UNDERSTANDING THE PUBLIC SECTOR PAY GAP

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Abstract

We uncover the short- and long-run structural determinants of the existing cross-country heterogeneity in public-private pay differentials for a broad set of OECD countries. We explore micro data (EU-SILC, 2004-2012) and macro data (1970-2014). Three results stand out. First, when looking at pay gaps based on individual data, more than half of the cross-sectional variation of the sample can be accounted for by the degree of exposure to international competition, and by the size of the public sector labour force and its composition (i.e. the intensity in the provision of pure public goods), while labour market institutions play a very limited role. Second, we find that pay gaps have narrowed significantly during the recent financial crisis; nevertheless, this decrease can be explained by the widespread process of fiscal consolidation rather than by structural factors. Third, we find that in the log-run openness to international trade and improvements in the institutional quality of governments are associated with decreases in the public-private wage gap. Our findings can be rationalised by a body of research stressing non-competitive wage settlements in the public sector.

Keywords: public sector pay gap, government monopolistic power, wage-setting institutions.

JEL classification: J31, J45, H50.

Resumen

En este artículo investigamos los determinantes estructurales de corto y largo plazo de la heterogeneidad existente entre países en los diferenciales salariales entre trabajadores públicos y privados, utilizando una muestra amplia de países de la OCDE. Usamos tanto microdatos (EU-SILC, 2004-2012) como datos agregados (1970-2014). Encontramos tres resultados principales. En primer lugar, al analizar los diferenciales salariales basados en datos individuales encontramos que más de la mitad de la variación en la sección cruzada puede explicarse por el grado de exposición a la competencia internacional, así como por el tamaño de la fuerza laboral del sector público y su composición (grado de intensidad en la provisión de bienes públicos puros), mientras que las instituciones del mercado de trabajo desempeñan un papel muy limitado. En segundo lugar, encontramos que los diferenciales salariales entre el sector público y el privado se han reducido significativamente durante la reciente crisis financiera. Sin embargo, esta reducción se explica por los procesos de consolidación fiscal, y no por factores estructurales. En tercer lugar, mostramos que en el largo plazo la apertura al comercio internacional y mejoras en la calidad institucional de los Gobiernos están asociadas a caídas en el diferencial salarial. Estos resultados empíricos son coherentes con una rama de la literatura teórica que enfatiza la existencia de procesos de determinación de los salarios no competitivos en el sector público.

Palabras clave: diferenciales salariales entre el sector público y el privado, poder monopolista del Gobierno, calidad institucional.

Códigos JEL: J31, J45, H50.

1 Introduction

In this paper we empirically study the short- and long-run structural determinants of the existing cross-country heterogeneity in public-private pay differentials for a broad set of OECD countries. It has been argued that the existence of positive wage premia may affect labour market outcomes because of distortions on the optimal allocation of the labour force among economic sectors and create overall economy productivity losses.[1]

An extensive literature has dealt with the estimation of public-private wage differentials in a large number of countries. The differentials tend not to be entirely explained by the individual attributes of workers, and are found to be heterogeneous across countries both in terms of their size and their sign, even though positive gaps tend to prevail, thus signalling the existence of a so-called public-private pay gap.[2] Overall, unexplained positive public-private wage differentials tend to be larger for female workers, workers at the lower-end of the wage distribution and younger workers.[3] The existence of earnings differentials between the public and the private sectors in a number of countries has also be highlighted by a strand of papers that uses macro (aggregate) data, [4] which stress the potential distortions in the labour market such a differential may induce.[5]

The literature has provided some theoretical explanations to account for the cross-country heterogeneity in public-private pay gaps. One body of research argues that the monopolistic power of governments in the provision of public services results in non-competitive wage settlements. For example, starting from the observation that wage gaps tend to be larger in countries with lower shares of government employment, some authors develop models in which a smaller group of public employees derive monopoly power from a tighter control of the production of public goods/services.[6] The link between the monopolistic power of governments and non-competitive wage settlements is amplified by the fact that the objective functions of the government and the private sectors may differ: whereas the latter is largely guided by market

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[1]See for instance Holm-Hadulla et al. (2010) and European Commission (2014).

[2]An overwhelming majority of the literature looks at wage level differentials. Nevertheless, some papers look at lifetime values of employment between public and private sectors, such as Dickson et al. (2014). These authors look at lifetime values instead of wage levels because they claim that differences in earnings mobility, earnings volatility, and job risk across sectors occur in many instances and may matter to forward-looking individuals.

[3]For some recent contributions to a fast expanding literature see Giordano et al. (2015), Depalo et al. (2015), European Commission (2014), or Christofides and Michael (2013), and the references quoted therein. On related grounds a strand of the literature looks at the "politicians' pay gap" (see in particular Peichl et al. (2013), for the case of Germany).

[4]See for instance Holm-Hadulla et al. (2010) and the references quoted therein.

[5]More recently, Cavalcanti and Rodrigues dos Santos (2015) develop an equilibrium model with endogenous occupational choice among the public and the private sectors, in which a public-private earnings premium is characterised. They calibrate the model to the Brazilian economy. They show that the presence of a public-private earnings premium can generate important allocation effects in the economy and sizeable productive losses.

[6]See Fernández-de-Córdoba et al. (2012) or Kollintzas et al. (2015). On related grounds, on the appropriation of resources by the bureaucracy in the form of higher wages see Marconi et al. (2009).

forces and profit constraints, the former may pursue political motives. For instance, it has been argued that politicians use public employment for redistributive purposes, directing income towards disadvantaged groups,[7] or that politicians are likely to link public wage agreements to election cycles.[8] [9] In turn, another set of theories stresses the fact that labour market institutions differ markedly between the public and the private sectors. For example, it has been documented that union density tends to be higher in the public sector.[10] On related grounds, it is argued that a wage premium arises because of differences in the bargaining power within the private and the public sectors.[11] Other explanations are linked to the degree of public wage setting centralization of countries.[12]

Surprisingly enough, there is very limited empirical evidence that could help validate the alternative theories to explain the public-private pay gap just described. European Commission (2014) provides simple rank correlations between public wage gaps estimated with 2010 data for 26 European Union (EU) countries and some country characteristics, such as labour market institutions and the size of the government as an employer. They find a positive correlation between the public-private wage gap and employment protection legislation, and conjecture that this might arise because higher compensations are needed to make public employment attractive when private employment is more strongly protected. They also find a negative correlation with the size of public employment in the labour force, as also shown by others.[13] In turn, within the public administration literature, Llorens (2008) studies the determinants of US state-level public-private wage gaps, and finds that, in particular cases, state unemployment, citizen liberalism, and unionisation affect the gap positively.

In this paper we aim to fill in this gap in the literature by providing broad-based empirical evidence on the variables driving the cross-country variation in public-private wage premia. To do so we use two different and complementary data sets to compute wage gaps. First, we estimate public-private pay gaps for 25 (mostly EU) countries on the basis of data from the "European Union Survey of Living Conditions"(EU-SILC henceforth) for the period 2004 to 2012. Following the extant literature, we define public workers as those employed in the Public Administration, Education, and Health industries, as opposed to market activities, which constitute the private sector. The estimated public pay gaps are at the average of the distribution, and control for observable characteristics of workers. Second, in order to expand the sample and

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[7]Alesina et al. (2000).

[8]See for example Matschke (2003)

[9]It has also been argued on theoretical grounds (Becker and Stigler (1974)) that the public wage premium may serve as an effective policy to fight corruption. Nevertheless, as discussed by Marconi et al. (2009) this is hard to justify for two main reasons. First, governments own other instruments to fight corruption. Second, the fight against a high degree of corruption could demand a much larger budget.

[10]Visser (2013).

[11]See for instance Holmlund (1993) and Holmlund (1997).

[12]See for instance Caponi (2014).

[13]See the stylised facts presented by Fernández-de-Córdoba et al. (2012) and Kollintzas et al. (2015).

analyse medium-term determinants, we use national accounts data for the period 1970-2014, covering 19 developed countries. In this case, by using aggregate data, we define the public pay gap as the ratio of total compensation per employee in the general government sector over that of the private sector.

Our main findings are the following. First, we show that more than half of the cross-sectional variation in micro-data-based public pay gaps over 2004-2012 can be accounted for by the size and composition (specialization in public or individual goods) of the public labour force, as well as exposure to international competition. Second, and on related grounds, we estimate that wage differentials have narrowed down significantly during the recent financial crisis. Nevertheless, pay gap changes between 2007 and 2012 can be explained by the widespread process of fiscal consolidation rather than by structural factors. Third, from a long run perspective (using macro data), we show that openness to international trade and improvements in the quality of governments have been associated with decreases in the public wage gap.

The rest of the paper is organised as follows. Section 2 describes the database, the estimation of the public pay gaps with micro data, and the linkages between different (micro and macro) measures of the gap. Section 3 analyses the determinants of the cross-country variation of pay gaps. First, of the cross-section of gaps estimated with micro data, next by exploiting the variation witnessed in the recent financial crisis, and finally, adopting a long run perspective. Finally, Section 5 gives concluding remarks.

