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6 August 2013

Online at <https://mpra.ub.uni-muenchen.de/48956/>
MPRA Paper No. 48956, posted 08 Aug 2013 16:50 UTC

PUBLIC-PRIVATE SECTOR WAGE DIFFERENTIALS IN SPAIN. AN UPDATED PICTURE IN THE MIDST OF THE GREAT RECESSION.

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ABSTRACT

Using the recent *Wage Structure Survey 2010*, this article examines the public-private sector wage gaps in Spain across the whole earnings distribution and the incidence of the gender gap in both sectors of the economy. Firstly, we find that there is positive wage premium to public sector employment which is not fully explained by employees' observable characteristics. Furthermore, this premium concentrates on low-skilled workers, while high-skilled individuals in the public sector suffer a pay penalty. Secondly, the gender gap is substantially larger in the private sector. Lastly, we analyse what happens in some specific activities, Education and Human health and social work, where both public and private sector coexist to a large extent. We discuss several explanations for these findings, coherent with international evidence, and the possible implications of the current process of downsizing of public sector employment associated to austerity measures.

KEYWORDS: wage gap, public sector, gender gap, quantile regression.

JEL CLASSIFICATION: J31, J45, J16, C21.

1. INTRODUCTION¹

The existence of an eventual wage premium to employment by the public sector with respect to the private one is a topic that not only has received attention from economic research but also from the general public. Although there are some qualifications, the existence of a wage premium to public sector employment represents quite an empirical regularity in labour market studies.² This topic has been under-researched in Spain mainly because data limitations, with most of available estimates dated between the late 80s and the middle 90s. The purpose of this article is to explore this issue in the Spanish case using a new source of earnings data, the *Wage Structure Survey 2010* (WSS 2010), aiming to cover this gap in the literature and to provide an up-to-date picture of the earnings gap between public and private sector employees. In this task, we explore both the average differential between both types of workers and the gap along the earnings distribution, disentangling the potential different gaps at different points of the distribution. In the light of these results, the implications of the measures fiscal consolidation carried out in Spain since May 2010, causing a reduction of both the volume of employment and the level of wages in the public sector, are discussed.

The rest of the article unfolds in four additional sections that follow this introduction. Section 2 briefly reviews the main reasons for the pervasive public-private sector wage differentials found in many developed countries and summarize the main previous literature for the Spanish case. The third section describes the characteristics, strengths and shortcomings of the database used in the analysis, while section 4 details the methodology of estimating such differences. Section 5 presents the main results and discuss their implications, while the last section, as usual, summarize the conclusions of the paper.

¹ Antón thanks financial support from the Spanish Ministry of Science and Innovation (project CSO2010-16413).

² For instance, in some developed countries (like Norway or Switzerland) there is an earnings penalty on public sector employees and the same applies in many cases to some types of jobs –particularly those requiring high skills- in a relevant number of countries. See, among other, Gregory and Borland (1999).

2. PUBLIC-PRIVATE WAGE DIFFERENTIALS IN HIGH-INCOME COUNTRIES

The surveys of Ehrenberg and Schwarz (1986), Bender (1998) and Gregory and Berland (1999) accounts for the main theoretical insights that explain the existence of a wage premium in the public sector. These works, jointly with the short literature review of recent progresses presented by Giordano *et al.* (2012), also summarize the main findings of empirical works disentangling the scope of the gap between public and private sector employees. According to these works there are several, non-competing, factors that might explain the existence of a positive wage premium enjoyed by public sector employees. Firstly, public sector usually doesn't have to compete with other firms in the production of public services. From this perspective, part of the monopoly power enjoyed by public administration might show in the enjoyment of economics rents by public employees. In the second place, following the argument displayed by Public Choice theorists, bureaucrats are rational agents with a utility function who maximize the budget under their control. In this respect, high wages contribute to the increase of the size of budgets. Thirdly, the pay premium would reflect the lack –or lower- level of gender discrimination in the public sector vis-à-vis the private sector. As female employees are overrepresented in public sector, the existence of lower discrimination would show directly into the existence of a wage premium. Fourthly, the public sector might have special interest in recruiting a highly educated workers compared with the requirements of the private sector, as a way to increase the prestige of public administration. Sixthly, a wage premium might simple reflect the prevalence worse working conditions -in terms of other non-monetary characteristics- of public sector jobs. If that was the case, according to the theory of compensating differentials, pay would have to be higher to compensate such more negative characteristics of the job. Seventhly, public employees, as voters, have a way of pressing their employers for higher wages that private sector workers do not have: their role as voters. Moreover, the large volume of public employees (14% of total employment in the OECD and more than 1/3 in countries such as Denmark or Sweden) increases the power of public employees as a pressure group. Linked to the previous argument, public sector usually has higher affiliation rates than private sector, leading to greater bargaining power

and better wages. For instance, according to the results of Visser (2006), who presents unionization rates for 15 developed countries in the public sector with respect to the private one, the rate of affiliation in the former is 2,15 times greater than in the latter (2,21 in Spain). In the eighth place, it is also worth mentioning the eventual measurement problems: the existence of different pay structures between the two sectors (public and private) might make the wage gap at a specific point in time or age an inadequate index of working life or even lifetime differences. In many cases, the access to specific civil servant jobs requires long years of (unpaid) preparation; in others, pay scales might be shorter in public service. Lastly, but certainly not least, the Administration might consider different (political) elements compared to the private sector when setting wages. The introduction of non-market consideration at the moment of fixing wages: decent pay, fair or living wages, equal pay, might lead to the development of a public sector wage premium. There is no reason whatsoever for the Public Administration, a political body, to follow the types of rules that govern the market (an economic body).

During the last three decades the estimation techniques used to calculate the public-private sector wage gap has progressively evolved towards complexity. Early works used Ordinary Least Squares (OLS) and a public-private sector dummy variable. This approach is refined, first, by the application of the Oaxaca-Blinder (OB) decomposition (Oaxaca, 1973; Blinder, 1973), which, modeling separately public and private sector earnings, allows splitting the average gap into a component associated to workers' characteristics and another one associated to structural differences in pay (differences in the coefficients, which is usually interpreted as the pure gap). An additional improvement in the analysis comes from the consideration of the eventual endogenous nature of sorting process into the public sector, that is, the fact that one person works in the public or private sector is not random and might depend of factors correlated with the variables that determine wages, making thus the estimators inconsistent. In a nutshell, the strategy of estimation widely followed to solve this problem is searching for an instrumental variable related to the sector of employment (public or private) but a priori exogenous to wages. Usually, these types of variables are used to estimate selection equations in models of endogenous switching. In

this respect, we can quote, among many others, the works of van der Gaag and Vijverberg (1988) for Ivory Coast or Hartog and Oosterbeek (1993) for the Netherlands. Furthermore, some authors, aiming to obtain estimates consistent for the whole population, control for self-selection into employment at the same time, as, for instance, Heitmuller (2006). Aiming to address the same kinds of problems, other studies are based on panel data and fixed-effects OLS (Disney and Gosling, 1998; Mueller, 2000) and the most recent ones combine fixed-effects and quantile regressions (Bargain and Melly, 2008; Campos and Centeno, 2012). Recent literature has tried to go beyond averages, focusing on exploring whether public-private sector pay differences are constant or change across the earnings distribution. For this kind of research, the most widely used tools are different types of econometric decompositions based in quantile regressions (mainly, the one proposed by Machado and Mata, MM, 2005) or propensity score matching (Ñopo, 2008). Melly (2005a) for Germany and Lucifora y Meurs (2006) for the United Kingdom, Italy and France exemplify the use of this technique. In this same framework, some authors have been able to control for the endogeneity of the employment decision (Cai and Liu, 2011) or the sector choice (Depalo and Giordano, 2011). To our knowledge, no study simultaneously accounts for both sources of endogeneity when assessing the pay gap along the whole wage distribution.

