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The disability pay gap in the UK: What is the role of the public sector?

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ABSTRACT

Using data from the UK Quarterly Labour Force Survey we provide the first evidence on variation in the disability pay gap between the public and private sector. Decomposing the disability pay gap at the mean we find evidence of a sizable unexplained pay gap in both sectors, but this is narrower in the public relative to the private sector, consistent with greater pay equality in the public sector. The unexplained disability pay gap increases across the pay distribution particularly in the private sector, suggesting a 'glass ceiling'. As such, our evidence suggests the public sector provides relative protection for disabled employees, especially at the top end of the wage distribution. This appears to be driven by the influence for females.

1. Introduction

Despite being sizeable in many countries, the disability pay gap (hereinafter, DPG) has attracted relatively limited academic and policy attention internationally, especially in comparison to other protected characteristics such as gender. This is particularly surprising in the UK where increasing the employment rate among disabled people has been a longstanding focus of policy, and has attracted renewed attention in light of labour supply constraints post COVID-19, and that disabled employees represent a growing and sizeable proportion of the workforce.[1] Further, to our knowledge, and despite being found to be important in the context of the gender pay gap (hereinafter, GPG) (for the UK, see Jones et al., 2018) there exists no evidence on the relationship between the DPG and sector internationally. This is surprising given sectoral differences in institutional and legislative frameworks relating to pay equality, including in the UK the 2011 Public Sector Equality Duty (PSED), previous evidence of wage compression in the public sector (Blackaby *et al.*, 2018) and well-established sectoral differences in equality practices (Hoque and Noon, 2004). Such evidence is therefore important in identifying whether and how such institutional differences impact on the DPG. Moreover it is particularly timely given the recent (July 2024) proposed extension of UK GPG Reporting legislation, which would require large employers to report their DPG.

This paper addresses this gap in the literature by applying well-established decomposition methods to nationally representative data from the Quarterly Labour Force Survey (QLFS) to explore sectoral differences in the size and determinants of the UK DPG. Recognising the importance of the earnings distribution for the public-private sector wage differential (Blackaby *et al.*, 2018; Murphy *et al.*, 2020), and aligned to the work on the GPG (see, for example, Arulampalam *et al.*, 2007) we consider the DPG both at the mean and across the wage distribution. This contrasts with the almost exclusive focus on the mean DPG within the existing literature (see Longhi *et al.*, 2012 and Hallock *et al.*, 2022 for exceptions) and recognises that the average DPG can disguise variation across the distribution, including so called 'sticky floors' and 'glass ceilings', where pay inequality is greater among lower and higher earners respectively (see, for example, Arulampalam *et al.*, 2007).

In doing so, we update previous evidence on the DPG in the UK, which relates to a period before the introduction of the 2010 Equality Act and associated PSED (Jones *et al.*, 2006; Longhi *et al.* 2012; Jones and Latreille, 2010), and provide the first analysis internationally of sectoral differences. We thereby contribute to the literature on the role of the employer on disability-related inequality (Schur *et al.*, 2009;

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[1] See Appendix Figure A.1.

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Jones, 2016; Jones *et al.*, 2021) and extend existing analysis of sectoral differences in wage inequality (see, for example, Arulampalam *et al.*, 2007, Miller, 2009 and Jones *et al.*, 2018 for gender) to disability.[2] This evidence is particularly timely given recent calls in the UK to monitor and make the DPG a policy target (House of Commons Work and Pensions Committee, 2021), the planned extension of employer GPG Reporting to disability (see the draft Equality (Race and Disability) Bill announced in the 2024 King's Speech), and is aligned to broader policy recognition of the importance of the demand side of the labour market (HM Government, 2021).[3] We further argue it is of broader relevance internationally given UK antidiscrimination legislation shares features with many other countries, including both the US and Australia.[4]

We find evidence of a raw and unexplained mean hourly DPG of 13.3 % and 6.6 % respectively. Both the raw and unexplained DPG, at the mean, and across the wage distribution, are narrower in the public compared to the private sector, consistent with the public sector offering relative 'good practice' in relation to disability pay equality. Nevertheless, substantial unexplained DPGs exist in both sectors. We further find that the raw and unexplained DPG increase across the distribution in the private sector, suggesting a 'glass ceiling' and possibly reflecting particular barriers to promotion for disabled employees. It is only at the bottom decile of the wage distribution in the public sector where we find no evidence of disability-related wage inequality. The relative protection of the public sector appears to predominately work through its effect for females.

The remainder of the paper is organised as follows. The next section provides a summary of the international evidence on the DPG and explores reasons why the DPG might vary by sector. A description of the QLFS, samples and variables used in the analysis is provided in Section 3. Section 4 explores sectoral differences in the mean DPG and Section 5 considers how this varies across the wage distribution. Section 6 briefly concludes.

2. The DPG and the potential role of sector

Evidence of a sizable mean DPG exists across countries including the UK (Jones *et al.*, 2006; Longhi *et al.* 2012) and US (DeLeire, 2001). These studies find that a significant part of the DPG is not explained by traditional human capital and work-related characteristics. Nevertheless, there is caution in interpreting the unexplained DPG in terms of discrimination given the potential for greater unobserved productivity effects relating to disability compared to other protected characteristics. Longhi *et al.* (2012) provide a rare exploration of the DPG across the wage distribution in the UK but document no consistent patterns in terms of widening or narrowing, suggesting the absence of 'sticky floors' or 'glass ceilings'.[5]

Aligned to the theoretical model of Stone and Colella (1996) which highlights the role of organisations in disability-related labour market inequality, studies have also recognised the importance of the employer. For example, Schur *et al.* (2009) use data from the US private sector 2001–2006 to show that corporate culture can have a significant impact on disability-related inequality at work, including, but not confined to, pay (see Schur *et al.*, 2009). Consistent with this, in Britain, Jones and Latreille (2010) find evidence that employer equality practices impact the unexplained mean DPG using linked employee-employer data from the 2004 Workplace Employment Relations Survey (WERS).

While sectoral variation in the DPG has not previously been explored, differences between sectors have been found to play a minimal role in broader analysis of disability inequality at work. For example, using data from WERS 2011, while Jones (2016) find smaller disability gaps in employees experience of work, as measured by perceptions of managers, job satisfaction, employee commitment and influence in the public compared to the private sector, such differences are not statistically significant. Similarly, Jones *et al.* (2021) find no moderating role for sector when exploring disability gaps in employees experience of the 2008 recession, including relating to wage freeze or cuts. This is perhaps surprising since sector might be expected to influence organisational policies and practices, norms and culture, as well as the reward system, all identified as important determinants of the treatment of disabled employees in the framework of Stone and Colella (1996).

