

**DOCUMENT DE TREBALL**

**XREAP2014-08**

**PUBLIC-PRIVATE SECTOR WAGE  
DIFFERENTIALS BY TYPE OF CONTRACT:  
EVIDENCE FROM SPAIN**

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# Public-private sector wage differentials by type of contract: evidence from Spain\*

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## Abstract

The article examines public-private sector wage differentials in Spain using microdata from the Structure of Earnings Survey (*Encuesta de Estructura Salarial*). When applying various decomposition techniques, we find that it is important to distinguish by gender and type of contract. Our results also highlight the presence of a positive wage premium for public sector workers that can be partially explained by their better endowment of characteristics, in particular by the characteristics of the establishment where they work. The wage premium is greater for female and fixed-term employees and falls across the wage distribution, being negative for more highly skilled workers.

**Key words:** Public-private sector wage gap; wage distribution; matched employer-employee data; decomposition methods.

**JEL codes:** C2, E3, J3, J4.

## Resumen

El artículo analiza las diferencias salariales entre sector público y privado en España a partir de microdatos de la *Encuesta de Estructura Salarial*. La evidencia obtenida aplicando diversas metodologías de descomposición muestra la importancia de distinguir por sexo y tipo de contrato y la existencia de una diferencia salarial favorable a los trabajadores públicos que se explica, en parte, por sus mejores dotaciones de características y, en particular, de las características de los establecimientos. La prima es mayor para las mujeres y los temporales y decrece a través de la distribución salarial, siendo negativa para los trabajadores más cualificados.

**Palabras clave:** Brecha salarial entre sector público y privado; distribución salarial; datos emparejados empresa-trabajador; métodos de descomposición.

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\* This study received financial support from research projects ECO2010-16006, ECO2010-16934 and CSO2011-29943-C03-02.

## 1. Introduction

The existence of wage differentials between public and private sector workers and the analysis of its origin has received considerable attention over the last few decades (see, for example, Smith, 1976a, 1976b, Dustmann and van Soest, 1998 and Hartog and Oosterberck, 1993 and, among more recent contributions, Lucifora and Meurs, 2006, Cai and Liu, 2011 and Chatterji et al., 2011). There are several reasons why the wages of public sector workers might potentially differ from those of their private sector counterparts. Among these reasons, particular emphasis has been afforded to such factors as the public sector's monopoly power in its provision of public services and its potential impact on public workers' wages; the presence of compensatory wage differentials of non-pecuniary working conditions and, the greater bargaining power of public workers resulting, among other circumstances, from their higher rates of union membership (Gregory and Borland, 1999 and Bender, 1998). Among the regularities identified in the large body of empirical studies that have addressed this issue in many countries, it should be stressed the existence, with few exceptions, of a public sector wage premium when comparing workers with similar productivity-related characteristics. Moreover, this premium is usually reported as being higher for women and low-skilled workers whereas, on the other hand, wage inequality levels tend to be comparatively smaller in the public sector (Gregory and Borland, 1999).

The aim of this article is to examine wage differentials between public and private sector workers in Spain, an economy where few analyses of this type have been undertaken to date (Lassibille, 1998, Albert et al., 1999, García-Pérez and Jimeno, 2007 and Hospido and Moral, 2013). In addition to examining these differences by gender and across the whole wage distribution, a separate study is conducted for workers on permanent and fixed-term contracts, a clearly necessary analysis in the particular case of Spain's labour market and which, to the best of our knowledge, has yet to be undertaken. Indeed, there are various reasons why the Spanish case constitutes an especially appropriate framework for conducting this type of analysis. Firstly, because the public-private sector wage gap in Spain is comparatively high from an international perspective, being ranked above the EU average (De Castro et al., 2013). Secondly, because in Spain, as in other European countries, in recent years the question of fiscal consolidation has been tackled specifically by adjusting public workers' wages. Finally, because Spain presents a very high rate of fixed-term employment in both its private and public sectors [according to Eurostat, in the year covered by this study – that is, 2010, Spain had the highest rate of fixed-term employment in the public sector in Europe (24.5%) and the second highest rate in the private sector (25.1%), being ranked well above the EU average of 13.9%, in both cases]. This is

due in the first instance to the very large discrepancy in the costs of terminating permanent and fixed-term contracts and to a business structure clearly geared towards low-tech production (Dolado et al., 2002 and Toharia et al., 2005) and, in the second, to elements such as budget constraints and structural weaknesses in the financing of the country's local authorities (Consejo Económico y Social, 2005).

The study employs various decomposition techniques and uses data from the 2010 wave of the Spanish Structure of Earnings Survey (*Encuesta de Estructura Salarial*), which provides the greatest public sector coverage. An additional feature of this source is that it is a matched employer-employee dataset, a type of data that has had a significant impact on wage determination analyses in general (Hamermesh, 2008 and Abowd and Kramarz, 1999) but whose use in the analysis of public-private sector wage differentials has been rare to date (among recent studies, only Chatterji, Mumford and Smith, 2011, and De Castro et al., 2013 use matched microdata). Among other advantages, the use of these data facilitates an examination of the contribution to public-private sector wage differentials of establishment characteristics, attributes that are often not given the necessary weight in this type of analysis.

The obtained results reveal a significant wage differential in Spain in favour of public sector workers, a differential that is largely explained by the differences in the endowments of the observed characteristics of public and private sector workers, especially those of male employees. Likewise, establishment characteristics are found to make a significant contribution to the differential, greater than individual or job characteristics. Other notable findings include the presence of a positive wage premium associated with working in the public sector that is not explained by the endowments of productive characteristics in the case of low skilled workers and a negative premium for high skilled workers, and lower levels of wage inequality in the public sector that cannot be attributed to differences between the characteristics of these workers and those of the private sector. Finally, the evidence obtained also confirms that there are significant differences associated with the type of contract in relation to both the size of the wage gap between the public and private sectors and to its origin. Among these, the presence of significant differences in the size of the wage premium associated with working in the public sector should be stressed, since the premium is comparatively smaller for men on fixed-term contracts and for women on permanent contracts.

The rest of the article is structured as follows. In the second section the literature examining wage differentials between the public and private sectors and by types of contract, is reviewed. The database used in the study is presented in the third section, while the fourth section focuses on the econometric methodologies used in the empirical analysis. The evidence

obtained is presented in the fifth section and the study finishes summarising the main conclusions.

## **2. Literature review**

The analysis conducted in this study considers two strands of the empirical literature on wage differentials: on the one hand, that which for decades has analysed the public-private sector wage gap; and, on the other, the more recent strand that addresses the study of wage differentials by type of contract.

### *2.1 Public-private sector wage differentials*

Numerous studies have undertaken analyses of the wage gap between the public and the private sectors in a broad manner, both temporally and spatially, since the seminal analyses of Smith (1976a, 1976b) for the United States. Those former studies estimate a Mincerian wage equation, using a dummy variable identifying public sector workers, and reveal the presence of a public sector wage premium. Despite their limitations, the same methodology has been applied in many subsequent studies in the field and these, with few exceptions, estimate a positive wage premium for public sector workers, a premium that is comparatively higher for women and in less developed countries (Giordano et al., 2011 and Depalo et al., 2013). Following the methodology proposed by Oaxaca and Blinder (Oaxaca, 1973 and Blinder, 1973), an alternative line of analysis has subsequently based its analysis on the decomposition of the wage gap between sectors into the effects attributable to differences in characteristics and in the returns to these characteristics (the latter component reflecting the wage premium paid by the public sector to workers with the same productivity-related characteristics as those of workers in the private sector). The results of this approach emphasize that the differences in these characteristics normally account for most of the public-private wage gap, but also confirm the presence of a positive public sector wage premium, which is greater for women (Belman and Heywood, 1988, Gunderson, 1979 and Rees and Shah, 1995).

The presence of a possible selection bias arising from the fact that individuals who choose to work in the public sector may have unobservable characteristics that differ from those presented by private sector workers, led to the estimation of endogenous switching regression models (Hartog and Oosterbeck, 1993, Dustman and van Soest, 1998, Zweimuller and Winter-Ebmer, 1994, Adamchick and Bedi, 2000 and Christopoulou and Monastirirotis, 2013). The results of such studies, however, do not always coincide, because while for most countries it is found that when controlling for selection bias the wage premium widens, in some cases the gap is closed and, moreover, the magnitude of the selection effect differs greatly between studies. This

may be related to the difficulty of accessing variables in the available databases that constitute credible exclusion restrictions and which allow the selection bias to be corrected (Siminski, 2013 and Budría, 2010). To overcome this difficulty, some studies present evidence from longitudinal databases that use fixed effects to control for workers' time invariant characteristics and which, at the same time, allow the researcher to work with the subsample of workers that switch sectors. The usual finding of these studies is that the size of the public sector wage premium falls considerably in relation to those obtained using cross-sectional data, to the point that the premium even disappears in some cases (Krueger, 1988, Bargain and Melly, 2008, Siminski, 2013 and Campos and Centeno, 2012).

The existence, in general, of a lower wage dispersion in the public sector implies, in turn, that the analysis of the average wage differential provides an incomplete view of the different processes of wage determination in the public and private sectors. This has led several authors to examine inter-sector wage differentials across the wage distribution using decomposition techniques of differences in wage distributions (Poterba and Rueben, 1994, Melly, 2005a, Christopoulou and Monastiriotis, 2013, Cai and Liu, 2011, Lucifora and Meurs, 2006 and Depalo et al., 2013). Their results largely coincide, confirming that, in general, the role of the characteristics varies at specific points in the wage distribution, so that the public sector wage premium is greater in the lower part of the distribution and becomes smaller in the higher quantiles, so as to at a given point the premium usually becomes negative.

Finally, recent studies highlight the need to analyse wage differentials solely in the case of workers that are strictly comparable (that is, in the case of those whose observable characteristics are present in both the public and private sectors). These studies undertake their analyses employing the matching methodology proposed by Nopo (2008), which allows the common support of the distributions and its impact on the decomposition of wage differentials to be established between sectors, and in some cases they find that the number of fully comparable individuals between the two sectors is very small (Ramoni-Perazzi and Bellante, 2006, Gimpelson and Lukiyanova, 2009 and Mizala et al., 2011).

Compared to the vast body of international literature in this field, evidence of the public-private sector wage gap in Spain is comparatively small and, with few exceptions, is not very recent. Thus, Lassibille (1998), Albert et al. (1999) and García-Pérez and Jimeno (2005 and 2007) have estimated endogenous regression models for various years between 1990 and 2001, and Giordano et al. (2011), Depalo et al. (2013) and De Castro et al. (2013) have included Spain in their comparative analyses of various European countries (in the latter case using the *European Structure of Earnings Survey*). There is a general consensus in their estimates of a high public sector

wage premium, always higher for women. Hospido and Moral (2013) obtain similar results using a different data source, the *Muestra Continua de Vidas Laborales*. García-Pérez and Jimeno (2005), Depalo et al. (2013) and Hospido and Moral (2013) also estimate quantile regressions, obtaining similar results to those obtained for other countries, namely a lower wage premium in the upper part of the wage distribution. When differentiating the sample by skill level, Hospido and Moral (2013) in fact obtain a negative wage premium for high-skilled public sector workers located in the upper part of the wage distribution.