Regarding Spanish literature, the shortness of high-quality databases has limited the number of analyses of public-private sector wage differentials. The main findings of these works are summarized in Table 1. Most of works use data of the late 80s or the early 90s. Overall, all works point out to the existence of an average positive wage premium to public sector employment, larger among males than among females. In addition, the available evidence also suggests a larger gender gap, both raw and unexplained, in the private sector than in the public one. Regarding the source and causes of this gap, some studies point out to the role of observable characteristics, whereas others underline the role of the unexplained component of the gap, the “true” differential. Last, it is also worth mentioning that those works that study the gap by education or earnings level often find that the gap decreases at high levels of education or wage. Differences among the different results has

to do more with the different databases used in the analyses, econometric specifications, the observable variables included in the equations, and the reference group when computing the unexplained gap.³

It is convenient to provide the reader with several remarks about public employment in Spain. Among public sector workers, we can find civil servants, who access to employment by public examinations and whose working conditions are regulated by administrative legislation. There is a second sort of workers employed by the public authorities that we could call standard public employees. These workers have their working conditions determined by the labour legislation applicable to their private counterparts. This means that they are affected by collective bargaining, can work on under fixed-term contracts and can be dismissed following the same rules that operate in the private economies. They might belong to public administration at any level, just as civil servants, but they can also work for state-owned enterprises. Both types of public employees have been affected by the decentralization process carried out in Spain, started in the early 80s and intensified since the middle 90s that have involved activities as substantial as education and health care. In this respect, both regional and local authorities enjoy certain autonomy for determining the working conditions –including pay- of public sector workers.⁴

³ In the results summarized by the table, when several sorts of results are presented in the reviewed studies, we try to select those results that take the private sector as the reference group when calculating the unexplained differential. In the same fashion, when dealing with the gender gap, we present the results that take males as the reference. We discuss this issue in more detail in the methodology section. See, among others, Oaxaca and Ransom (1994) for a discussion about this issue.

⁴ See, for example, Muñoz de Bustillo and Antón (2013) for a summary of how the decentralization process has affected the distribution of public labour force by type of public administration.

Table 1. Main studies on the public-private sector wage gap in Spain

Study	Database	Methodology	Results
Alba and San Segundo (1995)	1990 complementary module of wages of the <i>Labour Force Survey</i>	Separate OLS regressions	Public-private sector gap: Raw gap of 50%. Similar returns to years of education in both sectors; secondary education are better paid in the private sector, while other levels are better remunerated in the public one.
García <i>et al.</i> (1997)	1991 <i>Class Structure, Conscience and Biography Survey</i>	Switching regression model with OB decomposition and quantile regressions with a dummy variable	Public-private sector gap Men Raw gap: 39% Unexplained gap: -19% The gap decreases at the top of the distribution and with schooling. Women Raw gap: 52% Unexplained gap: -67%
Ugidos (1997)	1988 <i>Survey of Wage Discrimination</i>	Switching regression model and control function with OB decomposition	Gender gap Public sector Raw gap: 19% Unexplained gap: 16% Private sector Raw gap: 33% Unexplained gap: 24%
Albert and Moreno (1998)	1991 <i>Class Structure, Conscience and Biography Survey</i>	Switching regression model and control function with OB decomposition	Public-private sector gap Raw gap: 16% Unexplained gap: -14%
Lassibille (1998)	1990-1991 <i>Basic Household Budgets Survey</i>	Switching regression model with OB decomposition	Public-private sector gap Men Raw gap: 31% Unexplained gap: -70% Women Raw gap: 70% Unexplained gap: -52%
Ullibarri (2003)	1991 <i>Class Structure, Conscience and Biography Survey</i>	Switching regression model	Public-private sector gap Men Raw gap: 34% Unexplained gap: -8% The gap decreases along the wage distribution. Gender gap Public sector Raw gap: 5% Unexplained gap: 4% Private sector Raw gap: 22% Unexplained gap: 23%
García-Pérez and Jimeno (2007)	1994-2001 <i>European Household Panel Survey</i>	Switching regression model with OB decomposition	Public-private sector gap Men Raw gap: 40% Unexplained gap: 60% Women Raw gap: 60% Unexplained gap: 45%
Muñoz de Bustillo and Antón (2012)	<i>Continuous Sample of Working Lives 2009 with tax information</i>	OB and MM decompositions	Public-private sector gap Men Raw gap: 17% Unexplained gap: 5% The gap decreases along the wage distribution. Gender gap Public sector Raw gap: 19% Unexplained gap: 18% Private sector Raw gap: 31% Unexplained gap: 23%
Giordano <i>et al.</i> (2012)	2004-2007 <i>European Union Statistics on Income and Living Conditions</i>	OLS with a dummy variable	Public-private sector gap Men Unexplained gap: 23% Women Unexplained gap: 26%
Hospido and Moral-Benito (2013)	<i>Continuous Sample of Working Lives 2010 with tax information</i>	MM decomposition	Public-private sector gap Men Raw gap: 29% Unexplained gap: inverted-U shaped, 26% at the median. Women Raw gap: 38% Unexplained gap: inverted-U shaped, 31% at the median.

Source: Authors' elaboration from the works quoted in the table.

The need for a new look at this topic in Spain is justified for three reasons. First, most of works are outdated. In this respect, a look at the impressive growth of public employment in Spain during the last decades makes this point clear (Muñoz de Bustillo and Antón, 2013). The devolution process commented above might have had implications on public-private sector gaps, which underlines the need for a recent portrait of earnings differentials. Furthermore, changes in the public sector wage policy (such as wage freezes in 1994 and 1997 and a lower nominal rate growth than in the private sector most of time) make advisable to re-estimate the public-private sector pay gap, now, with a more adequate and recent statistical database and a more ambitious methodology. Second, the most recent studies use databases that present quite serious problems when trying to estimate the public-private sector pay gap and, in any case, we provide a estimation with a new source that, as it is argued in the next section, present several advantages over other current alternatives. Lastly, it seems very relevant to have deep knowledge of the implications of public sector employment at the present turbulent times, when serious cutbacks of both remunerations and labour force in this sector are experiencing severe reductions.

3. DATA

As mentioned before, Spain has a long tradition of shortcomings in terms of earnings data. That has made quite difficult to present accurate and up-to-date information about public-private sector wage differentials. Recently, there has been some advancement in data collection that has opened new venues to address this issue. The first one is the introduction of wage information in the *Labour Force Survey* (LFS) by linking tax data with individual labour market data traditionally recorded by the LFS. Nevertheless, the wage data is made available only in a very aggregate fashion, giving information about the wage decile of the worker, making the information less than suitable for the purpose of this type of study.

The second is the *Continuous Sample of Working Histories* (CSWH), a sample of administrative records of the Spanish Social Security Administration linked to income tax data that allows identifying labour income and several basic job characteristics. This

database includes those public sector employees affiliated to the general regime of the Spanish pension system (around 70% of total public sector employees). The circumstance of being comprised by this pension system does not depend on a voluntary choice, but it is roughly random, partly based on historical reasons. However, it presents three relevant shortcomings for the purpose of a research that tries to assess earnings gaps controlling for human capital characteristics. Firstly, occupational group is barely available through an obsolete variable ideated in 1967, according to which many people in skilled jobs several decades ago might well be considered low-skilled employees nowadays. The second problem refers to the codification of education: this information consists in the level of schooling recorded in Local Registers in 1996 (with, literally, some random updates since then), in which the registration is not compulsory. This means not only that information on education cannot be representative but also that it is not accurate for those who did not have finished their studies by the middle nineties. The third problem has to do with the lack of information on working hours, although the database provides some information on whether employees hold part-time jobs.

The third source of improvement comes from the new wave of the *Wage Structure Survey* (WSS), of 2010, used by Muñoz de Bustillo and Antón (2012) and Hospido and Moral-Benito (2013). This survey is the main and most detailed source of information on labour earnings in Spain. Carried out by the National Statistics Institute on roughly a four-year basis and with a two-stage stratified sampling design, it contains information on monthly and annual wages earned by salaried employees in 2010 (INE, 2012). It is a survey of establishments and its sample exceeds 200,000 employees. The universe covered by this source includes both private and public sector workers –both civil servants and other types of public sector employees- in Industry, Construction and Services. Apart from the exclusion of Agriculture, livestock and fishing activities and domestic services and extraterritorial bodies (not included in the survey), the only restriction regarding public sector workers has to do with the fact that, in the sector Public Administration, Defence and Compulsory Social Security, only those public sector employees affiliated to the general

regime of the Social Security system are surveyed.⁵ In this respect, the problems of the data are tiny compared to the ones present in the rest of alternatives mentioned here: excluding the Public Administration, Defence and Compulsory Social Security, coverage of public employees is complete and, including this sector, more than 8 out of 10 public sector workers are comprised by the data source.⁶ Furthermore, the database contains accurate information on education, occupation and working time as well as it provides details on firm characteristics such as type of collective bargaining and firm's market target. The main disadvantage of using this database –which shares with the CSWH- has to do with the poor household and personal available information. Since it only includes details on employed people, it is not possible to control for selection associated to employment. Therefore, necessarily, results will be only representative for people in work. A second issue worth to be mentioned has to do with the impossibility of modelling the process by which an individual is employed by the public or the private sector. If the unobservable factors that affect sorting into public sector employment are correlated with non-observable characteristics determining earnings, then estimated coefficients in an econometric model of wages ignoring selection might be inconsistent. Nevertheless, a recent work of Melly and Puhani (2013) suggest that the main driver of public-private sector wage gap is structural rather than linked to self-selection. Furthermore, in order to model the sorting process, convincing instrumental variables (exclusion restrictions), affecting the probability of being employed in one or another sector but exogenous to wage determination, are

⁵ Standard public sector employees are affiliated to the general region of Social Security. Nevertheless, some civil and military servants join another scheme with different retirement conditions. The exceptions among civil servants refer to some jobs in Justice, Diplomacy and Public Administration, among others. They are usually jobs that do not have a private counterpart. See, for instance, López (2007) for details. Furthermore, apart from not affecting standard employees, it is not clear at all that the special conditions governing their scheme are beneficial for them. In this respect, it is not very likely that there might be a correlation between belonging this regime and unobservable characteristics linked to personal skills, particularly, after implementing extensive controls for observable characteristics.