In the context of gender, there is, however, consistent evidence of a narrower GPG and lower gender pay inequality in the public relative to private sector across countries (for the UK see Chatterji *et al.*, 2011 and Jones *et al.*, 2018, for Europe see Arulampalam *et al.*, 2007 and for the US see Miller, 2009).[6] Such evidence also emphasises the importance of considering the wage distribution. For example, Arulampalam *et al.* (2007) find increasing gender wage inequality across the distribution and a glass ceiling in both the public and private sector in Britain. Studies on gender suggest enhanced equality policies and practices (Jones *et al.*, 2018), as well as family friendly practices (Chatterji *et al.*, 2011), higher rates of unionisation (Jones *et al.*, 2018) and greater formalisation and transparency within wage structures (Stewart, 2014) as possible drivers of greater pay equality within the public sector. Consistent with this, Wass and Jones (2023) document dramatic sectoral differences in the prevalence of disability-related workplace equality practices in Britain, with far higher rates of monitoring relative pay and promotion by disability within the public relative to the private sector. Moreover, in the US, Ameri *et al.* (2019) find a narrower unexplained DPG in the presence of union coverage and, more generally, one might expect the compressed wage structure in the public sector (Blackaby *et al.*, 2018) to reduce the DPG and disability-related pay inequality.

Since many of the arguments relating to sectoral variation in the GPG potentially apply to disability, they provide a motivation for our exploration of sectoral differences in the DPG.[7] In being the first to do so, this paper extends the international literature on the DPG and disability-related wage-inequality and adds new evidence on disability to existing evidence on sectoral differences in wage inequality.

3. QLFS

We use data from the largest household survey in the UK, the QLFS (Office for National Statistics, 2022), which contains information on disability defined according to UK legislation.[8] The QLFS has previously been used to analyse the DPG (see, for example, Longhi *et al.*, 2012),

[2] The latter is related to a broader literature exploring heterogeneity in public-private sector pay differentials (for the UK see Blackaby *et al.*, 2018 and Murphy *et al.*, 2020).

[3] In Wales, there is a target to eliminate the DPG by 2050.

[4] Disabled people are protected from employer discrimination and employers are required to make reasonable adjustments to support disabled people in work.

[5] In the US private sector Hallock *et al.* (2022) similarly find no clear patterns in relation to the DPG but that the disability gap in non-pay employment benefits narrows over the earnings distribution.

[6] Consistent with this, the literature on the public sector pay premium finds this is larger for females than males (see, for example, Murphy *et al.*, 2020), where again disability has not previously been explored.

[7] Mandel and Semyonov (2021) similarly extend these arguments and argue that the public sector is more protective of vulnerable subgroups of workers classified by race in the US.

[8] The 2010 Equality Act applies to Great Britain rather than the UK. Northern Ireland continues to be covered by prior UK legislation (Disability Discrimination Act 1995) and so is retained within our sample. This does not affect our results (see Section 4).

public sector pay premium (see, for example, Murphy *et al.*, 2020), and variation in the GPG by sector (Jones *et al.*, 2018).[9] We pool data from 2013 to 2022, the longest period over which consistent information on disability and pay is available to provide a robust analysis.[10,11] The analysis focuses on working-age (age 16–64) employees and their main job, and we exclude full-time students and those working outside the UK.

3.1. Disability

Disability is defined according to the 2010 Equality Act where a long-term health problem substantially limits day-to-day activities. Individuals are asked '*Do you have any physical or mental health conditions or illnesses lasting or expecting to last 12 months or more?*'. Those who respond positively are then asked, '*Does your condition or illness reduce your ability to carry out day-to-day activities?*' to which individuals can respond *Yes, a little; Yes, a lot*; and *Not at all*. As per guidance from the UK Government Statistical Service on the Equality Act 2010, those who respond 'yes' to the first and second question (either 'a little' or 'a lot') are defined as disabled (see ONS, 2021). Remaining individuals form the non-disabled group. As is typical in the literature, we predominately focus on this global, binary measure.[12] Of our employee sample, 14.2 % are disabled and this is higher in the public (15.2 %) compared to private sector (13.9 %) (see Table 1 for details).[13]

While widely used, there are well-established limitations of using self-reported information on disability for labour market analysis. Measurement error, whereby individuals have different thresholds for reporting, will downward bias estimates of the DPG. Offsetting this, if disability is used to justify inferior economic outcomes, the DPG will be overestimated (see Bound, 1991).[14] The influence of the latter is likely to be restricted by the focus on employees (Longhi *et al.*, 2012) and there is little reason to expect this to vary by sector since our measure of disability does not require individuals to identify as disabled, or disclose disability at work.[15]

Table 1
Hourly Earnings (£) by disability and sector.

	All	Disabled	Non-disabled	Disability gap (%)
Panel A: All				
Mean	15.21 (9.84)	13.49 (8.60)	15.50 (10.00)	−12.97
10th percentile	6.86	6.52	6.92	−5.78
Lower quartile	8.75	8.18	8.89	−7.99
Median	12.38	11.00	12.66	−13.11
Upper quartile	18.70	16.21	19.22	−15.66
90th percentile	26.82	23.08	27.48	−16.01
N	206,555	29,413 [14.24]	177,142	
Panel B: Public sector				
Mean	15.78 (8.12)	14.44 (7.41)	15.78 (8.21)	−8.46
10th percentile	7.80	7.56	7.88	−4.06
Lower quartile	10.00	9.45	10.13	−6.71
Median	13.87	12.75	14.08	−9.45
Upper quartile	19.23	17.88	19.24	−7.07
90th percentile	24.71	22.83	25.03	−8.79
N	53,547	8138 [15.20]	45,409	
Panel C: Private sector				
Mean	15.09 (10.38)	13.12 (8.99)	15.40 (10.55)	−14.81
10th percentile	6.60	6.30	6.67	−5.55
Lower quartile	8.41	7.80	8.56	−8.88
Median	11.83	10.30	12.04	−14.45
Upper quartile	18.40	15.38	19.04	−19.22
90th percentile	27.82	23.29	28.59	−18.54
N	153,008	21,275 [13.91]	131,733	

Source: Authors calculations based on the QLFS 2013–2022.
Notes: (i) All figures are based on working-age employees and exclude full-time students. (ii) The DPG is measured as a percentage of the relevant non-disabled figure in each case. (iii) Standard deviations are provided for the mean in parenthesis (). (iv) The proportion of the sample who are disabled is provided in square parenthesis [].