2 Data and variables

2.1 The public-private pay gap with micro data

As regards sources of micro data, we use the "European Union Statistics on Income and Living Conditions" (EU-SILC) survey, given its cross-country comparability, data availability for the pre- and post-crisis periods (2004-2012), and the fact that it covers most of European Union countries (all with the exception of Finland, Malta, Bulgaria and Croatia), as well as Norway and Iceland. The distinction between public and private sector employment is based on NACE (Statistical Classification of Economic Activities), Rev.2. The most recent data refers to the 2013 EU-SILC wave, which includes employment and earnings information pertaining to 2012. In this framework, as it is standard in the literature, the government sector is an approximation based on either the aggregation of the O (Public Administration and Defence, Compulsory Social Security), P (Education) and Q (Health and social work) sectors of the NACE classification (broad definition), or only the O sector (restricted definition). With the EU-SILC database it is not possible to separate public employees from private sector employees in any of the sectors, being this particularly relevant for activities P and Q, where private providers are more

prevalent.[14] In the case of EU-SILC data, the definition of wages per employee is computed based on the individual gross monthly earnings (including only monetary earnings and excluding financial income from investments, assets, savings, stocks, and shares) before netting out taxes and social contributions, and the number of hours worked per week in the main job.

We estimate the part of the wage gap that remains unexplained after (observable) individual characteristics are controlled for. We follow the common approach of running Mincer-type wage regressions taking the logarithm of gross income per hour as the dependent variable. The set of covariates includes binary variables denoting married status, low and high education, managerial position, part-time job, gender, year and region fixed effects, as well as a second degree polynomial in experience (or age and age squared whenever information on experience is not available).[15]

The specification also includes a binary variable (public) denoting that the individual works in the public sector. Thus, as per the usual approach, the coefficient associated with the variable (public) represents the earnings differential (evaluated at the mean of the distribution) that remains once the other relevant determinants are controlled for and, if estimated to be positive, it is labelled a public-private pay differential/premium/gap (or pay penalty if negative).[16]

The specification for each country looks as follows:

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[14]According to ESA 2010, the general government sector consists of "institutional units which are non-market producers whose output is intended for individual and collective consumption, and are financed by compulsory payments made by units belonging to other sectors, and institutional units principally engaged in the redistribution of national income and wealth". As such, the non-market activities O, P, and Q, represent the best proxy for the general government sector when this indicator is not provided. Having said this, it is worth noting that it is not possible to carry out a broad check on how well these non-market activities encompass general government employees, due to the lack of across-countries homogeneous datasets. Indeed, there exists heterogeneity across countries in the public sector involvement in the different sectors of the economy. For example, according to Danmarks Statistik and the Spanish Labour Force Survey, while in Denmark the number of general government employees in the Health and Education sectors is close to 90% and more than 80%, respectively; in Spain these percentages are about 50% and 60%, respectively. On the contrary, the vast majority of workers in sector O are public sector employees: 94% and 97% in Denmark and Spain, respectively.

[15]It must be stressed that there may be other relevant characteristics that affect the wage differential. In particular, in this study data limitations prevent us to control for a number of factors: among others, fringe benefits (which are typically higher in the private sector) and pension rights (generally higher in the public sector), but also non monetary factors, such as job security, that is generally larger in the public sector. Finally, our data do not allow to control for the sample selection bias due to the possibility that sorting of employees between sectors is not random but occurs on the basis of unobserved characteristics. All this said, it has to be mentioned that the bulk of our results is in line with previous country-specific analyses with finer data (for a recent contribution, see Hospido and Moral-Benito (2014), and the references quoted therein). For more details, see Giordano et al. (2015) and Depalo et al. (2015).

[16]Other approaches to measure unexplained gaps in mean outcomes comprise the so-called "Oaxaca-Blinder" decomposition, see Oaxaca (1973) and Blinder (1973), and the alternative proposed by Neumark (1988). We follow the approach of a dummy indicator for convenience and because it tends to be bounded by the two standard Oaxaca-Blinder gaps. Moreover, the Neumark (1988) approach systematically overstates the contribution of observables to mean outcome differences. For a discussion on these four approaches, see Elder et al. (2010).

$$y_i = X_i\beta + \delta\text{public}_i + \sum_{t=2004}^{2012} \lambda_t + \epsilon_i \qquad (1)$$

where ϵ_i is an iid idiosyncratic error term and the coefficients β, δ and $\sum_{t=2004}^{2012} \lambda_t$ are estimated by Ordinary Least Squares (OLS). Table I shows the estimates of the coefficient δ i.e. the public sector pay gap. In a subsequent section of the paper we will identify the variables that account for the cross-sectional heterogeneity of δ, its evolution during the recent financial crisis, and its dynamics during the last decades.

Individual characteristics account for a substantial fraction of the observed public-private wage gap, but there remains an unexplained gap. For the pool of euro area countries, the estimated unexplained wage gap over the 2004-2012 period for the broad NACE proxy to the government sector (OPQ sectors) is 60% lower than the estimated unconditional wage gap (Table I, column (2) versus (1)), since the observable characteristics between the two sectors are different, e.g. in the public sector workers are on average better educated than in the private sector. For the period 2004-2012 as a whole positive wage gaps are estimated for 21 out of the 23 analysed EU countries. Unexplained wage gaps are larger for countries that suffered fiscal stress over the crisis (Cyprus, Spain, Ireland, Portugal, Greece and Italy) and Luxembourg, and tend to be higher when a more restricted definition of the government sector (NACE O sector) is considered (Table I, column (5)), i.e. when looking at the sectors in which there exists a quasi-monopoly power of the government as service provider. There has been a reduction in the estimated (unexplained) wage gap as a consequence of the economic crisis and the recent fiscal consolidation episode (Table I, column (4) versus (3)). For the euro area as a whole (pool), the estimated conditional wage gap for the period 2010-2012 for the broad NACE proxy of government-related activities is 40% lower than the one estimated for the 2004-2009 period. In general, the wage premium falls more markedly in countries with larger pre-crisis levels.

2.2 The public-private pay gap with macro data

Regarding macro (aggregate) data, we focus on the general government sector as defined by the National Accounts, for the period 1970-2014. The longer time span is the first advantage of complementing micro-based pay gaps with gaps computed from macro data. In this latter case, our sample covers 19 developed countries: Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Sweden, United Kingdom, and United States. The primary source of government wage bill data and all macroeconomic variables used throughout the study (GDP, prices, total economy wages and employment, population) is Eurostat for EU countries and the OECD (Economic Outlook Database) for non-EU countries (see Table A.1 of Appendix A for the definition and sources of all the variables used in the paper). General government employment data, in turn, are taken from the OECD database. The measure of aggregate (macro) wages chosen for our analysis is

TABLE I

ESTIMATES OF THE PUBLIC PAY GAP
EU-SILC 25 COUNTRIES

	Full Sample 2004-2012 (1)	Full Sample 2004-2012 (2)	Pre-Crisis 2004-2009 (3)	Crisis 2010-2012 (4)	Full Sample 2004-2012 (5)
Dep. Variable: Gross Income per Hour					
Euro area pool	0.182*** (0.002)	0.074*** (0.002)	0.089*** (0.003)	0.048*** (0.004)	0.100*** (0.003)
Belgium	0.064*** (0.006)	0.005 (0.005)	-0.001 (0.007)	0.018* (0.010)	0.039*** (0.007)
Germany	0.096*** (0.006)	0.019*** (0.006)	0.025*** (0.008)	0.009 (0.009)	0.118*** (0.005)
Estonia	0.037*** (0.010)	0.058*** (0.009)	0.048*** (0.011)	0.080*** (0.015)	0.129*** (0.014)
Ireland	0.347*** (0.009)	0.207*** (0.009)	0.200*** (0.011)	0.220*** (0.015)	0.193*** (0.012)
Greece	0.382*** (0.007)	0.188*** (0.006)	0.207*** (0.007)	0.150*** (0.012)	0.110*** (0.007)
Spain	0.369*** (0.004)	0.265*** (0.004)	0.266*** (0.005)	0.262*** (0.007)	0.193*** (0.005)
France	0.045*** (0.006)	0.025*** (0.007)	0.047*** (0.007)	-0.091*** (0.020)	0.042*** (0.008)
Italy	0.285*** (0.003)	0.176*** (0.003)	0.187*** (0.004)	0.151*** (0.005)	0.106*** (0.004)
Cyprus	0.508*** (0.011)	0.390*** (0.009)	0.371*** (0.012)	0.417*** (0.013)	0.271*** (0.010)
Latvia	0.211*** (0.013)	0.111*** (0.013)	0.141*** (0.019)	0.073*** (0.016)	0.170*** (0.018)
Lithuania	0.242*** (0.013)	0.113*** (0.015)	0.113*** (0.015)	0.211*** (0.023)	0.154*** (0.023)
Luxembourg	0.272*** (0.012)	0.255*** (0.009)	0.239*** (0.012)	0.284*** (0.014)	0.257*** (0.012)
Netherlands	0.137*** (0.014)	0.093*** (0.009)	0.070*** (0.011)	0.128*** (0.014)	0.159*** (0.011)
Austria	0.186*** (0.006)	0.090*** (0.006)	0.091*** (0.006)	0.088*** (0.010)	0.054*** (0.008)
Portugal	0.422*** (0.008)	0.195*** (0.007)	0.204*** (0.008)	0.175*** (0.011)	0.207*** (0.009)
Slovenia	0.244*** (0.007)	0.109*** (0.011)	0.090*** (0.012)	0.135*** (0.019)	0.086*** (0.016)
Slovakia	0.064*** (0.006)	0.046*** (0.006)	0.056*** (0.007)	0.028*** (0.010)	0.104*** (0.007)
Czech Republic	0.102*** (0.006)	0.087*** (0.006)	0.094*** (0.007)	0.073*** (0.010)	0.132*** (0.008)
Denmark	0.035*** (0.012)	-0.058*** (0.012)	-0.064*** (0.014)	-0.041* (0.022)	0.027* (0.016)
Hungary	0.180*** (0.006)	0.042*** (0.006)	0.075*** (0.008)	-0.003 (0.008)	0.128*** (0.008)
Poland	0.301*** (0.005)	0.119*** (0.005)	0.117*** (0.006)	0.120*** (0.008)	0.127*** (0.007)
Sweden	-0.040*** (0.011)	-0.123*** (0.012)	-0.127*** (0.015)	-0.118*** (0.021)	0.034** (0.017)
United Kingdom	0.088*** (0.006)	0.015*** (0.005)	0.016** (0.007)	0.013 (0.009)	0.129*** (0.007)
Iceland	-0.037*** (0.006)	-0.123*** (0.010)	-0.126*** (0.012)	-0.111*** (0.020)	0.022* (0.013)
Norway	-0.067*** (0.013)	-0.135*** (0.014)	-0.134*** (0.021)	-0.132*** (0.020)	0.010 (0.019)
Controls	NO	YES	YES	YES	YES
Public Sector Defined as:	Broad	Broad	Broad	Broad	Restricted

