0.097	0.105
50-99 workers	0.162	0.152	0.146	0.147	0.149	0.150	0.155	0.155	0.159	0.166
100-499 workers	0.231	0.233	0.223	0.223	0.226	0.230	0.232	0.232	0.235	0.232
+500 workers	0.288	0.312	0.291	0.284	0.284	0.283	0.284	0.281	0.278	0.270
Ownership										
Natural person (&)	—	—	—	—	—	—	—	—	—	—
Corporation	0.188	0.141	0.138	0.143	0.151	0.160	0.170	0.183	0.200	0.228
Other types of company	0.074	0.054	0.047	0.048	0.050	0.054	0.059	0.066	0.075	0.092
Workers' cooperatives and similar	0.154	0.084	0.108	0.128	0.142	0.156	0.174	0.188	0.205	0.220
Public sector	0.228	0.245	0.241	0.237	0.230	0.228	0.230	0.230	0.228	0.217
Intercept	3.383	3.108	3.262	3.347	3.411	3.463	3.506	3.550	3.596	3.669
Observations	524,441	524,441								

Notes: See Table 3.

Table A.2
QUANTILE REGRESSION ESTIMATES OF LOG REAL DAILY WAGES. SPAIN (MCVL, 2010)

	OLS	Percentiles								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
Gender										
Men (&)	—	—	—	—	—	—	—	—	—	—
Women	-0.150	-0.095	-0.104	-0.113	-0.123	-0.138	-0.150	-0.166	-0.187	-0.213
Citizenship/Place of birth										
Spanish born in Spain (&)	—	—	—	—	—	—	—	—	—	—
Spanish not born in Spain and double citizenship	0.010	-0.012	-0.007	-0.003*	0.000*	0.004	0.007	0.014	0.020	0.037
UE and developed countries	0.057	0.054	0.055	0.056	0.057	0.058	0.056	0.054	0.055	0.049
Developing countries	0.006	-0.005	0.004*	0.010	0.015	0.018	0.016	0.019	0.015	0.001*
Labour market experience										
<4 years (&)	—	—	—	—	—	—	—	—	—	—
4-10 years	0.075	0.104	0.087	0.076	0.069	0.065	0.058	0.053	0.047	0.037
>10 years	0.173	0.177	0.159	0.149	0.144	0.144	0.142	0.144	0.146	0.147
Job tenure										
< 6 months (&)	—	—	—	—	—	—	—	—	—	—
≥6 months and <1 year	0.057	0.061	0.051	0.047	0.044	0.047	0.048	0.049	0.051	0.048
≥1 year and <3 year	0.070	0.081	0.062	0.056	0.051	0.051	0.052	0.055	0.057	0.055
≥3 years and <6 years	0.101	0.097	0.081	0.077	0.075	0.074	0.077	0.082	0.084	0.082
≥6 years	0.200	0.175	0.163	0.163	0.167	0.170	0.179	0.187	0.191	0.180
Job category										
WCHS	0.794	0.625	0.650	0.670	0.695	0.724	0.759	0.818	0.904	1.043
WCMS	0.499	0.350	0.367	0.401	0.435	0.467	0.498	0.540	0.592	0.686
WCLS	0.209	0.167	0.157	0.160	0.167	0.178	0.190	0.213	0.245	0.303
BCHS	0.140	0.170	0.148	0.139	0.133	0.126	0.123	0.123	0.132	0.147
BCMS	0.080	0.110	0.088	0.081	0.076	0.070	0.066	0.068	0.071	0.076
BCLS(&)	—	—	—	—	—	—	—	—	—	—
Contract type										
Open-ended (&)	—	—	—	—	—	—	—	—	—	—
Temporary per task / Others	-0.024	-0.055	-0.045	-0.040	-0.036	-0.032	-0.028	-0.025	-0.024	-0.014
Casual	0.039	0.025	0.020	0.020	0.017	0.013	0.015	0.019	0.024	0.039
Working time										
Full-time (&)	—	—	—	—	—	—	—	—	—	—
Part-time (>1/2 working time)	-0.381	-0.432	-0.425	-0.413	-0.399	-0.388	-0.376	-0.366	-0.358	-0.352
Part-time (1/2 working time)	-0.621	-0.675	-0.674	-0.667	-0.660	-0.651	-0.643	-0.626	-0.599	-0.539
Part-time (<1/2 working time)	-1.061	-1.583	-1.344	-1.218	-1.124	-1.036	-0.950	-0.848	-0.721	-0.561
Firm size										
0	0.096	0.026	0.053	0.066	0.079	0.086	0.095	0.105	0.118	0.143
1-4 workers (&)	—	—	—	—	—	—	—	—	—	—

(Sigue)



(Continuación)