In using cross-sectional data from the QLFS, our measure of disability captures the stock of disabled employees at a point in time. In this respect we aggregate across what might be very different dynamic patterns of disability, from a single year disability spell to permanent disability. Differences in chronicity have previously been found to be an important element of severity which affects the labour market impact of disability (see for example, Meyer and Mok, 2019). In additional analysis using the longitudinal LFS we construct a two-year definition of disability which is thought to be less affected by measurement error (see, for example, Jenkins and Rigg, 2004). While the mean DPG and unexplained DPG is larger for the two-year relative to the single year

[9] While the Annual Survey of Hours and Earnings arguably contains more accurate information on pay and sector since it is based on employer records, as is typical in employer provided information, information on employee disability is not available. Other surveys which contain information on pay, sector and disability tend to be based on a smaller sample (for example, Understanding Society) and/or are now quite dated (for example, WERS 2011).

[10] The QLFS has a rotational panel design such that, in every quarter, 20 per cent of individuals are in their first wave and 20 per cent are in their fifth and final wave. To avoid having repeated information on the same individual our sample is restricted to individuals in wave 1. The period is affected by COVID-19, and we explore the impact of including this (see Section 4). While disability prevalence among employees increases over the period (see Appendix Figure A.1) and the raw DPG widens (see Appendix Figure A.2), sectoral differentials do not vary consistently over time.

[11] A two-year public sector pay freeze from 2010 was followed until 2017 by a period of pay restraint, with a 1% average pay cap on public sector awards. The public sector wage premium diminished in the UK over this period (Murphy *et al.*, 2020).

[12] We explore heterogeneity by the type and severity of disability in Appendix Table A.1. Individuals are asked to indicate the nature of their health problem (s) from a list 17 (18 in 2020) responses, in a similar manner to Jones (2022), we construct a measure of severity based on (1) multiple health problems and, (2) the distinction between being limited *a lot* and *a little*. Information on the main health problem is also used to create an aggregate measure of impairment type.

[13] This pattern has been consistent over the period considered here (see Appendix Figure A.1). The nature of disability is also similar by sector (see Appendix Table A.1).

[14] The same would be true if a reverse causal relationship exists whereby low wages increase the risk of disability.

[15] Using an activity rather than work-limiting definition of disability is also likely to reduce the impact of adjustments for disability at work on reporting, which despite being required as part of equality legislation, might vary by sector.

measure, the sectoral differences we highlight are robust to this change (results are available upon request).

3.2. Hourly pay

The dependent variable is the (log) gross hourly pay. Hourly pay is derived from gross weekly pay in the last pay period in the respondent's main job based on total usual hours worked (and includes paid overtime since this is not collected separately). Outliers are eliminated using the standard ONS recommended filter so that the maximum hourly wage is £99.[16]

3.3. Sector

Comparisons are made between the public and private sector. Employees are classified as working in the public, private or non-profit sector based on a series of questions about the nature of their employer. The public sector is defined as that 'owned, funded or run by central or local government' (see Millard and Machin, 2007).[17] The private sector includes everything outside this, including 'charities, voluntary organisations or trusts' (see Jones *et al.*, 2018 among others for a similar approach).[18] The LFS definition is known to overestimate the size of the public sector relative to the National Accounts definition and, following Dolton and Makepeace (2011), those in Universities, Polytechnics or other grant funded educational establishments, and those who are temporary agency workers, are reclassified to the private sector respectively.[19] About 26 % of our sample work in the public sector (see Table 1).[20]

Table 1 provides some initial descriptive statistics on hourly pay by disability and sector. Consistent with the literature, the data confirm a small raw average public sector hourly wage premium and a more compressed earnings structure compared to that in the private sector. The mean raw national DPG is 13.0 %. It is considerably narrower in the public sector (8.5 %) compared to the private sector (14.8 %). In the public sector, the raw DPG is fairly constant across the wage distribution, with the exception it is narrower at the lowest decile. In contrast, the DPG increases across the wage distribution in the private sector, leading to a more pronounced sectoral DPG differential among higher earners.

3.4. Explanatory variables

The QLFS contains comprehensive information about other personal and work-related characteristics and, consistent with previous studies including Jones *et al.* (2006) and Longhi *et al.* (2012), our control variables are designed to capture well-established determinants of earnings. Our personal characteristics include gender, age (and age squared), educational attainment, and ethnicity.[21] Our additional controls for work-related characteristics include workplace size, work region (using the 12 NUTS level-1 regions of the UK), tenure (measured by the number of months in present organisation) (and tenure-squared), permanent/temporary contract and part-time employment. Controls for broad occupation (measured by the Standard Occupational Classification (SOC) 2010 major groups) are also included, although given concerns relating to endogeneity, the sensitivity of the results to the inclusion of occupation, and the use of narrow rather than broad occupational groups is explored.[22,23] A full set of summary statistics for the explanatory variables by disability and sector are included in Appendix Table A.3.[24]

The summary statistics confirm several established sectoral differences, including that employees in the public sector are on average, older, have longer tenure, higher qualification levels and, are more likely to work in professional occupations and in larger workplaces. The patterns by disability are fairly consistent across sectors and align to national evidence, with disabled employees on average older, having lower average educational attainment and more likely to work part-time.

4. The mean DPG

4.1. Pooled models

To estimate the raw and adjusted DPG, and their difference across sectors we initially estimate a series of regression models which pool disabled and non-disabled employees. The Ordinary Least Squares (hereinafter, OLS) wage equation is estimated as follows:

$$ln\ E_{it} = \mu + \alpha D_{it} + \gamma P_{it} + \delta D_{it}P_{it} + \boldsymbol{x_{it}\beta} + \varepsilon_{it} \quad (1)$$

We regress the log of hourly pay ($ln\ E_{it}$) for employee i in year t on the binary measure of disability introduced above (D_{it}). We first estimate the model with a constant (μ) and disability indicator to estimate the raw DPG, which is given by the coefficient α.[25] We build up the model successively and include controls for personal and work-related characteristics ($\boldsymbol{x_{it}}$), to identify the adjusted DPG which exists after accounting for other observable characteristics. In this specification, α can be interpreted as a measure of disability-related wage inequality, albeit including the influence of unobservable characteristics which determine earnings and vary by disability (see discussion below). In additional specifications we include controls for public sector employment (P_{it}), and an interaction between public sector and disability ($D_{it}P_{it}$) to explore whether the DPG and adjusted DPG vary by sector (the latter indicated by the significance of δ).[26]

The coefficient estimates for the pooled regression models are presented in Table 2. In Panel A (columns (1)-(4)) we present successively more comprehensive specifications, which account for personal and

[16] This results in 0.1 per cent of observations being removed.