Notes: This table shows the estimates of the public sector pay gap conditional on observable characteristics (equation 1). The public sector is defined as industries (NACE Rev. 2) O (Public Administration), P (Education), and Q (Health and social work), except column (5), where the public sector only comprises the industry O. The dependent variable is gross income per hour, computed as the ratio of individual gross monthly earnings (including only monetary earnings and excluding financial income from investments, assets, savings, stocks, and shares) before netting out taxes and social contributions, and the number of hours worked per week in the main job. Controls include: binary variables denoting public sector (which coefficient is shown) married status, low and high education, managerial position, part-time job, gender, year and region fixed effects, as well as a second degree polynomial in experience (or age and age squared whenever information on experience is not available). The specification of column (1) does not include observable characteristics (unconditional public sector pay gap). Robust standard errors are in parenthesis, clustered at the individual level. Significance levels: *: 10%; **: 5%; ***: 1%.

compensation per employee. The main reason why we focus on total compensation rather than on wages is data limitations in terms of sample size and coverage of countries in our sample. We compute compensation per employee using compensation of employees and employment data. Compensation of private sector employees is defined as total economy compensation of employees minus compensation of government employees. Compensation per private employee is defined as private compensation of employees divided by total employees minus government employment minus self-employment. In Figure I, panels A and B, we show the evolution over time of public-private pay differentials for a selection of countries. The evolution of the wage gaps is to a high extent country-specific, although there exists a pattern of decreasing pay gaps in the 1970s, stabilization, and a subsequent increase since the 1990s, at least for some countries. Regarding the level, countries in northern Europe have lower and negative pay differentials when compared with other EU countries, United States, and Japan.

The use of macro data allow us to use a delimitation of the government sector, the general government, that is more accurate that the approximation based on non-market activities (NACE sectors O, P and Q) used in the previous section.[17] The main disadvantage is that the wage gap thus computed does not control for characteristics of the labour force, therefore it tends to be larger. We will address this bias on a subsequent section by performing our regressions in first differences, hence removing this bias in levels. Our implicit assumption is that the bias remains relatively constant over time.

In Figure I, panels C and D, we compare the wage gaps computed from macro data with those computed from micro data, both conditional and unconditional on characteristics (columns (2) and (1) of Table I, respectively), for the group of countries present in both samples over the sample period in which they overlap (2004-2012). As expected, the wage gaps computed from macro data are generally larger, but are much closer to the unconditional wage gaps computed from micro data. More importantly, the cross-country patterns observed in the micro data are preserved in the macro aggregates, hence the analysis with aggregate data is meaningful.[18]
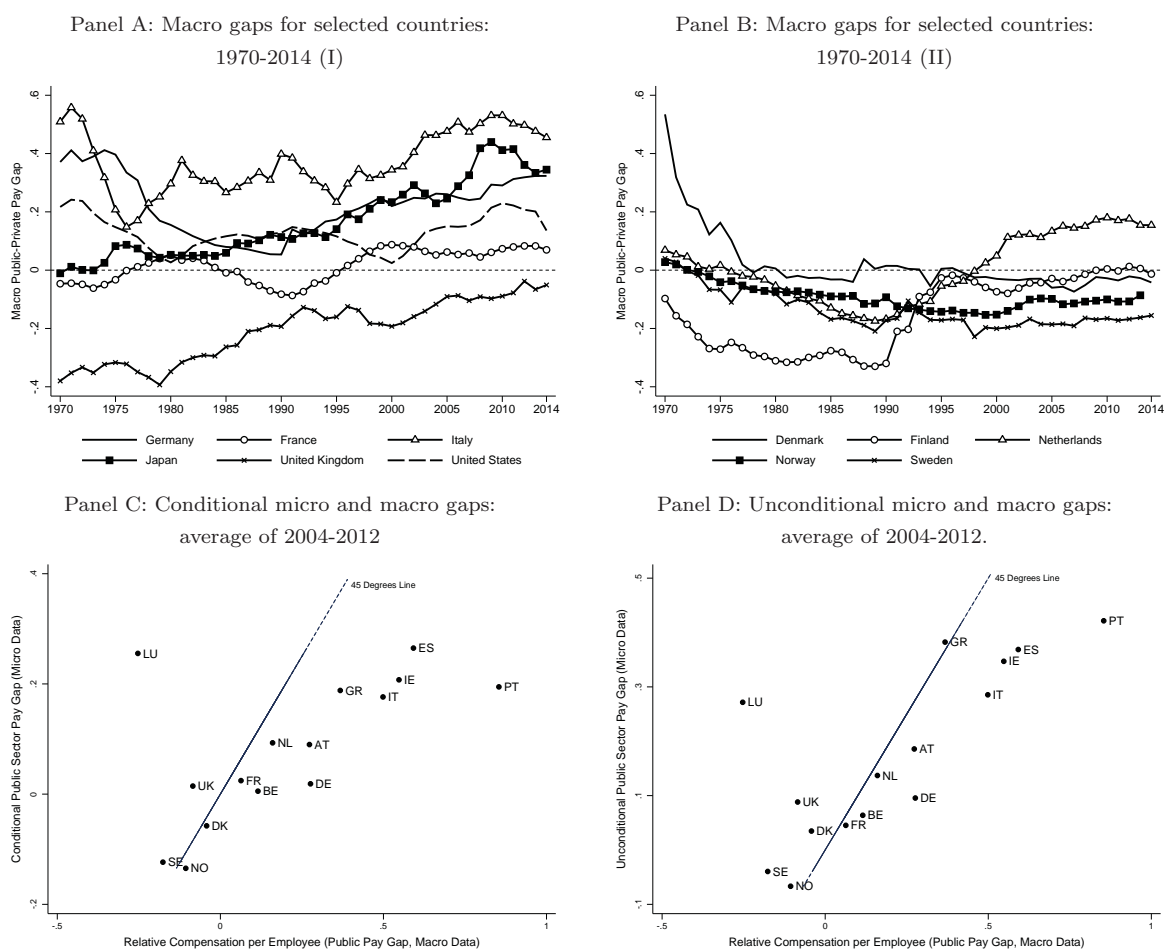
2.3 Hypotheses to be tested

We characterise the variables that explain the cross-country variation in the public-private wage gap. Our choice of covariates relies on a body of research that has rationalised the existence of public-private wage differentials. Hence, we view our paper as an empirical test of these theories.

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[17]Nevertheless, it is worth mentioning that while the choice of macro data sources and definitions insures the best available degree of harmonization and comparability, there might be measurement problems both within and across countries. Differences/changes in working hours, privatization, differences/changes in the size of the public sector over time, or changes in the skill composition of the labour force over time might distort the view on certain issues.

[18]One country, Luxembourg, significantly deviates: it has a large micro wage gap and a below average macro gap. For the sake of transparency we decided not to drop this country from the sample. The results are qualitatively very similar had we chosen to do so (first-differencing removes the largest part of the bias).

FIGURE I

PUBLIC-PRIVATE PAY DIFFERENTIALS COMPUTED FROM MACRO DATA
AND COMPARISON WITH MICRO-BASED PAY GAPS

Panel A: Macro gaps for selected countries:
1970-2014 (I)

Panel B: Macro gaps for selected countries:
1970-2014 (II)

Panel C: Conditional micro and macro gaps:
average of 2004-2012

Panel D: Unconditional micro and macro gaps:
average of 2004-2012.

Notes: Panels A and B show the evolution of public-private pay differentials (computed from macro data) for a selection of countries. Panel C compares the public sector pay gap conditional on observed worker characteristics (EU-SILC, see equation 1) with the wage gap computed from aggregate macro data (National Accounts). Panel D compares the latter with the public sector pay gap computed from micro data (EU-SILC) unconditional on observed characteristics. With the exception of Luxembourg, the cross-country patterns of micro vs. macro pay gaps are similar.

