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# Understanding the Gender Pay Gap within the UK Public Sector

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## Executive Summary

*Aims and approach*

By applying established regression and decomposition methods to secondary data from the 2018 Annual Survey of Hours and Earnings (ASHE) and the 2016-2018 Quarterly Labour Force Survey (QLFS) this report aims to enhance our understanding of the drivers of the contemporary gender pay gap (GPG) within the UK public sector. This is done in several stages, including through comparisons between the public and private sector, and within the public sector on the basis of occupations covered by Pay Review Bodies (PRBs). In both cases we consider GPGs at the mean and then across the earnings distribution. Throughout our analysis we separate the raw hourly GPG into two elements to better understand its drivers. The first element is that part of the raw gap which can be explained by differences in observable personal and work-related characteristics between men and women, such as job tenure or contract type. The second element is that part of the raw gap which is not explained by the observable characteristics in our model and is closer to a measure of unequal treatment on the basis of similar characteristics. Evidence of the latter, or what we refer to as an unexplained GPG, is of particular interest given the remit of PRBs in relation to anti-discrimination legislation under the Equality Act (2010).

*Key results and implications*

Confirming previous evidence, our analysis of ASHE confirms that the raw GPG in the UK in 2018 is narrower within the public (19 per cent) than the private (21 per cent) sector. However, and in contrast to earlier studies, the unexplained component estimated using the Oaxaca–Blinder decomposition method is found to be at least as large within the public sector as the private sector. This questions the extent to which, as has previously been claimed, the public sector remains a ‘beacon of good practice’ in terms of gender equality and suggests renewed emphasis might be required.

Further exploration of the GPG across the distribution highlights a prominent ‘glass ceiling’ in the public, but not in the private sector. That is, the unexplained GPG is particularly pronounced towards the top end of the wage distribution in the public sector, where it accounts for most of the GPG. This suggests that, despite evidence of a compressed wage distribution, public sector employers need to pay particular attention to gender inequality among higher earners.

Comparisons within the public sector indicate that, on average, there is a narrower GPG in occupations covered by the five PRBs considered here, than those occupations that are not covered by PRBs. However, the GPG in PRB occupations is largely unexplained. As a result, the unexplained GPG is actually at least as large in PRB occupations as in non-PRB occupations, despite the remit of the PRBs. This reinforces the important distinction between the GPG as a measure of the average wage gap and the adjusted or unexplained GPG as a measure of earnings inequality. Analysis across the wage distribution also indicates a pronounced ‘glass ceiling’ in PRB occupations, confirming the need for attention beyond the mean GPG, and particularly towards the top end of the earnings distribution, within PRBs.

There is, however, considerable heterogeneity identified across the five PRB occupations analysed, consistent with the increasing emphasis on within occupation analysis of the GPG and highlighting the need for greater recognition and exploration of differences within the public sector. The largest raw GPG is within the Review Body on Doctors’ and Dentists’ Remuneration (DDRB) (20 per cent) and it is narrowest in the NHS Pay Review Body (NHSPRB) (5 per cent) and Police Remuneration Review Body (PRRB) (8 per cent). The extent to which these can be explained by gender differences in productivity-related characteristics is relatively small and, as such, an unexplained GPG exists across all of the

PRBs. The magnitude of the unexplained GPG continues to vary across PRBs and is largest within the DDRB (15 per cent) suggesting the current review of the GPG in medicine is particularly timely.

Although the analysis highlights substantial and largely unexplained gender differences in workforce composition across PRBs, including in the NHSPRB which is predominately female (nearly 80 per cent) and the PSPRB and PRRB which are predominately male (about 65-70 per cent), the contribution of gender differences in the allocation of women into and across PRBs within the public sector is found to play a relatively minor role in determining the public sector GPG. Indeed, while the raw public sector GPG would be 15 per cent if there was no gender difference in the probability of working across PRBs, it would only be 4 per cent if there were no GPGs within public sector occupations.

