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Public sector wage compression and wage inequality: gender and geographic heterogeneity

Jørn Rattsø[1], Hildegunn E. Stokke[1,*]

[1]Department of Economics, Norwegian University of Science and Technology, Trondheim, Norway
*Corresponding author: Email: hildegunn.e.stokke@ntnu.no

Abstract

Studies of wage inequality concentrate on private wages. Public sector wages are typically assumed to contribute to the overall wage equality. We challenge this understanding in an analysis of the relative skill premium in the public versus private sectors. The analysis of heterogeneity across gender and geography is based on rich register data for Norway. The raw data confirm the relative wage compression in the public sector. However, this is a male phenomenon and only prevalent in large cities when unobserved worker and firm characteristics are taken into account. With identification based on shifters between private and public sectors and movers between city-size groups, wage setting for female workers in the public sector increases wage inequality in all regions, particularly in the periphery. The result is consistent with policies promoting the recruitment of high-educated female workers and the expansion of public services in the periphery counterbalancing the desired equality effect of public wages.

JEL classifications: J31, J45, R23

1. Introduction

The rising skill premium over time has been an important source of growing wage inequality. Influential articles by Acemoglu and Autor (2011) and Autor (2014) show how skill demand with technological progress is a driving force. The studies concentrate on market adjustments for male private sector workers. We extend the understanding of wage inequality by including public sector wages to investigate the relative wage compression between public and private sectors.

The broad literature comparing public and private wages concludes that the wages in the public sector are more compressed. The stylized fact is shown in the overview by Lausev (2014)—public sector pay compression results from governments 'overpaying' unskilled workers and 'underpaying' skilled workers. It follows that the public sector contributes to wage equality. We challenge this result by addressing the heterogeneity of public sector wages. While the overall public sector wage policies typically are oriented towards wage equality, conflicting goals related to the recruitment of high-educated workers and the promotion of public services in the periphery are observed. In the analysis, heterogeneity of relative wage compression is investigated with respect to gender and geography. Identification is based on shifters between sectors and movers between regions taking into

account individual observable and unobservable characteristics of workers and firms. The main result is that relative public sector wage compression is a male phenomenon and prevalent only in large cities. Wage setting for female workers in the public sector increases wage inequality in all regions, particularly in the periphery.

We apply the standard framework of wage inequality analysis, Mincer equations, to analyse the relative college premium between the public and private sectors. All comparisons of public and private workers struggle with selection issues. The regression models here include observed individual worker characteristics and capture unobservables using fixed effects for regions, workers, and firms. The identification consequently is based on shifters between the sectors and movers between city-size groups. Compared to existing studies, we also account for unobserved firm quality, motivated by recent studies of matching in the labour market (Leknes *et al.*, 2022). As discussed by Baum-Snow and Ferreira (2015), another threat to identification is that unobservables are correlated with decisions—here change in sector of employment and migration between geographical areas. Positive unobserved personal shocks may be associated with shifting to the private sector and moving to a larger city. The endogeneity problem is not fully solved with worker and firm fixed effects, and this represents a limitation in terms of causal identification.

Relevant studies in the literature include the estimates by Hausmann *et al.* (2020) using separate wage equations for private and public sectors and distinguishing workers by education levels. They find that high educated in the public sector gain less compared to middle educated. An analysis of unionization by Card *et al.* (2020) throws light on the roles of gender, skill, and public sector employment for wage inequality in the USA and Canada. They observe that 'there is substantial wage compression in all periods for both men and women' in the public sector (p. 162). The alternative approach to handle potential endogeneity is to estimate a structural model to compare the wages of the two sectors, as suggested by Postel-Vinay and Turon (2007). Based on the model, Dickson *et al.* (2014) offer evidence of public sector wage compression covering several European countries. The sectoral wage differences are partly understood as compensating differentials for other aspects of the employment conditions, notably job risk and pension systems.

There is a geographic aspect of wage inequality since city labour markets are different from labour markets in the periphery. The combined geographic and private–public dimensions affect the overall wage inequality. Regional within-country variation in wage inequality is expected since industrial structure and education level differ across regions and geographic mobility is constrained. Lindley and Machin (2014) show higher increases in relative demand for skill in more technologically advanced US states. A city-size wage inequality premium is shown by Glaeser *et al.* (2009), Baum-Snow and Pavan (2013), and Moretti (2013), and the sources of the geographic inequality are further studied by Baum-Snow *et al.* (2018). They relate higher return to skills in cities to agglomeration economies driven by technological change. Analyses of agglomeration effects, recently Carlsen *et al.* (2016), find higher urban wage premiums for high-educated compared to low-educated workers. Leknes *et al.* (2022) show that a significant part of the urban wage premium, and in particular a significant part of the difference in urban wage premium between low- and high-educated workers, can be explained by assortative matching between workers and firms.

Public sector wage setting is different from private markets. The variation in public sector wage systems across countries explains some of the differences in private–public wage gaps. In addition, the gaps will reflect the private market characteristics such as industrial structure and labour market institutions. In the literature comparing private and public firms, private firms are associated with profit maximization and competition contributing to efficiency. Public firms have broader objectives, and the influential model of De Fraja (1993) assumes that both consumer surplus and union utility are taken into account. The different objectives may explain that private ownership can lead to higher effort and thereby higher wages (Bastos *et al.*, 2014). In the wage setting, public ownership allows a role for political

guidelines typically motivating wage equality. Finan *et al.* (2017) emphasize institutional aspects, notably limitations on the formulation of contracts in the public sector and typical rigid civil service rules affecting hiring criteria, promotion patterns and wage levels. In this way, the equality goals are built into the institutional system.

The public sector is held accountable for labour market practices and open democratic states can hardly avoid the principle of equal pay for equal work. The achievements vary, but the pressure is clearly in this direction. At the political level, public sector wage policies are oriented towards equality—raising wages at the bottom of the wage distribution and holding back at the top. Lower wages for the high educated in public versus private sectors are observed in many countries. Hospido and Moral-Benito (2016) and Hausmann *et al.* (2020) address skill and education in private–public comparisons. In the private sector, wages are determined in a combination of market determination and bargaining between employers and unions, with large differences in institutional setups and strengths among involved interests.

To estimate the relative skill wage premium, we use register data for Norway during 2001–2014. The skill premium is measured by the college-educated to high-school-educated wage gap for private and public sectors separately. The raw data confirm the pattern of relatively lower skill premium in the public sector. However, in the aggregate, more compressed wages in the public compared to the private sector are fully explained by differences in observed and unobserved worker characteristics in the two sectors. Addressing gender and geographic heterogeneity reveals interesting structural variation. To capture the geographical dimension of wage inequality we separate between the larger Oslo area, other city regions with more than 65,000 inhabitants, and the rest of the country. Public sector wage compression is only found for male workers in large cities, while for female workers, the public sector increases wage inequality in all regions, particularly in the periphery. In terms of the selection on unobserved ability in the private sector, we find opposite effects for male and female workers. While high-ability college-educated men are more likely to self-select into the private sector (relative to high-ability high-school-educated men), high-ability college-educated women are relatively more likely to self-select into the public sector. Without controlling for worker-fixed effects, the degree of relative wage compression in the public sector is overestimated for male workers and underestimated for female workers. Failing to account for unobserved firm quality overestimates the degree of public sector wage compression for both genders. Our main finding is that the public sector reduces urban wage inequality for men, while it adds to wage inequality in the periphery. This brings new evidence to the policy debate about wage inequality and regional differentiation of public sector wages.