⁶ According to the Spanish LFS of the 3rd quarter of 2010 (a quarter selected because the reference month for the WSS 2010 is October), there was no worker employed by the public sector in the domestic personnel sector, the presence of this type of workers is negligible in Agriculture, livestock and fishing activities and neither public nor private sector employee in extraterritorial bodies. According to the LFS, the percentage of public sector workers in the relevant sectors (leaving aside Agriculture, livestock and fishing activities and Activities of households as employers but including the partially covered Public Administration, Defense and Compulsory Social Security) is 22.2% of total employees, while the WSS 2010 gives a figure of 18.2%. Excluding the partially covered sector, coverage is complete.

needed.⁷ Unfortunately, this search can be cumbersome and most of the variables used in the Spanish literature are dubiously exogenous to earnings.⁸ In the worst of the cases, a descriptive interpretation of the results is possible and it is useful as long as it allows exploring some implications of the role of public sector employment in the labour market, for instance, its consequences on the gender pay gap or earnings inequality.

Finally, it is worth mentioning a recent comparative paper of the European Central Bank (Giordano *et al.*, 2012) –on which we have commented above– that explores the public-private sector wage gap in 10 European countries that includes Spain using the *European Union Statistics on Living Conditions* (EU-SILC). This database does not contain information on the type of employer (public or private), but the authors skip this problem comparing employees in Public Administration, Defence and Compulsory Social Security, Education and Health and Social Work with the rest of salaried workers. All the former are considered as employed by the public sector as a whole, while the latter are seen as employed exclusively in the private economy. In spite of the useful comparative perspective this paper, we think that this approach is not appropriate for a national case when better alternatives are available.

In sum, we think that, according to the reasons explained above, the database used in the article incorporates remarkable advantages and improvements over previous attempts of measuring public-private sector pay gaps in recent times in Spain. Particularly, it seems more appropriate than the CSWL and the EU-SILC.

⁷ In this respect, it is advisable to keep in mind that bad instruments –either weakly correlated with the endogenous right-hand side variable or dubiously exogenous to it– can make more harm than good (Bound *et al.*, 1995; Staiger and Stock, 1997; Angrist and Pischke, 2009; McKenzie *et al.*, 2010). For instance, if instruments are weak (weakly correlated with the potentially endogenous variables), the precision of estimates can dramatically diminish. Indeed, these sorts of issues might be behind the large variability of results for previous estimates of the gaps for Spain.

⁸ For instance, García *et al.* (1997) chooses marital status and whether the person is a household head as exclusion restrictions; Ugidos (1997), father's education; Albert and Moreno (1998), marital status; Lassibille (1998), marital status, family income and the demographic and economic structure of the household as instrumental variables; Pons and Blanco (2000), marital status, whether the father works or worked in the public sector; whether the mother works or worked and parents' schooling level; Ullibarri (2003), parents' education and sector of employment (public or private sector); finally, García-Pérez and Jimeno (2007) selects spouse's education and sector of affiliation, capital income and savings rate. In all these cases, there are good reasons for being skeptical about the exogeneity of the mentioned variables with respect to earnings.

4. METHODOLOGY

In order to investigate of the existence and size of wage differences between public and private sector employees a double methodology is followed. In first place, the well-known Oaxaca-Blinder decomposition (Oaxaca, 1973; Blinder, 1973) is used to estimate which part of the average gap is explained by differences in workers' observable characteristics and which one is associated to the different remuneration of such characteristics in both sectors. This strategy requires selecting a reference group whose returns to observable endowments are considered as standard or a reference. From a theoretical perspective, it is more appropriate referring to the earnings gap as the existence of a public sector wage premium rather than “discrimination” against private workers. Therefore, public employees are chosen as the reference group.⁹ Formally, the difference (Δ) between average log-hourly gross earnings of public and private sector earnings (w_1 and w_2) can be decomposed in the following way:

$$\Delta = \bar{w}_1 - \bar{w}_2 = (\bar{x}_{i1} - \bar{x}_{i2})b_2 + (b_1 - b_2)\bar{x}_{i1} = \Delta^{\text{explained}} + \Delta^{\text{unexplained}} \quad [1]$$

where x represents a set of worker and firm characteristics (including a constant), b is the vector of coefficients from an OLS regression of w on x for each group, and overbars denote means. The total gap can be decomposed into a gap explained to characteristics ($\Delta^{\text{explained}}$) and another unexplained by such endowments, or due to differences in returns to them ($\Delta^{\text{unexplained}}$). The first component refers to earnings differences observed if both types of workers had the same characteristics and public sector employees were paid as their private counterparts, whereas the second one has to do with the gap observed if workers employed by private firms had the same observable endowments as employees holding public jobs.

In addition, we explore, using the same strategy, in which sector male-female wage gaps not due to differences in productivity are narrower. In this case, it is reasonable to

⁹ This is the most common choice in the literature. For a discussion on the selection of the reference group, see Oaxaca and Ransom (1994).

consider that the reference group, which defines the returns to observable characteristics considered as standard, are male workers.

In second place, we try to disentangle how the premium or penalty evolves across the earnings distribution. Several approaches have been proposed to address this issue and compute the gaps conditioned on observable characteristics across the whole wage distribution. We follow the approach firstly proposed by Machado and Mata (2005), though we apply their method following the slightly modified but equivalent version suggested by Albrecht *et al.* (2003) and De la Rica *et al.* (2008), adapted to this case.¹⁰ The basic idea is to construct the counterfactual public sector wage distribution that would exist in the hypothetical case that public sector employees' characteristics were remunerated exactly at the same rate private employees get for their endowments. In more detail, the procedure unfolds as follows:

- 1) Estimate quantile regressions for 99 percentiles separately using the public and private sector employees' dataset, obtaining $b^1(q)$ and $b^2(q)$, respectively.
- 2) For each quantile, take a draw from the public workers' sample and compute the predicted log-wage at each quantile q using the estimated coefficients $b^1(q)$, i.e., obtain $x^1 b^1(q)$. Repeat the process, but applying estimated coefficients for private sector workers, $b^2(q)$, and compute the predicted log-wage $x^1 b^2(q)$.
- 3) Repeat step two M times and, in this way, obtain a counterfactual distribution of public sector employees that reflects their remunerations as if they were paid as private ones and the predicted distribution of public sector employees retaining their characteristics and specific returns. Following Albrecht *et al.* (2008), M is set to 100.

¹⁰ Other ways of analyzing unexplained wage gaps across the whole distribution have been proposed by DiNardo *et al.* (1996), based on semiparametric estimation methods, and Gardeazábal and Ugidos (2005) and Melly (2005b) using quantile regression.

- 4) Profiting from the linearity of quantile regression, calculate the counterfactual gap, that is, the wage differential associated with coefficients, as $x^l b^l(q) - x^l b^2(q)$.¹¹

Regarding quantile regressions, following Koenker (2005), the model to be estimated can be expressed in the following way:

$$w(q) = x\beta(q) + \varepsilon(q) \quad [3]$$

where w denotes hourly gross wages (in logs), x includes a set of employee's observable characteristics, β is the parameter to be estimated, which captures the proportional wage change in the q^{th} quantile conditional on x and ε_q is a disturbance satisfying $E(u(q) | x) = 0$. Therefore, one can write conditional population quantiles $Quant_q(w | X = x)$ as

$$Quant_q(w | X = x) = x\beta(q) \quad [4]$$

β can be consistently estimated by minimizing the sum of weighted absolute deviations using q and $1-q$ as weighting factors for positive and negative errors, respectively.