Although Performance Related Pay (PRP) is much less prevalent in the public than the private sector and, within PRBs in particular, there is evidence of an unexplained gender gap in the probability of receipt of PRP, with females less likely to receive PRP, particularly in the public sector. Conditional on receipt of PRP, there is also a gender gap in the amount of PRP, but this is considerably larger within the private sector. On this basis, future plans to introduce PRP in the public sector should pay particular attention to the potential drivers of the observed gender gap in receipt of PRP, that is, who receives PRP.

*Limitations and extensions*

The availability of reliable information on pay, and personal and work-related characteristics in our data is key to separating the explained and unexplained components of the GPG. Nevertheless, despite the comprehensiveness of the approach which combines analysis of ASHE and the QLFS, there will inevitably be important productivity-related characteristics which are unobserved (e.g. personality) or only partially captured within our analysis (e.g. actual labour market experience). As such, the unexplained gap can only ever be a proxy for wage inequality, and we cannot directly measure unequal pay or discrimination within this analysis. We further condition on the observable characteristics of workers in different sectors and occupations without accounting for the complex selection processes that determine who is in work and where they work, and the role of the employer, through for example occupational barriers, in such outcomes. More detailed analysis of gender differences in the probability of working across PRBs, which takes into account the complex relationships with subject choice and parental occupation, may be useful in this regard.

The use of large scale, nationally representative, secondary data permits analysis across the public and private sector and facilitates comparison across PRBs. Nevertheless, to enhance the depth of analysis within specific PRB occupations it should be supplemented by further examination of specific occupations, including those within PRBs not covered by this report. This would be best achieved by using organisational administrative payroll data and a census of workers, rather than the relatively small samples available within these specific occupations in broader surveys. This would also facilitate a more detailed understanding of the role of the nature of pay scales and pay awards to gender pay equality, aligned to recent requirements in terms of reporting organisational GPGs.

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## Abbreviations

| | |
|---|---|
| AFPRB | Armed Forces' Pay Review Body |
| AMEs | Average Marginal Effects |
| ASHE | Annual Survey of Hours and Earnings |
| BHPS | British Household Panel Study |
| DDRB | Review Body on Doctors' and Dentists' Remuneration |
| GPG | Gender Pay Gap |
| IDBR | Inter-Departmental Business Register |
| NCARRB | National Crime Agency Remuneration Review Body |
| NHSPRB | NHS Pay Review Body |
| NMW | National Minimum Wage |
| OLS | Ordinary Least Squares |
| OME | Office of Manpower Economics |
| ONS | Office for National Statistics |
| PRBs | Pay Review Bodies |
| PRP | Performance Related Pay |
| PRRB | Police Remuneration Review Body |
| PSPRB | Prison Service Pay Review Body |
| QLFS | Quarterly Labour Force Survey |
| SDS | Secure Data Service |
| SIC | Standard Industrial Classification |
| SOC | Standard Occupational Classification |
| SSRB | Senior Salaries Review Body |
| STRB | School Teachers' Review Body |
| UKDA | UK Data Archive |
| USoc | Understanding Society |
| WERS | Workplace Employment Relations Survey |

# 1. Introduction

## 1.1 Motivation and background

The gender pay gap (hereinafter, GPG) has attracted increasing policy attention in the UK since the then Prime Minister announced his aim to "end the gender pay gap in a generation" (David Cameron, October 2015). The introduction of GPG reporting requirements for large organisations in 2017 formed part of a strategy to make GPGs more transparent and encourage employers to explore and address the drivers of their GPG. The publication in April 2018 of over 10,000 organisational GPGs, across both the public and private sector, and the associated media attention, together with the GPG among high paid employees at the BBC which emerged as a result of a requirement to disclose individual salaries, has further raised public, legal and media attention on the issue of gender inequality in the UK.[1]

The new reporting requirements extend the obligations of public sector organisations in England and statistical evidence confirms a consistent GPG in favour of men but also one that varies considerably across public sector organisations and has failed to narrow over time.[2] Nevertheless, as a whole, the public sector has been found to have a narrowing influence on the UK GPG, particularly through a lower within sector GPG but also through a relative concentration of women in the public sector, which on average offers a pay premium relative to the private sector (Jones *et al*., 2018). This report aims to provide an in-depth exploration of the contemporary drivers of the public sector GPG, focusing in particular on specific occupations within the public sector, principally those covered by the Pay Review Bodies (hereinafter, PRBs).[3]