	OLS	Percentiles								
		10%	20%	30%	40%	50%	60%	70%	80%	90%
5-9 workers	0.038	0.043	0.034	0.031	0.030	0.028	0.028	0.027	0.032	0.039
10-19 workers	0.062	0.061	0.053	0.052	0.050	0.052	0.053	0.058	0.060	0.072
20-49 workers	0.094	0.089	0.081	0.079	0.079	0.079	0.083	0.088	0.094	0.106
50-99 workers	0.135	0.129	0.123	0.121	0.120	0.124	0.129	0.135	0.139	0.145
100-499 workers	0.183	0.180	0.173	0.174	0.176	0.180	0.183	0.186	0.192	0.196
+500 workers	0.250	0.274	0.260	0.252	0.250	0.242	0.240	0.238	0.240	0.233
Ownership										
Natural person (&)	—	—	—	—	—	—	—	—	—	—
Corporation	0.112	0.091	0.092	0.094	0.099	0.104	0.108	0.112	0.115	0.123
Other types of company	0.014	0.018	0.016	0.013	0.013	0.012	0.012	0.012	0.010	0.008
Workers' cooperatives and similar	0.116	0.059	0.084	0.103	0.117	0.132	0.147	0.160	0.169	0.158
Public sector	0.197	0.231	0.234	0.226	0.219	0.214	0.209	0.201	0.192	0.168
Intercept	3.471	3.200	3.342	3.423	3.482	3.532	3.583	3.630	3.683	3.783
Observations	523,329	523,329								

Notes: See Table 3.

REFERENCES

- ABADIE, A. (1997): "Changes in the Spanish labour income structure during the 1980's: a quantile regression approach", *Investigaciones Económicas*, 21, 253-272.
- ABADIE, A.; ANGRIST, J. and IMBENS, G. (2001): "Instrumental variables estimates of the effect of subsidized training on the quantiles of trainee earnings", *Econometrica*, 70(1), 91-117.
- ALBA, A.; ARRANZ, J. M. and MUÑOZ-BULLÓN, F. (2007): "Exits from unemployment: recall or new job", *Labour Economics*, 14, 788-810.
- ANTONCZYK, D.; FITZENBERGER, B. and SOMMERFELD, K. (2010): "Rising wage inequality, the decline of collective bargaining and the gender wage gap", *Labour Economics*, 17(5), 794-826.
- ARIAS, O.; HALLOCK, K. and SOSA-ESCUADERO, W. (2001): "Individual heterogeneity in the returns to schooling: instrumental variables quantile regression using twins data", *Empirical Economics*, 26(1), 7-40.
- ARRANZ, J. M. and GARCÍA-SERRANO, C. (2011): "Are the MCVL tax data useful? Ideas for mining", *Hacienda Pública Española*, 199(4), 151-186.
- ARRANZ, J. M.; GARCÍA-SERRANO, C. and HERNANZ, V. (2012): "How do we pursue 'Labourmetrics'? An application using the MCVL", *Alcamentos, UAH Working Papers*, n.º 1201.
- ARULAMPALAM, W.; BOOTH, A. L. and BRYAN, M. L. (2007): "Is there a glass ceiling over Europe? Exploring the gender pay gap across the wages distribution", *Industrial and Labor Relations Review*, 60(2), 121-144.
- ATKINSON, A. B. (2008): *The changing distribution of earnings in OECD countries*, Oxford University Press, New York.
- AUTOR, D.; KATZ, L. and KEARNEY, M. (2006): "The polarization of the US labor market", *American Economic Review*, 96(2), 189-194.
- (2008): "Trends in US wage inequality: revising the revisionists", *Review of Economics and Statistics*, 90(2), 300-323.
- BILLGER, S. M. and LAMARCHE, C. (2010): "Immigrant heterogeneity and the earnings distribution in the United Kingdom and United States: new evidence from a panel data quantile regression analysis", *IZA, Discussion Paper* n.º 5260.
- BUCHINSKY, M. (1994): "Changes in U.S. wage structure 1963-1987: an application of quantile regression", *Econometrica*, 62(2), 405-458.
- (1997): "The dynamics of changes in the female wage distribution in the USA: a quantile regression approach", *Econometrica*, 13(1), 1-30.
- BUDRÍA, S. and PEREIRA, P. T. (2011): "Educational qualifications and wage inequality: evidence for Europe", *Revista de Economía Aplicada*, 56, 5-34.
- CAMERON, C. A. and TRIVEDI, P. K. (2005): *Microeconometrics: methods and applications*, Cambridge University Press.
- (2010): *Microeconometrics using Stata*, Stata Press (revised edition).