After determining the scope of public-private sector wage differentials we carried out a comparative assessment of the extent of the gender gap in the public and the private sector. In order to do so, as it is common in this type of analysis, the structure of remunerations of males is considered the reference. Therefore, being w^m and w^f the log-wage of male and female employees, the average wage gap can be expressed as

$$\Delta = \bar{w}_m - \bar{w}_f = (\bar{x}_{im} - \bar{x}_{if})b_m + (b_m - b_f)\bar{x}_{if} = \Delta^{\text{explained}} + \Delta^{\text{unexplained}} \quad [5]$$

Analogously, adapting the procedures described above, the unexplained difference between men and women at each quantile can be obtained as $x^f b^m(q) - x^f b^f(q)$. Computing these formulae for each economic sector, we can make some guesses about how the current downsize of public sector employment might affect the gender pay gap in Spain.

¹¹ Standard errors of this expression can be computed using the asymptotic expression for the covariance matrix suggested by Albrecht *et al.* (2008). We compute them but they are not showed in the figures in order to favour the clarity of the presentation. They are available from the authors upon request.

After carrying out all the proposed analysis, we study in detail what happens in two important sectors of activity where both the public and the private sector play an active role as employers: Education and Human health and social work.

5. PUBLIC-PRIVATE WAGE DIFFERENCES IN SPAIN

5.1 DESCRIPTIVE STATISTICS

First of all, several comments on the control variables are convenient. Although, as mentioned, the WSS 2010 does not contain information on household characteristics, we profit from reliable information on hourly gross wages (which is provided by the employers according to their registers) and a wide set of variables describing the work relationship and the activity of the firm and the context where it operates. In this respect, we use as much as information as possible taking into account the available variables and possible limitations in terms of observations when specifically assessing the situation in some sectors of activity like education and health. Particularly, the variables included in our analysis as controls in order to explore the earnings gaps are the following ones: age (3 dummies), education (7 dummies), nationality (a dummy), tenure (continuous), type of contract (indefinite or fixed-term, a dummy), part-time condition (a dummy), supervisory role at work (a dummy), firm size (2 dummies), sector of activity (14 dummies), occupation (8 dummies), type of collective agreement (4 dummies), firm's target market (3 dummies) and region (6 dummies). When diagnosing the situation in Education and Human health and social work, the variable occupation is recoded in 4 categories and the type of collective agreement and firm's target market are not included in the estimated equations because of problems of multi-collinearity.

As mentioned above, the coverage of the database in terms of public employment is remarkable, with only a fraction of public sector employees in Public Administration Defense and Compulsory Social Security excluded. The percentage of total employees in the public sector is 18.2% (15.2% among males and 21.7 among females). Particularly, in Education this proportion rises up to 38.5% (46.5% and 34.4% among men and women,

respectively). The main descriptive statistics (means and standard deviations) of all the variables used in the econometric analysis are presented in Tables 2-4. As usual in this kind of work, we restrict the empirical exercise to workers between 20 and 59 years old.

Table 2. Main descriptive statistics of the whole sample of employed population

	Men				Women			
	Private sector		Public sector		Private sector		Public sector	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Hourly gross wage (euros)	12.7	10.0	15.5	9.5	15.5	9.5	13.7	7.0
Monthly working hours	38.5	5.9	36.0	6.0	36.0	6.0	35.0	6.0
Age								
Aged 20-29	0.167	0.373	0.076	0.266	0.076	0.266	0.098	0.297
Aged 30-39	0.357	0.479	0.276	0.447	0.276	0.447	0.308	0.462
Aged 40-49	0.284	0.451	0.353	0.478	0.353	0.478	0.349	0.477
Aged 50-59	0.191	0.393	0.295	0.456	0.295	0.456	0.246	0.431
Education								
None	0.027	0.163	0.018	0.134	0.018	0.134	0.007	0.085
Primary	0.154	0.361	0.080	0.271	0.080	0.271	0.042	0.202
Lower secondary	0.282	0.450	0.206	0.405	0.206	0.405	0.140	0.347
Upper secondary	0.112	0.316	0.136	0.343	0.136	0.343	0.110	0.313
Lower vocational training	0.092	0.289	0.065	0.247	0.065	0.247	0.101	0.302
Upper vocational training	0.113	0.317	0.092	0.290	0.092	0.290	0.077	0.266
Short university degree	0.082	0.275	0.116	0.321	0.116	0.321	0.244	0.429
Long university degree and post-graduate studies	0.137	0.344	0.286	0.452	0.286	0.452	0.278	0.448
Foreign nationality	0.075	0.263	0.021	0.142	0.021	0.142	0.015	0.121
Tenure (years)	8.9	9.2	12.3	10.2	12.3	10.2	10.8	9.6
Temporary contract	0.197	0.398	0.269	0.443	0.269	0.443	0.388	0.487
Part-time contract	0.075	0.264	0.067	0.249	0.067	0.249	0.107	0.310
Supervisor	0.218	0.413	0.208	0.406	0.208	0.406	0.146	0.354
Firm size								
Less than 50 employees	0.367	0.482	0.104	0.305	0.104	0.305	0.091	0.288
Between 50 and 199 employees	0.282	0.450	0.203	0.403	0.203	0.403	0.158	0.365
200 or more employees	0.352	0.478	0.693	0.461	0.693	0.461	0.750	0.433
Activity								
Manufacturing and others: Mining and quarrying and Electricity, gas, steam and air conditioning supply	0.366	0.482	0.025	0.155	0.025	0.155	0.005	0.071
Water supply, sewerage, waste management and remediation activities	0.034	0.181	0.069	0.254	0.069	0.254	0.019	0.135
Construction	0.116	0.320	0.031	0.173	0.031	0.173	0.011	0.104
Wholesale and retail trade; repair of motor vehicles and motorcycles; Accommodation and food service activities	0.105	0.307	0.004	0.065	0.004	0.065	0.004	0.065
Transportation and storage	0.058	0.234	0.133	0.339	0.133	0.339	0.052	0.221
Information and communication	0.064	0.244	0.040	0.195	0.040	0.195	0.024	0.154
Financial and insurance activities	0.046	0.210	0.014	0.119	0.014	0.119	0.013	0.112
Real state activities	0.003	0.052	0.002	0.039	0.002	0.039	0.001	0.032
Professional, scientific and technical activities	0.059	0.236	0.067	0.250	0.067	0.250	0.064	0.244
Administrative and support service activities	0.082	0.274	0.015	0.122	0.015	0.122	0.015	0.123

Source: Authors' analysis from SES 2010.

Table 2. Main descriptive statistics of the sample (continued)

	Men				Women			
	Private sector		Public sector		Private sector		Public sector	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Activity								
Public administration and defence; compulsory social security	0.000	0.016	0.281	0.450	0.281	0.450	0.261	0.439
Education	0.008	0.087	0.107	0.309	0.107	0.309	0.128	0.334
Human health and social work activities	0.017	0.131	0.154	0.361	0.154	0.361	0.357	0.479
Arts, entertainment and recreation	0.023	0.149	0.041	0.199	0.041	0.199	0.030	0.170
Other service activities	0.020	0.139	0.017	0.128	0.017	0.128	0.017	0.130
Occupation								
Managers	0.044	0.205	0.031	0.173	0.031	0.173	0.016	0.126
Professionals	0.111	0.314	0.302	0.459	0.302	0.459	0.426	0.494
Technicians and associate professionals	0.197	0.397	0.168	0.374	0.168	0.374	0.145	0.352
Clerical support workers	0.079	0.270	0.131	0.337	0.131	0.337	0.194	0.395
Service and sales workers	0.088	0.283	0.135	0.341	0.135	0.341	0.144	0.351
Skilled agricultural, forestry and fish	0.005	0.067	0.009	0.095	0.009	0.095	0.002	0.042
Craft and related trades workers	0.220	0.414	0.084	0.277	0.084	0.277	0.005	0.072
Plant and machine operators, and assemblers	0.155	0.362	0.060	0.238	0.060	0.238	0.003	0.056
Elementary occupations	0.103	0.303	0.080	0.271	0.080	0.271	0.065	0.247
Collective agreement								
National and sectoral	0.314	0.464	0.108	0.311	0.108	0.311	0.098	0.298
Subnational and sectoral	0.414	0.493	0.127	0.333	0.127	0.333	0.170	0.376
Firm-level	0.204	0.403	0.466	0.499	0.466	0.499	0.288	0.453
Work centre-level	0.044	0.206	0.039	0.194	0.039	0.194	0.034	0.180
Other	0.024	0.153	0.259	0.438	0.259	0.438	0.410	0.492
Firm's target market								
Local or regional	0.337	0.473	0.649	0.477	0.649	0.477	0.721	0.448
National	0.465	0.499	0.266	0.442	0.266	0.442	0.226	0.418
European Union	0.073	0.261	0.013	0.113	0.013	0.113	0.008	0.088
World	0.125	0.331	0.072	0.259	0.072	0.259	0.045	0.208
Region								
North-West	0.124	0.329	0.109	0.312	0.109	0.312	0.113	0.317
North-East	0.163	0.370	0.105	0.307	0.105	0.307	0.110	0.313
Madrid	0.156	0.363	0.135	0.342	0.135	0.342	0.163	0.369
Centre	0.126	0.331	0.150	0.357	0.150	0.357	0.169	0.375
East	0.266	0.442	0.244	0.429	0.244	0.429	0.244	0.430
South	0.131	0.337	0.207	0.405	0.207	0.405	0.155	0.362
Canary Islands	0.035	0.183	0.050	0.217	0.050	0.217	0.046	0.210
Observations	98,142		15,581		70,178		18,331	

Source: Authors' analysis from SES 2010.