[17] It includes 'a nationalised industry/state corporation', 'Central government or civil service', 'Local government or council (including fire services and local authority controlled schools/colleges)', 'A health authority or NHS Trust', 'The armed forces', 'some other kind of organisation'. We explore variation within the public sector in Appendix Tables A.2 and A.4.

[18] The results are robust to this choice (see Section 4).

[19] This results in public sector employment being about 3 percentage points lower than the original QLFS measure.

[20] In addition to the type of public sector organisation, in further analysis we also separate the public sector based on occupational coverage of the Pay Review Bodies (PRBs) which make independent recommendations to government on the pay of approximately half of public sector workers (see Jones and Kaya, 2019). Disabled employees are broadly equally distributed across types of public sector organisation, although they are less likely to be covered by PRBs, in part likely a reflection of differences in occupational distribution (see Appendix Table A.2).

[21] We explore the results for males and females separately in Sections 4 and 5.

[22] The SOC classification changed in 2020 but the LFS contains a variable which maps SOC2020 to SOC2010. If occupational segregation is partly due to discrimination, including controls for occupation will underestimate the unexplained component of the DPG. However, if occupational segregation is driven by individual preferences the exclusion of occupation will overstate the unexplained gap.

[23] We do not included controls for industry given its relationship with sector but explore the sensitivity of our findings to this in Section 4.

[24] Further descriptive statistics separately by gender are available upon request.

[25] All models also include controls for proxy responses and year-quarter fixed effects given the nature of the data.

[26] In additional specifications, we explore heterogeneity in the relationship between the DPG and sector by (1) replacing the binary measure of sector to capture constituent parts of the public sector and (2) replacing the binary measure of disability with measures of the severity and type of disability.

Table 2
Sectoral variation in the raw and adjusted mean DPG.

	Panel A: DPG				Panel B: Sectoral variation in the DPG			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disability	−0.143***	−0.098***	−0.082***	−0.065***	−0.161***	−0.113***	−0.092***	−0.073***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
Public sector	–	–	−0.047***	−0.071***	0.084***	−0.001	−0.052***	−0.076***
			(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Disability × public sector	–	–	–	–	0.060***	0.054***	0.034***	0.032***
					(0.007)	(0.006)	(0.006)	(0.005)
Personal characteristics	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Work-related characteristics	No	No	Yes	Yes	No	No	Yes	Yes
Occupation	No	No	No	Yes	No	No	No	Yes
Adj-R^2	0.04	0.31	0.39	0.48	0.05	0.31	0.39	0.48
N	206,555	206,555	206,555	206,555	206,555	206,555	206,555	206,555

Notes: (i) Coefficients are from the OLS earnings equation specified in Eq. (1). Reference category is non-disabled (columns (1)-(4)) and non-disabled private sector (columns (5)-(8)). (ii) Robust standard errors in parentheses. (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (iv) All models include a constant term, control for proxy interviews and year x quarter fixed effects.

work-related characteristics, but pool estimates of the DPG across sectors. In Panel B (columns (5)-(8)) we perform a similar exercise but allow the DPG to vary between the public and private sector. Consistent with earlier evidence we find a raw national DPG of −0.143 log points or 13.3 % (column (1)).[27] This narrows after the inclusion of personal characteristics (column (2)), work-related characteristics (column (3)) and occupation (column (4)). The adjusted DPG of 6.3 % is about half the raw DPG but remains pronounced and significant, consistent with sizeable potential disability-related wage inequality in the UK. In column (5), we find that the raw DPG is smaller in the public (8.7 %) than the private sector (14.9 %), consistent with previous evidence relating to gender (Jones *et al.*, 2018). Including controls, particularly for work-related characteristics narrows this differential but the adjusted DPG remains considerably smaller (about half as large) in the public compared to private sector, consistent with greater disability-related wage inequality in the latter.[28,29]

In Appendix Tables A.4 and A.5 we present further estimates based on the most comprehensive specification to explore heterogeneity in these relationships within the public sector (Table A.4) and by the characteristics of disability (Table A.5). In Table A.4 we consider both the type of public sector organisation (column (1)) and coverage by the independent PRBs (columns (2) and (3)). Relative to the private sector, disabled employees in local government and health (which together account for >80 % of public sector employment) (column (1)) experience a narrower adjusted DPG, suggesting greater disability-related pay equality is not universal in the public sector. Turning to coverage of the PRBs in column (2), relative to the private sector, the adjusted DPG is lower among both occupations covered and not covered by PRBs consistent with relative protection regardless of this specific pay setting arrangement. There is, however, some evidence that the adjusted DPG varies among occupations covered by PRBs (column (3)), being significantly narrower than the private sector in occupations covered by the NHS PRB, the PRBs relating to the police, prison service and teachers.[30]

In Table A.5 estimates are presented by disability severity (columns (1) and (2)) and disability type (column (3)). Considering the nature of disability, we find a larger DPG for those with severe relative to non-severe disability, but also that the public sector offers greater protection (both in absolute and relative terms) to those with more severe disability. The type of disability is a less important determinant of size of the DPG or the sector differential, although the narrowing influence of the public sector is not statistically significant for disabled employees with health problems relating to sight/hearing.