## *2.2. Wage differentials between permanent and fixed-term workers*

The second line of analysis refers to wage differentials by type of contract. Studies in this field were first undertaken in the early nineties and interest has been particularly intense in recent years, focused above all in certain countries, mainly European, characterized by their high proportion of fixed-term contracts. The most commonly used methodology consists in estimating wage equations that incorporate a dummy variable to control for the type of contract and the usual finding is the presence in all economies of a wage penalty for fixed-term workers (Jimeno and Toharia, 1993, Blanchard and Landier, 2002 and Gustafsson et al., 2001). More recent studies have undertaken comparative analyses, finding that the size of the wage penalty for fixed-term workers presents a significant international heterogeneity, being of an intermediate size in the case of Spain (Brown and Sessions, 2005, Comi and Grasseni, 2009 and Boeri, 2011). Other studies that control for the selection of individuals according to contract type find that the wage penalty for fixed-term workers undergoes changes when introducing this control, albeit that the sign varies between studies (Picchio, 2006, Hagen, 2002 and Mertens et al., 2007). Finally, analyses in this line of research have been also undertaken across the entire distribution, with the finding that the wage penalty for fixed-term workers is usually greater in the lower part of the distribution (Mertens and McGinnity, 2004, Mertens et al., 2007 and Comi and Grasseni, 2009).

Given the importance of fixed-term contracts in the Spanish labour market, this is unsurprisingly one of the countries in which wage differentials by type of contract have been studied most. Thus, Jimeno and Toharia (1993) and Hernanz (2003), when estimating wage equations with dummy variables for the type of contract, identify a wage penalty for fixed-term workers. Likewise, after undertaking a decomposition exercise, De la Rica and Felgueroso (1999) conclude that much of the observed differential can be attributed to the better characteristics of the permanent workers. Similarly, Hernanz (2003), De la Rica (2004) and Davia and Hernanz (2004) estimate endogenous regression models in seeking to correct any selection bias and their results confirm that fixed-term workers do not constitute a random sample. Indeed, Davia and

Hernanz (2004) report almost no discrimination and De la Rica (2004) finds a negative premium for those on fixed-term contracts of 10%.

### 3. Data

The source from which the microdata used in this study are drawn is the 2010 wave of the Structure of Earnings Survey (*Encuesta de Estructura Salarial*, hereinafter, EES). The EES is conducted by Spain's National Statistics Institute in line with a standardised methodology for all EU countries. The survey includes wage earners that have contributed to the Social Security system throughout the whole month of October of the reference year and its design corresponds to a two-stage sampling of wage earners from the contribution accounts held by the Social Security. One of its most important features is, therefore, that it includes matched employer-employee microdata (i.e., observations for various workers employed in each establishment).

The EES consists of independent cross-sections that are produced every four years and at present four waves are available, corresponding to 1995, 2002, 2006 and 2010. The survey's coverage has expanded over this period and, for the purposes of this research, it should be stressed that in 2010 it included for the first time the branch of activity corresponding to section O of the NACE-2009 classification: Public Administration and Defence; Compulsory Social Security (so that the wave covers establishments of all sizes affiliated to the general social security system whose economic activity falls under sections B to S of the NACE-2009 classification of economic activities). This branch of activity constitutes a sizeable part of the public sector, since the only other public sector workers in other branches of activity are those employed in publicly controlled firms. Consequently, the 2010 wave of the survey provides a comprehensive coverage of the public sector and one that is greater in all circumstances than that provided by previous waves, which explains why this empirical analysis is limited to the 2010 wave. In delimiting the public and private sectors, the study considers public sector workers as those that in the dichotomous variable "Ownership or Control of the Company" are included in the category corresponding to public ownership or control (as opposed to private). This includes all individuals employed in the branch of activity of Public Administration and Defence; Compulsory Social Security, as well as those employed in public enterprises in sections of activity other than these<sup>1</sup>.

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<sup>1</sup> Thus, the public workers considered in this study include all kinds of civil servants. However, note that it only includes those affiliated to the general social security system, and so it does not include, given that they do not form part of the EES, those affiliated to mutual societies or minority social security systems covering such areas as justice or the armed forces.



The data source provides very detailed information about the workers' wages and characteristics (sex, age, education and nationality); about their jobs (occupation, tenure, type of contract, type of employment, be it part- or full-time, and the undertaking of supervisory tasks) and about the enterprises or establishments (sector of activity, size, type of collective agreement and region). Wage information includes the various components that make up the wage and covers different periods of time. The wage concept used in the empirical analysis is the gross hourly wage, calculated from the wage corresponding to the month of October, divided by the number of hours worked in that month<sup>2</sup>. Wages are expressed in gross terms and their calculation includes any payment made by the firm, including commissions, bonuses for working nightshifts or weekends, as well as overtime.

In conducting the empirical analysis certain individuals were excluded, namely, those of a nationality other than Spanish, those under the age of 16 or over the age of 65 and those with hourly wages of less than two and a half or more than two hundred euros. The final sample from the 2010 wave of the EES comprises 157,774 observations, 89,953 corresponding to men (71,428 on a permanent contract and 18,525 on a fixed-term contract) and 67,821 women (52,239 on a permanent contract and 15,582 on a fixed-term contract). Of these, 23,416 (14.8% of the total) work in the public sector – 10,067 men (11.2%) and 13,349 women (19.7%)<sup>3</sup>. The descriptive statistics of the sample can be consulted in Table A.1 in the Appendix.

## 4. Methodology

The study employs three different techniques for the decomposition of the public-private sector wage differentials in Spain. The first, the Oaxaca-Blinder methodology (Oaxaca, 1973 and Blinder, 1973), allows a detailed decomposition of the average wage differential of individuals in both sectors. The second, a methodology proposed by Ñopo (2008), serves as a robustness check of the former, insofar as the decomposition takes into consideration the effect of the presence of individuals that share strictly the same observed characteristics. Finally, the third methodology,

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<sup>2</sup> October's wage is taken as the reference, since being employed in that month is the requisite that defines the survey population. The total number of hours worked in that month is calculated as the worker's normal working week in October multiplied by 4.35, plus the number of overtime hours worked.

<sup>3</sup> In order to examine the actual coverage of the public sector of the EES, a comparison was made with the *Encuesta de Población Activa* (using information corresponding to the third quarter of 2010 in the case of the EPA). When the comparison is restricted to the sectors covered by the EES, although the survey seems to suffer from a certain underestimation of the public sector, in general the coverage is high. Thus, public sector employees constitute 14.8% of all employees according to the EES and 22.2% according to EPA data, the percentages being 11.2% and 18.5% in the case of men and 19.7% and 26.7% for women. This underestimation of the public sector by the EES can be attributed to the fact that it does not include public sector workers affiliated to mutual societies and minority social security systems.

developed by Fortin, Lemieux and Firpo (2011), provides a detailed decomposition of the wage differentials across the wage distribution. The three techniques are described below.

#### 4.1. Oaxaca-Blinder decomposition

The Oaxaca-Blinder technique is based on the separate estimation for each group of the Mincerian type semi-logarithmic wage equation of the form:

$$w_i = X_i \beta + \varepsilon_i \quad (1)$$

where  $w_i$  corresponds to the logarithm of worker  $i$ 's gross hourly wage;  $X_i$  is a vector of individual explanatory variables plus a constant term;  $\beta$  is a vector of parameters and  $\varepsilon_i$  is a random error term.

The explanatory variables considered in the empirical analysis include individual characteristics as well as job and establishment characteristics. The former serve as controls for the highest level of education attained by an individual (distinguishing three categories: primary, secondary and tertiary education) and age (comprising three groups: under 30, between 30 and 45 and over 45). The job characteristics include occupation (three categories corresponding to low-, medium- and high-skilled jobs, respectively); years of tenure in current job (differentiating four groups: 0 to 3 years, 4 to 10, 11 to 20 and more than 20 years); the type of contract (permanent or fixed-term); the type of employment (full-time or part-time) and the performing of supervisory tasks. Finally, the establishment characteristics include size (distinguishing four categories); the region of location and the type of collective agreement (distinguishing between single-establishment, national and sub-national sector agreements).

After empirically estimating the wage structure of the labour market with the joint sample of individuals in the public and private sectors, and using the jointly estimated wage structure for the individuals of both sectors as the reference wage structure in the decomposition (see Oaxaca and Ransom, 1994 and Neumark, 1988)<sup>4</sup>, depending on the properties of the ordinary least squares estimator, the difference in the average wage of the public and private sectors ( $\Delta$ ) can be decomposed as follows:

$$\Delta = (\bar{W}^{pub} - \bar{W}^{priv}) = (\bar{X}^{pub} - \bar{X}^{priv}) \hat{\beta}^* + \left\{ \bar{X}^{pub} (\hat{\beta}^{priv} - \hat{\beta}^*) + \bar{X}^{priv} (\hat{\beta}^* - \hat{\beta}^{pub}) \right\} \quad (2)$$

where  $\bar{W}^{pub}$  and  $\bar{W}^{priv}$  are the average public and private sector wages;  $\bar{X}^{pub}$  and  $\bar{X}^{priv}$  are the average observed characteristics of the individuals in both sectors and  $\hat{\beta}^{pub}$ ,  $\hat{\beta}^{priv}$  and  $\hat{\beta}^*$  are the

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<sup>4</sup> The estimation of the reference wage structure also includes a dummy variable for the group membership of each observation, since failure to do so can lead to a bias in the decomposition, given that the characteristics component may be overstated and the corresponding returns understated, as a result of the omission of group-specific intercepts (Elder et al., 2010).

coefficients estimated following the wage regression on the set of explanatory variables for the public and private sectors and the two sectors pooled, respectively.

The first component on the right-hand side of equation (2) represents the effect on the average wage differential of the differences in characteristics (or the “explained” component), while the second corresponds to the effect of the coefficients (or the “unexplained” component). It should also be noted that this procedure provides a detailed decomposition (i.e., distinguishing the contribution of each individual explanatory variable to the differential to be explained, differentiating, in turn, between the corresponding effects associated with endowments and returns). To avoid the identification problem that arises in this type of decomposition, associated with the fact that the choice of a specific reference in each group of explanatory dummy variables can in practice affect the results of the detailed decomposition through the relative contribution of each explanatory variable to the returns component (Oaxaca and Ransom, 1999), when estimating the equation the strategy of normalization of dummy variables suggested by Yun (2005) was adopted, which allows the actual contribution of each variable to the returns component of the decomposition to be estimated.

#### 4.2. *Ñopo decomposition*

Ñopo (2008) proposes an alternative method to that of the Blinder-Oaxaca decomposition which, using a non-parametric approach based on matching techniques, emphasizes the differences between the groups being compared in the supports of the distributions of observable characteristics and their impact on the results of the decomposition. The assumption is that, as there may be differences in the observable characteristics of the workers in both sectors that lead to particular combinations of characteristics for which identical individuals cannot be found in both sectors, the results of the Oaxaca-Blinder decomposition could be affected. This would occur to the extent that this technique assumes that estimates of the wage equations are also valid out of the support of the observable characteristics for which they are estimated, which would ultimately lead to an overstatement of that part of the wage differential unexplained by differences in the endowments of characteristics. Accordingly, a decomposition is proposed that breaks down the differential wage to be explained into four terms, two of which are analogous to the elements of the Oaxaca-Blinder decomposition (but computed only over the common support of the distributions of characteristics), while the other two account for differences in the supports.

Thus, in line with this methodology (for more details see Ñopo, 2008), and taking as our starting point equation (2), the public-private sector wage differential can be expressed in terms of four additive elements:

$$\Delta = (\Delta EXP + \Delta PUB + \Delta PRIV) + \Delta UNEXP \quad (3)$$

where  $\Delta EXP$  is the part of the average public-private sector wage gap ( $\Delta$ ) that can be explained by differences in the distributions of the characteristics of workers in the public and private sectors over the common support;  $\Delta PUB$  is the part of the wage gap that is explained by the existence of public sector employees that are not present in the common support of the distributions of characteristics and  $\Delta PRIV$  is the part of the wage gap that can be explained by the presence of private sector workers out of the common support. Finally,  $\Delta UNEXP$  is the unexplained part of the wage gap (i.e., that part of the difference that is attributed to unobservable characteristics or to different returns between the two groups in the observable characteristics). By analogy with the Oaxaca-Blinder decomposition, the sum of the first three elements corresponds to the component “explained” by differences in the characteristics, while the fourth term corresponds to the “unexplained” component.