The GPG, the difference in the average wage between men and women, is distinct from unequal pay or pay discrimination. The former is determined in part by unequal pay but is also a function of the distribution of women and men within the labour market (e.g. in terms of occupation), and their productive characteristics (e.g. education and work experience), often referred to as structural features of the labour market. In contrast, the latter is the pay gap that exists between comparable men and women, that is, after adjusting for differences in personal and work-related characteristics. The existence of an adjusted or 'unexplained' GPG, that is, between men and women with similar characteristics is aligned to the principle of 'equal pay for work of equal value' explicit within the NHS PRB Terms of Reference and the requirement across PRBs to take account of the broader legal environment in terms of anti-discrimination legislation under the Equality Act (2010). Nevertheless, information on the magnitude of the GPG and, that part which can be explained, or is due to differences in characteristics, remains important, with the government arguing GPG transparency informs female career choices in particular (Business in the Community, 2015).

In terms of academic research there has been considerable interest in quantifying the size of the public-private pay differential and tracking its movements over time, with a consistent

[1] See, for example, public including campaigns such as #PayMeToo.

[2] See for example, https://www.theguardian.com/society/2018/mar/30/nine-out-of-10-public-sector-bodies-pay-men-more-than-women, https://www.channel4.com/news/public-sector-reveals-gender-pay-gap, https://www.theguardian.com/world/2019/mar/31/gender-pay-gap-widens-public-sector-women-men and https://www.theguardian.com/society/2019/apr/03/nhs-trusts-gender-pay-gap-public-sector.

[3] The OME provides the secretariat to eight PRBs which make recommendations on the pay of about 2.5 million workers or 45 per cent of public sector employees: Armed Forces' Pay Review Body (hereinafter, AFPRB), Review Body on Doctors' and Dentists' Remuneration (hereinafter, DDRB), NHS Pay Review Body (hereinafter, NHSPRB), Prison Service Pay Review Body (hereinafter, PSPRB), School Teachers' Review Body (hereinafter, STRB), Senior Salaries Review Body (hereinafter, SSRB), Police Remuneration Review Body (hereinafter, PRRB), National Crime Agency Remuneration Review Body (hereinafter, NCARRB). Due to data restrictions this report considers six of these, which we collectively refer to as PRBs throughout. We are unable to consider either the NCARRB or SSRB due to their limited coverage and occupational composition and we are only able to consider the AFPRB within our supplementary (Quarterly Labour Force Survey) data due to the exclusion of the Armed Forces from the Annual Survey of Hours and Earnings. As such, our attention tends to focus on five PRBs.

finding being a greater raw and adjusted public sector pay premium for women (Blackaby *et al*., 2012; Cribb *et al*., 2014a). Consistent with this, analysis of the GPG by sector finds smaller gaps within the public than the private sector (see Chatterji *et al*., 2011; Stewart, 2014a; Jones *et al*., 2018). Moreover, such analysis finds that, although smaller in magnitude, a significant 'unexplained' pay gap exists within the public sector, a potential indicator of gender pay inequality. In contrast to the narrowing trend in the GPG since the 1970s, Jones *et al*. (2018) find that the raw GPG has been unchanged since 2010 across both sectors and this has been attributed to a stalling of the long-term narrowing of the 'explained' gender gap, or that women's characteristics are no longer converging with men. Future narrowing might, therefore, require a more proactive approach, with particular attention on the unexplained pay gap, which has been largely flat in the public sector, despite the introduction of a range of equality initiatives, including most recently, the Public Sector Equality Duty 2011.