Section 2 presents the data and the econometric approach. The analysis of public sector wage compression is presented in Section 3. Section 4 investigates geographic heterogeneity in wage inequality and estimates the city size effect on the sectoral wage premia. Section 5 offers a first look at differences along the wage distribution. Concluding remarks are shown in section 6.

2. Data and econometric approach

To estimate the skill wage premium, we use register data on hourly wages and worker characteristics from 2001 to 2014. The dataset is computed from three administrative registers: employment, tax, and education. The employment register links workers and firms and gives information on work contracts for all employees. It includes the duration of the contract, the type of contract,[1] and the exact number of hours worked per week.

[1] The employment register separates into three contract types: full-time contracts with at least 30 h of work per week, part-time contracts with 20–29 h of work per week, and part-time contracts with fewer than 20 h of work per week.

We calculate the number of hours worked per year, which is combined with data on annual wage income from the tax register to give a measure of hourly wages for all employees. The education register covers the entire adult population and gives detailed information about workers' level of education. We also have information on the age, gender, immigrant status, industry affiliation, firm affiliation, and home region of all individuals.

We concentrate on native, full-time workers aged 25–55 years, holding at least a high school degree.[2] The dataset includes 6,668,634 observations and 1,001,104 different workers. The workers are allocated to 56 industries, 89 labour market regions, and approximately 190,000 firms. In the main analysis, we separate between two levels of education; high school degree and any college education with degree, and the analysis estimates the wage premium of college-educated workers relative to workers with high school education. To capture the geographic dimension of the wage gap, we separate between three region types: the larger Oslo area, other cities with at least 65,000 inhabitants in 2010, and the periphery.[3] There is no register separating between private and public sector workers and the distinction between the two sectors is therefore made at the industry level. We define the public sector as the three industries public administration, health care, and education, while the remaining 53 industries constitute the private sector. It should be noted that the public sector is complex and consists of a variety of institutions, including fully and partly owned enterprises and foundations. We concentrate on the core public administration and the two large industries dominated by public employees—health care and education. A detailed description of the activities of the three industries is given in Supplementary Appendix Table A.1. They include large professions almost exclusively hired by the public sector—nurses, doctors, and teachers. There is some contracting out of public services, but the small number of private employees (for instance at private schools or private nursing homes) is unlikely to influence the results of the analyses made.

Panels A and B of Table 1 report descriptive statistics of male and female worker-year observations, respectively, both aggregate and separately for the two education groups. Among men, 43% of the observations refer to college-educated workers, while almost two-thirds of the female observations are from workers with a college degree. Overall, 36% of male observations are from workers employed in manufacturing (including construction), 44% in services, and 20% in the public sector. Among the college educated, the public sector share is higher (36%), while high-school-educated workers are relatively more likely to work in manufacturing. Female observations are overrepresented in the public sector with an overall employment share of 56%, which increases to 68% among the college educated. Women with high school education are relatively more likely to work in services. The geographical allocation is roughly similar across male and female observations with 30–35% in Oslo, 42–44% in other cities, and 23–26% in the periphery. The share of observations in Oslo is higher for the college-educated than for workers with high school education, and the difference between the education groups is larger for men than for women. The share of

[2] We exclude workers in the primary industries (agriculture, fishing, and forestry), as well as workers without a high school degree. This gives a dataset of approximately 10.8 million worker–year observations. The tax register gives information on total annual earnings, rather than separate earnings for each work contract. Workers with more than two contracts during a year (700,000 observations), as well as workers with one full-time and one part-time contract (470,000 observations), are excluded. For workers with two full-time contracts, we allow for a maximum of three months of overlap between the contracts (320,000 observations dropped). We also exclude workers whose contract length is less than 3 months during a year (150,000 observations). Missing data on hours worked, annual earnings, level of education, or industry affiliation amounts to 1.1 million observations. We further exclude workers that change education level after entering the labour market as full-time employees (300,000 observations), workers with 1 and 2 years of higher education, but no degree (450,000 observations), and workers with a high school degree based on a mix of vocational and academic tracks (500,000 observations). To avoid extreme observations, we exclude the top and bottom 1% of the wage distribution. This leaves a dataset of about 6.67 million observations.

[3] We apply the same definition of the larger Oslo area as in Bhuller (2009). It consists of 11 of the 89 labour market regions and had a total population of almost 1.5 million in 2010. Other cities (at least 65,000 inhabitants) include 15 regions and have an average population of 135,000. Lastly, the periphery consists of the remaining 63 regions, where the average population is about 20,000.

Table 1. Descriptive statistics (mean values) by gender and level of education

Variables	All	High school	College
Panel A: Men			
Log hourly wage (in 2010 NOK)	5.58	5.49	5.69
Age	39.3	39.2	39.5
Sector of employment:			
Manufacturing	0.362	0.487	0.192
Services	0.441	0.434	0.451
Public	0.197	0.079	0.357
Location:			
Larger Oslo area	0.301	0.238	0.386
Other cities	0.436	0.446	0.422
Periphery	0.263	0.316	0.192
Periphery with low public employment share	0.153	0.191	0.103
Periphery with high public employment share	0.11	0.125	0.089
No. of observations	3,922,562	2,255,650	1,666,912
Share of observations		0.575	0.425
Panel B: Women			
Log hourly wage (in 2010 NOK)	5.40	5.27	5.47
Age	39.1	39.4	38.9
Sector of employment:			
Manufacturing	0.099	0.151	0.071
Services	0.341	0.516	0.246
Public	0.56	0.333	0.683
Location:			
Larger Oslo area	0.355	0.32	0.374
Other cities	0.415	0.426	0.409
Periphery	0.23	0.254	0.217
Periphery with low public employment share	0.123	0.142	0.112
Periphery with high public employment share	0.107	0.112	0.105
No. of observations	2,746,072	968,746	1,777,326
Share of observations		0.353	0.647

Notes: We distinguish between two types of periphery regions based on the intensity of the public sector. Periphery regions where the public sector accounts for more than 40% of employment are defined as having high public sector presence (applies to 26 of the 63 periphery regions).
Source: Authors' calculations.

observations in other cities is similar across education groups, while the periphery share is higher among the low educated, especially for male observations.[4]

The longitudinal data at the individual level allows for the investigation of heterogeneity of wage inequality. College wage premium relative to high-school education serves as measure of inequality. The education level of the workers is taken as given and is constant for all workers in the sample. The main heterogeneity addressed concern gender and geography. Identification of sectoral and regional wage differences is based on shifters between the private and the public sector and movers between region types. There are 68,493 shifters (accounting for 7% of workers and 9% of observations) and 101,343 movers (10% of workers and 13% of observations).[5] Compared to workers that do not shift between sectors, shifters are more likely to live in Oslo and to be college educated and female. Workers that move geographically are younger, less likely to work in manufacturing and more likely to be college educated, compared to non-movers. The age distributions of shifters and movers (in the shift/move-year) are illustrated in Figure 1. The age of workers that shift

[4] Descriptive statistics within the private and the public sector are given in Supplementary Appendix Table A.2.