According to the literature, conditional on characteristics, public and private sector workers can be paid differently for two broad reasons: (i) the government is the only provider of certain goods and services, which may generate non-competitive wage settlements. Also, the private and the public sectors may have different objective functions: whereas the former is a profit-maximiser, the latter may pursue other objectives such as vote maximization, redistribution, and so on, which also generate non-competitive wage policies. (ii) Wage setting institutions may differ between the private and the public sector (union density, collective bargaining, centralization, etc.).

We proxy for the monopolistic power of governments with four variables. First, the ratio of public employment over total employment, which accounts for the size of the government sector as an employer. This variable is expected to correlate negatively with the public wage gap: a smaller public labour force is more likely to form an insider group of workers that enjoy market power in the supply of labour to the public sector, and hence can settle more favourable wage policies. Second, the ratio of Public Administration employees over total public employees. This accounts for the composition of the public labour force, whether it is tilted towards the provision of pure public goods (those in the Public Administration, where the public sector faces limited competition from the private sector), or to individual goods (like health and education, where competition from the private sector is higher). Hence, it is expected to correlate positively with the public wage premium. Third, government effectiveness (from the Worldwide Governance Indicators), which proxy for the institutional quality of the public sector, expected to have a negative correlation with the wage gap. Higher wage gaps, being possibly the result of distortions in the economy, are less likely to exist if the quality of institutions is high. And fourth, exposure to international competition. This is expected to have a negative correlation with the wage gap, as foreign competition can help increase the efficiency and discipline the process of setting wages in the economy. We measure exposure to international competition with the share of tradable sectors (agriculture and manufacturing) in total value added. We also use an index of openness, the ratio of imports and exports over GDP.

Our test on the second set of theories relies also on four variables. First, one measure of how much legislation protect workers (OECD), namely, the degree of employment protection in the economy, which is expected to correlate positively with the wage gap. In view of the theories highlighting wage setting institutions, we expect that countries with a higher protection of employment will exhibit higher public pay gaps, since the better the conditions to work in the private sector, the higher the required wages in the public sector in order to attract workers. Second, countries with a higher trade union density (both in the public and in the private sectors) will exhibit generally lower wage gaps, since trade unions are more likely to reduce the dispersion of wages by collective bargaining. Regarding the relationship between union density and the wage gap, probably the crucial determinant is the difference in union density between the public and the private sector. We test if this variable has predictive power in explaining the wage gap, but our analysis is limited by a too small number of observations with available data. Third, we include an indicator of whether wages in the government sector are settled by collective bargaining as opposed to unilateral decisions. Collective bargaining is more likely to reduce the wage gap, if the bargaining process involves independent bodies that take into account the labour conditions in the economy. Finally, we include an indicator of centralization in the update of government wages. If wage updates in the government sector are centralised,

the wage gap is expected to be higher, as public wages are more likely to deviate from the conditions of local labour markets.[19]

3   The determinants of the public-private wage gap

3.1   Cross-sectional determinants of the micro estimates

Given that our OLS cross-section regressions are performed on a small number of observations (25 countries for which we have estimates of the wage gap) we first explore the relationship of the wage gap with the variables linked to the monopolistic power of the government sector and, separately, to those proxying wage setting institutions. In a third specification, we add together those variables that were significant in the first stage, and also add other proxies for economic conditions, namely per capita GDP, deficit, debt, and GDP growth, in order to check the robustness of the results.

Table II shows the results of the regression of the wage gap on the degree of the government monopolistic power.[20] Column (1) shows that countries with a lower percentage of public employees, a composition of the public workforce tilted towards goods that are provided exclusively by the public sector, and that are less opened to international competition, have significantly higher wage gaps. Quantitatively, a one standard deviation decrease in the percentage of public employees (5.1 percentage points, being the mean 29.0%) is associated with an increase in the public pay gap of 5.2 percentage points (or .41 standard deviations, being the mean 8.5%); a one standard deviation increase in the share of public workers in the Public Administration with respect to overall public workers (8.3 percentage points, being the mean 32.9%) is associated with an increase of the public pay gap of 5.8 percentage points; and a one standard deviation increase in the share of tradable sectors in total value added (5.4 percentage points, being the mean 17.7%) is associated with a decrease in the wage gap of 5.0 percentage points. The only variable whose coefficient is statistically indistinguishable from zero is the quality of the

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[19]Our choice of variables referring to each class of models stems from the empirical implications they entail. We stress size, composition, quality, and efficiency of the public sector as more related to the monopolistic power of governments, and labour market institutions as more related to public wage settlements. It must be stressed though that this taxonomy is sometimes not straightforward, and some variables could be justified in the context of both type of models. We follow this approach to ease exposition and because it provides a good guidance to specify the regressions.

[20]Note that the dependent variable is estimated from micro data, and hence it is subject to uncertainty. We make the assumption that the noise induced by the estimation is uncorrelated with the country characteristics, and hence this noise only yields higher standard errors, which go against finding a significant relationship between the covariates and the dependent variable. This seems reasonable, as Eurostat provides a common framework for the EU-SILC database. Note also that some of the country characteristics are also obtained from EU-SILC (e.g. the percentage of public employees). For the same reason, it is reasonable to assume that the possible measurement error is uncorrelated with the observed covariates, yielding again only higher variances. Moreover, we try alternative specifications with additional data sources when this is possible, to check the robustness of the results. In any case, we are aware of the difficulties of giving a causal interpretation to the coefficients, as orthogonality between the covariates and the error term is clearly not guaranteed. Our focus is on checking the cross-country implications of the the theories explaining the wage gap, and we favour a prudent predictive interpretation of our results.

government sector, although it bears the expected sign. When this variable is removed from the regression, the other three remain statistically significant, see column (2). The R-squared from this regression shows that these three variables explain 60 percent of the variation of the wage gaps in our sample. This provides support to the theories linking the wage gap with the monopolistic provision of goods and services carried out by the government sector.

TABLE II

DETERMINANTS OF THE PUBLIC SECTOR PAY GAP

GOVERNMENT MONOPOLISTIC POWER

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: NACE Proxy to Government Sector Wage Gap (2004-2012)						
% Public Employees	-0.0103**	-0.0110**	-0.0073*		-0.0142***	-0.0076*
	(0.0041)	(0.0041)	(0.0038)		(0.0032)	(0.0039)
% Public Administration Employees	0.0070**	0.0075***	0.0083***	0.0113***		0.0080***
	(0.0028)	(0.0022)	(0.0028)	(0.0024)		(0.0027)
Government Effectiveness	-0.0197					
	(0.0383)					
% Value Added Tradable Sectors	-0.0091**	-0.0087**		-0.0059	-0.0093**	
	(0.0035)	(0.0031)		(0.0037)	(0.0033)	
% Public Employees (over Population)				-0.0195**		
				(0.0077)		
% Compensation of Employees in Collective Goods					0.0044**	
					(0.0020)	
Openness						-0.0002
						(0.0005)
Constant	0.3393	0.3130	0.0253	0.0045	0.4718***	0.0552
	(0.2308)	(0.2006)	(0.1615)	(0.1568)	(0.1589)	(0.1843)
Observations	24	24	25	24	24	24
Adjusted R-squared	0.59	0.60	0.49	0.56	0.54	0.49

Notes: This table shows the regression of the public sector pay gap on country characteristics linked to the government monopolistic power in the provision of public services. The regression in column (6) excludes Luxembourg, as its openness is an outlier with respect to the sample (larger than the mean plus 5 standard deviations). Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