Table 3. Main descriptive statistics of the sample of population employed in Education

	Men				Women			
	Private sector		Public sector		Private sector		Public sector	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Hourly gross wage (euros)	17.4	12.3	14.5	13.5	13.8	10.7	13.6	5.0
Monthly working hours	26.9	12.1	29.6	11.1	26.2	11.2	31.6	9.2
Age								
Aged 20-29	0.132	0.339	0.112	0.315	0.200	0.400	0.133	0.339
Aged 30-39	0.389	0.488	0.342	0.474	0.351	0.477	0.336	0.472
Aged 40-49	0.301	0.459	0.349	0.477	0.279	0.449	0.347	0.476
Aged 50-59	0.178	0.383	0.197	0.398	0.170	0.376	0.185	0.388
Education								
None	0.004	0.063	0.001	0.025	0.008	0.088	0.000	0.021
Primary	0.020	0.140	0.007	0.085	0.049	0.215	0.019	0.136
Lower secondary	0.049	0.217	0.044	0.205	0.073	0.261	0.050	0.218
Upper secondary	0.060	0.238	0.111	0.315	0.050	0.219	0.112	0.316
Lower vocational training	0.031	0.173	0.014	0.119	0.056	0.231	0.014	0.116
Upper vocational training	0.059	0.235	0.041	0.198	0.075	0.263	0.032	0.176
Short university degree	0.222	0.416	0.141	0.348	0.274	0.446	0.287	0.452
Long university degree and post-graduate studies	0.555	0.497	0.640	0.480	0.414	0.493	0.486	0.500
Foreign nationality	0.079	0.270	0.034	0.182	0.058	0.234	0.020	0.142
Tenure (years)	7.9	8.2	8.8	8.2	7.4	8.4	9.0	8.4
Temporary contract	0.235	0.424	0.606	0.489	0.251	0.433	0.532	0.499
Part-time contract	0.392	0.488	0.278	0.448	0.461	0.499	0.209	0.407
Supervisor	0.162	0.368	0.140	0.347	0.129	0.336	0.150	0.357
Firm size								
Less than 50 employees	0.313	0.464	0.026	0.159	0.362	0.481	0.027	0.163
Between 50 and 199 employees	0.328	0.470	0.066	0.249	0.356	0.479	0.082	0.274
200 or more employees	0.360	0.480	0.908	0.289	0.282	0.450	0.891	0.312
Occupation								
High-skill white-collar	0.857	0.350	0.844	0.363	0.766	0.423	0.789	0.408
Low-skill white-collar	0.107	0.309	0.102	0.302	0.177	0.382	0.177	0.382
High-skill blue-collar	0.019	0.136	0.030	0.171	0.001	0.025	0.004	0.065
Low-skill blue-collar	0.017	0.131	0.024	0.153	0.056	0.230	0.030	0.170
Region								
North-West	0.088	0.284	0.096	0.295	0.087	0.282	0.097	0.297
North-East	0.186	0.389	0.091	0.287	0.198	0.399	0.104	0.305
Madrid	0.206	0.405	0.139	0.346	0.167	0.373	0.160	0.367
Centre	0.088	0.284	0.171	0.377	0.074	0.262	0.181	0.385
East	0.313	0.464	0.238	0.426	0.329	0.470	0.200	0.400
South	0.100	0.301	0.211	0.408	0.117	0.321	0.207	0.405
Canary Islands	0.019	0.136	0.054	0.226	0.027	0.163	0.050	0.218
Observations	748		1,663		1,648		2,342	

Source: Authors' analysis from SES 2010.

Table 3. Main descriptive statistics of the sample of population employed in Human health and social work activities

	Men				Women			
	Private sector		Public sector		Private sector		Public sector	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Hourly gross wage (euros)	11.9	12.8	19.5	12.0	8.9	6.2	15.3	8.0
Monthly working hours	36.0	7.8	36.3	4.8	33.4	9.0	35.4	4.8
Age								
Aged 20-29	0.176	0.381	0.077	0.267	0.211	0.408	0.101	0.302
Aged 30-39	0.365	0.482	0.235	0.424	0.314	0.464	0.274	0.446
Aged 40-49	0.256	0.436	0.331	0.471	0.287	0.453	0.326	0.469
Aged 50-59	0.203	0.402	0.357	0.479	0.187	0.390	0.299	0.458
Education								
None	0.025	0.157	0.010	0.101	0.016	0.125	0.005	0.068
Primary	0.141	0.348	0.096	0.295	0.099	0.299	0.041	0.199
Lower secondary	0.182	0.386	0.143	0.350	0.191	0.393	0.101	0.302
Upper secondary	0.084	0.278	0.049	0.216	0.065	0.247	0.049	0.216
Lower vocational training	0.122	0.327	0.073	0.260	0.237	0.425	0.187	0.390
Upper vocational training	0.091	0.287	0.056	0.229	0.097	0.295	0.080	0.271
Short university degree	0.157	0.363	0.176	0.381	0.190	0.392	0.340	0.474
Long university degree and post-graduate studies	0.198	0.399	0.398	0.490	0.105	0.306	0.196	0.397
Foreign nationality	0.073	0.260	0.026	0.158	0.078	0.268	0.013	0.113
Tenure (years)	6.9	7.4	12.6	9.7	5.8	6.8	11.6	9.8
Temporary contract	0.226	0.418	0.361	0.480	0.269	0.443	0.432	0.495
Part-time contract	0.169	0.375	0.036	0.186	0.346	0.476	0.074	0.261
Supervisor	0.189	0.392	0.149	0.356	0.137	0.344	0.095	0.293
Firm size								
Less than 50 employees	0.184	0.388	0.021	0.143	0.245	0.430	0.031	0.172
Between 50 and 199 employees	0.241	0.428	0.085	0.279	0.263	0.440	0.084	0.277
200 or more employees	0.575	0.494	0.894	0.307	0.492	0.500	0.886	0.318
Occupation								
High-skill white-collar	0.429	0.495	0.611	0.488	0.343	0.475	0.582	0.493
Low-skill white-collar	0.326	0.469	0.310	0.463	0.560	0.496	0.376	0.484
High-skill blue-collar	0.057	0.233	0.038	0.192	0.002	0.045	0.003	0.051
Low-skill blue-collar	0.187	0.390	0.040	0.197	0.095	0.293	0.040	0.196
Region								
North-West	0.077	0.267	0.112	0.315	0.122	0.327	0.121	0.326
North-East	0.152	0.360	0.093	0.291	0.148	0.355	0.107	0.309
Madrid	0.110	0.312	0.138	0.345	0.122	0.328	0.158	0.365
Centre	0.104	0.306	0.188	0.391	0.127	0.333	0.195	0.396
East	0.353	0.478	0.220	0.414	0.292	0.455	0.235	0.424
South	0.155	0.362	0.179	0.383	0.144	0.351	0.134	0.341
Canary Islands	0.047	0.213	0.071	0.256	0.045	0.207	0.050	0.218
Observations	1,706		2,407		6,489		6,546	

Source: Authors' analysis from SES 2010.