[5] Some workers shift between sectors or move between regions more than once, so in total, we have 82,577 sector shifts and 127,080 geographic moves. Descriptive statistics of shifters/non-shifters and movers/non-movers are given in Supplementary Appendix Table A.3.

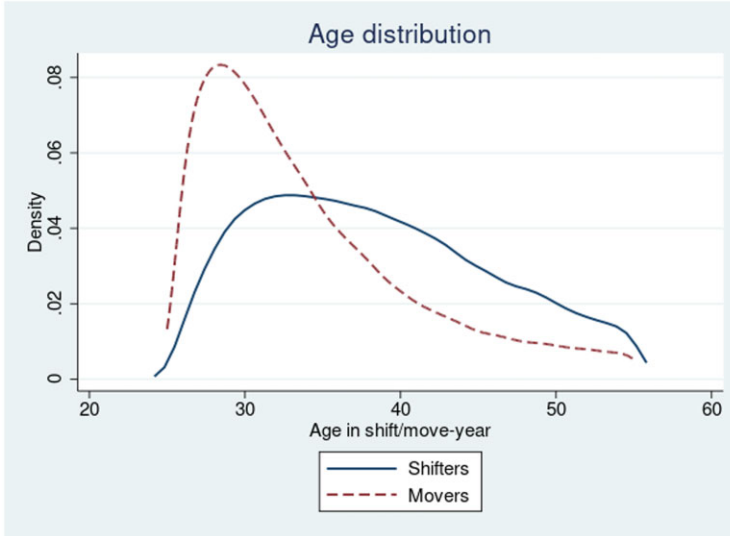

Figure 1. Age distributions: shifters and movers.

between the private and the public sector is more equally distributed than the age of workers that move geographically, which is more concentrated among young workers.

The identification issues involved are discussed in Section 1. Combes *et al.* (2012a) examine distributions of fixed effects in different cities in France and argue that selective migration is not a serious problem for the city-size coefficients. The choice of private versus public sectors is less studied, but Rattsø and Stokke (2019) suggest an identification strategy correcting for the bias resulting from the heterogeneity of unobservable characteristics between public–private shifters and public stayers. In their analysis, shifters early in the period studied are compared with workers still in the public sector that shift later. Late shifters serve as counterfactual for early shifters to the private sector, and the findings indicate some overestimation due to the positive selection of shifters to the private sector.

In this analysis, we extend the identification based on shifters and movers by introducing firm fixed effects that control for firm quality. We start by estimating the aggregate skill wage premium while allowing the premium to vary between the private and the public sectors. We run a hedonic regression of individual hourly wages for the period 2001–14 that controls for observable worker characteristics:

$$lnw_{irst} = \alpha_1 \cdot coll_i + \alpha_2 \cdot coll_i \cdot pub_{it} + \alpha_3 \cdot pub_{it} + X_{it}\beta + \gamma_t + \lambda_r + \eta_s + \varepsilon_{irst} \qquad (1)$$

where w_{irst} is the hourly wage income for worker i employed in industry s in region r in year t, $coll_i$ is a dummy that equals one if the worker is college educated, and pub_{it} is a dummy that equals one if the worker is employed in the public sector in year t. The vector of worker characteristics (X_{it}) includes controls for gender and age, while year, regional, and industry fixed effects are represented by γ_t, λ_r, and η_s, respectively. The industry fixed effects are based on industries within the private sector, which means that α_3 refers to wages in the public sector relative to the reference industry in the private sector ('wholesale trade') for high-school-educated workers. The error term is given by ε_{irst}. Due to limited overlap in occupations between the private and the public sector, as well as between low- and high-educated workers, the regression does not control for occupation-fixed effects. The estimated college wage premium is given by the coefficient α_1 in the private sector and by

$\alpha_1 + \alpha_2$ in the public sector. Relative wage compression in the public sector implies $\alpha_2 < 0$. The skill wage premiums are estimated both aggregate and separately for male and female workers.

To address selection into the private and public sectors based on unobserved abilities and account for differences in firm quality we extend the specification in Equation (1) to include worker and firm fixed effects (μ_i and σ_f, respectively). As workers in our sample do not change their level of education after entering the labour market as full-time employees, the introduction of worker-fixed effects means that the college dummy cannot be estimated. Firm fixed effects are identified based on individuals changing firms during the period of study and take account of the effect of firm quality on an individual's wage, which will be different between firms that the individual works for. As firms do not shift between the private and public sectors, the public dummy drops from the regression. This implies that the regression with fixed effects can only estimate the interaction term between the dummies for college education and public sector employment:

$$lnw_{ifrst} = \alpha_2 \cdot coll_i \cdot pub_{it} + X_{it}\beta + \gamma_t + \lambda_r + \eta_s + \mu_i + \sigma_f + \varepsilon_{ifrst} \tag{2}$$

In this case, the identification is based on workers shifting between the private and the public sector during the period of study. The coefficient α_2 represents the additional college premium received in the public sector compared to the private sector and a negative estimate implies public sector wage compression. By comparing the estimated coefficients for the interaction term with and without worker-fixed effects, we can shed some light on the selection into the private sector for different education groups and for men versus women. To formally test for the degree of selection bias, we apply the method of Combes *et al.* (2012b) to compare worker fixed-effects distributions for workers in the private and the public sector for each gender-education group.

Handling selection based on unobservables is a challenge in an analysis of private and public sector workers. Wages in the private sector are determined by market forces and are assumed to reflect productivity differences across gender, education groups, and cities. The estimates of worker-fixed effects measure the unobserved ability of workers influencing their productivity. Public sector wages are determined in processes under political control and in addition, the productivity of public services is hard to evaluate given that they are not sold at the market. There is no clear relationship between wages and productivity in the public sector. The estimated worker fixed effects for public sector workers are understood as an approximation of their ability.