To be able to apply this procedure,  $\tilde{\text{Nopo}}$  (2008) proposes applying matching methods to simultaneously identify the common support (those groups of workers in the public and private sectors with similar observable characteristics) and decompose the wage differential in line with equation (3) without imposing any restrictions on the way in which the explanatory variables affect the dependent variable. A notable feature of this method is that the results of the decomposition tend to coincide with those obtained with the Oaxaca-Blinder decomposition when the common support includes all the individuals analysed (i.e., if  $\Delta PUB$  and  $\Delta PRIV$  take a null value) ( $\tilde{\text{Nopo}}$ , 2008). However, its main drawback is that it can be affected by the ‘curse’ of high dimensionality, since the inclusion of a large number of explanatory variables for matching can substantially reduce the number of observations found in the common support.

#### 4.3. *The Fortin-Lemieux-Firpo decomposition*

Fortin, Lemieux and Firpo (2011) have recently proposed a technique for empirically decomposing differences between two distributions of a variable. Ultimately, it provides a decomposition of the differences that exist between the distributions in the value of any distributional statistic, such as the value of a quantile or an inequality index, depending on the differences in observable characteristics and in the returns to these observables, respectively. It is a procedure that has a notable advantage over comparable techniques proposed in the economics literature and which also allow empirical decompositions of differences between distributions based on the construction of counterfactual distributions (DiNardo, Fortin and Lemieux, 1996, Juhn, Murphy and Pierce, 1993, Machado and Mata, 2005 and Melly, 2005b, 2006). Thus, while these techniques consist of aggregate decompositions which, with some partial exceptions, provide only the separate effects of the set of characteristics and returns, Fortin, Lemieux and

Firpo's (2011) technique provides a detailed decomposition that allows, in addition, knowledge of the individual contribution of each explanatory variable considered in the analysis via the characteristics and returns components.

This technique is based on the estimation of a regression in which the independent variable (the wage) is replaced by a wage transformation, the recentered influence function (hereinafter, RIF), so as to be able to undertake a standard Oaxaca-Blinder decomposition of any distributional statistic based on the regression results (for further details, see Fortin, Lemieux and Firpo, 2011). The decomposition takes the following form:

$$\Delta_{Q_b} = (\bar{X}^{pub} - \bar{X}^{priv})\hat{\gamma}_{Q_b}^* + \{\bar{X}^{pub}(\hat{\gamma}_{Q_b}^{priv} - \hat{\gamma}_{Q_b}^*) + \bar{X}^{priv}(\hat{\gamma}_{Q_b}^* - \hat{\gamma}_{Q_b}^{pub})\} \quad (4)$$

where  $\Delta_{Q_b}$  is the difference in the quantile  $Q_b$  (or, as stated before, in any other statistic) of the wage distributions of the public and private sectors;  $\bar{X}^{pub}$  and  $\bar{X}^{priv}$  are the average observed characteristics of the public and private sectors and  $\hat{\gamma}_{Q_b}^{pub}$ ,  $\hat{\gamma}_{Q_b}^{priv}$  and  $\hat{\gamma}_{Q_b}^*$  are the coefficients estimated after the regression of the RIF variable of the quantile  $Q_b$  on the set of explanatory variables for the public sector, private sector and the two sectors pooled, respectively<sup>5</sup>. The first component of the right-hand side of the equation represents the effect on the differential between distributions caused by differences in characteristics (the "explained" component), while the second corresponds to the effect of the coefficients (the "unexplained" component) and, as noted above, in each of them the contribution of each individual explanatory variable can be distinguished.

## 5. Results

### 5.1. Descriptive evidence

Table 1 and Figure 1 contain information on the wage differential observed between the public and private sectors in Spain, measured in logarithms of hourly wages and expressed in a disaggregated form for male and female workers and, within these groups, for those on permanent or fixed-term contracts. They show a highly significant differential in favour of public sector workers, and one that is substantially higher for women (0.463 log points) than it is for men (0.352 points). A similar differential is found in favour of workers on permanent contracts (with a gap of 0.377 points for men and 0.497 for women) in comparison with workers on fixed-term contracts (0.314 and 0.461, respectively). Furthermore, the wage differential between the two sectors is also found not to be homogenous across the whole wage distribution, it being

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<sup>5</sup> In conducting the decomposition the same methodological decisions have been taken as with the Oaxaca-Blinder decomposition with regard to such aspects as the reference wage structure and the normalisation of the dummy variables.

relatively lower in the two tails of the distribution than in the central part. This occurs regardless of the gender of the workers but not of the type of contract, because the wage differential, unlike the rest, presents in general an increasing profile for individuals on fixed-term contracts.

FIGURE 1 AROUND HERE

TABLE 1 AROUND HERE

Table 2 contains information on wage inequality in both sectors, measured using the Gini coefficient. The table shows that inequality levels are systematically lower in the public sector than they are in the private, regardless of the gender of the workers. This is the case, however, only of individuals on permanent contracts, since, by contrast, in the case of workers on fixed-term contracts there are no statistically significant differences in wage inequality between the two sectors at conventional levels.

TABLE 2 AROUND HERE

Table A.1 in the appendix contains the descriptive statistics for the sample used in the analysis. These statistics reveal significant differences in the characteristics of workers employed in the public and private sectors. Without seeking to be exhaustive, the public sector workers have on average, irrespective of their sex and contract type, higher levels of education, work experience (proxied by age) and length of tenure; they are characterized by their greater presence in occupations requiring high-skill levels, in full-time work and on fixed-term contracts, and the majority work in large establishments covered by single-establishment collective agreements.

*5.2. Econometric decompositions: average wage differentials*

Table 3 contains the results of the decomposition of the average public-private sector wage differential obtained with the Oaxaca-Blinder technique. The information includes the size of the average wage differential, the values of the two components on the right-hand side of equation (2), and the detailed results for each of the two components (characteristics and coefficients) based on the contribution of each individual explanatory variable. A positive value for any of these components indicates that it is an element that originates a positive wage differential for individuals working in the public sector.

TABLE 3 AROUND HERE

Based on the results of the decomposition, in the case of men, the bulk of the average public-private sector wage differential (0.352 log points) is explained by differences in the endowment of characteristics (0.312), the contribution of the unexplained component – or wage premium – being much less relevant (0.041). This holds true for employees on permanent contracts and for those on fixed-term contracts. Thus, among permanent workers in both sectors there is an average wage differential of 0.378 log points, 0.311 of which are explained by the characteristics component, so that the estimated wage premium would be 0.067 points. In the case of fixed-term workers, characteristics explain 0.281 of the 0,314 points of difference, and so in this case the public sector wage premium (0.033 points) is lower than that of the permanent workers. The results of the detailed decomposition show that although several individual variables exhibit a significant explanatory power (including the level of education<sup>6</sup>, tenure and occupation), the establishment characteristics play a prominent role. Thus, size alone explains a third of the characteristics component for all male workers (this proportion being slightly lower for men on fixed-term contracts) and, overall, the failure to consider the establishment characteristics means that the part explained by the characteristics falls from 0.312 to 0.169 log points.

The average wage differential for women (0.463 log points) can also largely be explained by differences in the endowment of characteristics (0.325). However, the wage premium in this case (0.138) is comparatively more significant than that of male workers, with a premium that more than triples that of their male counterparts. Unlike the men's, the women's wage premium is particularly high for workers on fixed-term contracts (0.214 points), and is significantly higher than that of permanent employees (0.126). Here, the individual variables with a notable explanatory power coincide with those for the male workers (most obviously education, length of tenure, occupation, and establishment size), although in this case the characteristics of the establishments have a less notable relative weight.

The results obtained up to this juncture allow us to conclude that in Spain there are significant wage differentials between workers in the public and private sectors, both for all the workers and distinguishing in terms of contract type, while the bulk of the differential can be explained by differences in observed productivity-related characteristics. However, there may be

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<sup>6</sup> The distribution of the population by level of education can affect the wage structure of an economy not only through the wage differentials between levels of education, but also through the differences in wage dispersion that occur within them, to the extent that in most countries wage dispersion tends to be higher among individuals with higher levels of education (Martins and Pereira, 2004, Buchinsky, 1994 and Gosling et al., 2000). Budría and Moro-Egido (2008) show that this situation is intensified in the specific case of Spain through educational mismatches, since they tend to increase wage inequality within each group and, moreover, their impact tends to grow significantly over time.

differences in the observable characteristics of the workers in the two sectors that lead to combinations for which it is not possible to find identical individuals, and this may well affect the results of the Oaxaca-Blinder decomposition. For this reason, and in order to check the robustness of the evidence obtained, Nopo's (2008) methodology was used, the results of which are presented in Table 4 based on a consideration of different groups of characteristics. Thus, first the individual characteristics (age and education) are considered; followed by the variables related to the job (tenure, type of employment, type of contract, tasks of supervision and occupation) and, finally, those relating to the characteristics of the establishment (region, firm size and type of collective agreement). In addition to the four elements of the equation (3), Table 4 also shows the percentage of workers in the public and private sectors that form part of the common support (CSPUB and CSPRIV, respectively).

#### TABLE 4 AROUND HERE

It is found that the percentage of workers included under the common support remains at a high level (quite close to 1) until the characteristics of the establishments are considered, when the percentage falls substantially. The most important component of the wage differential up to this point is the unexplained portion ( $\Delta$  UNEXP), which accounts for about two thirds of the total differential, but when the establishment's characteristics are considered the contribution of this component falls significantly. The wage premium attributable to the public sector is, in fact, substantially lower according to the results of this method (being almost null in the case of men and presenting a value of 0.087 points in the case of women, which contrast with the values of 0.041 and 0.138, respectively, obtained with the Oaxaca-Blinder technique). The evidence also suggests that the main explanatory component when considering the set of independent variables arises from the existence of private sector workers that remain out of the common support as they have no counterpart in the public sector ( $\Delta$  PRIV). In any case, these results serve to reinforce the consideration that the characteristics of the establishments are a noteworthy determinant of the public-private sector wage differential.

#### *5.3. Econometric decompositions: differentials across the wage distribution*

The next step in the empirical analysis involves examining the origin of the wage differentials between sectors across the whole wage distribution. To do this, the evidence obtained after applying the methodology proposed by Fortin, Lemieux and Firpo is presented. Tables 5-7 and Figures 2-4 contain the results (shown separately for each of the groups considered in the decomposition of the public-private sector differential) for the Gini coefficient and the logarithm of



the hourly wage by quantiles. To facilitate presentation, Figure 2 distinguishes only between the aggregate contribution of the characteristics and returns components, while Figures 3 and 4 show the detailed results of the individual effects of each of the explanatory variables associated with the two components. Here again, to facilitate presentation, the explanatory variables are grouped into individual characteristics (age and education), job characteristics (tenure, contract, employment type, supervision and occupation) and establishment characteristics (the remaining variables considered).