Given the small number of observations of these regressions, it is important to check that no outliers drive these results. In Figure II (panels A to C) we plot the correlation between each covariate of the specification in column (2) with the dependent variable once the effect of the other covariates is removed, i.e. the partial correlations.[21] We can see that these correlations are genuine, and are not driven by extreme observations.
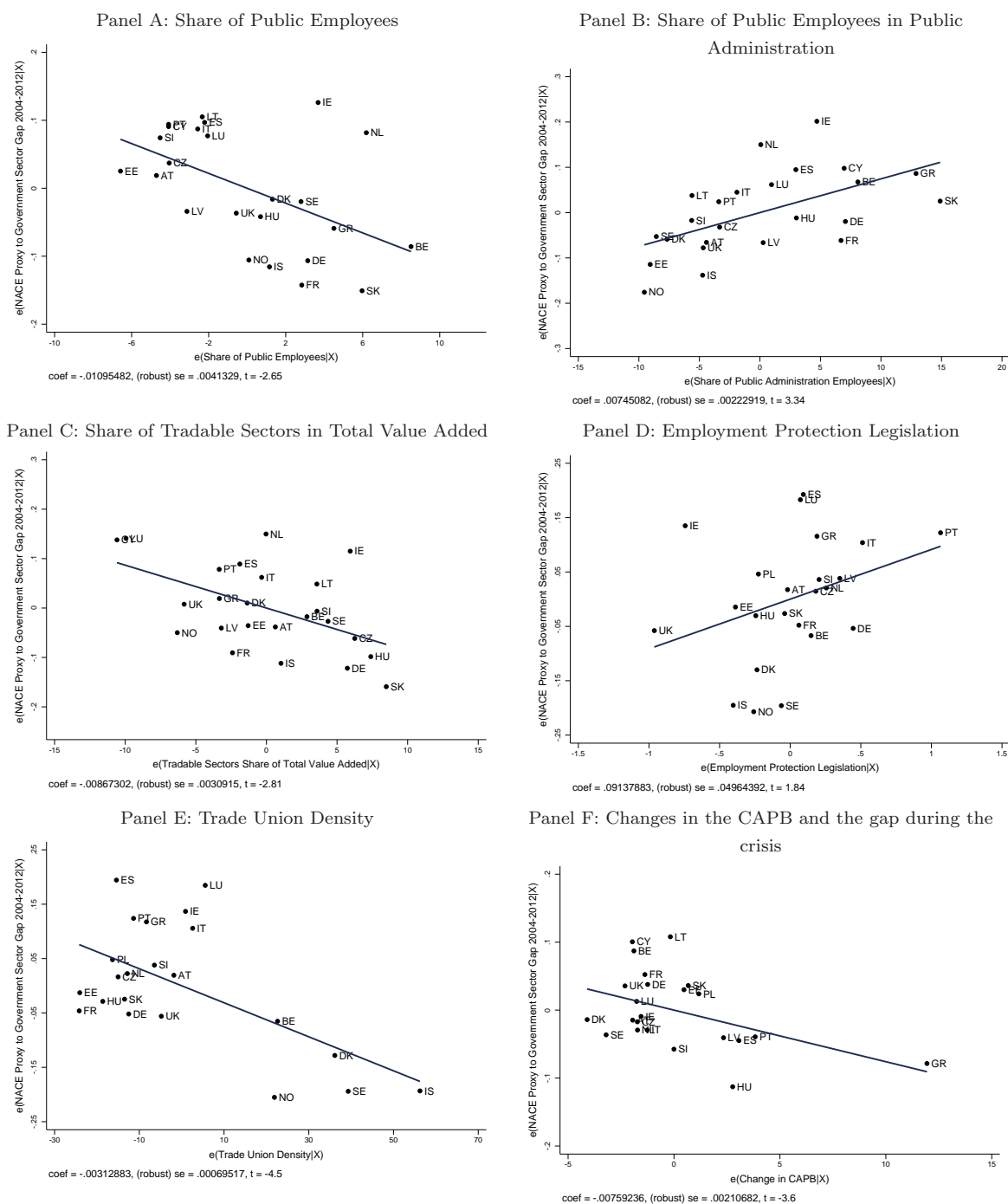
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[21]That is, we show the scatter plot of the unexplained part of the dependent variable and the unexplained part of each covariate of column (2), where the unexplained part is given by the residuals of the regression on the other covariates. For example, the partial correlation of the wage gap and the share of public employees (panel A) is constructed as follows. First, regress the wage gap on the share of public employees in industry O and the share of tradable sectors in total value added (the other two covariates of column (2)), and obtain the residuals. Second, regress the share of public employees on the share of public employees in industry O and the share of tradable sectors in total value added, and obtain the residuals. Third, plot both series of residuals. Note that the slope of the scatter plot is precisely the coefficient reported in column (2) of Table II, and hence the picture allows to determine the existence of outliers driving the estimates. Note also that Panels D to F of Figure II show partial correlations of bivariate relationships, hence they are just simple scatter plots in deviations with respect to the mean.

The following columns of Table II check the robustness of these findings. Column (3) removes the share of tradable sectors in total value added. The size and composition of the public labour force remain significant explanatory variables of the public pay gap, being able to explain almost half of its variance. Columns (4) to (6) substitute each covariate by an alternative measure, capturing the same economic concept. Column (4) computes the size of public labour force as the percentage of public employees over population, yielding an even lower point estimate. Column (5) substitutes the share of public employees in the Public Administration by the percentage of total compensation of employees aimed at collective goods, whose provision is carried out exclusively by the government sector, as opposed to individual goods, such as health and education (the source of these data is COFOG). This variable is positively correlated with the public pay gap, reinforcing the message that a higher monopolistic power of the government sector is associated with a higher wage gap. Finally, column (6) substitutes the share of tradable sectors in total value added by log openness. In this case, this variable enters non-significantly in the regression, although with the expected sign. Overall, this robustness checks are highly supportive of the main findings: the positive association between the public sector pay gap and the monopolistic power that the public sector enjoys in the production of certain goods and services.

In Table III we test the theories that link the wage gap with the wage setting institutions that prevail in the public vs. the private sector. In the joint regression of the wage gap against employment protection, trade union density, collective bargaining and centralization of wage updates, none of the covariates is statistically significant, although employment protection, trade union density, and centralization bear the expected signs, see column (1). In the following columns we consider the bivariate relationships of each of these variables with the public pay gap. In this case, countries with a higher protection of employment are associated with a significantly higher public pay gap, as well as countries with a higher trade union density. Quantitatively, a one standard deviation increase in employment protection legislation is associated with a 3.9 percentage points increase in the public wage gap (.34 standard deviations), and a one standard deviation increase in trade union density is associated with a 6.8 percentage points increase in the wage gap. The correlation of both variables with the wage gap (in deviations with respect to the mean) is displayed in Figure II (panels D and E). As can be seen in Panel E, the negative relationship between the public pay gap and trade union density is driven by the Nordic countries. Actually, removing them from the regression yields a non-significant relationship between both variables. Moreover, the variable trade union density corresponds to the whole economy. If we consider instead the difference in trade union density between the public and the private sector, we do not find a significant relationship with the public pay gap, see column (4). Nevertheless, this result must be taken with caution as the number of observations of this regression is very

Figure II

The Public Pay Gap and potential determinants

Panel A: Share of Public Employees

coef = -.01095482, (robust) se = .0041329, t = -2.65

Panel B: Share of Public Employees in Public Administration

coef = .00745082, (robust) se = .00222919, t = 3.34

Panel C: Share of Tradable Sectors in Total Value Added

coef = -.00867302, (robust) se = .0030915, t = -2.81

Panel D: Employment Protection Legislation

coef = .09137883, (robust) se = .04964392, t = 1.84

Panel E: Trade Union Density

coef = -.00312883, (robust) se = .00069517, t = -4.5

Panel F: Changes in the CAPB and the gap during the crisis

coef = -.00759236, (robust) se = .00210682, t = -3.6

Notes: This figure shows the partial correlations between the public sector pay gap and country characteristics. Panels A to C show partial correlations with characteristics linked to the government monopolistic power in the provision of public services, see column (2) of Table II. Specifically, Panels A, B, and C, show the partial correlation of the size of the public sector (share of public sector employees), the composition of the public sector (specialization in public goods) and exposure to international trade (specialization in tradable goods), respectively. Panels D and E show the correlation (in deviations with respect to the mean) between labour market institutions and the public sector pay gap. Panel D shows the correlation of an index of employment protection legislation (column (2) of Table III) and panel E of an index of trade union density (column (3)). Finally, panel F shows the correlation (in deviations with respect to the mean) between improvements in the CAPB during the crisis and changes in the public sector pay gap, see column (1) of Table IV. Improvements in the CAPB are computed as the CAPB in 2012 minus the minimum in the period 2007-2011. Changes in the public sector pay gap correspond to the same period.

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low. We also consider the relationship between the wage gap and the coverage of collective bargaining agreements, which may capture better the pay homogenization induced by trade unions. This relationship is negative, as expected by theory, but not statistically significant (the p-value is .17, not shown). In column (5) we show that there is not a significant bivariate relationship between the wage gap and wages being set by collective bargaining. On the contrary, countries where wage updates are carried out in a centralised manner have on average a wage gap 10.8 percentage points higher than countries where wage updates are decided in a decentralised manner, see column (6). Overall, these results provide also some evidence on the link between wage setting institutions across countries and the public pay gap prevailing in these countries. However, they explain less of the cross-country variation of the wage gap than theories stressing the monopolistic environment in which governments operate, and the results are less robust.

TABLE III

DETERMINANTS OF THE PUBLIC SECTOR PAY GAP
DIFFERENT WAGE SETTING INSTITUTIONS

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: NACE Proxy to Government Sector Wage Gap (2004-2012)						
Employment Protection Legislation	0.0415 (0.0420)	0.0914* (0.0496)				
Trade Union Density	-0.0017 (0.0015)		-0.0031*** (0.0007)			
Bargaining	-0.0172 (0.0506)				-0.0414 (0.0484)	
Centralization	0.0620 (0.0530)					0.1086** (0.0477)
Public - Private Trade Union Density				0.0008 (0.0031)		
Constant	0.0136 (0.1098)	-0.1688 (0.1426)	0.1703*** (0.0326)	0.0435 (0.0973)	0.1252*** (0.0239)	0.0677** (0.0242)
Observations	20	23	22	11	23	23
Adjusted R-squared	0.14	0.07	0.32	-0.10	-0.01	0.18

Notes: This table shows the regression of the public sector pay gap on cross-country differences in labour market institutions. Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

These findings are further confirmed when we implement a horse race between both theories (not shown).[22] Specifically, we add together the proxies for the monopolistic power of governments and the wage setting institutions (the latter added one at a time). When we regress the public wage gap against the percentage of public employees, the share of public employees in

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[22]The results are not shown for the sake of brevity, but are presented in Table B.1 of Appendix B. We further check the robustness of these results by incorporating additional explanatory variables with potential in explaining the cross-country variation in wage gaps. In particular, we add different proxies of economic conditions, such as per capita GDP, the general government deficit, the level of debt, and real GDP growth. It turns out that only the general government deficit has some significant explanatory power in accounting for the variation in the public pay gaps, and in all specifications the size and composition of the public workforce, as well as exposure to foreign competition keep their statistical significance.