We extend the specification in Equation (2) to allow for geographic heterogeneity in skill wage premiums:

$$\begin{aligned} lnw_{ifst} = {} & \alpha_2 \cdot coll_i \cdot pub_{it} + \textstyle\sum_{k=1}^{2}((\alpha_{3,k} + \alpha_{4,k} \cdot pub_{it}) \cdot coll_i \cdot city_{k,it}) \\ & + \textstyle\sum_{k=1}^{2} (\alpha_{5,k} + \alpha_{6,k} \cdot pub_{it}) city_{k,it} + X_{it}\beta + \gamma_t + \eta_s + \mu_i + \sigma_f + \varepsilon_{ifst} \end{aligned} \tag{3}$$

where $city_{1,it}$ and $city_{2,it}$ are dummy variables that equal one if the worker is located in the larger Oslo area and in other cities, respectively.[6] The periphery regions act as the reference category. With this specification, we can estimate the skill wage premiums across the three region types, while allowing for separate effects in the private and the public sector.

The reference category is the college wage premium for private sector workers in the periphery. For periphery regions, the additional skill premium received in the public sector

[6] Since the specification includes firm fixed effects, the coefficients on the city dummies and the interaction terms between city dummies and the public dummy ($\alpha_{5,k}$ and $\alpha_{6,k}$, respectively) are identified from individuals who work in the same firm but live in different geographic areas. These coefficients are not reported in the result section and do not affect the estimated skill wage premiums.

compared to the private sector is given by α_2. The geographic variation in the skill premium follows from the estimated coefficients. The additional skill premium for private sector workers in the larger Oslo area and in other cities (compared to the periphery) are given by $\alpha_{3,1}$ and $\alpha_{3,2}$, respectively. For public sector workers, the additional college wage premium received in the larger Oslo area and in other cities are given by $\alpha_{3,1} + \alpha_{4,1}$ and $\alpha_{3,2} + \alpha_{4,2}$, respectively. It follows that the additional skill premium received in the public sector compared to the private sector is given by $\alpha_2 + \alpha_{4,1}$ and $\alpha_2 + \alpha_{4,2}$ in the larger Oslo area and in other cities, respectively. If $\alpha_{4,1} \neq 0$ and/or $\alpha_{4,2} \neq 0$, then the difference in skill wage premiums across sectors has a regional dimension and there is spatial variation in the degree of public sector wage compression. To allow for heterogeneity among periphery regions, we also apply a specification that separates between four region types: the larger Oslo area, other cities, periphery regions with well-developed private labour markets, and periphery regions dominated by the public sector.

3. Public sector wage compression—sources and gender differences

Consistent with most of the literature, we measure wage inequality by the college wage premium and estimate the degree of public sector wage compression by separating private and public sectors, as described by Equations (1) and (2) in Section 2. The estimation is based on about 6.67 million observations of private and public sector workers during 2001–14. The results are given in Table 2, for all workers in panel A and separately for men and women in panels B and C, respectively. Relative compression of public sector wages implies lower college wage premium in the public compared to the private sector. Without controlling for any worker characteristic, the skill wage premium is 24.5% and 19.9% in the private and the public sector, respectively (column 1).[7] Public sector wage compression is present in the raw data for both male and female workers, although much stronger for men. The raw unadjusted male skill premium is 11.7% points lower in the public compared to the private sector, while the sectoral difference is only 2.2% points for female workers. This is consistent with the observations of Card *et al.* (2020) for the USA and Canada.

Introducing observable controls and capturing unobservables by worker and firm fixed effects, we find that these factors fully explain the raw differences in skill premiums in the private and public sectors. There is no significant difference in adjusted skill premium between the private and public sectors for male workers in Norway, while for women, the adjusted skill premium is relatively higher in the public sector. The analysis is documented in columns (2)–(6) of Table 2, where we gradually extend the controls for worker characteristics to identify the true degree of relative wage compression between sectors.

Starting out from the raw unadjusted sectoral difference in male college wage premium of 11.7 percentage points, controlling for age in column (2) does not affect the gap much. The additional effect of regional fixed effects in column (3) reduces the difference in sectoral skill wage premiums to 9.4 percentage points. If college-educated workers are relatively more likely to work in cities (where wages are higher), then the unadjusted skill premium is too high. This is the case in the private sector, where 42.5% of college-educated men work in the larger Oslo area compared to only 23.6% of high-school-educated men. In the public sector, the difference in the urban-rural location between low- and high-educated workers is much less (the share of workers in the larger Oslo area is 31.4% and 26.4% for the college and high school educated, respectively). In column (4), we account for potential industry differences between low- and high-educated workers by controlling for industries within the private sector. This further reduces the difference between sectors, and the skill wage

[7] Throughout the article, we approximate log-point differences as percentage differences. The exact percentage change can be calculated from the formula $100(e^{lnx-lny} - 1)$, which gives a skill wage premium of 27.8% ($e^{0.245} - 1 = 0.278$) in the private sector and of 22% ($e^{0.199} - 1 = 0.22$) in the public sector.

Table 2. Sources of public sector wage compression

Variables	ln w (1)	ln w (2)	ln w (3)	ln w (4)	ln w (5)	ln w (6)
Panel A: All workers						
College	0.245***	0.269***	0.242***	0.201***		
	(0.0009)	(0.0009)	(0.0008)	(0.0009)		
College × Public	−0.046***	−0.056***	−0.039***	0.002	−0.004	0.014***
	(0.0014)	(0.0012)	(0.0012)	(0.0012)	(0.0025)	(0.0024)
Public	−0.191***	−0.137***	−0.132***	−0.16***	−0.078***	
	(0.001)	(0.001)	(0.001)	(0.0015)	(0.0022)	
Obs.	6,668,634	6,668,634	6,668,634	6,668,634	6,668,634	6,535,737
R^2	0.17	0.25	0.28	0.34	0.25	0.20
Panel B: Male workers						
College	0.27***	0.272***	0.244***	0.2***		
	(0.0011)	(0.001)	(0.0011)	(0.0011)		
College × Public	−0.117***	−0.112***	−0.094***	−0.05***	−0.021***	0.003
	(0.0021)	(0.0021)	(0.0021)	(0.0022)	(0.0033)	(0.0034)
Public	−0.092***	−0.112***	−0.108***	−0.128***	−0.072***	
	(0.0017)	(0.0017)	(0.0017)	(0.0022)	(0.0029)	
Obs.	3,922,562	3,922,562	3,922,562	3,922,562	3,922,562	3,852,930
R^2	0.17	0.21	0.24	0.32	0.29	0.24
Panel C: Female workers						
College	0.252***	0.265***	0.24***	0.198***		
	(0.0015)	(0.0015)	(0.0014)	(0.0014)		
College × Public	−0.022***	−0.025***	−0.01***	0.032***	0.015***	0.021***
	(0.0018)	(0.0017)	(0.0017)	(0.0017)	(0.0036)	(0.0039)
Public	−0.131***	−0.145***	−0.136***	−0.173***	−0.083***	
	(0.0012)	(0.0012)	(0.0012)	(0.0024)	(0.0036)	
Obs.	2,746,072	2,746,072	2,746,072	2,746,072	2,746,072	2,671,529
R^2	0.18	0.21	0.23	0.28	0.19	0.16
Year FEs	v	v	v	v	v	v
Age/gender		v	v	v	v	v
Regional FEs			v	v	v	v
Industry FEs				v	v	v
Worker FEs					v	v
Firm FEs						v