TABLES 5 TO 7 AROUND HERE

FIGURES 2 TO 4 AROUND HERE

The evidence shows that the causes of the observed wage differential between all the workers of the public and private sector differ significantly across the wage distribution (the results being relatively similar for men and women). Thus, the contribution of the differences in the endowment of characteristics is relatively low on the left-hand side of the distribution, which presents a clearly upward profile, so that there is a particularly strong influence in the right tail (Figure 2). The contribution of the unexplained component, meanwhile, presents a downward profile, to the extent that it acquires negative values in the upper part of the distribution. These results suggest, therefore, that while the comparatively less-skilled individuals receive a significant positive wage premium in the public sector, the most highly skilled individuals receive a lower wage than the one they would obtain in the private sector with their observed characteristics.

When distinguishing by type of contract, however, the results are found to differ for fixed-term workers and permanent employees, albeit that the latter's results largely coincide with those of the overall analysis. These differences are particularly marked in the case of women on fixed-term contracts, for whom the contribution of both components is very similar across virtually all the distribution (with the exception of its two tails). Thus, the wage premium of fixed-term workers in the public sector is relatively homogeneous across the entire distribution (except for the first decile of the distribution, in which it is smaller). In the case of men on fixed-term contracts, the component explained by characteristics presents a growing weight across virtually the entire distribution, while the wage premium is relatively stable in the lower half of the distribution, falling thereafter to become negative in the upper quartile.

In short, in line with the evidence presented in previous studies for both Spain and other countries, the wage premium paid by the public sector is higher for low-skilled workers, and this premium decreases as we move towards higher levels in the wage distribution, becoming clearly

negative for the most highly skilled employees. However, the analysis conducted here reveals a new result, as the fall in the wage premium for the high-skilled workers is not so clear in the case of those on fixed-term contracts, since among the male workers it is only recorded in the upper half of the wage distribution, and it is not observed at all for women on fixed-term contracts.

The results of the detailed decomposition of the characteristics component (Figure 3) confirm that the establishment characteristics present a more significant contribution across the wage distribution than the respective contributions of individual or job characteristics to the public-private sector wage differential in the case of men, while for women their influence is relatively similar to those of the other characteristics. They also show that the upward profile observed for the whole set of the characteristics component is repeated in all the subsets of the explanatory variables. The detailed decomposition of the wage premium components (Figure 4) points to some additional issues of interest. Thus, for both sexes the wage premium associated with individual characteristics is positive for fixed-term workers, while it is negative for permanent employees. The analysis that does not differentiate by type of contract presents a result that clearly disguises a number of competing situations. The wage premium when controlling for job characteristics is positive for men and negative for women, because of the significant negative wage premium received by fixed-term workers in the public sector associated with these characteristics. Finally, the wage premium when controlling for the establishment characteristics is only slightly significant for all groups, except that of low-skilled men in stable employment.

Finally, evidence regarding the origin of the differences in the public-private sector wage inequality (Table 7) reveals that the lowest levels of inequality in the public sector cannot be explained by a composition effect, since the relative endowments of characteristics presented by individuals in the public sector are a factor that, *ceteris paribus*, would lead to greater wage inequality in all the groups analysed. Thus, the origin of this phenomenon is fully explained by the contribution of the returns component (again across all groups, with the exception of fixed-term female workers, for whom this component is not statistically significant). As such, this evidence suggests that the lower wage inequality in the public sector is attributable solely to the differences in the wage-setting mechanisms of the private sector.

## 6. Conclusions

This study has analysed public-private sector wage differentials in Spain employing matched employer-employee microdata obtained from the most recent wave of the Structure of Earnings Survey (*Encuesta de Estructura Salarial*). In addition to examining these differences separately by gender and across the wage distribution, a separate analysis is conducted here for

the first time examining the wage gap between workers on permanent and fixed-term contracts in both sectors. This situation has not been studied to date, and is justified, among other factors, by the fact that the high number of fixed-term contracts in both the private and public sectors makes the Spanish labour market quite distinct in comparative terms.

The empirical analysis of the origin of the wage gap between sectors has been undertaken employing various decomposition techniques. The results of this analysis show that, in line with evidence from previous studies, the bulk of the significant wage differential observed in Spain in favour of public sector workers can be explained by their different endowments of observed characteristics, while the size of the resulting pay premium is appreciably higher in the case of women. The evidence obtained also suggests that the establishment characteristics make a greater contribution to the differential than individual or job characteristics. This is confirmed by implementing the procedure proposed by Ñopo (2008), the results of which suggest that the failure to consider the establishment characteristics most likely causes an overestimation of the public sector wage premium. It is also found that the origin of the total wage differential between the public and private sectors differs significantly across the wage distribution, increasing on the left-hand side and decreasing on the right, so that in Spain, in common with other countries, there is a positive wage premium associated with working in the public sector for low-skilled individuals, while a negative wage premium is found in the case of the high-skilled workers. Finally, the lower levels of wage inequality observed in the public sector cannot be explained by differences in the characteristics of workers in the public and private sectors, but seem to be attributable to the particularities of their wage-setting mechanisms.

The evidence obtained also confirms that there are significant differences associated with the type of contract with regards to both the size of the wage gap between the public and private sectors and to its origin. Thus, in relation to the first difference, it is observed that the wage differential in favour of the public sector is comparatively higher for permanent workers; that the wage differential presents an increasing profile for individuals on fixed-term contracts but, on the contrary, is decreasing for those on a permanent contract, and that the highest levels of wage inequality in the public sector occur only in the case of individuals on a permanent contract. In relation to the second point, significant differences are found by type of contract in the size of the wage premium (the premium being comparatively lower for individuals on fixed-term contracts in the case of men and for those on permanent contracts in the case of women) and in the origin of the wage differential between sectors across the wage distribution (highlighting the relatively homogeneous wage premium across the wage distribution that is observed for women on fixed-term contracts).

The analysis inevitably suffers certain limitations that, due to the characteristics of the database used, cannot be addressed. The first concerns the possible selection bias associated with the choice of sector (public or private) made by the workers, and which stems from the possibility that this decision is related to unobserved characteristics that simultaneously affect wages. The method usually employed to correct this problem (the estimation of endogenous switching models) requires, however, the use of credible exclusion restrictions, which are always difficult to achieve and that are not actually available in the *Encuesta de Estructura Salarial*. Likewise, to the extent that this information source is composed of cross-sectional data, it is not possible to control for the unobservable heterogeneity of individuals, something that many previous studies have achieved by introducing individual fixed effects in the context of panel data, or to examine the wage impact associated with a change of sector.

To conclude, in the period following the specific year covered by this study (that is, 2010), significant changes have occurred in the Spanish economy affecting wages in both the public and private sectors. In the case of the former, public sector wages have been affected by severe adjustments implemented within a framework of fiscal consolidation. They may also have been affected by the great number of job losses – a phenomenon limited to the private sector at the beginning of the economic crisis – that have subsequently been recorded in the public sector. In the case of the latter, the intense regulatory changes in collective bargaining that constituted part of the 2012 labour reform may well have meant significant changes to wage determination processes, especially in the private but also in the public sector. As such, it would be of undoubted interest to consider in the future the evolution of public-private sector wage differentials in Spain in the period immediately following the one examined in this article.

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FIGURES AND TABLES

Figure 1. Public-private sector wage differentials across the wage distribution.

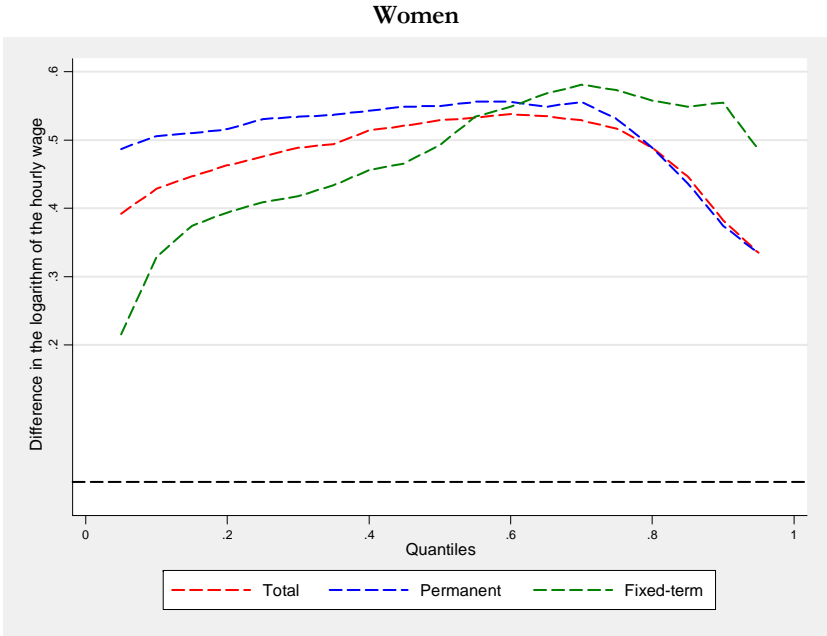




Figure 2. Aggregate decomposition of the public-private sector wage differentials.

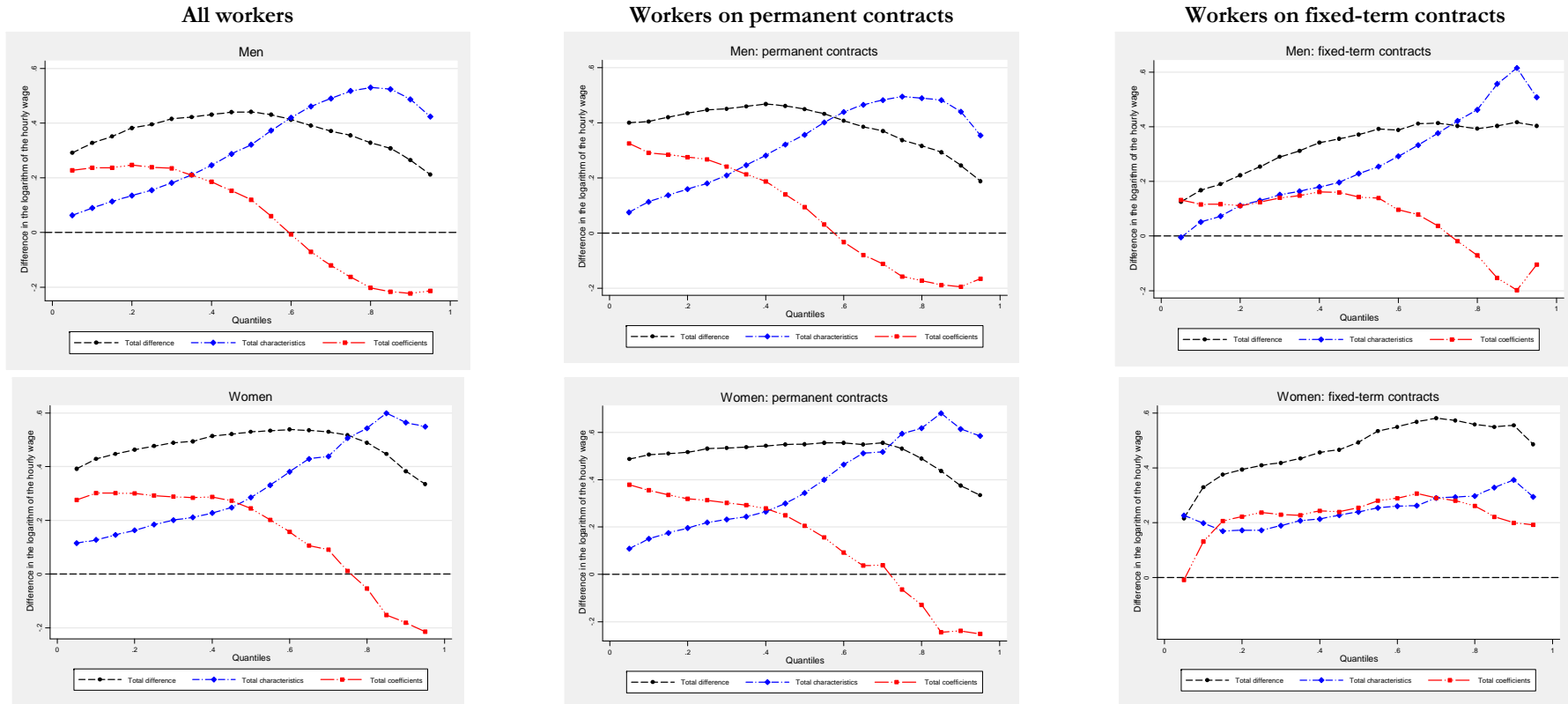


Figure 3. Detailed decomposition of the public-private sector wage differentials. Effect of the characteristics.