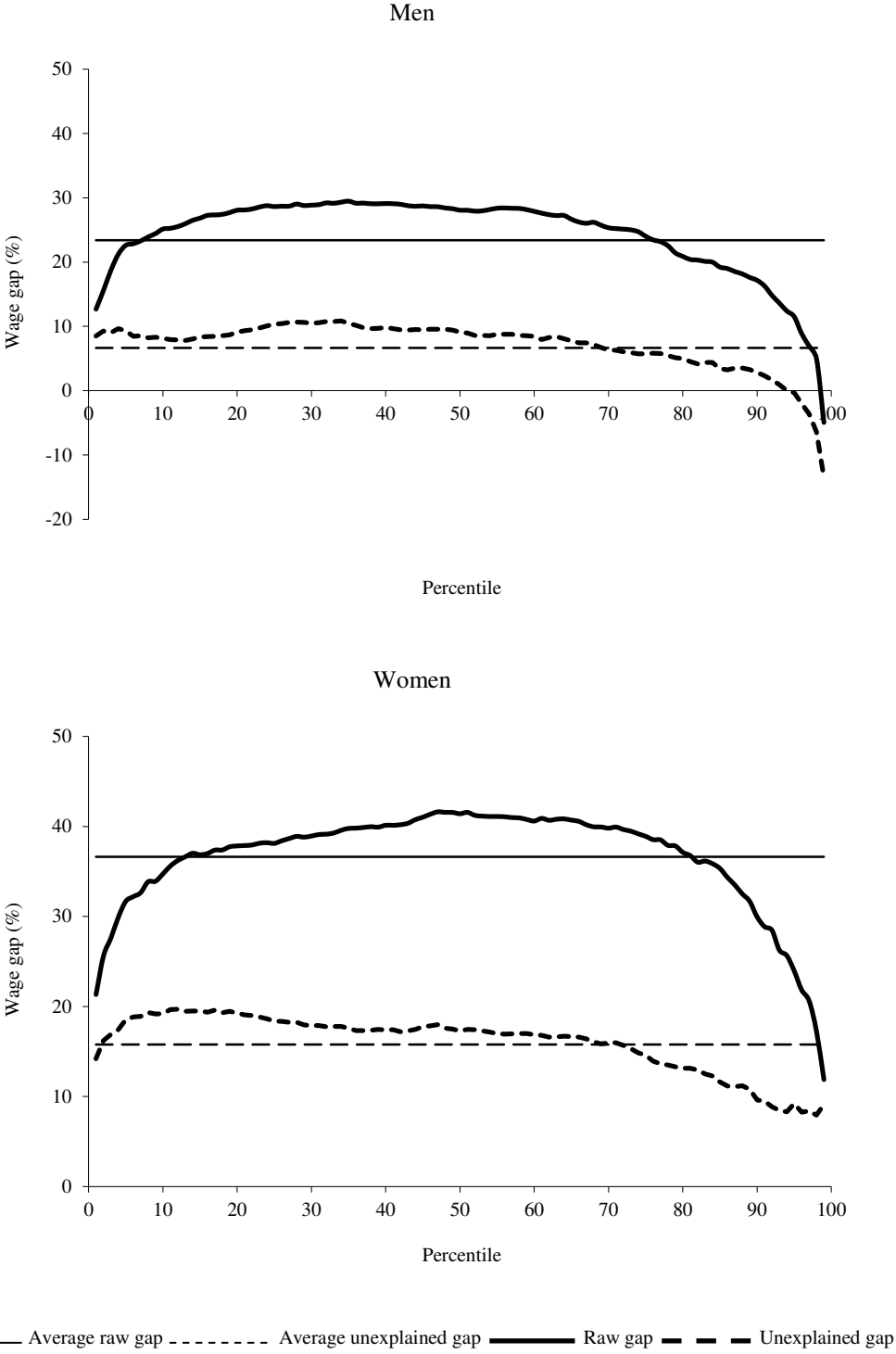
5.2 ECONOMETRIC ANALYSIS

In the econometric analyses carried out with the WSS 2010, we experiment with different specifications, considering different sets of variables. Since there are no substantial differences in the results, here, for reasons of simplicity and space, we only report the results from the most complete models, which include all the variables stated above.¹²

In the first place, we comment on the results of the analyses of the public-private sector pay gap in the economy as a whole (Figure 1). In the case of men, public sector workers are paid 23% more than their private counterparts, but this premium decreases up to roughly 13% when observable characteristics are taken into account. The raw gap across the whole distribution is positive and inverse-U shaped, with lower values at the very bottom and the very top of earnings distribution. Nevertheless, the most interesting finding has to do with the unexplained gap: it is barely above 10% across most of the distribution but dramatically diminishes at the top, becoming even negative for the most qualified employees. The pattern is very similar in the case of females, being the main difference that the premiums are larger for them than for males and that the differential is not negative at any point of the distribution.

¹² Specifically, we estimate a first model including only age, education, nationality and region, a second model comprising also tenure, part-time condition, type of contract, supervisory role and firm size; a third model adds occupation and sector of activity and a the last incorporates type of collective agreement and firm's target market. As mentioned in the main text, the results obtained under the different models do not differ very much.

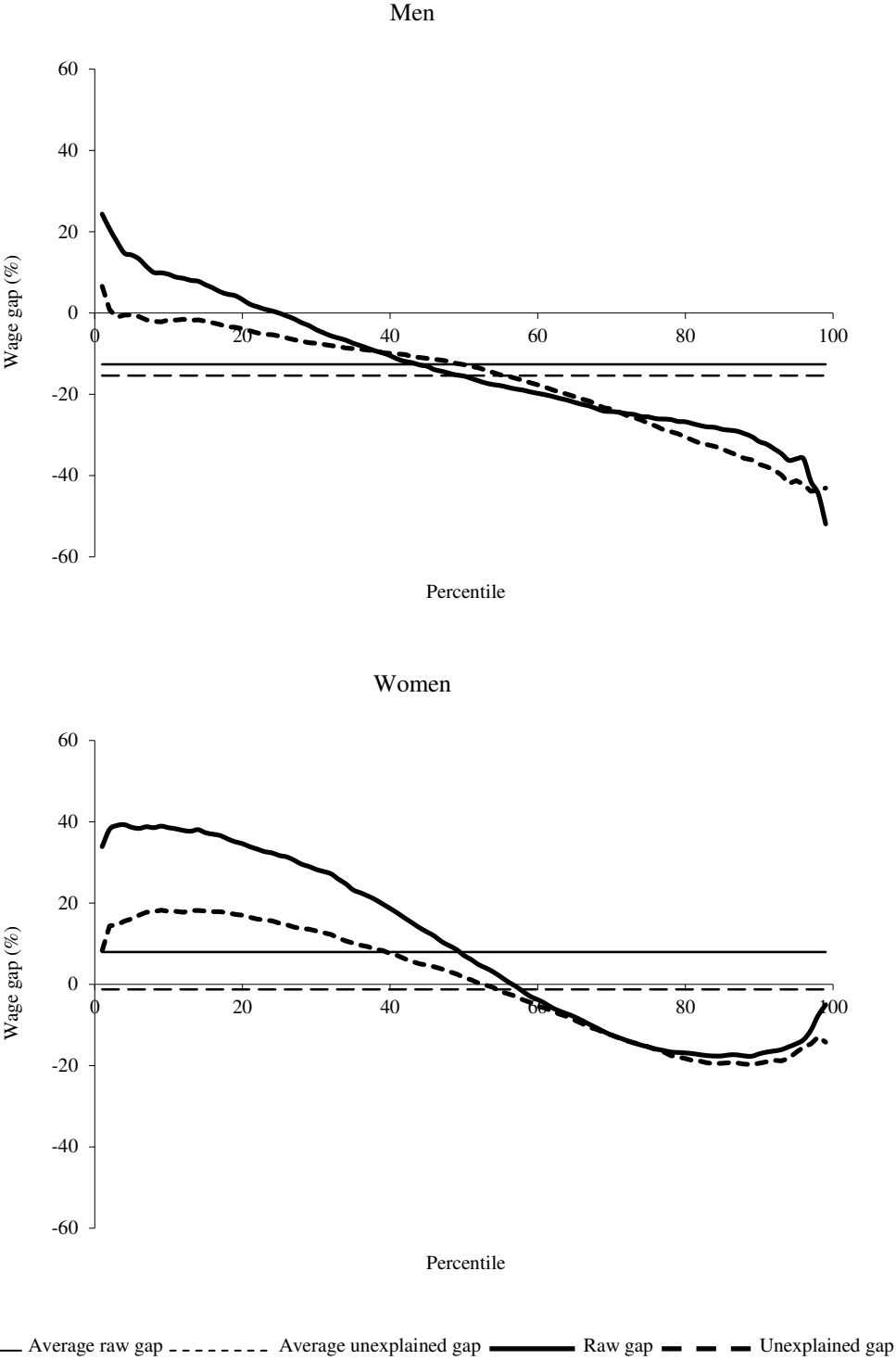
Figure 1. Public-private sector pay gaps in Spain (2010)



Source: Authors' analysis from the WSS 2010.