Notes: The industry fixed effects (FEs) are based on industries within the private sector. In columns (5) and (6), the R^2 reported is within workers. Robust standard errors (clustered by workers) are given in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.
Source: Authors' calculations.

premium is now 5 percentage points lower in the public compared to the private sector. This implies that college-educated male workers are more likely to be employed in high-wage private industries compared to workers with high school education.[8]

In columns (5) and (6), we account for unobservables captured by worker and firm fixed effects, interpreted as worker ability and firm quality. The results with worker fixed effects in column (5) show that the difference in ability between high- and low-educated workers is larger in the private than in the public sector. This contributes to the public sector wage compression. Taking into account that high-ability college-educated men are more likely to self-select into the private sector (relative to high-ability high-school-educated men) reduces the sectoral difference in the skill wage premium to 2.1 percentage points. Firm quality is

[8] Note that the inclusion of industry fixed effects changes the interpretation of the public sector dummy, which now refers to wages in the public sector relative to the reference industry in the private sector ('wholesale trade') for high-school-educated workers. As seen from Table 2, the public sector wage penalty for the high school educated increases when compared to 'wholesale trade' as opposed to all private sector industries.

accounted for in column (6). If the college educated are relatively more likely to work in high-quality firms, then the skill wage premium is overestimated when firm fixed effects are not included. We find that the difference in firm quality between college- and high-school-educated workers is larger in the private than in the public sector. Failing to account for unobserved firm quality overestimates the degree of public sector wage compression. As seen from column (6), this factor eliminates the rest of the difference in wage compression for male workers between the private and public sectors.

For female workers, the public sector wage compression in the raw data is much smaller than for men. The skill wage premium is 2.2 percentage points lower in the public compared to the private sector. The inclusion of region and industry-fixed effects decreases the relative wage compression in the public sector. College-educated women in the private sector are more likely to work in cities (compared to high-school-educated women), while in the public sector, the city share varies less across low- and high-educated women. Also, college-educated women are overrepresented in high-wage private industries. Taken together, this gives an estimated skill wage premium that is 3.2 percentage points higher in the public compared to the private sector for female workers. Controlling for worker-fixed effects reduces the additional premium in the public sector to 1.5 percentage points. Compared to high-ability high-school-educated women, high-ability college-educated women are more likely to self-select into the public sector, contrary to the findings for men. Failing to control for worker fixed effects will in this case underestimate the degree of relative wage compression in the public sector. Including firm fixed effects reveals that the difference in firm quality between college- and high-school-educated workers is somewhat larger in the private than in the public sector. In the preferred specification, the skill wage premium is 2.1 percentage points higher in the public compared to the private sector (significant at 1% level). The public sector contributes to larger inequality among women.[9]

The degree of selection into the private sector is investigated by comparing worker fixed-effects distributions for private and public sector workers. The fixed effect of each worker is related to the sector where the worker was employed in 2014 or the last year available in the dataset. Figure 2 compares the worker fixed-effects distributions across sectors for four worker groups defined by gender and level of education. To formally test for the degree of selection bias, the distribution of worker fixed effects in the private sector is approximated by taking the distribution of worker fixed effects for public sector workers, shifting it by an amount A, and dilating it by a factor D. Table 3 reports the estimated shift parameters for the different worker groups. For college-educated men, the ability distribution of private sector workers lies 0.053 units to the right of the ability distribution of public sector workers and the difference between the two distributions is significant at the 1% level. For high-school-educated men, the estimated shift parameter is much lower (0.018) and is not significant at the conventional 5% level. This implies that high-ability college-educated men are much more likely to sort into the private sector than high-ability high-school-educated men. For women, we find the opposite pattern. The degree of selection into the private sector is lower (and less statistically significant) for college-educated than for high-school-educated workers, with estimated shift parameters of 0.027 and 0.037, respectively. These findings are consistent with the estimates in Table 2, where worker selection into the private sector based on unobserved ability explains part of the observed public sector wage compression for men, while for women, it contributes to more dispersed wages in the public sector. Without controlling for worker fixed effects, the

[9] Private–public shifters are overrepresented in public administration and underrepresented in health care and to some extent in the education industry. Supplementary Appendix Table A.4 re-estimates Table 2 with workers in health care and education excluded. The degree of public wage compression is about 2 percentage points higher, but the selection bias due to unobserved worker ability still has opposite signs for male and female workers.

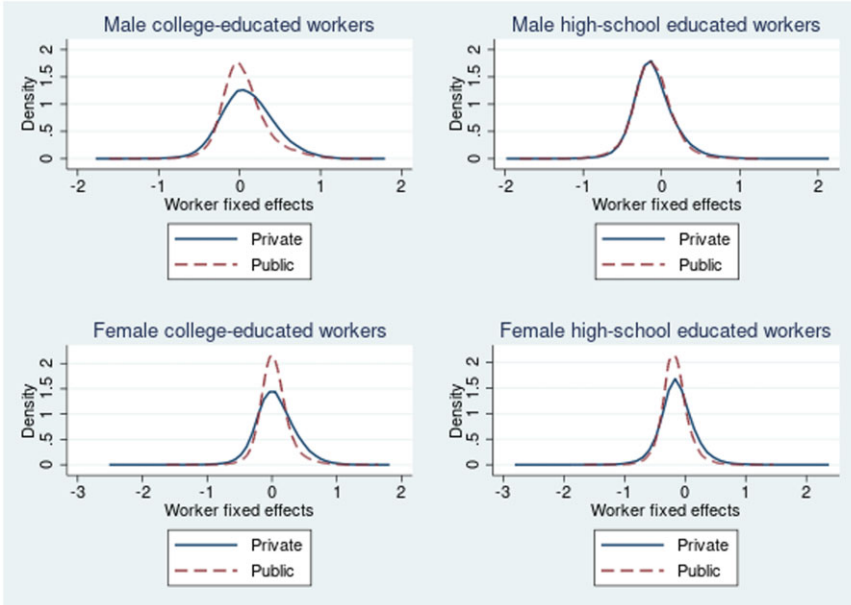

Figure 2. Worker-fixed-effects distributions: private versus public sector.