Figure 4. Detailed decomposition of the public-private sector wage differentials. Effect of the coefficients.



**Table 1.**  
**Public-private sector wage differentials in Spain.**

	Male			Female		
	All	Permanent	Fixed-term	All	Permanent	Fixed-term
Average	0.352	0.377	0.314	0.463	0.497	0.461
percentiles						
10	0.327	0.404	0.168	0.429	0.506	0.329
20	0.382	0.434	0.223	0.463	0.516	0.394
30	0.416	0.450	0.290	0.489	0.534	0.418
40	0.431	0.468	0.342	0.514	0.543	0.456
50	0.441	0.449	0.372	0.529	0.550	0.493
60	0.413	0.407	0.388	0.538	0.556	0.549
70	0.370	0.370	0.414	0.529	0.556	0.581
80	0.328	0.316	0.393	0.489	0.489	0.558
90	0.265	0.245	0.417	0.383	0.375	0.555

*Notes:* The table shows the public-private sector differential of the logarithm of the hourly wage.

**Table 2.**  
**Public-private sector wage inequality in Spain. Gini coefficient.**

	Male			Female		
	All	Permanent	Fixed-term	All	Permanent	Fixed-term
Public sector	0.089	0.080	0.104	0.089	0.081	0.099
Private sector	0.109	0.109	0.100	0.109	0.110	0.096
Differential	-0.020*	-0.029*	0.004	-0.020*	-0.029*	0.003

\* Indicates that the difference between the two sectors is statistically significant at the 1% level.

**Table 3.**  
**Decomposition of the public-private sector wage differentials. Average wages and the Oaxaca-Blinder technique.**

		Male	Male: permanent	Male: fixed-term	Female	Female: permanent	Female: fixed-term
Total	Public sector	2.659 (0.006)***	2.723 (0.006)***	2.462 (0.012)***	2.558 (0.005)***	2.620 (0.006)***	2.434 (0.008)***
	Private sector	2.306 (0.003)***	2.345 (0.003)***	2.148 (0.005)***	2.095 (0.003)***	2.122 (0.003)***	1.974 (0.007)***
	Differential	0.352 (0.006)***	0.378 (0.007)***	0.314 (0.013)***	0.463 (0.006)***	0.498 (0.007)***	0.461 (0.011)***
	Characteristics	0.312 (0.006)***	0.311 (0.007)***	0.281 (0.014)***	0.325 (0.006)***	0.372 (0.007)***	0.247 (0.014)***
	Coefficients	0.041 (0.006)***	0.067 (0.007)***	0.033 (0.016)**	0.138 (0.006)***	0.126 (0.007)***	0.214 (0.013)***
Characteristics	Age	0.017 (0.001)***	0.019 (0.001)***	0.009 (0.001)***	0.012 (0.001)***	0.018 (0.001)***	0.004 (0.002)*
	Education	0.054 (0.002)***	0.046 (0.002)***	0.069 (0.007)***	0.068 (0.002)***	0.064 (0.003)***	0.080 (0.005)***
	Tenure	0.057 (0.002)***	0.061 (0.002)***	0.043 (0.005)***	0.067 (0.002)***	0.088 (0.003)***	0.042 (0.005)***
	Contract	-0.001 (0.000)**	0.000 (0.000)	0.000 (0.000)	-0.003 (0.001)***	0.000 (0.000)	0.000 (0.000)
	Employment type (full-/part-time)	0.001 (0.000)**	0.004 (0.000)***	0.000 (0.000)	0.003 (0.001)*	0.006 (0.001)***	-0.005 (0.003)
	Supervisory tasks	-0.004 (0.001)***	-0.004 (0.001)**	0.000 (0.000)	-0.002 (0.000)**	0.000 (0.001)	0.000 (0.000)
	Occupation	0.032 (0.001)***	0.026 (0.001)***	0.052 (0.006)***	0.051 (0.001)***	0.056 (0.002)***	0.038 (0.004)***
	Region	-0.007 (0.001)***	-0.009 (0.001)***	-0.002 (0.002)	-0.008 (0.000)***	-0.010 (0.001)***	-0.001 (0.002)
	Size	0.104 (0.003)***	0.105 (0.003)***	0.086 (0.007)***	0.095 (0.003)***	0.107 (0.003)***	0.053 (0.007)***
	Type of collective agreement	0.058 (0.003)***	0.062 (0.004)***	0.024 (0.009)**	0.042 (0.003)***	0.042 (0.004)***	0.036 (0.007)***
Coefficients	Age	0.072 (0.013)***	-0.111 (0.009)***	0.058 (0.016)***	0.005 (0.011)	-0.092 (0.008)***	0.034 (0.019)*
	Education	0.070 (0.015)***	-0.049 (0.011)***	-0.049 (0.017)***	0.394 (0.014)***	0.094 (0.019)***	0.244 (0.013)***
	Tenure	-0.001 (0.000)	-0.003 (0.002)	0.064 (0.019)***	0.010 (0.001)***	-0.007 (0.001)***	0.065 (0.025)**
	Contract	0.034 (0.004)***	0.000 (0.000)	0.000 (0.000)	0.009 (0.002)***	0.000 (0.000)	0.000 (0.000)
	Employment type (full-/part-time)	0.031 (0.010)***	-0.028 (0.024)	0.039 (0.008)***	0.030 (0.006)***	0.011 (0.010)	0.032 (0.005)***
	Supervisory tasks	0.022 (0.010)**	0.017 (0.011)	0.007 (0.032)	0.013 (0.012)	-0.008 (0.012)	0.059 (0.034)*
	Occupation	-0.008 (0.004)	-0.016 (0.006)**	0.026 (0.009)***	-0.021 (0.005)***	-0.028 (0.006)***	0.009 (0.008)
	Region	-0.001 (0.004)	-0.007 (0.005)	0.019 (0.009)*	-0.013 (0.005)**	-0.019 (0.004)***	0.008 (0.013)
	Size	-0.036 (0.013)**	-0.030 (0.015)*	-0.032 (0.022)	-0.028 (0.010)***	-0.042 (0.014)***	-0.003 (0.013)
	Type of collective agreement	0.054 (0.007)***	0.054 (0.008)***	0.042 (0.014)***	0.040 (0.004)***	0.042 (0.005)***	0.032 (0.008)***
	Constant	-0.198 (0.031)***	0.241 (0.037)***	-0.142 (0.057)**	-0.299 (0.026)***	0.175 (0.031)***	-0.266 (0.053)***
N		89.953	71.428	18.525	67.821	52.239	15.582

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 4.**  
**Decomposition of the public-private sector wage differentials. Average wages and the Ñopo's technique.**

	Men						Women						
<b>All:</b> Differential 0.352	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV	<b>All:</b> Differential 0.463	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV
Individual characteristics	0.187	0.000	0.000	0.165	1.000	0.999	Individual characteristics	0.224	0.000	0.000	0.239	1.000	1.000
+ Job characteristics	0.138	0.001	0.001	0.212	0.993	0.951	+ Job characteristics	0.193	0.002	0.010	0.259	0.985	0.936
+ Establishment characteristics	0.073	-0.014	0.291	0.002	0.769	0.140	+ Establishment characteristics	0.122	-0.014	0.268	0.087	0.675	0.123
<b>Permanent:</b> Differential 0.378	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV	<b>Permanent:</b> Differential 0.497	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV
Individual characteristics	0.162	0.000	0.000	0.215	1.000	0.999	Individual characteristics	0.222	0.000	0.000	0.275	1.000	1.000
+ Job characteristics	0.139	0.000	0.006	0.233	1.000	0.947	+ Job characteristics	0.214	0.000	0.014	0.270	1.000	0.926
+ Establishment characteristics	0.095	0.004	0.287	-0.009	0.870	0.154	+ Establishment characteristics	0.136	0.004	0.282	0.076	0.789	0.128
<b>Fixed-term:</b> Differential 0.314	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV	<b>Fixed-term:</b> Differential 0.461	$\Delta$ EXP	$\Delta$ PUB	$\Delta$ PRIV	$\Delta$ UNEXP	CSPUB	CSPRIV
Individual characteristics	0.198	0.001	0.000	0.115	0.998	0.999	Individual characteristics	0.217	0.000	0.000	0.244	0.997	0.999
+ Job characteristics	0.197	0.013	-0.021	0.125	0.972	0.966	+ Job characteristics	0.245	0.012	-0.002	0.205	0.956	0.983
+ Establishment characteristics	-0.036	0.058	0.198	0.093	0.462	0.085	+ Establishment characteristics	0.136	0.027	0.148	0.150	0.445	0.102

*Notes:* Individual characteristics include age and education; job characteristics include tenure, contract, type of employment, supervisory tasks and occupation; establishment characteristics include all the other variables: region, size and collective agreement type. CSPUB and CSPRIV represent, respectively, the proportion of workers in the public and private sectors that form part of the common support.

**Table 5.**  
**Decomposition of the public-private sector wage differentials. Quantiles and the Fortin-Lemieux-Firpo technique. Men.**