Public Administration, the share of tradable sectors in total value added, and the employment protection legislation, it turns out that only those variables reflecting the monopolistic power of the public sector are significant in explaining the wage gap, having similar coefficients as those found in Table II. This result is confirmed when we include the variable trade union density, whose coefficient is not statistically significant. Moreover, if we add the indicator of centralised wage updates, it also enters non-significantly. We also checked that these results are robust to excluding the years of the financial crisis, which may introduce some noise in the relationship between the wage gap and its fundamentals. Actually, the estimates are more precisely estimated when using the sample 2004-2007, and none of the economic conditions have explanatory power.[23] In addition, we also check the robustness of the results to adopting a narrower definition of the public sector. We restrict it to Public Administration (industry O), i.e. we consider Education and Health (industries P and Q) to belong to the private sector. We find that the public sector wage gap under such a definition is also significantly related to the size and composition of public sector employees, as well as exposure to international trade. Labour market institutions do not have predictive power in explaining the wage gap, once the other variables are controlled for.[24] We also analysed the relationship between the overall pay gap and that of female workers and workers at the lower-end of the income distribution. If the public sector follows more egalitarian practices in the setting of wages, (at least part of) the overall pay gap may be the result of discrimination (for example to women) in the private sector. We found that indeed in almost all countries the conditional pay gap is larger for female workers and workers at the first quartile of the income distribution, see Appendix B.4.[25] However, the cross-country differences in the pay gap of women and low income workers are virtually the same as those of the overall population (the correlations are .99 and .98, respectively). Hence, the structural determinants uncovered in this section also account for a large fraction of the cross-country variability in pay gaps of these groups. Overall, then, we find support that the government monopolistic power explains a large part of the cross-country variation in the public pay gap, at least in our sample of 25 (mostly) EU countries.[26]

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[23]See Table B.2 of the Appendix.

[24]Results are shown in Table B.3 of the Appendix.

[25]The gap for female workers is computed by estimating equation (1) for the sample of females. The gap at the first quartile of the income distribution is computed via a quantile regression with the same covariates as equation (1).

[26]We also tried running these specifications exploiting the panel structure of EU-SILC (2004-2012) with country fixed effects and with/without a lag of the public pay gap. These regressions did not deliver meaningful estimates, probably due to the fact that changes in the structural characteristics of the public labour force take some time to be reflected on the public pay gap. For this reason, we view the long-run regressions performed in Section 4 as more likely to capture the dynamic relationship between the structural characteristics of a country and the pay gap. Moreover, we find evidence that the recent evolution of the pay gap is explained by the process of fiscal consolidation, rather by structural factors, see the next section.

3.2 Exploiting changes during the financial crisis

During the last few years, the majority of EU countries have undergone intense fiscal consolidation processes aimed at controlling increasing fiscal deficits stemming from the financial crisis. We showed in Table I that wage gaps indeed got reduced during the crisis/consolidation period, showing a marked dynamic behaviour. Thus, in this section we study whether the change observed in the gap during this period is linked to changes in its structural determinants or only reflects the effect of fiscal consolidation measures. Before we proceed, we raise a flag in interpreting the results of this section, given our small sample size, the turbulent times associated with the financial crisis, and the different set of austerity measures undertaken in each country, which may introduce additional noise in the estimations.

We define the fiscal effort as the difference in the cyclically adjusted primary balance (CAPB) between 2012 and the minimum of the period 2007-2011. This definition takes into account that some countries carried out front-loaded fiscal consolidations, while others delayed this process. Of the 23 EU countries in our sample, during the period 2007-2012 18 countries posted the lowest CAPB in 2008-2010, 1 in 2007, 3 in 2011, and only 1 exhibited the worst CAPB in 2012, which was nevertheless contained (Denmark, with a CAPB of 1.7 percent of GDP). Armed with this definition, we study whether countries that made larger fiscal efforts brought the public pay gap down more.

Column (1) of Table IV shows that indeed improvements in the CAPB have been associated with significant decreases in the public sector pay gap in the 23 EU countries of our sample. The point estimate suggests that a country improving its CAPB in 3.3 percentage points of GDP (the average of our sample) was able to reduce the public pay gap 2.5 percentage points. Note that the average reduction of the pay gap is 1.5 percentage points, hence this decrease is very large. Panel F of Figure II shows the correlation (in deviations with respect to the mean) of the change in the CAPB and the change in the wage gap. Note that the slope is affected by the huge improvement in the CAPB of Greece, of more than 10 percentage points above the average. If Greece is removed from the regression, the point estimate is even lower (-0.0092), although its statistical significance decreases (to a p-value of .08). Columns (2) to (6) of Table IV explores whether the variables that explain the heterogeneity in the levels of the wage gap can also account for the evolution during the crisis. It turns out that no variable enters significantly, suggesting that their effects are mainly felt in the long-run. The only exception is the employment protection legislation, which enters significantly but with an opposite sign (more labour protection being associated with a lower wage gap). This result, which is at odds with theory, is driven by two countries, Estonia and Slovakia, which elicited legislation to reduce the protection of workers, but at the same time experienced increases in the public pay gap.

TABLE IV

THE PUBLIC PAY GAP DURING THE CRISIS

DETERMINANTS OF CHANGE BETWEEN 2007 AND 2012

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: Change in NACE Proxy to Government Sector Wage Gap (2012-year of worst CAPB)						
$\Delta_{12-\min}\text{CAPB}_c$	-0.0076***	-0.0066***	-0.0076***	-0.0081***	-0.0106***	-0.0061***
	(0.0021)	(0.0020)	(0.0022)	(0.0024)	(0.0030)	(0.0016)
$\Delta_{12-\min}\text{\% Public Employees}_c$		-0.0061				
		(0.0073)				
$\Delta_{12-\min}\text{\% Public Administration Employees}_c$			0.0010			
			(0.0031)			
$\Delta_{12-\min}\text{\% Value Added Tradable Sectors}_c$				0.0090		
				(0.0107)		
$\Delta_{12-\min}\text{Employment Protection Legislation}_c$					-0.1185**	
					(0.0551)	
$\Delta_{12-\min}\text{Trade Union Density}_c$						0.0053
						(0.0075)
Constant	0.0097	0.0126	0.0105	0.0050	0.0010	0.0034
	(0.0142)	(0.0130)	(0.0159)	(0.0155)	(0.0123)	(0.0149)
Observations	23	23	23	22	20	19
Adjusted R-squared	0.16	0.17	0.13	0.18	0.25	0.18

Notes: This table shows the regression of the change in the public sector pay gap on the improvement in the Cyclically Adjusted Primary Balance (CAPB) during the crisis. This improvement is computed as the CAPB in 2012 minus the minimum in the period 2007-2011. The change in the public pay gap corresponds to the same time period. Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

4 Long-run determinants of the public pay gap

To identify the long-run determinants of the dynamics of the public pay gap, we run the following regression:

$$\Delta\text{Wage Gap}_{ct} = \beta'\Delta X'_{ct} + \sum_t \lambda_t + \epsilon_{ct} \qquad (2)$$

where $\Delta\text{Wage Gap}_{ct}$ is the change in the macro wage gap between t and $t-1$; ΔX_{ct} are changes in possible determinants of the dynamics of the wage gap namely, percentage of public employees, openness, share of public employees in Public Administration, government effectiveness, employment protection, and trade union density; and $\sum_t \lambda_t$ are period fixed-effects. The estimation is carried out by pooled OLS. Following the literature on growth, in order to remove the effects of the business cycle, each period is a five-year average.

Table V shows the results. In column (1) we start by studying the relationship between the dynamics of the wage gap and those of the size of the public labour force and exposure to trade. The availability of data for these two variables allows us to estimate the regression covering the whole period 1975 to 2014 (8 five-year periods). We find that increases in the size of the labour force and in exposure to foreign competition are significantly associated with reductions in the public sector pay gap. The point estimates suggest that an increase of one standard deviation

in the change of the percentage of public employees (1.5 percentage points) is associated with a decrease of 2.7 percentage points (0.29 standard deviations) in the change of the wage gap. Also, an increase of one standard deviation in the change of the openness ratio (9.4 percentage points) is associated with a decrease of 1.6 percentage points (0.17 standard deviations) in the change of the wage gap. This last association is very robust to different specifications, whereas the relationship between the percentage of public employees and the wage gap, although always negative, is somewhat less stable (see the following columns). In column (2) we include as an additional determinant the first difference of the share of public workers that work in Public Administration. The lower availability of data for this variable reduces our estimation to a shorter time period, and therefore decreases considerably the number of observations. The point estimate suggests that increases in this ratio are associated with increases in the wage gap but, opposite to the cross-sectional regressions, the relationship is not statistically significant (p-value is 0.31). In column (3) we include the first difference of an index of government quality (the International Country Risk Guide Indicator of Quality of Government), which captures the level of efficiency of the public sector. This index has the advantage that is available for all countries in our sample and for a long time period (1984-2012). We see that improvements in the quality of government are associated with lower wage gaps (in first differences). A one standard deviation increase in the change of government quality is associated with a 2.7 percentage points decrease in the change of the pay gap, which is 0.34 standard deviations, being this relationship statistically significant. Moreover, this relationship holds when we use an alternative measure of the quality of the public sector, the index of government effectiveness of the Worldwide Governance Indicators, see column (4). In this case, a one standard deviation increase in the change of government quality is associated with a significant 2.6 percentage points decrease in the change of the pay gap, which is 0.33 standard deviations.[27] Figure III shows that this association is not driven by outliers, although the estimation comprises just 3 time periods. Moreover, the association between improvements in government quality (including either indicator) and decreases in the pay gap is robust to including country fixed effects in the change of the wage gap (not shown). With respect to variables linked to wage setting institutions: employment protection and trade union density, we find no statistical relationship with respect to the wage gap, see columns (5) and (6). Although the sign of employment protection is positive, it lacks statistical significance, whereas changes of trade union density are estimated to be uncorrelated with changes in the wage gap. Overall, this long run analysis corroborates the importance of accounting for the government monopolistic power in explaining the wage gap. From a long time period perspective, increases in foreign competition and improvements in the institutional quality of governments are associated with significant reductions in the public sector pay gap. The evidence also suggests that increases in the number of employees are also associated with reductions in the public sector pay gap, but in this case the estimates are more noisy.