- CARRASCO, R.; JIMENO, J. F. and ORTEGA, C. (2011): "Accounting for changes in the Spanish wage distribution: The role of employment composition effects", *Working Papers*, n.º 1120, Bank of Spain, Madrid.
- CHISWICK, B.; LEE, A. T. and MILLER, P. W. (2008): "How immigrants fare across the earnings distribution in Australia and the United States", *Industrial and Labor Relations Review*, 61(3), 353-373.
- DAVIA, M. A. and HERNANZ, V. (2004): "Temporary employment and segmentation in the Spanish labour market: an empirical analysis through the study of wage differentials", *Spanish Economic Review*, 6, 291-318.
- DEL RÍO, C.; GRADÍN, C. and CANTÓ, O. (2011): "The measurement of gender wage discrimination: the distributional approach revisited", *Journal of Economic Inequality*, 9(1), 57-86.
- DE LA RICA, S. (2004): "Wage gaps between workers with indefinite and fixed-term contracts: the impact of firm and occupational segregation", *Moneda y Crédito*, 219, 43-69.
- DE LA RICA, S.; DOLADO, J. J. and LLORENS, V. (2008): "Ceilings or floors? Gender wage gaps by education in Spain", *Journal of Population Economics*, 21(3), 1432-1475.
- FITZENBERGER, B. and WILKE, R. A. (2010): "New insights into unemployment duration and posts unemployment earnings in Germany", *Oxford Bulletin of Economics and Statistics*, 72(6), 794-826.
- GARCÍA, J.; HERNÁNDEZ, P. and LÓPEZ-NICOLÁS, A. (2001): "How wide is the gap? An investigation of gender wage differences using quantile regression", *Empirical Economics*, 26(1), 149-168.
- GARDEAZÁBAL, J. and UGIDOS, A. (2005): "Gender wage discrimination at quantiles", *Journal of Population Economics*, 18, 165-179.
- GOSLING, A.; MACHIN, S. and MEGHIR, C. (2000): "The changing distribution of male wages in the U.K.", *Review of Economic Studies*, 67(4), 635-666.
- HOSPIDO, L. and BONHOMME, S. (2012): "The cycling of earnings inequality: Evidence from Spanish social security data", *Working Papers*, n.º 1225, Bank of Spain, Madrid.
- IZQUIERDO, M. and LACUESTA, A. (2009): "Assimilation of immigrants in Spain: A longitudinal analysis", *Labour Economics*, 16(6), 669-678.
- (2012): "The contribution of changes in employment composition and relative returns to the evolution of wage inequality: the case of Spain", *Journal of Population Economics*, 25(2), 511-543.
- JENKINS, S. P. and GARCÍA-SERRANO, C. (2004): "The relationship between unemployment benefits and re-employment probabilities: evidence from Spain", *Oxford Bulletin of Economics and Statistics*, 66, 239-60.
- JIMENO, J. F. and TOHARIA, L. (1993): "The effects of fixed-term employment on wages: theory and evidence from Spain", *Investigaciones Económicas*, XVII(3), 475-494.
- JIMENO, J. F.; IZQUIERDO, M. and HERNANZ, V. (2001): "La desigualdad salarial en España: descomposición y variación por niveles de salarios", *Papeles de Economía Española*, 88, 113-125.
- KATZ, L. and AUTOR, D. (1999): "Change in the wage structure and earnings inequality", in O. Ashenfelter and D. Card (eds.), *Handbook of Labor Economics*, 3A, North-Holland, Amsterdam.
- KOENKER, R. and BASSET, J. (1978): "Regression quantiles", *Econometrica*, 46(1), 33-50.
- KOENKER, R. and BILIAS, Y. (2001): "Quantile regression for duration data: a reappraisal of the Pennsylvania reemployment bonus experiment", *Empirical Economics*, 26(1), 199-220.
- LEMIEUX, T. (2008): "The changing nature of wage inequality", *Journal of Population Economics*, 21(1), 21-48.
- MACHADO, J. A. and MATA, J. (2001): "Earnings functions in Portugal 1982-1994: Evidence from quantile regressions", *Empirical Economics*, 26, 115-134.
- MARTINS, P. S. and PEREIRA, P. T. (2004): "Does education reduce wage inequality? Quantile regression evidence from 16 countries", *Labour Economics*, 11, 355-371.

- MINCER, J. (1974): *Schooling, experience and earnings*, New York: National Bureau of Economic Research.
- OECD (2007): *Employment Outlook 2007*, Paris.
- OI, W. and IDSON, T. (1999): "Firm size and wages", in O. Ashenfelter and D. Card (eds.), *Handbook of Labor Economics*, Vol. 3, Amsterdam: North Holland, 2166-2214.
- PALACIO, J. I. and Simón, H. (2004): "Dispersión salarial entre establecimientos y desigualdad salarial en España", *Revista de Economía Aplicada*, XII(36), 47-81.
- PIKETTY, T. and SÁEZ, E. (2006): "The evolution of top incomes: a historical and international perspective", *American Economic Review*, 96(2), 200-2005.
- PRIETO, J.; PESTANA, C. and VIEIRA, J. C. (2008): "What a quantile approach can tell us about returns of education in Europe?", *Education Economics*, 16(4), 391-410.
- SIMÓN, H. (2005): "Employer wage differentials from an international perspective", *Economic Letters*, 88, 284-288.
- (2009): "La desigualdad salarial en España: una perspectiva internacional y temporal", *Investigaciones Económicas*, 33(3), 439-472.
- (2010): "International differences in wage inequality: a new glance with European matched employer-employee data", *British Journal of Industrial Relations*, 48(2), 310-346.
- SIMÓN, H.; RAMOS, R. and SANROMÁ, E. (2008): "Labour segregation and immigrant and native-born wage distributions in Spain: an analysis using matched employer-employee data", *Spanish Economic Review*, 10(2), 135-168.