Occupational segregation by gender is a key feature of the UK labour market and an established determinant of the GPG (Blau and Kahn, 2000), with women being concentrated in lower paying occupations such as caring, leisure and other services. Within the public sector, PRBs cover occupations with pronounced gender segregation (e.g. nurses and the armed forces) and substantial variation in pay (e.g. nurses compared to medical practitioners). Such segregation is reflected in concerns about workforce diversity in selected PRBs such as the armed forces (AFPRB, 2017), where targets have been set to increase female recruits.[4] However, recent analysis by Stewart (2015) shows that, in Britain, about half of the GPG can be attributed to differences in the GPG within occupations and, occupations such as medical practitioners and prison service officers, both covered by PRBs, are among the twenty occupations found to have the highest GPG. The more disaggregated within occupation focus of this report is also aligned to recent attention within specific government departments.[5]

Although policy and public attention on the GPG tends to focus at the middle of the earnings distribution, making comparisons between the average man and woman, academic evidence is increasingly concerned with the entire pay distribution (see, for example, Arulampalam *et al*., 2007). Indeed, how the GPG and its unexplained and explained components vary across the distribution has the potential to enhance our understanding of the drivers of the GPG, including in relation to 'glass ceilings' and 'sticky floors' i.e. barriers for women at the top and bottom of the earnings distribution respectively. Such evidence is therefore important to inform and more effectively target government policies and PRB practices.

While the majority of evidence on the GPG examines a measure of usual hourly pay, recent organisational reporting highlights that gender bonus gaps are pronounced, consistent with bonuses being a less transparent form of pay. Although it remains relatively limited (Bryson *et al*., 2017), there is increasing emphasis on performance related pay (hereinafter, PRP) in the public sector, which has seen a movement from automatic progression to PRP as an incentive for effort. In exploring gender differences in the prevalence of PRP and providing some initial evidence in relation to the PRP GPG in the public sector, this project will provide insights on the potential implications of different payment systems for gender equality.[6]

[4] Although we are unable to consider this explicitly, workforce diversity is a strategic priority for the SSRB, motivated by the need to be more representative of society and the workforces for which they have responsibility (SSRB, 2017). Particular concerns are raised in relation to gender diversity among senior police officers and officers in the armed forces.

[5] For example, in May 2018 the Secretary of State for Health and Social Care Jeremy Hunt promised to "eradicate the GPG in medicine". For further information see: https://www.rcplondon.ac.uk/news/rcp-president-professor-jane-dacre-lead-nhs-pay-gap-review.

[6] Equality concerns have, for example, been raised in relation to pay progression and performance awards in the Prison Service (PSPRB, 2019).

### 1.2 Research aims

This project aims to comprehensively explore the contemporary GPG in the UK public sector. It will quantify the size and determinants of the GPG across the public and private sector and within the public sector, in particular distinguishing between the influence of other personal and work-related characteristics to identify the unexplained pay gap which exists among otherwise comparable workers. In doing so, it will address the OME's research interest in the 'drivers of GPGs in public sector workforces' but will also contribute to understanding gender diversity within individual PRB occupations. The analysis will be enhanced by consideration of the pay distribution and PRP.

The specific objectives of the research are as follows:

1. To measure and model the contemporary GPG in the public and private sector, at the mean and across the earnings distribution. To identify and distinguish between explained and unexplained components of the GPG to form an estimate of wage inequality and identify gender differences in personal and work-related characteristics which are important drivers of the public sector GPG.

2. To estimate the contribution of 'within' and 'between' occupation GPGs to the public sector GPG and to provide comparable evidence of GPGs between PRB and non-PRB occupations, and across PRB occupations. To further quantify pay inequality within PRB occupations and distinguish this from other drivers of PRB occupation GPGs.

3. To identify gender differences in the probability of working within PRB occupations and to examine the extent to which these differences are a result of gender differences in personal characteristics.

4. To further explore public sector gender gaps in rewards in relation to PRP and provide estimates of gender inequality in PRP as appropriate.

These aims will be achieved through undertaking econometric analysis of secondary data, predominately from the Annual Survey of Hours and Earnings (hereinafter, ASHE), a nationally representative and reliable source of earnings information in the UK. These data, which are based on mandatory reporting by employers to ONS, cover a 1 per cent sample of employee jobs from HMRC's PAYE system, are made available annually and contain accurate information to identify sector and occupation, as well as a range of other personal and work-related characteristics which determine pay. Supplementary analysis will be performed on the Quarterly Labour Force Survey (hereinafter, QLFS), the largest household survey in the UK, which collects information on pay, sector and a comprehensive set of personal and work-related characteristics, but from individuals themselves. ASHE provides the ONS headline measure of the GPG but both data sources have been extensively used to explore public sector pay (see, for example, Bryson and Forth, 2017; Stewart, 2014a; Cribb *et al*., 2014a; and Blackaby *et al*., 2012).