4.2. Decomposition analysis

In a similar manner to Jones *et al.* (2018) for gender, we then estimate wage equations separately for disabled (*d*) and non-disabled (*n*) employees (and sector (*S*), including the entire economy, the public and the private sector, respectively) with the same control variables ($\boldsymbol{x_{it}}$), and apply well-established regression and decomposition methods (Oaxaca, 1973; Blinder, 1973) to isolate the contribution of observable characteristics of workers and their jobs and estimate an unexplained DPG within each sector.[31] The precise decomposition can take alternative forms, but our main results are based on the following:

$$\overline{\ln E_{n,S}} - \overline{\ln E_{d,S}} = \left(\overline{\boldsymbol{x}_{n,S}} - \overline{\boldsymbol{x}_{d,S}}\right)\boldsymbol{b}_{n,S} + \overline{\boldsymbol{x}_{d,S}}\left(\boldsymbol{b}_{n,S} - \boldsymbol{b}_{d,S}\right) \quad (2)$$

where the bar denotes the mean value and, the coefficient $\boldsymbol{b}$ is the OLS estimate of $\boldsymbol{\beta}$, the 'return' to personal and work-related characteristics.[32] The first term on the right-hand side measures that part of the raw DPG that is explained by disability-related differences in observable personal and work-related characteristics. The second term captures disability-related differences in the return to those attributes, which is likely to reflect an upper bound measure of discrimination given the influence of disability on unobserved productivity and/or preferences (see DeLeire, 2001, Jones *et al.*, 2006 and Longhi *et al.*, 2012). Sectoral variation in the unexplained gap may therefore reflect sectoral differences in disability-related wage inequality but could also stem from sectoral differences in disability-related unobserved productivity effects, whether due to differences in support via workplace accommodation or

[27] Percentages are calculated as exp(α) – 1.

[28] Interestingly the raw public sector premium for non-disabled employees turns into an adjusted public sector penalty consistent with the importance of composition effects (Blackaby *et al.*, 2018 and Murphy *et al.*, 2020). In this respect, an alternative interpretation is that the adjusted public sector pay penalty is lower for disabled compared to non-disabled employees.

[29] Given our sample is based on those who select into paid employment we also estimated our most comprehensive specifications accounting for selection using a Heckman selection model (Heckman, 1979) where selection into our sample (relative to non-employment), is modelled using a probit model with the following personal characteristics: age band, gender, highest qualification, disability, ethnicity, proxy response and time period. Marital status, the number of dependent children and their interaction, which are excluded from the wage equation are also included to provide identification. However, accounting for selection into work made no difference to our findings (results available upon request).

[30] Indeed, when wage equations are estimated separately by PRB we observe no adjusted DPG among the police, prison service or teachers.

[31] For simplicity we now assume the constant is included in $\boldsymbol{x_{it}}$.

[32] Equation (2) uses the coefficients for non-disabled employees as the non-discriminatory base. Our conclusions are not sensitive to instead using the coefficients from a pooled model (see Section 4).

matching abilities to job demands.[33] Regardless of the precise mechanism we interpret a narrower unexplained DPG as an indication of greater disability-related equality.[34]

These results, based on the most comprehensive set of personal and work-related characteristics, are presented in Table 3. Consistent with the pooled analysis, about half of the 13.3 % national DPG is unexplained, and while we cannot precisely identify its remaining drivers, it is suggestive of wage inequality. Despite differences in the definition of disability, empirical set-up and use of data pre-UK Equality Act, the figures are of similar magnitude to previous evidence in the UK, including males in 2003 (Jones *et al.*, 2006) and those with physical disability 1997–2003 (Longhi *et al.*, 2012). While the proportion of the DPG explained is similar in the public and private sector, the smaller raw public sector DPG means the unexplained DPG is also smaller compared to the private sector (4.2 % compared to 7.4 %). Nevertheless, the unexplained DPG is significantly different from zero in both sectors.

In the lower panel of Table 3 the explained component of the DPG is further separated into its constituent parts to identify the contribution of personal and work-related characteristics in explaining the DPG within each sector. The patterns are similar across sectors, with qualifications and occupation dominating the explained component, although these effects are partially offset by the influence of age (and, in the public sector, tenure), which acts to narrow the DPG.

In Appendix Table A.6, we explore the robustness of our findings. First, we consider the definition of our core variables, including, excluding the non-profit sector from our definition of the private sector (column (1)), defining disability according to work-limiting rather than activity-limiting disability (column (2)) and using weekly as opposed to hourly pay (column (3)). We subsequently test the sensitivity of our findings to changing the specification of the wage equation to exclude occupation (column (4)) and then including detailed (3-digit) occupation (column (5)), include industry (column (6)) and union membership (column (7)).[35] Then we explore the role of our sample by restricting our analysis to full-time employees and prime age workers (in columns (8) and (9) respectively), and excluding data from Northern Ireland given differences in equality legislation (column (10)) and from 2020 onwards due to the potential influence of COVID19 (column (11)). We further modify the decomposition method so that coefficients from a pooled model form the reference group (Fortin, 2008) (column (12)). None of these changes alter our main conclusions, the DPG and the unexplained DPG remain lower in the public than the private sector. Finally, to explore sectoral differences among a more comparable sample between sectors we exclude small workplaces (column (13)), which might have less formalised human resource policies relative to larger firms, and union members (column (14)), given evidence unions act to compress the wage distribution. While the public sector DPG and unexplained DPG are wider once union members are excluded, both remain lower in the public than the private sector consistent with the role of institutional differences in pay or equality practice on sectoral differences in the DPG.

In the absence of clearly reliable instruments for sector choice studies tend not to control for selection into sector (see Arulampalam *et al.*, 2007, Chatterji *et al.*, 2011 and Jones *et al.*, 2018). However, since unobservable characteristics, including personality traits, preferences for risk and motivation for public sector work are potential determinants of selection into the public sector and earnings we further explore the role of selection into sector using a Heckman selection approach (Heckman, 1979). In the first stage, sector of employment is modelled using probit model as a function of disability, the covariates discussed above, and the number of dependent children and regional public sector employment concentration (which form our exclusion restrictions). The number of dependent children is widely used to model selection into work but might also affect sector selection given the evidence of greater family friendly policies in the public sector (Chatterji *et al.*, 2011). Since sector choice is also likely to be a function of the availability of public sector employment opportunities, we further control for public sector

Table 3
Decomposition of the mean DPG by sector.