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[27]Kaufmann et al. (2010) note that the Worldwide Governance Indicators use reasonably comparable methodologies over time, then the indicators can be meaningfully compared both across countries and over time.

TABLE V

LONG-RUN DETERMINANTS OF THE PUBLIC PAY GAP

|	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: ΔGeneral Government Sector "Macro" Wage Gap$_{ct}$						
Δ% Public Employees$_{ct}$	-0.0178***	-0.0087	-0.0180**	-0.0340**	-0.0131	-0.0336*
	(0.0068)	(0.0183)	(0.0089)	(0.0162)	(0.0112)	(0.0176)
ΔOpenness$_{ct}$	-0.0016**	-0.0021**	-0.0016**	-0.0020***	-0.0005	-0.0019**
	(0.0007)	(0.0010)	(0.0008)	(0.0006)	(0.0015)	(0.0007)
Δ% Public Administration Employees$_{ct}$		1.4048				
		(1.3675)				
ΔQuality of Government$_{ct}$			-0.2457*			
			(0.1320)			
ΔGovernment Effectiveness$_{ct}$				-0.1631**		
				(0.0630)		
ΔEmployment Protection Legislation$_{ct}$					0.0699	
					(0.1028)	
ΔTrade Union Density$_{ct}$						-0.0023
						(0.0059)
Five-Year Dummies	YES	YES	YES	YES	YES	YES
Time Period	1975--2014	1980--2014	1985--2014	2000--2014	1990--2014	2000--2014
Observations	146	56	110	57	91	57
Adjusted R-squared	0.28	0.13	0.21	0.36	0.17	0.28

Notes: This table shows the regression of five-year changes in the macro wage gap on five-year changes of country characteristics linked to the government monopolistic power in the provision of public services and labour market institutions (long run determinants of the public pay gap, equation 2). Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

In Table VI we test that our strategy to take five-year averages effectively removed the effects of the business cycle. We add as additional determinants to the change in the wage gap the first difference of several proxies of economic conditions, namely real GDP, the general government deficit, the level of public debt, and the unemployment rate. None of these variables enter significantly in either regression, whereas the coefficients of percentage of public employees, openness, and government effectiveness remain stable and statistically significant, the only exception being the coefficient of government quality in column (4), with a p-value of .19. This reassures the robustness of the association between the dynamics of the government sector and the public pay gap.

5   Conclusions

In this paper we provide descriptive evidence on the determinants of the levels and dynamics of the public pay premia in a large set of mostly EU countries. We show three results. First, more than half of the cross-sectional variation in public pay gaps can be accounted for by the size and composition of the public labour force, as well as exposure to international competition.

FIGURE III

PARTIAL CORRELATION BETWEEN GOVERNMENT EFFECTIVENESS
AND THE PUBLIC PAY GAP
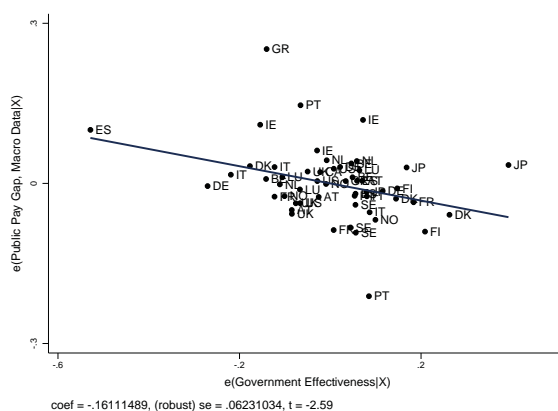
Notes: This figure shows the correlation between five-year changes in the quality of public services of a country and changes in the public sector pay gap, once other characteristics are controlled for, namely changes in the number of public employees and changes in openness, see column (4) of Table V. The negative slope indicates that improvements in the quality of public services are associated in the long run with lower public sector pay gaps.

Second, the evolution of the gap during the recent financial crisis is significantly explained by improvements in fiscal positions. Third, openness to international trade and improvements in the quality of governments have been associated in the long run with decreases in the public pay gap.

These findings are rationalised by a extensive body of research that stresses that the non-competitive environment in which the government sector operates is at the root of the higher earnings enjoyed in the public sector. Given the important effects this has on the labour market and the competitiveness of countries, our findings shed some light on the source of these inefficiencies and help policy makers design public wage bill policies aimed at providing the correct incentives, improve overall efficiency, and achieve fiscal soundness.

TABLE VI

LONG-RUN DETERMINANTS OF THE PUBLIC PAY GAP:
ROBUSTNESS

	(1)	(2)	(3)	(4)
Dep. Variable: ΔGeneral Government Sector "Macro" Wage Gap$_{ct}$				
Δ% Public Employees$_{ct}$	-0.0184**	-0.0223**	-0.0194*	-0.0208**
	(0.0087)	(0.0099)	(0.0101)	(0.0100)
ΔOpenness$_{ct}$	-0.0015*	-0.0016*	-0.0016*	-0.0016*
	(0.0008)	(0.0008)	(0.0009)	(0.0008)
ΔQuality of Government$_{ct}$	-0.2381*	-0.2539*	-0.3421**	-0.1888
	(0.1301)	(0.1485)	(0.1317)	(0.1447)
ΔLog Real GDP$_{ct}$	-0.0607			
	(0.1242)			
ΔDeficit$_{ct}$		0.0035		
		(0.0047)		
ΔDebt$_{ct}$			-0.0001	
			(0.0007)	
ΔUnemployment Rate$_{ct}$				0.0051
				(0.0065)
Five-Year Dummies	YES	YES	YES	YES
Time Period	1985--2014	1985-2014	1985--2014	1985--2014
Observations	110	99	94	102
Adjusted R-squared	0.20	0.22	0.21	0.21

Notes: This table shows the regression of five-year changes in the macro wage gap on five-year changes on country characteristics linked to the government monopolistic power in the provision of public services and business cycle variables. Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

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Appendices

A Data: Definitions and Sources

TABLE A.1

DATA: DEFINITIONS AND SOURCES

VARIABLE	SOURCE	DEFINITION
% of Public Employees	EU-SILC	Number of employees in industries O, P, Q (Nace Rev. 2) over total number of employees
% of Public Administration Employees	EU-SILC	Number of employees in industry O (Nace Rev. 2) over total number of public employees
Government Effectiveness	Worldwide Governance Indicators	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
% of Value Added in Tradable Sectors	Eurostat	Gross value added in agriculture and manufacturing over total gross value added.
% of Public Employees (over Population)	EU-SILC & Eurostat	Number of employees in industries O, P, Q (Nace Rev. 2) over population.
% of Compensation of Employees in Collective Goods	Eurostat (COFOG)	Total general government (GG) compensation of employees minus GG compensation of employees in health, education and social protection.
Openness	World Bank	Exports plus imports over GDP.
Employment Protection Legislation	OECD	Indicator of the procedures and costs involved in dismissing individuals and groups of workers. We use version 2 of the indicator (1998-2013) for the cross-section regressions and version 1 (1985-2013) for the long-run regressions.
Trade Union Density	OECD and Visser (2013)	Ratio of wage and salary earners that are trade union members , divided by the total number of wage and salary earners.
Coverage of Collective Bargaining	Visser (2013)	Employees covered by collective (wage) bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain.
Bargaining	Table 2 of European Commission (2014)	The predominant regime of wage setting in the government sector is collective bargaining as opposed to unilateral decision.