The analysis will have three core elements. First, analysis of the GPG will be undertaken between the public and private sector to explore the determinants of public sector GPG across the distribution and in comparison to the private sector. This will be followed by a more detailed analysis of the drivers of the GPG within the public sector and across PRB occupations in particular. In both cases the focus will be on quantifying the determinants of the GPG at the mean and across the earnings distribution through established regression and decomposition based approaches (Oaxaca, 1973; Blinder, 1973; Machado and Mata, 2005), which isolate the contribution of observable characteristics of workers and their jobs from unobserved influences, where the latter will include unequal treatment in the labour market. In addition to exploring the individual GPG for each PRB occupation, we also

quantify and model gender differences in the probability of working in different PRB occupations, allowing us to separate the role of 'within' and 'between' occupation GPGs to the overall public sector GPG.

Achieving these objectives will provide the following high quality and timely evidence relevant to government policy and the PRBs:

1. It will provide contemporary evidence after a period of public sector wage restraint in an era of austerity on differences in the size and drivers of the GPG across the earnings distribution and quantify the role of gender differences in characteristics and gender inequality in public sector GPGs. Further, understanding both explained and unexplained pay gaps will help to identify potentially effective levers for government policy in narrowing the UK GPG.

2. By providing the first evidence on GPGs within particular PRB occupations it will facilitate comparisons within the public sector and fill evidence gaps recognised by the PRBs (e.g. in relation to unexplained GPGs), in order to identify and inform areas in need of greater policy action, including in which occupations pay inequality appears to be most pronounced.[7] Assessing the size of unexplained occupation GPGs will be particularly important in ensuring PRBs can evidence their commitment to relevant legal anti-discrimination obligations.[8] At the organisational level, this information could be used to inform the development of proactive action plans to address departmental GPGs as part of annual GPG reporting. Further, in comparing PRB occupations to the rest of the public sector, where pay is determined by collective bargaining, the analysis will also provide more general insights into differences within the public sector.

3. By providing the first consistent evidence on the scale and drivers of gender segregation within PRB occupations it will facilitate comparisons across PRBs and enhance OME understanding of workforce diversity within PRBs. This will be useful in predicting the impact of structural change and differential investment across government departments and in considering issues of recruitment and retention in relation to gender. Further, in using this information to identify that part of the public sector GPG which is driven by the allocation of men and women across PRBs, rather than that which is due to GPGs within PRBs, it will provide further evidence on the drivers of the public sector GPG.

4. By providing the first evidence on GPGs in PRP by sector, and within the public sector, the analysis will provide insights into the impact of different pay systems on pay inequality.

The remainder of the report is structured as follows. Chapter two provides an overview of relevant economic theory and summarises the extensive empirical evidence in this area, focusing particularly on the UK. Chapter three outlines the principal data source, ASHE, in detail and explains the use of supplementary data from the QLFS. It also describes and discusses the measures and introduces the statistical methods employed. Chapter four presents and discusses the results. Chapter five concludes and provides some areas for future research.

[7] The analysis will be complementary to specialised and occupation specific evidence, for example, that arising from the recently commissioned review of the GPG in medicine which will use data based on departmental pay records.
[8] The NCARRB (2018) explicitly recognise and are making efforts to address risks of equal pay litigation. The STRB (2019) also highlights the need for further research into the equality implications of the teachers' pay system.

## 2. Literature Review

### 2.1 Introduction

In what follows, we briefly summarise the main theories that have been commonly used in the literature to explain the GPG, namely human capital and discrimination theories. Then, based on findings from previous empirical research, we discuss the main drivers of the UK GPG. These include productivity-related characteristics (e.g. education and work experience) and pay discrimination, but also the distribution of women and men within the labour market (e.g. occupation and public/private sector) and other institutional factors. Then we review the findings of the existing literature on the sectoral and occupational differences in workforce composition and the GPG with a particular attention to the UK public sector and PRB occupations. Finally, we present the findings of previous studies on gender differences in PRP.