		All			Permanent contract holders			Fixed-term contract holders		
		10th percentile	Median	90th percentile	10th percentile	Median	90th percentile	10th percentile	Median	90th percentile
Total	Public sector	2.134 (0.009)***	2.655 (0.008)***	3.204 (0.011)***	2.234 (0.009)***	2.715 (0.008)***	3.228 (0.013)***	1.909 (0.016)***	2.433 (0.014)***	3.073 (0.025)***
	Private sector	1.807 (0.004)***	2.214 (0.004)***	2.939 (0.006)***	1.831 (0.004)***	2.265 (0.004)***	2.983 (0.007)***	1.741 (0.006)***	2.061 (0.005)***	2.655 (0.014)***
	Differential	0.327 (0.010)***	0.441 (0.008)***	0.265 (0.013)***	0.404 (0.010)***	0.449 (0.009)***	0.245 (0.014)***	0.168 (0.018)***	0.372 (0.015)***	0.417 (0.029)***
Characteristics	Characteristics	0.090 (0.006)***	0.321 (0.007)***	0.487 (0.014)***	0.113 (0.007)***	0.356 (0.008)***	0.440 (0.015)***	0.052 (0.015)***	0.229 (0.012)***	0.416 (0.036)***
	Coefficients	0.237 (0.010)***	0.120 (0.008)***	-0.222 (0.016)***	0.291 (0.011)***	0.094 (0.009)***	-0.195 (0.017)***	0.116 (0.024)***	0.143 (0.015)***	-0.198 (0.043)***
	Age	0.004 (0.002)**	0.014 (0.001)***	0.033 (0.002)***	0.005 (0.002)**	0.017 (0.002)***	0.037 (0.003)***	0.006 (0.002)***	0.009 (0.002)***	0.015 (0.004)***
Characteristics	Education	0.020 (0.002)***	0.046 (0.002)***	0.104 (0.006)***	0.017 (0.002)***	0.084 (0.003)***	0.084 (0.006)***	0.025 (0.006)***	0.072 (0.006)***	0.125 (0.020)***
	Tenure	0.036 (0.002)***	0.055 (0.003)***	0.075 (0.005)***	0.039 (0.003)***	0.065 (0.003)***	0.075 (0.005)***	0.028 (0.006)***	0.030 (0.005)***	0.073 (0.014)***
	Contract	-0.001 (0.001)*	-0.002 (0.000)***	0.001 (0.001)*	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Coefficients	Full-/part-time	0.005 (0.001)***	0.003 (0.000)***	-0.003 (0.001)***	0.010 (0.002)***	0.005 (0.001)***	-0.004 (0.002)***	-0.003 (0.002)	-0.001 (0.001)	0.003 (0.002)
	Supervisory tasks	-0.001 (0.000)***	-0.004 (0.001)***	-0.007 (0.002)***	-0.002 (0.001)**	-0.004 (0.001)**	-0.006 (0.002)**	0.000 (0.000)	0.000 (0.001)	0.001 (0.002)
	Occupation	0.008 (0.002)***	0.035 (0.002)***	0.052 (0.003)***	0.008 (0.002)***	0.032 (0.002)***	0.035 (0.003)***	0.010 (0.007)	0.030 (0.006)***	0.116 (0.016)***
Coefficients	Region	-0.005 (0.001)***	-0.013 (0.002)***	0.001 (0.001)	-0.006 (0.002)***	-0.017 (0.002)***	-0.001 (0.002)	-0.006 (0.003)**	-0.003 (0.003)	-0.004 (0.004)
	Size	0.065 (0.005)***	0.114 (0.004)***	0.137 (0.007)***	0.064 (0.005)***	0.127 (0.005)***	0.134 (0.008)***	0.066 (0.010)***	0.074 (0.007)***	0.121 (0.021)***
	Type of collective agreement	-0.042 (0.006)***	0.074 (0.004)***	0.095 (0.009)***	-0.023 (0.006)***	0.087 (0.005)***	0.087 (0.010)***	-0.075 (0.011)***	0.018 (0.008)**	0.167 (0.027)***
Coefficients	Age	-0.002 (0.028)	0.055 (0.019)***	0.164 (0.021)***	-0.016 (0.017)	-0.101 (0.013)***	-0.261 (0.021)***	0.035 (0.029)	0.093 (0.023)***	0.162 (0.044)***
	Education	0.227 (0.038)***	0.068 (0.021)***	-0.141 (0.022)***	-0.106 (0.015)***	-0.095 (0.013)***	0.150 (0.029)***	0.174 (0.060)***	0.145 (0.032)***	-0.134 (0.065)**
	Tenure	0.255 (0.023)***	0.268 (0.016)***	0.327 (0.023)***	0.088 (0.018)***	0.148 (0.015)***	0.191 (0.023)***	0.025 (0.036)	-0.008 (0.043)	0.579 (0.143)***
Coefficients	Contract	0.050 (0.008)***	0.032 (0.005)***	0.020 (0.007)***	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
	Full-/part-time	0.052 (0.022)**	-0.000 (0.012)	0.048 (0.017)***	-0.030 (0.049)	-0.047 (0.030)	0.001 (0.041)	0.043 (0.013)***	0.016 (0.008)*	0.073 (0.018)***
	Supervisory tasks	0.000 (0.003)	0.005 (0.004)	-0.034 (0.008)***	0.018 (0.004)***	0.001 (0.004)	-0.045 (0.009)***	-0.002 (0.005)	0.001 (0.004)	-0.012 (0.011)
Coefficients	Occupation	0.077 (0.015)***	-0.039 (0.006)***	-0.032 (0.006)***	0.037 (0.019)*	-0.046 (0.008)***	-0.017 (0.006)***	0.060 (0.017)***	0.034 (0.010)***	-0.006 (0.018)
	Region	-0.005 (0.008)	0.009 (0.006)	-0.030 (0.010)***	-0.017 (0.009)*	0.011 (0.007)	-0.032 (0.012)***	0.086 (0.014)***	0.019 (0.010)*	0.007 (0.032)
	Size	0.011 (0.019)	-0.063 (0.019)***	-0.029 (0.019)	0.037 (0.031)	-0.073 (0.020)***	-0.024 (0.022)	0.056 (0.044)	-0.042 (0.024)*	-0.263 (0.101)***
Coefficients	Type of collective agreement	0.068 (0.015)***	0.067 (0.010)***	0.013 (0.016)	0.126 (0.019)***	0.040 (0.011)***	0.022 (0.018)	0.043 (0.025)*	0.033 (0.020)	-0.050 (0.032)
	Constant	-0.495 (0.058)***	-0.281 (0.037)***	-0.528 (0.047)***	0.156 (0.075)**	0.257 (0.052)***	-0.181 (0.073)**	-0.405 (0.100)***	-0.148 (0.070)**	-0.554 (0.202)***
	N	89,953	89,953	89,953	71,428	71,428	71,428	18,525	18,525	18,525

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

**Table 6.**  
**Decomposition of the public-private sector wage differentials. Quantiles and the Fortin-Lemieux-Firpo technique. Women.**

		All			Permanent contract holders			Fixed-term contract holders			
		10th percentile	Median	90th percentile	10th percentile	Median	90th percentile	10th percentile	Median	90th percentile	
Total	Public sector	2.080 (0.006)***	2.526 (0.006)***	3.085 (0.010)***	2.168 (0.007)***	2.574 (0.008)***	3.115 (0.012)***	1.931 (0.014)***	2.399 (0.011)***	3.001 (0.018)***	
	Private sector	1.651 (0.003)***	1.997 (0.004)***	2.703 (0.008)***	1.663 (0.004)***	2.024 (0.004)***	2.740 (0.009)***	1.602 (0.008)***	1.906 (0.007)***	2.445 (0.023)***	
	Differential	0.429 (0.007)***	0.529 (0.007)***	0.383 (0.013)***	0.506 (0.008)***	0.550 (0.009)***	0.375 (0.015)***	0.329 (0.016)***	0.493 (0.013)***	0.555 (0.029)***	
	Characteristics	0.127 (0.007)***	0.285 (0.007)***	0.564 (0.017)***	0.150 (0.008)***	0.344 (0.009)***	0.614 (0.020)***	0.198 (0.021)***	0.239 (0.014)***	0.356 (0.039)***	
Characteristics	Coefficients	0.301 (0.009)***	0.244 (0.008)***	-0.181 (0.020)***	0.355 (0.010)***	0.205 (0.010)***	-0.239 (0.023)***	0.131 (0.028)***	0.254 (0.015)***	0.199 (0.036)***	
	Age	0.004 (0.002)**	0.004 (0.002)**	0.034 (0.004)***	0.007 (0.003)**	0.007 (0.003)***	0.048 (0.005)***	0.004 (0.003)	0.000 (0.002)	0.008 (0.007)	
	Education	0.018 (0.002)***	0.064 (0.003)***	0.130 (0.006)***	0.016 (0.002)***	0.061 (0.003)***	0.120 (0.007)***	0.028 (0.005)***	0.098 (0.006)***	0.130 (0.016)***	
	Tenure	0.034 (0.002)***	0.054 (0.003)***	0.115 (0.007)***	0.046 (0.004)***	0.078 (0.004)***	0.137 (0.009)***	0.031 (0.007)***	0.029 (0.005)***	0.074 (0.015)***	
	Contract	-0.008 (0.001)***	-0.005 (0.001)***	0.007 (0.002)***	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	
	Full-/part-time	0.007 (0.002)***	0.003 (0.002)*	0.001 (0.004)	0.004 (0.003)*	0.008 (0.002)***	0.011 (0.004)***	0.033 (0.005)***	-0.001 (0.004)	-0.037 (0.010)***	
	Supervisory tasks	-0.000 (0.000)*	-0.001 (0.001)**	-0.003 (0.002)*	0.000 (0.000)	0.000 (0.001)	0.001 (0.002)	0.000 (0.001)	0.000 (0.001)	0.001 (0.002)	
	Occupation	0.027 (0.002)***	0.050 (0.002)***	0.068 (0.004)***	0.029 (0.003)***	0.057 (0.003)***	0.073 (0.004)***	0.032 (0.006)***	0.033 (0.005)***	0.052 (0.010)***	
	Region	-0.003 (0.001)***	-0.009 (0.001)***	-0.009 (0.002)***	-0.002 (0.001)*	-0.011 (0.001)***	-0.012 (0.002)***	-0.000 (0.003)	-0.001 (0.003)	-0.002 (0.005)	
	Size	0.060 (0.004)***	0.082 (0.004)***	0.145 (0.009)***	0.057 (0.005)***	0.094 (0.005)***	0.175 (0.009)***	0.082 (0.011)***	0.058 (0.008)***	0.023 (0.021)	
	Type of collective agreement	-0.012 (0.005)***	0.042 (0.004)***	0.075 (0.011)***	-0.008 (0.005)***	0.050 (0.005)***	0.061 (0.013)***	-0.013 (0.014)	0.024 (0.009)***	0.108 (0.020)***	
	Coefficients	Age	-0.011 (0.019)	0.002 (0.014)	-0.010 (0.023)	0.004 (0.011)	-0.028 (0.012)**	-0.025 (0.023)	0.012 (0.027)	-0.015 (0.020)	0.130 (0.074)*
		Education	0.300 (0.043)***	0.133 (0.020)***	-0.141 (0.030)***	-0.124 (0.016)***	-0.399 (0.014)***	-0.465 (0.023)***	0.031 (0.022)	0.167 (0.022)***	0.023 (0.090)
		Tenure	-0.090 (0.012)***	-0.088 (0.014)***	0.016 (0.032)	0.130 (0.015)***	0.184 (0.016)***	0.386 (0.035)***	-0.175 (0.053)***	-0.280 (0.069)***	-0.006 (0.255)
		Contract	0.018 (0.004)***	0.008 (0.003)***	-0.009 (0.006)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
		Full-/part-time	0.072 (0.011)***	0.013 (0.007)*	-0.005 (0.012)	0.021 (0.018)	0.000 (0.013)	-0.017 (0.021)	0.062 (0.010)***	0.017 (0.006)***	0.033 (0.013)***
Supervisory tasks		0.001 (0.002)	0.007 (0.002)***	-0.011 (0.006)*	0.003 (0.002)	0.014 (0.003)***	-0.013 (0.008)	0.006 (0.003)**	-0.006 (0.004)	-0.014 (0.011)	
Occupation		0.063 (0.012)***	-0.033 (0.007)***	-0.076 (0.010)***	0.056 (0.015)***	-0.044 (0.009)***	-0.078 (0.009)***	0.050 (0.017)***	0.013 (0.010)	-0.022 (0.022)	
Region		0.004 (0.006)	-0.014 (0.006)**	-0.028 (0.013)**	-0.015 (0.007)**	-0.024 (0.008)***	-0.038 (0.012)***	0.056 (0.011)***	-0.010 (0.011)	-0.003 (0.033)	
Size		0.007 (0.021)	-0.004 (0.023)	-0.095 (0.022)***	-0.002 (0.025)	-0.019 (0.021)	-0.122 (0.034)***	-0.008 (0.018)	0.004 (0.032)	0.045 (0.025)*	
Type of collective agreement		0.053 (0.010)***	0.033 (0.006)***	0.030 (0.011)***	0.040 (0.010)***	0.039 (0.008)***	0.037 (0.014)***	0.039 (0.019)**	0.037 (0.011)***	0.043 (0.020)**	
Constant	-0.115 (0.060)*	0.186 (0.038)***	0.148 (0.061)**	0.243 (0.048)***	0.482 (0.039)***	0.096 (0.068)	0.058 (0.083)	0.327 (0.083)***	-0.029 (0.274)		
<i>N</i>		67,821	67,821	67,821	52,239	52,239	52,239	15,582	15,582	15,582	

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$



Table 7.