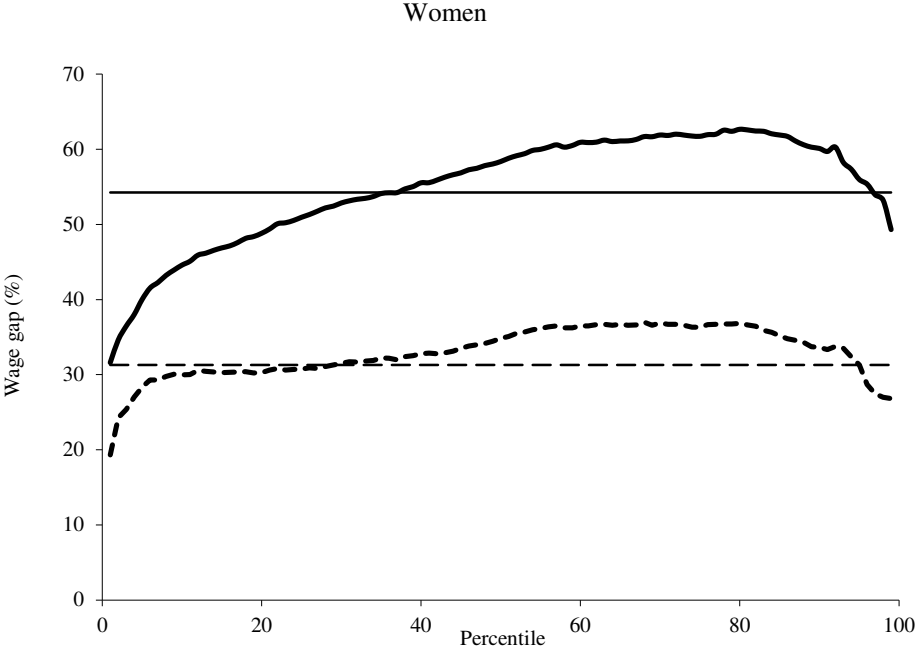
In the second place, we have a look at what happens at two areas of activity where the public and the private sectors coexist to a large extent, Education (Figure 2) and Human health and social work (Figure 3). In the case of education, the first observation is that the average gap in favour of public sector employees is tiny, being even negative in raw terms among males. In the case of men, the largest penalty is suffered by the most skilled educational workers, whereas, among women, although the pattern follows a quite similar shape captures a positive premium for at the bottom and a non-negligible penalty at the top. The results for workers employed in health-related activities differ. There is a substantial and positive public-private sector gap both among male and female employees, of roughly 50 and 30% in raw and net (associated to unexplained characteristics) terms, respectively. The main difference between both sexes is that the premium decreases very fast for the most skilled men.

Figure 2. Public-private sector pay gaps employed in the Education in Spain (2010)



Source: Authors' analysis from the WSS 2010.

Figure 3. Public-private sector pay gaps employed in Human health and social work activities sector in Spain (2010)

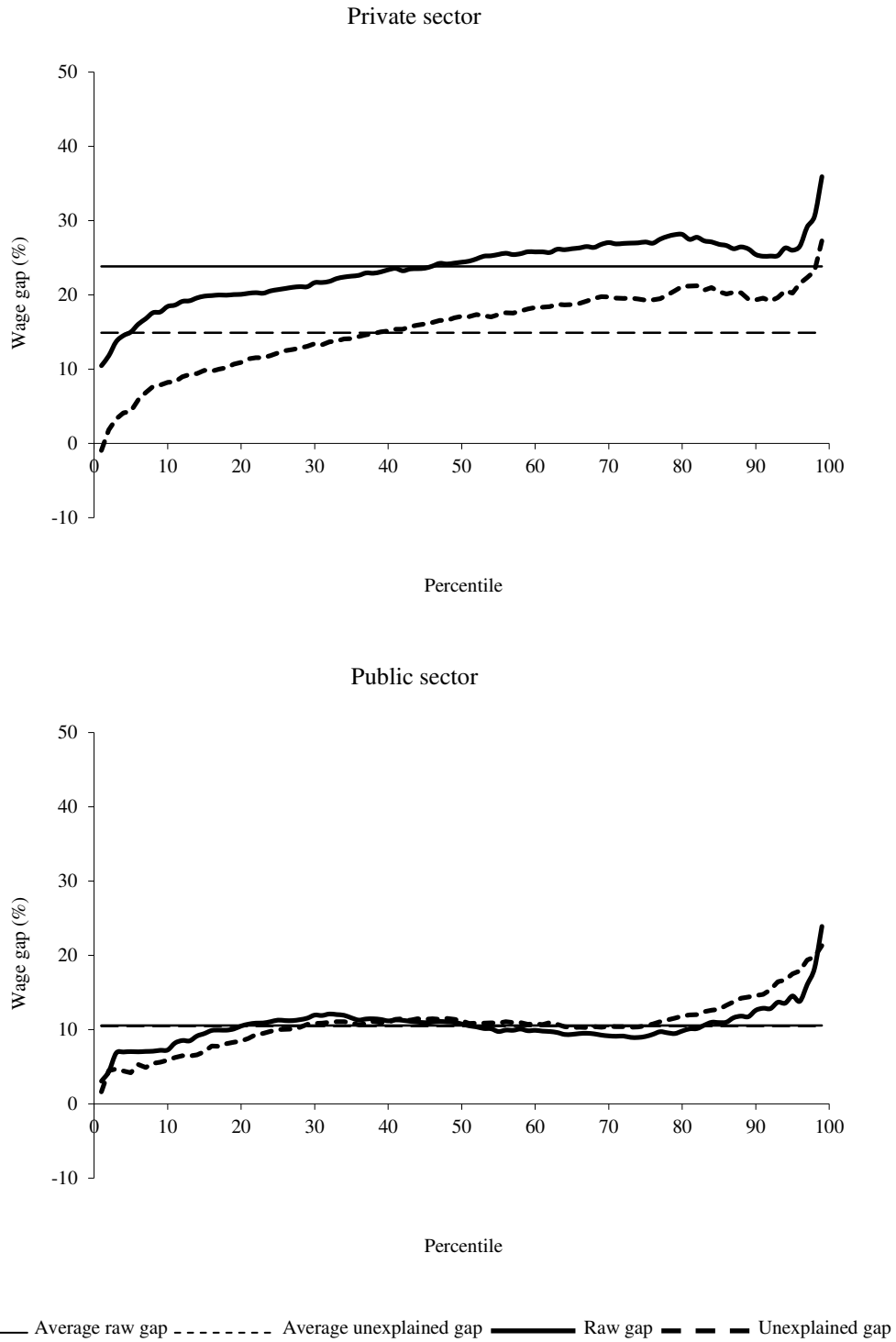


———— Average raw gap - - - - - Average unexplained gap ——— Raw gap - - - - - Unexplained gap

Source: Authors' analysis from the WSS 2010.