	All	Public	Private
DPG	0.125***	0.082***	0.144***
	(0.003)	(0.006)	(0.004)
Explained	0.061***	0.041***	0.073***
	(0.003)	(0.004)	(0.003)
	[48.8 %]	[49.6 %]	[50.4 %]
Unexplained	0.064***	0.041***	0.071***
	(0.003)	(0.004)	(0.003)
	[51.2 %]	[50.4 %]	[49.6 %]
Explained by:			
Age	−0.015***	−0.010***	−0.016***
	(0.001)	(0.001)	(0.001)
	[−12.0 %]	[−12.2 %]	[−11.1 %]
Female	0.012***	0.006***	0.014***
	(0.001)	(0.001)	(0.001)
	[9.6 %]	[7.3 %]	[9.7 %]
Qualifications	0.021***	0.023***	0.021***
	(0.001)	(0.001)	(0.001)
	[16.8 %]	[28.0 %]	[14.6 %]
Ethnicity	−0.002***	−0.001***	−0.002***
	(0.000)	(0.000)	(0.000)
	[−1.6 %]	[−1.2 %]	[−1.4 %]
Proxy	−0.000**	−0.000	−0.000*
	(0.000)	(0.000)	(0.000)
	[0.0 %]	[0.0 %]	[0.0 %]
Region of work	0.006***	0.003***	0.007***
	(0.001)	(0.001)	(0.001)
	[4.8 %]	[3.7 %]	[4.9 %]
Tenure	−0.003***	−0.009***	−0.001**
	(0.000)	(0.001)	(0.000)
	[−2.4 %]	[−11.0 %]	[−0.7 %]
Part-time	0.005***	0.002***	0.006***
	(0.000)	(0.000)	(0.000)
	[4.0 %]	[2.4 %]	[4.2 %]
Temporary contract	0.000**	−0.000	0.001***
	(0.000)	(0.000)	(0.000)
	[0.0 %]	[0.0 %]	[0.7 %]
Workplace size	0.004***	0.000	0.007***
	(0.001)	(0.000)	(0.001)
	[3.2 %]	[0.0 %]	[4.9 %]
Sector	0.002***	–	–
	(0.000)		
	[1.6 %]		
Occupation	0.042***	0.035***	0.047***
	(0.001)	(0.002)	(0.002)
	[33.6 %]	[42.8 %]	[32.6 %]
Year/quarter	−0.010***	−0.009***	−0.011***
	(0.001)	(0.001)	(0.001)
	[−8.0 %]	[−11.0 %]	[−6.9 %]
N	206,555	53,547	153,008

Notes: (i) Decompositions are calculated using the relevant non-disabled coefficients as the baseline. (ii) Figures in () are standard errors; figures in [] are percentages of the overall DPG. (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (iv) Wage equations include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

[33] An unexplained DPG would be consistent with observationally equivalent disabled employees being less productive than non-disabled employees. A lower unexplained gap would therefore be consistent with a reduction in the unobserved impact of disability on productivity.

[34] Such differences might also stem from differential sector selection, if for example, more productive disabled employees disproportionately select into the public sector relative to their non-disabled counterparts. We explore the robustness of our findings to accounting for selection into the public sector in Appendix Table A.7.

[35] Union membership is only asked in a single quarter each year and so these estimates are based on a smaller subsample.

Table 4
Decomposition of the mean DPG by sector and gender.

	All	Public	Private
Panel A: Males			
DPG	0.131***	0.116***	0.138***
	(0.006)	(0.011)	(0.007)
Explained	0.046***	0.036***	0.052***
	(0.004)	(0.008)	(0.005)
	[35.2 %]	[31.3 %]	[37.8 %]
Unexplained	0.085***	0.080***	0.086***
	(0.004)	(0.009)	(0.005)
	[64.8 %]	[68.7 %]	[62.2 %]
N	96,512	16,450	80,062
Panel B: Females			
DPG	0.093***	0.057***	0.110***
	(0.004)	(0.007)	(0.005)
Explained	0.046***	0.031***	0.053***
	(0.003)	(0.005)	(0.004)
	[49.1 %]	[54.5 %]	[48.3 %]
Unexplained	0.048***	0.026***	0.057***
	(0.003)	(0.005)	(0.004)
	[50.9 %]	[45.5 %]	[51.7 %]
N	110,043	37,097	72,946

Notes: (i) Decompositions are calculated using the relevant non-disabled coefficients as the baseline. (ii) Figures in () are standard errors; figures in [] are percentages of the overall DPG. (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (iv) Wage equations include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

employment concentration in the area of residence.[36] The selection corrected decomposition results are presented in Appendix Table A.7.[37] For both sectors, correcting for selection (which is statistically significant only in the private sector wage equation) has only a small impact and leaves our key finding of a smaller unexplained DPG in the public sector unchanged.[38] Sector selection bias does not therefore appear to drive our results.

Given the well-established gender differences in pay and the sectoral pay premium we present the corresponding (aggregate) decomposition results separately by gender in Table 4. The raw and unexplained DPG is larger for males than females regardless of sector. For males the unexplained DPG is more similar across sectors since a larger component of the male raw DPG is explained in the private relative to the public sector. For females the unexplained DPG is smaller in the public relative to the private sector, consistent with it being the sectoral difference for females that is driving the overall findings.[39]

5. The DPG across the distribution

The above analysis follows the existing literature and decomposes the mean DPG. To explore the DPG across the unconditional wage distribution, we utilise the method of Firpo *et al.* (2009) based on a recentred influence function (RIF) where the RIF for quantile $q(\tau)$ is given by:

$$RIF(Y;\ q(\tau), F_Y) = q(\tau) + \frac{(\tau - \mathbb{I}\{Y \leq q(\tau)\})}{f_Y(q(\tau))} \tag{3}$$

$1\{\cdot\}$ is an indicator for whether the dependent variable Y (in our case log hourly earnings) is at or below quantile $(q(\tau))$, F_Y denotes the marginal (unconditional) distribution and $f_Y(q(\tau))$ reflects the density at $q(\tau)$. Using this approach, the model can be estimated by OLS with the dependent variable replaced by the $RIF(Y;\ q(\tau), F_Y)$ (RIF-OLS). In a similar manner to at the mean, these coefficient estimates can be used to decompose the DPG across the distribution using a RIF decomposition methodology proposed by Firpo *et al.* (2018) which uses the reweighting strategy of DiNardo *et al.* (1996) to construct the counterfactual wage distribution.[40] Consistent with our analysis at the mean we use both pooled RIF-OLS models and RIF decompositions on specifications equivalent to Eq. (1) and (2). In this way we can compare the unexplained DPG across the wage distribution and identify the presence of 'sticky floors' or 'glass ceilings' (see, Arulampalam *et al.*, 2007).

As at the mean, Table 5 first presents results for RIF-OLS regression models which pool disabled and non-disabled employees and explore the adjusted DPG across the distribution (10th, 25th, 50th, 75th and 90th percentiles). We present results for our most comprehensive specification which includes personal and work-related characteristics, including occupation. Coefficients for the national DPG are presented in Panel A, whereas sectoral variation the DPG is explored in Panel B. Consistent with evidence at the mean, there is a significant negative adjusted DPG throughout the distribution, suggesting wage inequality among both low and high earners. The adjusted DPG rises continuously,

[36] This is measured at a more disaggregate spatial scale (20 areas) than the controls for region of work (12 regions).