## Decomposition of the public-private sector wage differentials. Wage inequality (Gini coefficient) and the Fortin-Lemieux-Firpo technique.

		Male	Male: permanent	Male: fixed-term	Female	Female: permanent	Female: fixed-term
Total	Public sector	0.089 (0.001)***	0.080 (0.001)***	0.104 (0.002)***	0.089 (0.001)***	0.081 (0.001)***	0.099 (0.001)***
	Private sector	0.109 (0.001)***	0.109 (0.001)***	0.100 (0.001)***	0.109 (0.001)***	0.110 (0.001)***	0.096 (0.002)***
	Differential	-0.020 (0.001)***	-0.029 (0.001)***	0.004 (0.002)*	-0.020 (0.001)***	-0.029 (0.001)***	0.003 (0.002)
	Characteristics	0.025 (0.001)***	0.016 (0.001)***	0.042 (0.004)***	0.028 (0.001)***	0.029 (0.002)***	0.008 (0.003)**
	Coefficients	-0.045 (0.002)***	-0.046 (0.001)***	-0.038 (0.005)***	-0.048 (0.002)***	-0.058 (0.002)***	-0.005 (0.004)
Characteristics	Age	0.002 (0.000)***	0.002 (0.000)***	0.001 (0.000)*	0.002 (0.000)***	0.004 (0.000)***	-0.000 (0.001)
	Education	0.004 (0.000)***	0.003 (0.000)***	0.004 (0.002)*	0.007 (0.000)***	0.005 (0.000)***	0.005 (0.001)***
	Tenure	0.002 (0.000)***	0.001 (0.000)*	0.003 (0.001)**	0.005 (0.001)***	0.005 (0.001)***	0.004 (0.001)***
	Contract	0.000 (0.000)***	0.000 (0.000)	0.000 (0.000)	0.002 (0.000)***	0.000 (0.000)	0.000 (0.000)
	Employment type (full-/part-time)	-0.001 (0.000)***	-0.001 (0.000)***	0.001 (0.000)	-0.001 (0.000)**	0.001 (0.000)	-0.007 (0.001)***
	Supervisory tasks	-0.000 (0.000)***	-0.000 (0.000)**	0.000 (0.000)	-0.000 (0.000)*	0.000 (0.000)	0.000 (0.000)
	Occupation	0.003 (0.000)***	0.002 (0.000)***	0.011 (0.002)***	0.002 (0.000)***	0.002 (0.000)***	0.001 (0.001)
	Region	0.000 (0.000)***	0.001 (0.000)***	0.001 (0.000)	-0.000 (0.000)	-0.001 (0.000)***	0.000 (0.000)
	Size	0.001 (0.001)*	0.000 (0.001)	0.003 (0.002)*	0.004 (0.001)***	0.006 (0.001)***	-0.006 (0.002)***
	Type of collective agreement	0.012 (0.001)***	0.009 (0.001)***	0.019 (0.003)***	0.008 (0.001)***	0.006 (0.001)***	0.010 (0.002)***
Coefficients	Age	0.013 (0.003)***	-0.017 (0.002)***	0.012 (0.004)***	-0.001 (0.002)	-0.000 (0.002)	0.006 (0.004)
	Education	-0.035 (0.003)***	0.023 (0.002)***	-0.039 (0.007)***	-0.044 (0.004)***	-0.019 (0.002)***	-0.009 (0.005)*
	Tenure	0.001 (0.003)	0.003 (0.002)	0.051 (0.015)***	0.009 (0.002)***	0.015 (0.003)***	0.026 (0.019)
	Contract	-0.003 (0.001)***	0.000 (0.000)	0.000 (0.000)	-0.003 (0.001)***	0.000 (0.000)	0.000 (0.000)
	Employment type (full-/part-time)	0.000 (0.003)	0.002 (0.005)	0.002 (0.002)	-0.009 (0.001)***	-0.006 (0.002)***	-0.002 (0.001)
	Supervisory tasks	-0.003 (0.001)***	-0.004 (0.001)***	-0.001 (0.001)	-0.002 (0.000)***	-0.002 (0.001)***	-0.002 (0.001)***
	Occupation	-0.007 (0.001)***	-0.002 (0.001)*	-0.007 (0.002)***	-0.010 (0.001)***	-0.009 (0.001)***	-0.007 (0.002)***
	Region	-0.004 (0.001)***	-0.002 (0.001)**	-0.008 (0.002)***	-0.004 (0.001)***	-0.002 (0.001)	-0.005 (0.004)
	Size	-0.006 (0.002)***	-0.002 (0.002)	-0.011 (0.004)***	-0.007 (0.002)***	-0.009 (0.003)***	0.005 (0.003)*
	Type of collective agreement	-0.009 (0.001)***	-0.009 (0.002)***	-0.007 (0.003)**	-0.003 (0.001)***	-0.002 (0.001)*	-0.002 (0.002)
	Constant	0.007 (0.006)	-0.037 (0.007)***	-0.029 (0.019)	0.025 (0.007)***	-0.023 (0.006)***	-0.014 (0.022)
	<i>N</i>	89,953	71,428	18,525	67,821	52,239	15,582

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$

## Appendix

**Table A.1.**  
**Descriptive statistics.**

	Men						Women					
	All		Permanent		Fixed-term		All		Permanent		Fixed-term	
	Public sector	Private sector	Public sector	Private sector	Public sector	Private sector	Public sector	Private sector	Public sector	Private sector	Public sector	Private sector
Logarithm of hourly wage	2.659	2.306	2.723	2.345	2.462	2.148	2.558	2.095	2.620	2.122	2.434	1.974
Age: less than 30	0.150	0.295	0.108	0.262	0.280	0.429	0.162	0.354	0.083	0.319	0.322	0.507
Age: between 30 and 45	0.488	0.475	0.486	0.500	0.493	0.371	0.501	0.471	0.501	0.494	0.502	0.367
Age: more than 45	0.362	0.230	0.406	0.238	0.227	0.200	0.337	0.176	0.416	0.187	0.177	0.125
Primary education	0.086	0.211	0.072	0.195	0.128	0.277	0.046	0.152	0.037	0.146	0.062	0.180
Secondary education	0.551	0.615	0.590	0.615	0.432	0.617	0.481	0.607	0.499	0.605	0.445	0.616
Tertiary education	0.363	0.174	0.338	0.190	0.440	0.107	0.473	0.241	0.463	0.249	0.494	0.203
Full-time	0.929	0.894	0.984	0.922	0.760	0.778	0.904	0.650	0.960	0.690	0.791	0.469
Tenure: 3 years or less	0.221	0.390	0.116	0.282	0.543	0.832	0.254	0.467	0.126	0.371	0.512	0.891
Tenure: between 4 and 10 years	0.245	0.322	0.226	0.381	0.304	0.083	0.257	0.338	0.212	0.396	0.348	0.081
Tenure: between 11 and 20 years	0.230	0.170	0.272	0.207	0.104	0.021	0.234	0.131	0.294	0.158	0.114	0.011
Tenure: more than 20 years	0.304	0.117	0.387	0.131	0.048	0.064	0.254	0.064	0.368	0.075	0.026	0.017
Permanent contract	0.754	0.803	1.000	1.000	0.000	0.000	0.669	0.816	1.000	1.000	0.000	0.000
Supervisory tasks	0.193	0.214	0.223	0.243	0.100	0.097	0.143	0.153	0.172	0.170	0.083	0.078
Skilled occupations	0.576	0.371	0.558	0.404	0.630	0.235	0.749	0.472	0.767	0.492	0.711	0.386
Semi-skilled occupations	0.357	0.542	0.392	0.525	0.252	0.613	0.187	0.377	0.180	0.370	0.200	0.408
Unskilled occupations	0.067	0.087	0.050	0.071	0.118	0.152	0.065	0.150	0.053	0.138	0.089	0.205
Size: less than 10	0.017	0.287	0.016	0.280	0.019	0.317	0.007	0.329	0.006	0.332	0.009	0.316
Size: between 10 and 49	0.084	0.317	0.080	0.317	0.097	0.314	0.058	0.239	0.051	0.238	0.073	0.248
Size: between 50 and 199	0.163	0.189	0.154	0.186	0.189	0.201	0.125	0.184	0.117	0.178	0.142	0.211
Size: 200 or more	0.736	0.207	0.750	0.216	0.695	0.168	0.810	0.247	0.827	0.252	0.776	0.226
National collective agreement for sector	0.027	0.276	0.029	0.291	0.021	0.217	0.035	0.337	0.033	0.337	0.038	0.335
Sub-national collective agreement for sector	0.100	0.561	0.088	0.541	0.135	0.641	0.120	0.525	0.120	0.521	0.122	0.543
Establishment-level collective agreement	0.873	0.163	0.883	0.168	0.844	0.141	0.845	0.138	0.847	0.141	0.840	0.122
Number of observations	10,067	79,886	7,375	64,053	2,692	15,833	13,349	54,472	8,288	43,951	5,061	10,521



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**Fageda, X.** (GiM-IREA), **Perdiguero, J.** (GiM-IREA)

“An empirical analysis of a merger between a network and low-cost airlines”  
(Maig 2011)





**XREAP2011-02**

**Moreno-Torres, I.** (ACCO, CRES & GiM-IREA)

“What if there was a stronger pharmaceutical price competition in Spain? When regulation has a similar effect to collusion”  
(Maig 2011)

**XREAP2011-03**

**Miguélez, E.** (AQR-IREA); **Gómez-Miguélez, I.**

“Singling out individual inventors from patent data”  
(Maig 2011)

**XREAP2011-04**

**Moreno-Torres, I.** (ACCO, CRES & GiM-IREA)

“Generic drugs in Spain: price competition vs. moral hazard”  
(Maig 2011)

**XREAP2011-05**

**Nieto, S.** (AQR-IREA), **Ramos, R.** (AQR-IREA)

“¿Afecta la sobreeducación de los padres al rendimiento académico de sus hijos?”  
(Maig 2011)

**XREAP2011-06**

**Pitt, D., Guillén, M.** (RFA-IREA), **Bolancé, C.** (RFA-IREA)

“Estimation of Parametric and Nonparametric Models for Univariate Claim Severity Distributions - an approach using R”  
(Juny 2011)

**XREAP2011-07**

**Guillén, M.** (RFA-IREA), **Comas-Herrera, A.**

“How much risk is mitigated by LTC Insurance? A case study of the public system in Spain”  
(Juny 2011)

**XREAP2011-08**

**Ayuso, M.** (RFA-IREA), **Guillén, M.** (RFA-IREA), **Bolancé, C.** (RFA-IREA)

“Loss risk through fraud in car insurance”  
(Juny 2011)

**XREAP2011-09**

**Duch-Brown, N.** (IEB), **García-Quevedo, J.** (IEB), **Montolio, D.** (IEB)

“The link between public support and private R&D effort: What is the optimal subsidy?”  
(Juny 2011)

**XREAP2011-10**

**Bermúdez, Ll.** (RFA-IREA), **Karlis, D.**

“Mixture of bivariate Poisson regression models with an application to insurance”  
(Juliol 2011)