VARIABLE	SOURCE	DEFINITION
Centralization	Table 2 of European Commission (2014)	There is de jure centralization of wage updates across the government sector as opposed to decentralization.
Log Per Capita GDP	Eurostat	Gross Domestic Product, chain linked volumes (2010), euro per capita.
Deficit	IMF & ECB	General government deficit (excluding the government assistance to the financial sector).
Debt	IMF	General government gross debt.
Real GDP Growth	Eurostat	Percentage change of Gross Domestic Product, chain linked volumes (2010).
Cyclically Adjusted Primary Balance (CAPB)	European Commission & ECB	Cyclically Adjusted Primary Balance excluding government assistance to the financial sector.
% of Public Employees (long-run regressions)	OECD	Number of employees in the general government sector over total number of employees
% of Public Administration Employees (long-run regressions)	Eurostat	Number of employees in Public Administration over total number employees in Public Administration, Education, and Health.
Quality of Government	International Country Risk Guide (ICRG) and Teorell et al. (2015)	The mean value of the ICRG variables "Corruption", "Law and Order" and "Bureaucracy Quality", where higher values indicate higher quality of government. Corruption is an assessment of corruption in the political system. Law and Order assesses the strength and impartiality of the legal system as well as the popular observance of the law. Bureaucratic Quality measures the institutional strength and quality of the bureaucracy.
Unemployment Rate	Eurostat	Unemployment rate, annual average.

B Additional Robustness Checks of the Cross-Country Determinants of the Public Pay Gap

B.1   Competing Theories and Business Cycle Variables

<div align="center">

TABLE B.1

DETERMINANTS OF THE PUBLIC SECTOR PAY GAP
GOVERNMENT MONOPOLISTIC POWER AND
WAGE SETTING INSTITUTIONS

</div>

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: NACE Proxy to Government Sector Wage Gap (2004-2012)						
% Public Employees	-0.0092**	-0.0091	-0.0121**	-0.0110***	-0.0113**	-0.0110**
	(0.0041)	(0.0056)	(0.0043)	(0.0036)	(0.0049)	(0.0041)
% Public Administration Employees	0.0071**	0.0065**	0.0078***	0.0045*	0.0072**	0.0073***
	(0.0025)	(0.0029)	(0.0024)	(0.0026)	(0.0028)	(0.0021)
% Value Added Tradable Sectors	-0.0078**	-0.0083*	-0.0075*	-0.0099***	-0.0087**	-0.0082**
	(0.0037)	(0.0040)	(0.0038)	(0.0033)	(0.0032)	(0.0033)
Employment Protection Legislation	0.0298					
	(0.0540)					
Trade Union Density		-0.0008				
		(0.0014)				
Log Per Capita GDP			0.0265			
			(0.0419)			
Deficit				0.0081*		
				(0.0044)		
Debt					0.0001	
					(0.0005)	
Real GDP Growth						-0.0081
						(0.0113)
Constant	0.1738	0.3063	0.0482	0.4225**	0.3232	0.3244
	(0.2051)	(0.2130)	(0.5080)	(0.1850)	(0.2225)	(0.1928)
Observations	22	21	24	23	24	24
Adjusted R-squared	0.48	0.49	0.59	0.62	0.58	0.59

Notes: This table shows the regression of the public sector pay gap on country characteristics linked to the government monopolistic power in the provision of public services, the labour market institutions, and the business cycle. Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

B.2 Sample 2004-2007

TABLE B.2
DETERMINANTS OF THE PUBLIC SECTOR PAY GAP
SAMPLE 2004-2007

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: NACE Proxy to Government Sector Wage Gap (2004-2007)						
% Public Employees	-0.0118***	-0.0086**	-0.0111***	-0.0110***	-0.0107***	-0.0112***
	(0.0036)	(0.0040)	(0.0036)	(0.0030)	(0.0037)	(0.0031)
% Public Administration Employees	0.0056**	0.0069**	0.0080***	0.0060**	0.0080***	0.0078***
	(0.0022)	(0.0025)	(0.0022)	(0.0025)	(0.0025)	(0.0020)
% Value Added Tradable Sectors	-0.0058*	-0.0070**	-0.0061*	-0.0076**	-0.0065**	-0.0063**
	(0.0028)	(0.0032)	(0.0030)	(0.0028)	(0.0025)	(0.0024)
Employment Protection Legislation	0.0268					
	(0.0421)					
Trade Union Density		-0.0011				
		(0.0012)				
Log Per Capita GDP			0.0076			
			(0.0453)			
Deficit				0.0031		
				(0.0040)		
Debt					0.0000	
					(0.0006)	
Real GDP Growth Change						-0.0026
						(0.0072)
Constant	0.2748	0.2618	0.1751	0.3510**	0.2478	0.2777*
	(0.2025)	(0.1524)	(0.4858)	(0.1663)	(0.1729)	(0.1516)
Observations	17	20	24	23	24	24
Adjusted R-squared	0.60	0.62	0.64	0.65	0.64	0.64

Notes: This table shows the correlation between the public sector pay gap and country characteristics linked to the government monopolistic power in the provision of public services, the labour market institutions, and the business cycle. This is the analogous of Table B.1 but for the sample 2004-2007 (excluding the crisis years). Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

B.3 Public Administration Pay Gap

TABLE B.3

DETERMINANTS OF THE PUBLIC ADMINISTRATION PAY GAP

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: Public Administration (Industry O) Wage Gap (2004-2012)						
% Public Administration Employees (over Total Employees)	-0.0184* (0.0103)	-0.0130 (0.0135)	-0.0190* (0.0100)	-0.0208** (0.0085)	-0.0140 (0.0108)	-0.0198** (0.0088)
% Public Administration Employees (over Public Employees)	0.0086** (0.0032)	0.0056 (0.0050)	0.0085*** (0.0030)	0.0074*** (0.0023)	0.0084*** (0.0022)	0.0089*** (0.0022)
% Value Added Tradable Sectors	-0.0046 (0.0030)	-0.0041 (0.0037)	-0.0047* (0.0026)	-0.0051** (0.0021)	-0.0044** (0.0020)	-0.0045* (0.0023)
Employment Protection Legislation	0.0018 (0.0373)					
Trade Union Density		-0.0010 (0.0009)				
Log Per Capita GDP			-0.0074 (0.0336)			
Deficit				0.0047* (0.0023)		
Debt					-0.0007 (0.0004)	
Real GDP Growth						0.0032 (0.0081)
Constant	0.0818 (0.0880)	0.1589* (0.0858)	0.1761 (0.3863)	0.1534** (0.0546)	0.0918 (0.0715)	0.0881 (0.0676)
Observations	22	21	24	23	24	24
Adjusted R-squared	0.22	0.24	0.35	0.37	0.41	0.35

Notes: This table shows the correlation between the Public Administration pay gap and country characteristics linked to the government monopolistic power in the provision of public services, the labour market institutions, and the business cycle. This is a table analogous to Table B.1, but the wage gap is that of the Public Administration (Industry O) vs. the rest of the economy, whereas in Table B.1 it is that of the NACE Proxy to the Government Sector (Industries O, P, and Q) vs. the rest of the economy. The presence of the private sector is negligible in Industry O, whereas it can have a large presence in Industries P and Q, depending on the country. Robust standard errors are in parenthesis. Significance levels: *: 10%; **: 5%; ***: 1%.

B.4 Pay Gap of Female Workers and Workers at the Lower-End of the Income Distribution

FIGURE IV

PUBLIC-PRIVATE PAY DIFFERENTIALS OF WOMEN AND LOW-INCOME WORKERS
AND COMPARISON WITH OVERALL PAY GAPS

Panel A: Female Workers:

Panel B: Low Income (Quartile 1) Workers:
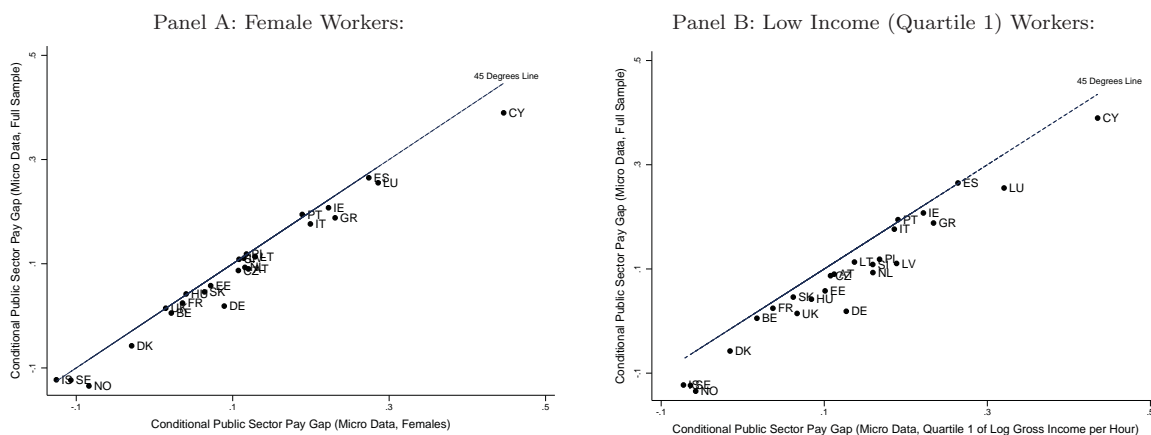
Notes: Panel A compares the public sector pay gap conditional on observed worker characteristics (EU-SILC, see equation 1) of the full sample and the sample of female workers. Panel B compares the pay gap of the full sample with that of workers at the first quartile of the income distribution. The gap of female workers is computed by estimating equation (1) for the sample of female workers. The gap of low-income workers is computed via a quantile regression with the same covariates as in equation (1). In almost all countries the gaps of women and low-income workers are larger than that of the full sample. Nevertheless, the cross-country differences remain.

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