[37] A full set of coefficient estimates from the sector choice equation are presented in Appendix Table A.8. The number of dependent children and public sector employment concentration are both positive and statistically significant. While it is not possible to distinguish between sectoral choice decisions that were made before or after disability onset, disability has a significant relationship with sector, with disabled employees 1.2 percentage points more likely to work in the public relative to the private sector even after accounting for controls.

[38] The DPG and unexplained DPG in the public sector is, however, not significantly different from zero after accounting for selection.

[39] With the exception of those aged 16-24 the patterns are relatively similar across age groups (see Appendix Table A.9).

[40] We implement this approach using Stata *oaxaca_rif* (Rios-Avila, 2020).

Table 5
Sectoral variation in the adjusted DPG across the wage distribution.

	Percentile				
Panel A: DPG	10th	25th	50th	75th	90th
Disability	−0.034***	−0.046***	−0.066***	−0.074***	−0.091***
	(0.004)	(0.003)	(0.004)	(0.004)	(0.006)
Public sector	0.049***	0.038***	−0.032***	−0.164***	−0.288***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)
Adj-R^2	0.16	0.33	0.43	0.34	0.19
N			206,555		
Panel B: Sectoral variation in the DPG	10th	25th	50th	75th	90th
Disability	−0.042***	−0.056***	−0.070***	−0.079***	−0.104***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.007)
Public sector	0.044***	0.032***	−0.035***	−0.166***	−0.295***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.006)
Disability × public sector	0.029***	0.039***	0.015	0.018*	0.048***
	(0.008)	(0.007)	(0.008)	(0.009)	(0.012)
Adj-R^2	0.16	0.33	0.43	0.34	0.19
N			206,555		

Notes: (i) Coefficients are from a RIF-OLS earnings equation. Reference category is non-disabled (Panel A) and non-disabled private sector (Panel B). (ii) Robust standard errors in parentheses. (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (iii) All models include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

from 3.3 % at the 10th percentile to 8.7 % at the 90th percentile, consistent with a 'glass ceiling' or greater disability-related wage inequality among higher earners.[41] Sectoral differences in the adjusted DPG are evident across the distribution, with the adjusted DPG significantly narrower in the public sector. Indeed, below the median the adjusted DPG in the public sector is <2 %, compared with 4–5 % in the private sector. The adjusted DPG increases across the distribution in both sectors but remains significantly (about 50 %) less in the public sector than the private sector at the 90th percentile. The protective role of the public sector identified above is therefore evident beyond the mean DPG.

The corresponding unconditional quantile decomposition results are presented in Table 6, where the results for all, public and private sectors are presented in Panels A, B and C respectively. The national raw and unexplained DPG increase across the distribution, with evidence of a glass ceiling or greater unexplained DPG among earners higher than the median.[42] In addition to potentially greater disability-related wage discrimination in higher paying roles, this may reflect particular barriers to progression for disabled employees, as well as more pronounced wage inequality resulting from more subjective elements of performance-related pay which characterise the top end of the wage distribution (see Green *et al.*, 2014).[43] While there is evidence of a raw DPG across the distribution in the public sector, the unexplained DPG at the bottom decile is small and statistically insignificant. The raw and unexplained DPG increase across the distribution in both sectors but to a greater absolute extent in the private sector. As such, the sectoral gap in the unexplained DPG, which is consistently smaller in the public sector than the private sector, aligned to the protective role of the public sector, is most pronounced at the upper end of the wage distribution. This is perhaps best illustrated in Fig. 1 which plots the raw and unexplained DPG for the public and private sector across the distribution and shows how the sectoral differences in the DPG and unexplained DPG are exacerbated above the median.

In Appendix Table A.10 we present the components of the explained DPG across the distribution. The patterns are largely common across sectors, with a similar dominance of qualifications and occupation as identified at the mean partially offset by the role of age, albeit the role of qualifications is more pronounced in the public sector. In relative terms the role of occupation diminishes moving up the wage distribution, particularly in the public sector. Part-time employment also contributes to the explained component at the bottom end of the wage distribution.

In Fig. 2(a) and (b) we plot the DPG and unexplained DPG by sector for males and females separately.[44] The DPG increases across the distribution for males in both sectors but for females this is only evident in the private sector. Instead, the DPG in the public sector is fairly constant across the distribution for females. We also observe a glass ceiling for males in both sectors but for females this is only evident in the private sector. Our findings in relation to the protective role of the public sector at the upper end of the distribution therefore appear to largely reflect the influence on females.

6. Conclusions

Motivated by evidence of sectoral differences in the GPG and gender wage equality we explore sectoral variation in the hourly DPG both at the mean and across the wage distribution. Applying established regression and decomposition methods to data from the QLFS 2013–2022 we find robust evidence of an unexplained DPG, consistent with the potential influence of disability-related wage inequality. This is evident across the wage distribution, but is particularly pronounced among higher earners, suggestive of disability-related barriers to progression. Aligned to claims that the public sector offers greater protection in terms of gender wage inequality (Jones *et al.*, 2018), the unexplained DPG is consistently narrower in the public compared to the private sector, and in most cases the difference is economically, as well as statistically, significant. The sectoral variation is particularly

[41] Consistent with previous evidence there is an adjusted public sector wage premium at the lower end of the wage distribution, but this turns into a penalty at, and above, the median.

[42] Arulampalam *et al.* (2007) define a glass ceiling as a 2 percentage points larger unexplained wage gap at the 90th percentile relative to other parts of the distribution.

[43] Unfortunately, we are not able to separate performance-related from basic pay in our analysis. Excluding those who report receiving performance-related pay does not however affect our findings. Evidence of a glass ceiling could also reflect changing disability-related unobserved productivity effects across the distribution. To the extent that older employees are disproportionately concentrated in the upper end of the earnings distribution it might also reflect variation in the DPG by age, but we find limited evidence of this (see Appendix Table A.9).

[44] A full set of coefficients by gender are reported in Appendix Table A.11.

Table 6
Decomposition of the DPG across the wage distribution, by sector.