Table 3. Comparison of worker fixed-effects distributions across sectors

Worker groups	Shift ($\hat{A}$)	R^2	Obs.
Panel A: Men			
Private versus public sector, college-educated workers	0.053***	0.815	210,172
	(0.0121)		
Private versus public sector, high-school-educated workers	0.018*	0.513	288,153
	(0.0106)		
Panel B: Women			
Private versus public sector, college-educated workers	0.027*	0.934	251,278
	(0.0139)		
Private versus public sector, high-school-educated workers	0.037**	0.959	137,562
	(0.0156)		

Notes: The table reports the estimated shift parameters, while the estimated dilation parameters are available upon request. Bootstrapped standard errors are given in parenthesis (re-estimating worker fixed effects in 100 bootstrapped iterations based on 10% random samples with replacement). ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.
Source: Authors' calculations.

degree of relative wage compression in the public sector is overestimated for male workers and underestimated for female workers.[10]

4. Geographic heterogeneity in public sector wage compression

To capture the geographic dimension of wage inequality, we separate between the larger Oslo area, other cities, and periphery regions. The skill wage premium is allowed to vary

[10] In Supplementary Appendix Figure A.1 and Table A.5, we offer a comparison of ability distributions across education groups. The findings indicate opposite effects of selection on relative wage inequality for male and female workers, consistent with the results in Tables 2 and 3.

across both regions and private–public sectors, as described by Equation (3) in Section 2. The differences in skill premiums are identified based on movers between the geographical regions and shifters between the private and public sectors. The results are documented in panel A of Table 4, separating between men and women.

We start out with the estimated city-size wage inequality premium in the private sector. The skill wage premium for men in the larger Oslo area is 3.4 percentage points higher than in the periphery (second row, column 1). The additional premium in other cities is 1.2 percentage points. Female private sector workers with college education have 2.3 and 1.2 percentage points higher premium in the larger Oslo area and in other cities, respectively, compared to the periphery (column 3, second and fourth row). It follows that the city-size wage inequality premium in the private sector is present for both men and women. The geographic effect can be related to the background urban wage premia. As documented by Carlsen *et al.* (2016), the wage gain in cities increases with workers' level of education. The estimates of skill wage premiums in the public sector indicate a different wage setting influencing both regional and gender variation. The skill wage premium for men in the public sector is 1.5 percentage points lower in Oslo than in the periphery (0.034–0.049 in rows 2 and 3, column 1). The lower skill premium reflects that public sector wages are more compressed in cities than in the periphery. For female public sector workers, the skill wage premium varies less between geographical areas, but tends to be relatively higher in cities (0.5 percentage points higher in Oslo than in the periphery).

Based on the estimated coefficients in panel A, we can compare the degree of wage compression in the private and the public sectors along the geographical dimension. Panel B of Table 4 sums up the additional skill wage premiums offered in the public compared to the private sector for the different geographical areas (Oslo, other cities, periphery). A negative value results when the skill premium is lower in the public than in the private sector. The finding is that geography matters for wage inequality, in particular among male workers. For men, the aggregate result in column (6) of Table 2 of similar skill wage premium across sectors hides important geographic heterogeneity. As seen from the first column, the additional premium in the public sector is negative and significant in the larger Oslo area (−2.2 percentage points), while it is positive and significant in other cities and in the periphery (1.3 and 2.7 percentage points, respectively). For women, the result shows that the positive additional premium in the public sector found in column (6) of Table 2, holds in all regions. The estimated effect is decreasing with urbanization—from 3.1 percentage points in the periphery to 1.3 percentage points in the larger Oslo area, shown in column (3). Our findings imply that the public sector reduces urban wage inequality for men while increasing female wage inequality, in particular in the periphery. Public sector wage compression is a male phenomenon and only prevalent in large cities.[11]

[11] We address four aspects of sample selection. First, we exclude the shift- and move-year of shifters and movers, respectively. The wage in the shift-year could represent a mix of private and public sector wages (depending on when during the year the worker changed sector). Similarly, the wage in the move-year could be a mix of wages at two different geographic locations. Secondly, we extend the dataset to include workers with one full-time and one (short or long) part-time contract, as well as workers with long part-time contracts (20–29 h of work per week). As documented in Supplementary Appendix Figures A.2a–A.2h, the distribution of hourly wages for workers with short part-time contracts (fewer than 20 h of work per week) differs significantly from the two other contract types (much higher mean hourly wages and larger variation). We do not consider short part-time workers to be comparable to the rest of the labour force and therefore do not include them in the robustness analysis. Third, workers with some college education (1 and 2 years), but no degree, are included in the dataset as high-school graduates. Fourth, workers with a high school degree based on a mix of vocational and academic tracks are included in the analysis. In all cases, the re-estimations given in Supplementary Appendix Tables A.6–A.13 confirm that public sector wage compression is a male phenomenon only prevalent in large cities. In addition, we divide the college educated into workers with 3–4 years of college and postgraduates, and, as an alternative regional classification, separate out the three largest cities from the 'Other city' group. The re-estimations in Supplementary Appendix Tables A.14–A.16 show that public sector wage compression for male workers in cities is driven by postgraduates and is only seen in the largest urban area, not in other large cities. The regressions in Table 4 control for worker selection based on unobserved ability in the private sector and in large cities. By comparing regressions with and without worker-fixed effects, we can study the degree of selection

Table 4. Geographic heterogeneity in public sector wage compression

	Men		Women	
Variables	(1)	(2)	(3)	(4)
Panel A: Wage regressions by gender				
College × Public	0.027***	0.04***	0.031***	0.037***
	(0.0051)	(0.0067)	(0.0069)	(0.0097)
College × Oslo	0.034***	0.034***	0.023***	0.027***
	(0.0036)	(0.0047)	(0.0063)	(0.0085)
College × Oslo × Public	−0.049***	−0.062***	−0.018**	−0.025**
	(0.0063)	(0.0076)	(0.0081)	(0.0106)
College × Other city	0.012***	0.012***	0.012**	0.016*
	(0.003)	(0.0044)	(0.0059)	(0.0083)
College × Other city × Public	−0.014***	−0.027***	−0.004	−0.011
	(0.0057)	(0.0072)	(0.0077)	(0.0104)
College × Periphery low		−0.001		0.006
		(0.0051)		(0.0098)
College × Periphery low × Public		−0.031***		−0.013
		(0.009)		(0.0125)
Obs.	3,852,930	3,852,930	2,671,529	2,671,529
R^2	0.24	0.24	0.16	0.16
Panel B: Summing up the geographic heterogeneity in public sector wage compression				
Additional premium in the public sector				
Larger Oslo area	−0.022***	−0.022***	0.013**	0.012**
	(0.005)	(0.005)	(0.0054)	(0.0054)
Other cities	0.013***	0.013***	0.027***	0.026***
	(0.0043)	(0.0043)	(0.0054)	(0.0054)
Periphery	0.027***		0.031***	
	(0.0051)		(0.0069)	
Periphery with low public employment share		0.009		0.024***
		(0.0069)		(0.009)
Periphery with high public employment share		0.04***		0.037***
		(0.0067)		(0.0097)

Notes: Panel A documents wage regressions by gender. The dependent variable is log hourly wages. All regressions include year, industry, worker, and firm fixed effects, as well as controls for age. In columns (1) and (3), the reference category is all periphery regions, while in columns (2) and (4), the reference category is periphery regions with high public sector presence (more than 40% of employment). The variable 'Periphery low' refers to the remaining periphery regions with public employment share below 40%. The R^2 reported is within workers. Based on the estimated coefficients in Panel A, the geographic heterogeneity in public sector wage compression is summed up in Panel B. Robust standard errors (clustered by workers) are given in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.
Source: Authors' calculations.