**XREAP2011-11**

**Varela-Irimia, X-L.** (GRIT)

“Age effects, unobserved characteristics and hedonic price indexes: The Spanish car market in the 1990s”  
(Agost 2011)

**XREAP2011-12**

**Bermúdez, Ll.** (RFA-IREA), **Ferri, A.** (RFA-IREA), **Guillén, M.** (RFA-IREA)

“A correlation sensitivity analysis of non-life underwriting risk in solvency capital requirement estimation”  
(Setembre 2011)

**XREAP2011-13**

**Guillén, M.** (RFA-IREA), **Pérez-Marín, A.** (RFA-IREA), **Alcañiz, M.** (RFA-IREA)

“A logistic regression approach to estimating customer profit loss due to lapses in insurance”  
(Octubre 2011)

**XREAP2011-14**

**Jiménez, J. L., Perdiguero, J.** (GiM-IREA), **García, C.**

“Evaluation of subsidies programs to sell green cars: Impact on prices, quantities and efficiency”  
(Octubre 2011)



**XREAP2011-15**

**Arespa, M.** (CREB)

“A New Open Economy Macroeconomic Model with Endogenous Portfolio Diversification and Firms Entry”  
(Octubre 2011)

**XREAP2011-16**

**Matas, A.** (GEAP), **Raymond, J. L.** (GEAP), **Roig, J.L.** (GEAP)

“The impact of agglomeration effects and accessibility on wages”  
(Novembre 2011)

**XREAP2011-17**

**Segarra, A.** (GRIT)

“R&D cooperation between Spanish firms and scientific partners: what is the role of tertiary education?”  
(Novembre 2011)

**XREAP2011-18**

**García-Pérez, J. I.**; **Hidalgo-Hidalgo, M.**; **Robles-Zurita, J. A.**

“Does grade retention affect achievement? Some evidence from PISA”  
(Novembre 2011)

**XREAP2011-19**

**Arespa, M.** (CREB)

“Macroeconomics of extensive margins: a simple model”  
(Novembre 2011)

**XREAP2011-20**

**García-Quevedo, J.** (IEB), **Pellegrino, G.** (IEB), **Vivarelli, M.**

“The determinants of YICs’ R&D activity”  
(Desembre 2011)

**XREAP2011-21**

**González-Val, R.** (IEB), **Olmo, J.**

“Growth in a Cross-Section of Cities: Location, Increasing Returns or Random Growth?”  
(Desembre 2011)

**XREAP2011-22**

**Gombau, V.** (GRIT), **Segarra, A.** (GRIT)

“The Innovation and Imitation Dichotomy in Spanish firms: do absorptive capacity and the technological frontier matter?”  
(Desembre 2011)

**2012**

**XREAP2012-01**

**Borrell, J. R.** (GiM-IREA), **Jiménez, J. L.**, **García, C.**

“Evaluating Antitrust Leniency Programs”  
(Gener 2012)

**XREAP2012-02**

**Ferri, A.** (RFA-IREA), **Guillén, M.** (RFA-IREA), **Bermúdez, L.I.** (RFA-IREA)

“Solvency capital estimation and risk measures”  
(Gener 2012)

**XREAP2012-03**

**Ferri, A.** (RFA-IREA), **Bermúdez, L.I.** (RFA-IREA), **Guillén, M.** (RFA-IREA)

“How to use the standard model with own data”  
(Febrer 2012)

**XREAP2012-04**

**Perdiguero, J.** (GiM-IREA), **Borrell, J.R.** (GiM-IREA)

“Driving competition in local gasoline markets”  
(Març 2012)

**XREAP2012-05**

D’Amico, G., **Guillen, M.** (RFA-IREA), Manca, R.

“Discrete time Non-homogeneous Semi-Markov Processes applied to Models for Disability Insurance”  
(Març 2012)



**XREAP2012-06**

**Bové-Sans, M. A.** (GRIT), Laguardo-Ramírez, R.  
“Quantitative analysis of image factors in a cultural heritage tourist destination”  
(Abril 2012)

**XREAP2012-07**

**Tello, C.** (AQR-IREA), **Ramos, R.** (AQR-IREA), **Artís, M.** (AQR-IREA)  
“Changes in wage structure in Mexico going beyond the mean: An analysis of differences in distribution, 1987-2008”  
(Maig 2012)

**XREAP2012-08**

**Jofre-Monseny, J.** (IEB), **Marín-López, R.** (IEB), **Viladecans-Marsal, E.** (IEB)  
“What underlies localization and urbanization economies? Evidence from the location of new firms”  
(Maig 2012)

**XREAP2012-09**

**Muñiz, I.** (GEAP), **Calatayud, D.**, **Dobaño, R.**  
“Los límites de la compacidad urbana como instrumento a favor de la sostenibilidad. La hipótesis de la compensación en Barcelona medida a través de la huella ecológica de la movilidad y la vivienda”  
(Maig 2012)

**XREAP2012-10**

**Arqué-Castells, P.** (GEAP), **Mohnen, P.**  
“Sunk costs, extensive R&D subsidies and permanent inducement effects”  
(Maig 2012)

**XREAP2012-11**

**Boj, E.** (CREB), **Delicado, P.**, **Fortiana, J.**, **Esteve, A.**, **Caballé, A.**  
“Local Distance-Based Generalized Linear Models using the dbstats package for R”  
(Maig 2012)

**XREAP2012-12**

**Royuela, V.** (AQR-IREA)  
“What about people in European Regional Science?”  
(Maig 2012)

**XREAP2012-13**

**Osorio A. M.** (RFA-IREA), **Bolancé, C.** (RFA-IREA), **Madise, N.**  
“Intermediary and structural determinants of early childhood health in Colombia: exploring the role of communities”  
(Juny 2012)

**XREAP2012-14**

**Miguelé, E.** (AQR-IREA), **Moreno, R.** (AQR-IREA)  
“Do labour mobility and networks foster geographical knowledge diffusion? The case of European regions”  
(Juliol 2012)

**XREAP2012-15**

**Teixidó-Figueras, J.** (GRIT), **Duró, J. A.** (GRIT)  
“Ecological Footprint Inequality: A methodological review and some results”  
(Setembre 2012)

**XREAP2012-16**

**Varela-Irimia, X-L.** (GRIT)  
“Profitability, uncertainty and multi-product firm product proliferation: The Spanish car industry”  
(Setembre 2012)

**XREAP2012-17**

**Duró, J. A.** (GRIT), **Teixidó-Figueras, J.** (GRIT)  
“Ecological Footprint Inequality across countries: the role of environment intensity, income and interaction effects”  
(Octubre 2012)

**XREAP2012-18**

**Manresa, A.** (CREB), **Sancho, F.**  
“Leontief versus Ghosh: two faces of the same coin”  
(Octubre 2012)



**XREAP2012-19**

**Alemany, R.** (RFA-IREA), **Bolancé, C.** (RFA-IREA), **Guillén, M.** (RFA-IREA)

“Nonparametric estimation of Value-at-Risk”

(Octubre 2012)

**XREAP2012-20**

**Herrera-Idárraga, P.** (AQR-IREA), **López-Bazo, E.** (AQR-IREA), **Motellón, E.** (AQR-IREA)

“Informality and overeducation in the labor market of a developing country”

(Novembre 2012)

**XREAP2012-21**

**Di Paolo, A.** (AQR-IREA)

“(Endogenous) occupational choices and job satisfaction among recent PhD recipients: evidence from Catalonia”

(Desembre 2012)

**2013**

**XREAP2013-01**

**Segarra, A.** (GRIT), **García-Quevedo, J.** (IEB), **Teruel, M.** (GRIT)

“Financial constraints and the failure of innovation projects”

(Març 2013)

**XREAP2013-02**

**Osorio, A. M.** (RFA-IREA), **Bolancé, C.** (RFA-IREA), **Madise, N.**, **Rathmann, K.**

“Social Determinants of Child Health in Colombia: Can Community Education Moderate the Effect of Family Characteristics?”

(Març 2013)

**XREAP2013-03**

**Teixidó-Figueras, J.** (GRIT), **Duró, J. A.** (GRIT)

“The building blocks of international ecological footprint inequality: a regression-based decomposition”

(Abril 2013)

**XREAP2013-04**

**Salcedo-Sanz, S.**, **Carro-Calvo, L.**, **Claramunt, M.** (CREB), **Castañer, A.** (CREB), **Marmol, M.** (CREB)

“An Analysis of Black-box Optimization Problems in Reinsurance: Evolutionary-based Approaches”

(Maig 2013)

**XREAP2013-05**

**Alcañiz, M.** (RFA), **Guillén, M.** (RFA), **Sánchez-Moscona, D.** (RFA), **Santolino, M.** (RFA), **Llatje, O.**, **Ramon, Ll.**

“Prevalence of alcohol-impaired drivers based on random breath tests in a roadside survey”

(Juliol 2013)

**XREAP2013-06**

**Matas, A.** (GEAP & IEB), **Raymond, J. Ll.** (GEAP & IEB), **Roig, J. L.** (GEAP)

“How market access shapes human capital investment in a peripheral country”

(Octubre 2013)

**XREAP2013-07**

**Di Paolo, A.** (AQR-IREA), **Tansel, A.**

“Returns to Foreign Language Skills in a Developing Country: The Case of Turkey”

(Novembre 2013)

**XREAP2013-08**

**Fernández Gual, V.** (GRIT), **Segarra, A.** (GRIT)

“The Impact of Cooperation on R&D, Innovation and Productivity: an Analysis of Spanish Manufacturing and Services Firms”

(Novembre 2013)

**XREAP2013-09**

**Bahraoui, Z.** (RFA); **Bolancé, C.** (RFA); **Pérez-Marín, A. M.** (RFA)

“Testing extreme value copulas to estimate the quantile”

(Novembre 2013)

**2014**

**XREAP2014-01**

**Solé-Auró, A.** (RFA), **Alcañiz, M.** (RFA)

“Are we living longer but less healthy? Trends in mortality and morbidity in Catalonia (Spain), 1994-2011”

(Gener 2014)



**XREAP2014-02**

**Teixidó-Figueres, J.** (GRIT), **Duro, J. A.** (GRIT)

“Spatial Polarization of the Ecological Footprint distribution”

(Febrer 2014)

**XREAP2014-03**

**Cristobal-Cebolla, A.;** **Gil Lafuente, A. M.** (RFA), **Merigó Lindhal, J. M.** (RFA)

“La importancia del control de los costes de la no-calidad en la empresa”

(Febrer 2014)

**XREAP2014-04**

**Castañer, A.** (CREB); **Claramunt, M.M.** (CREB)

“Optimal stop-loss reinsurance: a dependence analysis”

(Abril 2014)

**XREAP2014-05**

**Di Paolo, A.** (AQR-IREA); **Matas, A.** (GEAP); **Raymond, J. Ll.** (GEAP)

“Job accessibility, employment and job-education mismatch in the metropolitan area of Barcelona”

(Maig 2014)

**XREAP2014-06**

**Di Paolo, A.** (AQR-IREA); **Mañé, F.**

“Are we wasting our talent? Overqualification and overskilling among PhD graduates”

(Juny 2014)

**XREAP2014-07**

**Segarra, A.** (GRIT); **Teruel, M.** (GRIT); **Bové, M. A.** (GRIT)

“A territorial approach to R&D subsidies: Empirical evidence for Catalanian firms”

(Setembre 2014)

**XREAP2014-08**

**Ramos, R.** (AQR-IREA); **Sanromá, E.** (IEB); **Simón, H.**

“Public-private sector wage differentials by type of contract: evidence from Spain”

(Octubre 2014)



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