### 2.2 An overview of GPG theory

Several economic theories have been put forward to explain the GPG in the labour market. The main explanations can be classified into two general perspectives: The first one, human capital theory, explains the GPG based on the gender differences in observed productivity-related characteristics, and the second one attributes the pay differential to the unequal treatment of women in the labour market – discrimination theories. In this section, we outline these two theories and look at the findings of the empirical literature in relation to these.

#### 2.2.1 Human capital theory

Human capital is a term that is used to refer to a person's knowledge, skills or experience, which determine individual's productivity in the labour market (see Schultz, 1960, 1961; Becker, 1964; Ben-Porath, 1967; Mincer, 1958, 1974). According to human capital theory, individual earnings depend on productivity and this is influenced by human capital which can be enhanced through investments in formal education and on-the-job training. This approach to the GPG suggests that women are paid less than men as a result of their lower human capital (Mincer and Polachek, 1974; Becker, 1985). According to this theory, traditional gender division of labour within the household results in women accumulating less human capital than men as women put less time and effort into market work or choose careers that are compatible with family responsibilities but for which on-the-job-training is less important (Mincer and Polachek, 1974; Becker, 1985). Women might also anticipate more interruptions in employment, mainly due to having children and, as a result, they have lower incentives to invest in formal education and on-the-job training (Becker, 1985). Moreover, interruptions in employment involve foregone time that could be used for further human capital accumulation and might result in depreciation of existing human capital (Mincer and Polachek, 1974; Sandell and Shapiro, 1980; Mincer and Ofek, 1982). Men, on the other hand, invest their time and effort in the labour market, enhancing their human capital and productivity, widening the gap between genders.

Historically human capital theory has been the most common approach to explaining gender differences in pay. One prominent method used in the literature to identify the role of human capital on the GPG has been the Oaxaca–Blinder decomposition, a regression-based decomposition method, which separates differences in average pay into a part that is explained by differences in human capital (e.g. education and work experience) and an unexplained component that is taken to reflect inequality in treatment (Oaxaca, 1973; Blinder, 1973). Using this type of decomposition analysis, recent studies show that, over the last few decades, human capital has become much less important in explaining the GPG. This is mainly due to the convergence between men and women in human capital investments, in particular to the increase in women's relative education and work experience

(Goldin, 2014; Blau and Kahn, 2017).[9] Previous studies for the UK also show that gender differences in human capital explain a shrinking proportion of the GPG (see, for example, Grimshaw and Rubery, 2007; Joshi *et al.*, 2007; Makepeace *et al.*, 2004; Manning and Swaffield, 2008; Olsen *et al.*, 2010). Indeed, a recent contribution by Jones *et al*. (2018) find that the downward trend in the explained differential has stalled since 2010 and that women's human capital characteristics are no longer converging with men.

### 2.2.2 Discrimination theories

The fact that the GPG persists despite the women's relative improvements in human capital suggests that the remaining unexplained difference in pay between men and women may be driven at least partially by the persistence of discrimination (Brynin, 2017). Labour market discrimination is defined as "a situation in which persons who provide labour market services and who are equally productive in a physical or material sense are treated unequally in a way that is related to an observable characteristic such as race, ethnicity, or gender" (Altonji and Black, 1999). Economic theories put forward a number of reasons why labour market discrimination may arise. The first, by Becker (1957), is personal prejudice or 'taste-based discrimination'. Becker's taste-based discrimination model argues that differences in the treatment of men and women in the labour market arise if at least some employers, workers or customers prefer or dislike interacting with members of a particular group and if they are willing to pay a price, such as by sacrificing profits, to avoid this interaction. For example, employers who are prejudiced against women may act as if female workers are more expensive to hire than they truly are and, as such, hire men at a higher wage than they would actually need to pay for an equally productive woman. On the other hand, the source of discrimination might be employees, who are prejudiced against members of a particular group and demand a wage premium to work alongside them, or it might be customers who get lower utility from purchasing services if they have to interact with the members of a particular group of workers. According to Becker's taste-based discrimination model, these preferences will create incentives for segregation in the labour market. An implication of this is that, in the absence of costs associated with segregation, workplace/firm segregation of workers will reduce the effect of taste-based discrimination on wage differentials.