Since geographic mobility is higher among workers early in their careers (documented in Figure 1), we study whether the geographic heterogeneity in public sector wage compression varies with the age of workers. We separate between young workers (aged 25–32 years) and old workers (aged 33–55 years). Young workers account for 26% of the observations, 52% of geographic moves and 26% of sector shifts. The finding that the public sector increases wage inequality among women is driven by workers in their early careers (see estimates in Table 5). For young female workers, the college wage premium is much higher in the public than in the private sector, from 4 to 5 percentage points sector difference in Oslo and other

bias. The gender difference in selection bias with respect to the sector of employment is found in all region types, although the self-selection of high-ability college-educated women into the public sector (relative to high-ability high-school-educated women) is relatively weaker in Oslo. Further, we find that high-ability workers sort into large cities, and the degree of selection is stronger for college-educated than for high-school-educated workers. This holds for both genders and in both sectors.

Table 5. Geographic heterogeneity in public sector wage compression: young versus old workers

Variables	Young workers		Old workers	
	Men (1)	Women (2)	Men (3)	Women (4)
Panel A: Wage regressions for young and old workers, by gender				
College × Public	0.047***	0.09***	0.013*	−0.001
	(0.0121)	(0.0172)	(0.0065)	(0.0096)
College × Oslo	0.055***	0.044***	0.006	0.003
	(0.0057)	(0.0103)	(0.0052)	(0.0101)
College × Oslo × Public	−0.066***	−0.046***	−0.027***	0.001
	(0.0119)	(0.0173)	(0.0083)	(0.0112)
College × Other city	0.017***	0.035***	−0.003	0.000
	(0.0047)	(0.0099)	(0.0044)	(0.0092)
College × Other city × Public	−0.017	−0.041**	−0.004	0.01
	(0.0113)	(0.0167)	(0.0075)	(0.0108)
Obs.	934,367	659,295	2,865,879	1,964,354
R^2	0.16	0.07	0.22	0.19
Panel B: Summing up the geographic heterogeneity in public sector wage compression				
Additional premium in the public sector				
Larger Oslo area	−0.019*	0.044***	−0.014**	0.000
	(0.0108)	(0.0135)	(0.0064)	(0.0069)
Other cities	0.03***	0.049***	0.009	0.009
	(0.0103)	(0.0146)	(0.0055)	(0.0071)
Periphery	0.047***	0.09***	0.013*	−0.001
	(0.0121)	(0.0172)	(0.0065)	(0.0096)

Notes: Panel A documents wage regressions for young (25–32 years of age) and old (33–55 years of age) workers by gender. The dependent variable is log hourly wages. All regressions include year, industry, worker, and firm fixed effects, as well as controls for age. The R^2 reported is within workers. Based on the estimated coefficients in Panel A, the geographic heterogeneity in public sector wage compression is summed up in Panel B. Robust standard errors (clustered by workers) are given in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.
Source: Authors' calculations.

cities to 9 percentage points in the periphery, all significant at the 1% level. For women later in their careers, there is no significant difference in skill premiums across sectors. This indicates that the public sector bids up wages to recruit high-educated female workers in the early stages of their careers. For men, public sector wage compression in large cities is confirmed for both young and old workers, while relatively higher public sector skill premium in the periphery mainly applies to male workers early in their careers, similar to women.

In a further analysis of the geographic dimension, we investigate the heterogeneity of periphery labour markets. In regions with less developed private industries, the public sector tends to dominate the local labour market, while the richer parts of the periphery enjoy economic growth driven by private industries. We distinguish between two types of peripheral labour markets based on the intensity of the public sector. Periphery regions where the public sector accounts for more than 40% of employment are defined as having high public sector presence. Columns (2) and (4) of Table 4 document the results. For female workers, the skill wage premium is higher in the public than the private sector in all regions. The additional premium in the public sector is highest in periphery regions where the public sector dominates (3.7 percentage points), but the difference between the two types of periphery regions is not significant. Interestingly, for male workers, the higher skill premium in the public sector in the periphery is entirely driven by periphery regions with high public sector presence (where the skill premium is 4 percentage points higher in the public compared to the private sector), while in periphery regions with low public employment share, there is

no significant difference in male skill premiums across sectors. In periphery regions with high public sector presence, the public sector contributes to higher wage inequality for both men and women.

5. Private–public wage gap along the wage distribution

We extend the characterization of the inequality in the skill premium by studying variation along the wage distribution. In an early contribution, Bargain and Melly (2008) study the sources of public sector wage compression using quantile regression. In an extension to worker-fixed effect quantile regression, Bargain *et al.* (2018) show that potential incidence parameter bias is likely. Hence, in this analysis, we control for observable worker characteristics (age, region type, industries within the private sector), but not for worker or firm-fixed effects.

To allow the degree of public sector wage compression to vary along the wage distribution, we estimate the skill premium in the two sectors at the 25th, the 50th, and the 75th percentile. The results are documented in Supplementary Appendix Tables A.17 and A.18. The raw unadjusted sectoral difference in skill premium increases along the distribution. For male workers, the skill premium is 8.5, 17.6, and 20.5 percentage points lower in the public compared to the private sector at the 25th, the 50th, and the 75th percentile, respectively (the mean sectoral difference documented in the first column of Table 2 is 12 percentage points). While the skill premium in the public sector is roughly similar at different quantiles (around 12–14%), the private sector skill premium varies from 23% at the 25th percentile to 34% at the 75th percentile. We find the same pattern for female workers, although the sectoral differences in skill premiums are much smaller (consistent with the mean difference of 2 percentage points documented in the first column of Table 2). At the 25th percentile, the skill premium is equal in the private and the public sector, while at the 50th and 75th percentile, the skill premium is 1.9 and 8.1 percentage points, respectively, lower in the public compared to the private sector. For both men and women, the degree of public sector wage compression in the raw data is larger at the top of the wage distribution than at the bottom. Controlling for age, region type (larger Oslo area, other cities, periphery), and industries within the private sector (five categories) decreases the relative wage compression in the public sector at all quantiles, but the differences along the distribution remain. For men, the skill premium is 5.9 and 14.2 percentage points lower in the public compared to the private sector at the 25th and 75th percentile, respectively. For women, relatively more compressed wages in the public sector are only prevalent at the top of the distribution (4.5 percentage points lower skill premium in the public sector), while at the median and at the bottom, the estimated skill premium is higher in the public than the private sector (at the 25th percentile, the skill premium is 3 percentage points higher in the public sector). The analysis needs to be developed further to investigate how selection into the private sector based on unobserved worker ability and firm quality varies along the wage distribution.