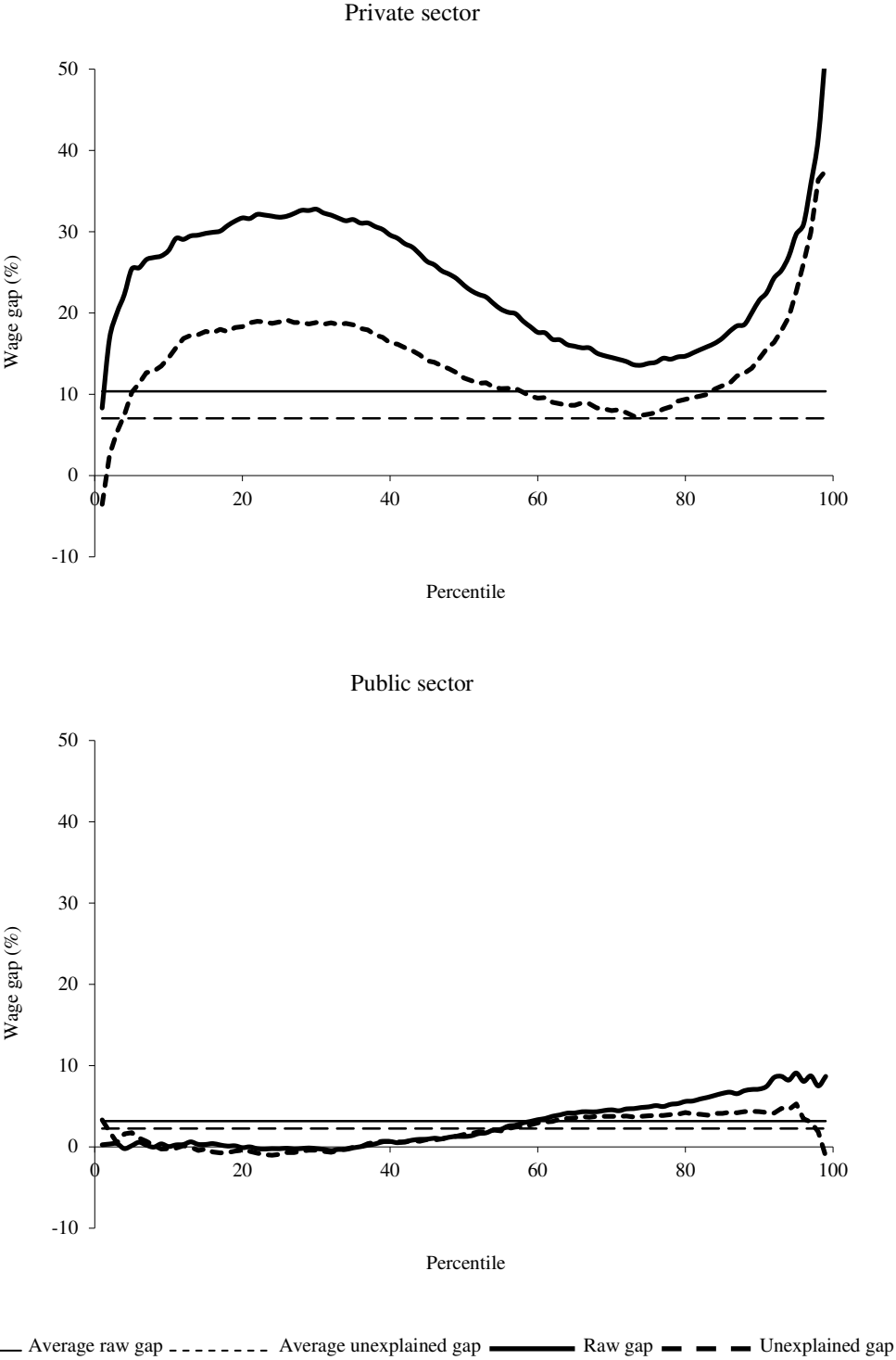
In the third place, we examine the scope and characteristics of the gender pay gap in both the private and the public sector. In the whole sample of employees (Figure 4), we can confirm that, firstly, gender gaps are higher in the private sector, both in raw terms and after controlling for observable worker and firm's characteristics. In the second place, in both sectors, the unexplained component of the differential between men and women increases along the distribution, being the pattern much steeper in the private sector. It is particularly interesting to explore what happens in the Education sector (Figure 5). The first element worth mentioning is the negligible extent of the gender gap in the public sector. However, in the private one, there are substantial penalties for women. The raw and net mean gaps are around 10 and 7%, respectively, and the women more hit are between the 10 and 40th percentiles and at the top of the distribution. The last set of results refers to Human health and social work (Figure 6). Again, penalties for women are higher in the private than in the public sector. Nevertheless, in this case, the increase in the unexplained gender gap is very clear in the private sector, whereas it is almost inexistent in the public one.

Figure 4. Gender wage gap by economic sector in Spain (2010)



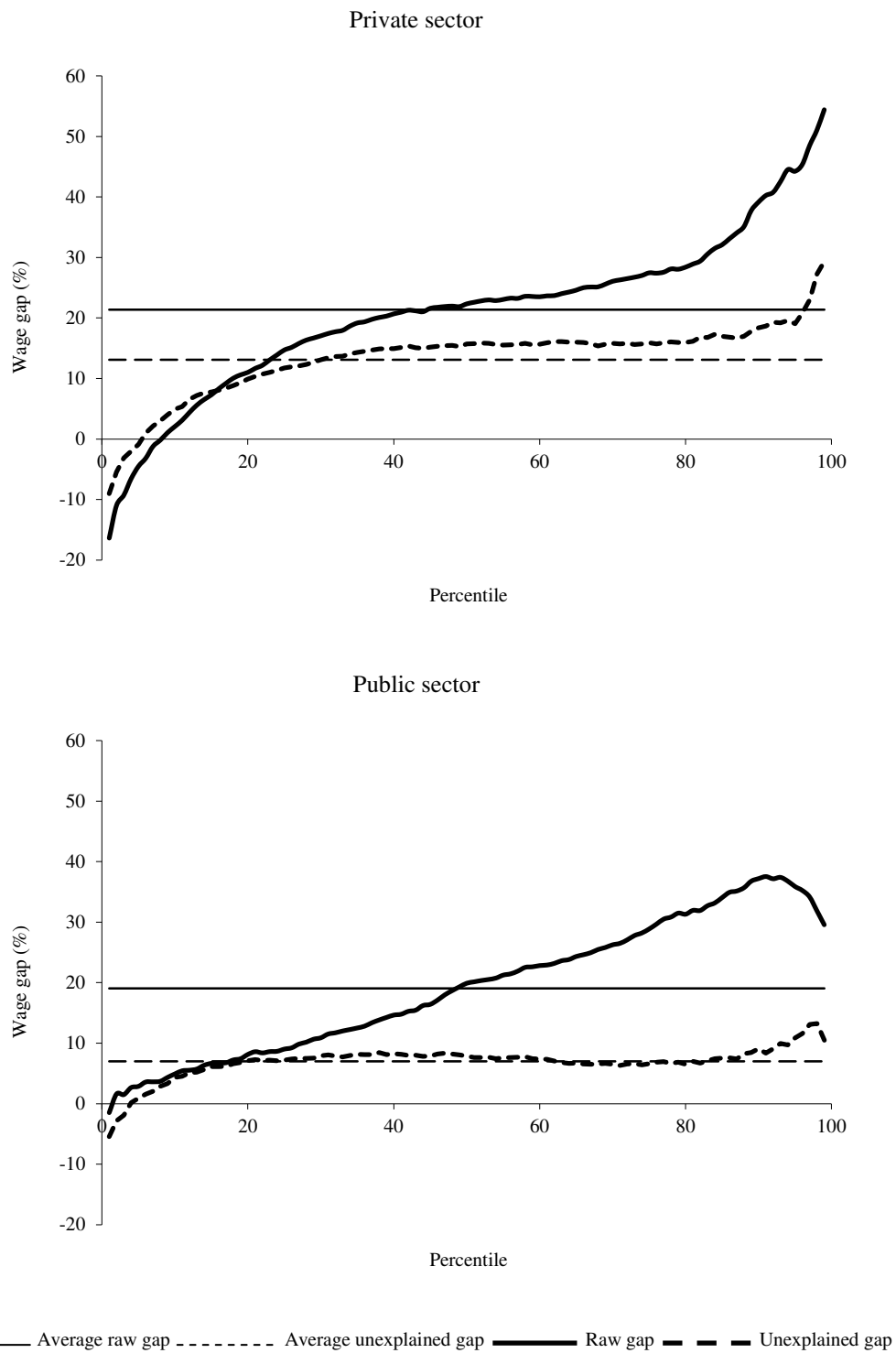
Source: Authors' analysis from the WSS 2010.

Figure 5. Gender wage gap by sector among workers employed in Education in Spain (2010)



Source: Authors' analysis from the WSS 2010.

Figure 6. Gender wage gap by sector among workers employed in Human health and social work in Spain (2010)



Source: Authors' analysis from the WSS 2010.

6. CONCLUSIONS

The aim of this article has been to provide a much-needed updated picture of the wage gap between public and private sector employees in Spain, as the public sector has experienced substantial transformations in both quantitative and qualitative terms since the early 90s, when most of previous studies are focused. Using the WSS 2010, which allows overcoming some of the problems presented by other current data sources, we have explored the premium to public employment for both males and females and the incidence of the gender gap among public and private employees. We have reached several conclusions. The first one refers to the existence of an average positive premium to public employment. Nevertheless, this gap concentrates on low-skilled workers, whereas very qualified employees in the public sector face a penalty with respect to similar individuals employed in the private economy. In the second place, we have found that the extent of the gender gap is smaller in the public sector and the incidence of a “glass-ceiling” effect is much more diffuse than among private employees. Third, we have explored the particularities of the Education and the Human health and social work sectors, where the public and the private economy largely coexist. The most important result has been the much lower importance of the public sector premium in the former activities.

Finally, we have interpreted our findings in the light of the specificities –mainly, the labour market institutions- of the Spanish economy and we have argued that the current process of downsizing of the public sector associated to current austerity measures might have non-negligible effects on earnings inequality and widen the gender gap.

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