As noted by Becker (1957) and later articulated by Arrow (1973), the taste-based discrimination model predicts the elimination of discrimination through competitive forces in the long run as prejudiced employers, who are willing to sacrifice profits by discriminating, will be driven out of business. This contrasts to the evidence of the existence and persistence of unexplained gender pay differentials. Subsequent research, however, has pointed out that Becker's taste-based discrimination model is in fact consistent with the evidence in the presence of imperfect information in the labour market about the location and preferences of customers, employees and employers (see Altonji and Black, 1999 for a review of this strand of the literature).

The second leading theory by Arrow (1973) and Phelps (1972), 'statistical discrimination' suggests that discrimination by employers may in fact be rational and not driven by prejudice. The presence of imperfect information in the labour market about workers' productivity leads employers to discriminate on the basis of predicted or actual differences between the average man and woman, i.e. stereotyping. In fact, as pointed out by earlier

[9] The literature highlights several factors as contributors to this convergence, such as increased control over fertility via the introduction of oral contraceptives (Goldin and Katz, 2002; Bailey, 2006); the introduction of new and improved household technologies (Greenwood *et al.,* 2005); the introduction of bottle feeding and the medical advances that improved maternal health (Albanesi and Olivetti, 2016); gender biased technological change (Goldin, 1990; Galor and Weil, 1996) and the expansion of service sector (Ngai and Petrongolo, 2017) that increased demand to skills that women have a comparative advantage; decrease in child care costs (Attanasio *et al.*, 2008); and cultural factors (Fernández *et al.*, 2004; Fernández and Fogli, 2009; Fernández, 2013).

research, employers face uncertainty about worker productivity implying that statistical discrimination is plausible (Altonji and Blank, 1999; Blau and Kahn, 2017). Although it is an empirical challenge to quantify labour market discrimination and disentangle the effects of taste-based and statistical discrimination, the empirical evidence finds support for both theories (see, for reviews, Altonji and Blank, 1999; Blau and Kahn, 2017).

What taste-based discrimination and statistical discrimination models have in common is that they begin by assuming discrimination arises due to agents acting individually or in other words in a competitive framework. Instead, in the monopsonistic discrimination model developed by Robinson (1933) imperfect competition in the labour market is the mechanism that drives the GPG. According to this model, a single employer, a monopsonist, can set wages below the productivity of their workers to obtain higher profits and if the labour supply of women is less sensitive to wage changes, then they may earn less than men even if they have the same productivity. A recent literature that builds on the monopsonistic discrimination model argues that women are less likely to leave their employer in response to changes in firm and market conditions (Barth and Dale-Olsen, 2009; Hirsch *et al.*, 2010; Ransom and Oaxaca, 2010), as they may have different valuations for employer-provided amenities or face smaller effective labour markets due to limited geographic mobility or higher commuting costs caused by domestic responsibilities (see, for a review, Hirsch, 2016; Manning, 2011). Collective models, on the other hand, assume that discrimination in the labour market arises if one group acts against another. For instance, in Bergmann's (1974) overcrowding model, exclusion of women from certain occupations can result in women crowding into a small number of occupations, depressing wages there for otherwise equally productive workers. Consistent with this, previous research finds evidence that both men and women employed in occupations where women are over-represented tend to earn lower wages (see, for example, Blau and Kahn, 2017; Goldin, 2014; Levanon *et al*., 2009). It is, however, important to note that collective action is only one possible explanation of overcrowding of women in certain occupations which is also consistent with employer discrimination and human capital theories (see Altonji and Blank, 1999 for a discussion). For example, women's concentration in certain occupations may be a result of the existence of more severe employer discrimination in other occupations. On the other hand, gender differences in pre-labour market human capital investments (e.g. subject choice) may lead to gender differences in comparative advantage across occupations and occupational crowding. Additionally, individual preferences for the characteristics of occupations may differ between comparable men and women.