In Section 4, we show that the additional skill premium in the public sector (compared to the private sector) decreases with urbanity, both for men and women. To allow the geographic heterogeneity in public sector wage compression to vary along the wage distribution, we estimate sectoral skill premia separately for the three region types at the 25th, 50th, and 75th percentile. Since the quantile regressions do not control for worker or firm fixed effects, the degree of relative wage compression is not directly comparable to the estimates in Table 4. The focus is rather on how the differences between region types vary along the wage distribution. The broad picture is that at all quantiles, the degree of public sector wage compression is larger in cities than in the periphery, consistent with the mean estimates in Section 4. Consider the results for workers at the bottom of the distribution given in panel A of Table 6. For male workers, the skill premium is 8 and 3.2 percentage points lower in the public compared to the private sector in the larger Oslo area and in the

Table 6. Geographic heterogeneity in public sector wage compression: Variations along the wage distribution.

	Men			Women		
Variables	Oslo ln w (1)	Other cities ln w (2)	Periphery ln w (3)	Oslo ln w (4)	Other cities ln w (5)	Periphery ln w (6)
Panel A: 25th percentile						
College	0.247***	0.213***	0.179***	0.199***	0.19***	0.163***
	(0.0008)	(0.0006)	(0.0009)	(0.0008)	(0.0008)	(0.0011)
College × Public	−0.08***	−0.047***	−0.032***	0.033***	0.038***	0.055***
	(0.002)	(0.0015)	(0.0018)	(0.0013)	(0.0011)	(0.0014)
Public	−0.049***	−0.053***	−0.034***	−0.091***	−0.05***	−0.025***
	(0.002)	(0.0014)	(0.0016)	(0.0013)	(0.0011)	(0.0014)
Obs.	1,180,920	1,710,125	1,031,517	974,382	1,139,386	632,304
R^2	0.13	0.13	0.12	0.16	0.19	0.20
Panel B: 50th percentile						
College	0.281***	0.251***	0.206***	0.239***	0.225***	0.19***
	(0.0008)	(0.0007)	(0.001)	(0.0009)	(0.0008)	(0.001)
College × Public	−0.134***	−0.12***	−0.105***	−0.006***	0.016***	0.04***
	(0.0021)	(0.0016)	(0.0019)	(0.0014)	(0.0011)	(0.0013)
Public	−0.081***	−0.083***	−0.047***	−0.135***	−0.097***	−0.068***
	(0.002)	(0.0015)	(0.0017)	(0.0014)	(0.0011)	(0.0013)
Obs.	1,180,920	1,710,125	1,031,517	974,382	1,139,386	632,304
R^2	0.16	0.15	0.12	0.15	0.17	0.17
Panel C: 75th percentile						
College	0.279***	0.261***	0.236***	0.285***	0.269***	0.225***
	(0.0011)	(0.001)	(0.0013)	(0.0013)	(0.0011)	(0.0015)
College × Public	−0.118***	−0.124***	−0.154***	−0.036***	−0.027***	−0.007***
	(0.0028)	(0.0022)	(0.0025)	(0.0021)	(0.0016)	(0.002)
Public	−0.147***	−0.143***	−0.065***	−0.187***	−0.15***	−0.1***
	(0.0026)	(0.0021)	(0.0023)	(0.0021)	(0.0016)	(0.0019)
Obs.	1,180,920	1,710,125	1,031,517	974,382	1,139,386	632,304
R^2	0.16	0.16	0.12	0.14	0.15	0.12

Notes: The regressions include year and industry-fixed effects, as well as controls for age. The industry-fixed effects are based on industries within the private sector (manufacturing, construction, retail, business services, and other services), which means that the coefficient on the 'Public' dummy (not in interaction terms) refers to wages in the public sector relative to the reference industry in the private sector ('other services') for high-school-educated workers. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.
Source: Authors' calculations.

periphery, respectively. For women, the estimated skill premium is higher in the public than the private sector and the difference increases from 3.3 percentage points in Oslo to 5.5 percentage points in the periphery. The same pattern is found at the median (for both genders) and at the top of the distribution for female workers. The only exception is estimates for men at the 75th percentile, where the degree of public sector wage compression is higher in the periphery than in Oslo (sector difference of 15.4 versus 11.8 percentage points).

A few distributional analyses of private–public wages have included worker-fixed effects. Recent contributions include Campos and Centeno (2012) and Hospido and Moral-Benito (2016). Broadly they find that positive selection into the public sector in the lower part of the distribution reduces the wage compression. Campos and Centeno (2012) covering 10 European countries conclude that the wage compression in several of the countries largely is driven by selection. Bargain *et al.* (2018) restore the compression result when a correction to the incidental parameter bias is introduced. A complete analysis of differences along the wage distribution requires further research and innovation in the handling of worker and firm fixed effects.

6. Concluding remarks

The contribution of this analysis is to investigate the role of public sector wages for wage inequality. The broad finding is that public sector wage compression is a male phenomenon and only prevalent in large cities. Wage setting for female workers in the public sector leads to increasing wage inequality in all regions, particularly in the periphery.

The main implication is that selection with respect to sector, geography, and firms must be taken into account to understand how public wages affect wage inequality. Our interpretation of the results is that the wage equality goal of governments may conflict with wage setting motivated by the recruitment of high-quality workers to government institutions and regional policy concerns. Public wages are broadly set according to pay scales bargained at the national level. The redistribution of income between regional and local governments in a national grant system is to the advantage of the periphery. The recruitment problems for high-educated workers in the periphery are combined with better-financed government institutions in the periphery. In the larger cities, the public sector competes with a vibrant private sector. Local institutions seem to have some room to handle the competition for workers and this affects the overall wage inequality.

The results motivate further analysis of urban wage inequality combining the influence of labour markets and agglomeration effects. The background of the variation in agglomeration effects across education groups is not well known. Another area worth further study is the wage policy of governments. Our evidence shows that in the periphery, the skill premium is larger in the public sector compared to the private sector. It is of interest to understand more about the handling of regional wage and price variation for different education groups within the public sector. At the regional level, general equilibrium adjustments are expected in the interaction of private and public sector labour markets. We do not pursue such mechanisms here, but promising frameworks for future work are the structural model of Bradley *et al.* (2017) on public wages and the empirical analyses of private–public labour market interaction by Faggio and Overman (2014) and Domeij and Ljungqvist (2019).

Supplementary material

Supplementary material is available on the OUP website. These are the replication file and the online appendix. The data used in this article are drawn from Norwegian administrative registers maintained by Statistics Norway. Researchers affiliated with an approved research institution or a public authority can apply for data from Statistics Norway: https://www.ssb.no/en/data-til-forskning/utlan-av-data-til-forskere.

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