	Percentile				
Panel A: All	10th	25th	50th	75th	90th
DPG	0.060***	0.083***	0.139***	0.174***	0.171***
	(0.004)	(0.003)	(0.004)	(0.005)	(0.006)
Explained	0.028***	0.054***	0.084***	0.071***	0.067***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
	[46.7 %]	[65.1 %]	[60.4 %]	[40.8 %]	[39.2 %]
Unexplained	0.032***	0.029***	0.055***	0.103***	0.104***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.006)
	[53.31 %]	[34.9 %]	[39.6 %]	[59.2 %]	[60.8 %]
N			206,555		
Panel B: Public	10th	25th	50th	75th	90th
DPG	0.040***	0.069***	0.099***	0.075***	0.092***
	(0.008)	(0.007)	(0.008)	(0.007)	(0.009)
Explained	0.030***	0.054***	0.055***	0.031***	0.028***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
	[75.0 %]	[78.3 %]	[55.6 %]	[41.3 %]	[30.4 %]
Unexplained	0.010	0.015**	0.045***	0.044***	0.064***
	(0.007)	(0.006)	(0.006)	(0.006)	(0.008)
	[25.0 %]	[21.7 %]	[45.5 %]	[58.7 %]	[69.6 %]
N			53,547		
Panel C: Private	10th	25th	50th	75th	90th
DPG	0.058***	0.094***	0.156***	0.213***	0.206***
	(0.005)	(0.004)	(0.005)	(0.007)	(0.008)
Explained	0.031***	0.061***	0.096***	0.095***	0.079***
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)
	[53.4 %]	[64.9 %]	[61.5 %]	[44.6 %]	[38.3 %]
Unexplained	0.026***	0.033***	0.060***	0.117***	0.126***
	(0.005)	(0.004)	(0.004)	(0.006)	(0.008)
	[44.8 %]	[35.1 %]	[38.5 %]	[54.9 %]	[61.2 %]
N			153,008		

Notes: (i) RIF decompositions are calculated using the relevant non-disabled coefficients as the baseline. (ii) Figures in () are standard errors; figures in [] are percentages of the overall DPG. (iii) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (iv) Wage equations include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

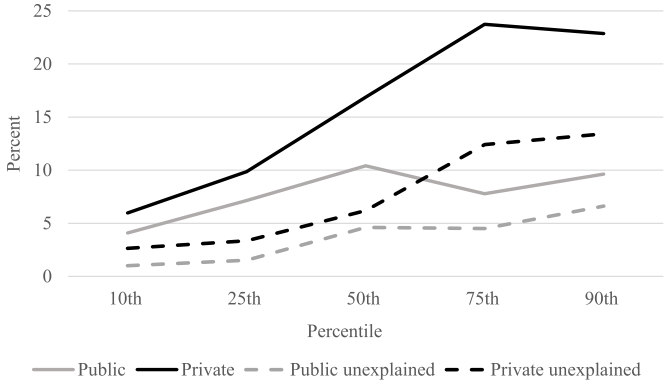

Fig. 1. The DPG and unexplained DPG across the wage distribution, by sector.
Notes: (i) RIF decompositions are calculated using the relevant non-disabled coefficients as the baseline. (ii) Wage equations include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

pronounced for females. Nevertheless, except for the very lowest wage earners, a significant unexplained DPG remains in the public sector, suggesting potential wage inequality in *both* sectors.

In relation to contemporary policy, our evidence of a raw and unexplained DPG, which does not appear to have diminished relative to earlier studies by Jones *et al.* (2006) and Longhi *et al.* (2012), would

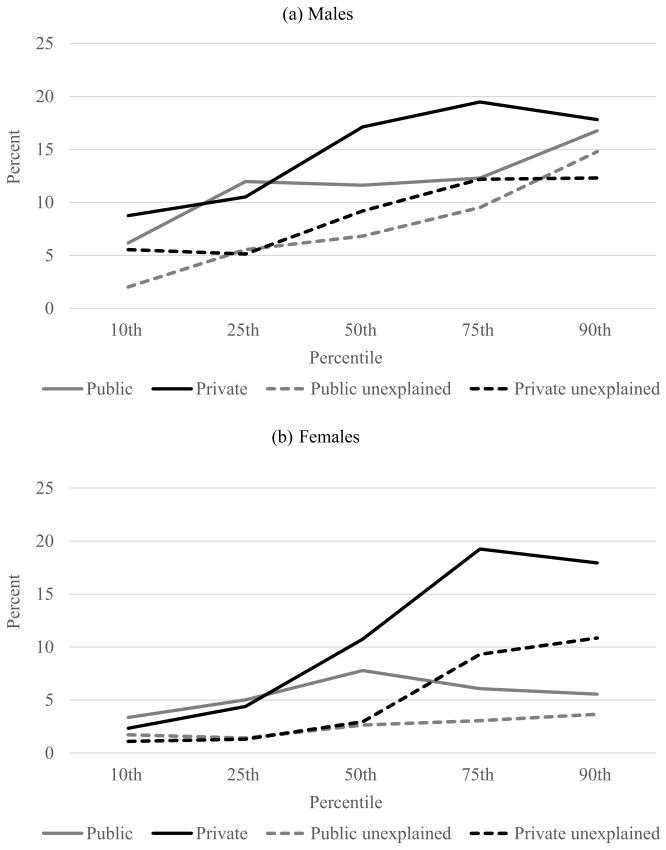

Fig. 2. The DPG and unexplained DPG across the wage distribution, by sector and gender.
Notes: (i) RIF decompositions are calculated using the relevant non-disabled coefficients as the baseline. (ii) Wage equations include a constant term, control for proxy interviews, year x quarter fixed effects and controls for personal and work-related characteristics and occupation.

support calls to monitor and target the national DPG, especially as disability prevalence increases among employees and in light of the neglected connection between the DPG and incentives to work. Evidence of a larger unexplained wage gap among high earners should prompt additional investigation to further explore its potential drivers, including in relation to disability-related differences in career progression over the life-cycle. The sectoral variation identified in this paper is consistent with the influence of the employer on the DPG (Schur *et al.*, 2009) and highlights the importance of future investigation of the role of differences in equality and pay practices across organisations, including but not constrained to those driven by sectoral variation. While currently limited by data availability in the UK, this is something future organisational DPG reporting might start to address. It is also important to explore the extent to which these findings are generalisable to other country contexts or relate to country specific structures and legislation, including the UK PSED.

CRediT authorship contribution statement

Melanie Jones: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.labeco.2024.102642.

Data availability

The authors do not have permission to share data.

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