### 2.3 Evidence

Although the UK GPG has decreased in recent decades, on average women still earn less than men (ONS, 2018). For instance, in April 2017, the overall GPG was 18.4 per cent, which is higher than the GPG for full-time employees (9.1 per cent) as well as that for part-time employees (-5.1 per cent).[10] This section reviews the existing evidence regarding the UK GPG. We start with an overview of the recent empirical findings on the drivers of the GPG at the mean and across the earnings distribution. Then, we summarise the findings of previous studies on the sectoral and occupational differences in workforce composition and the GPG with a particular attention to public sector and PRB occupations. Finally, we present the findings of the existing studies on gender differences in PRP.

[10] Although the overall GPG may therefore appear surprising, it is explained by the prevalence of part-time work among women which tends to pay less per hour than full-time work (see discussion below). Latest ONS figures show that around 40 per cent of female employees work part-time compared to 12 per cent of men or, around 77 per cent of part-time jobs are held by female employees (see ONS Labour Market bulletin, October 2018).

### 2.3.1 Drivers of the UK GPG

*Work experience*

Gender differences in work experience and labour force attachment are important contributors to the GPG. Historically, women have had lower labour force participation rates, and conditional on participation they work fewer hours and/or experience more career interruptions than men (Blau and Kahn, 2017). Consequently, they have less years of work experience and general training, and as a result, accumulate less human capital than men. Moreover, human capital depreciation during career interruptions further lower women's wages upon their return to the labour market. In fact, there is considerable evidence that gender differences in work experience account for a significant portion of the GPG (see, for a review, Blau and Kahn, 2017). For the UK, using regression-based decomposition techniques discussed above, the evidence suggests that up to 56 per cent of the UK GPG can be attributed to work experience if detailed work-life history variables, such as prior experience of full-time and part-time work as well as years spent in unpaid care work are considered (Olsen *et al*., 2018). Consistently, Swaffield (2007) finds that the unexplained portion of the GPG reduces by almost 40 per cent if more detailed work history measures are used.[11]

*Educational qualifications*

Another important determinant of human capital, formal educational qualifications, have a substantial impact on pay, but is found to be relatively unimportant in explaining the contemporary UK GPG. Olsen and Walby (2004), using data from the British Household Panel Study (hereinafter, BHPS), find that only 8 per cent of the GPG can be explained by the level of education. Nevertheless, recent studies stress that differences in the quality or type of education may be an important factor in explaining the GPG, in particular among college graduates. For example, for UK graduates in their early career, the difference between subject of study by men and women has been found to have an impact on the GPG (e.g. Machin and Puhani, 2003; Chevalier, 2002, 2007). This is mainly driven by the fact that subjects studied by women are associated with higher risk of unemployment and lower pay in general, while men dominate subjects offering the greatest prospects after graduation (Chevalier, 2002). An important question is then, why gender differences in subject choice emerge and whether they arise from personal choice, reflecting underlying gender differences in preferences, or inequality in access, through for example, pre-labour market discrimination.

*Other personal characteristics*

The GPG also varies significantly by age. In the UK, the gap is found to be insignificant at school-leaving age, becomes positive but narrower for women in their 20s or 30s, then rises to a peak pay gap level for women at the age of 45 and then declines slightly (Olsen *et al.*, 2010). One possible explanation for this pattern is the differences across cohorts. Younger cohorts of women are not only more educated than older counterparts (Blau and Kahn, 2017), but also, they "begin their career in a more gender-equal world" (Wharton, 2009). Alternatively, it might also be that the GPG increases with age because women are less likely than men to get training (Manning and Swaffield, 2008) or be promoted in their careers (Harkness, 2005; Brynin, 2017). Consistent with the former, historical British evidence showed that women are less likely to receive work-related training than men (see, for example, Blundell *et al*., 1996), while more recent evidence suggests that this trend has

[11] In the absence of actual work experience, most of the empirical literature relies on proxies such as age or potential work experience, that is age minus years of formal education (minus the school starting age). However, these measures potentially overstate women's actual labour market experience as women experience more interruptions in employment than men.

been reversed, with women now being more likely to receive any training, on- and off the-job training, and off-the-job training with an employer contribution (Jones *et al*., 2008). Regarding gender differences in promotions, the empirical evidence indicates that women in Britain actually have higher promotion rates than men, but they receive a lower wage reward to promotion, and the gender difference in these rewards increases by age (Booth *et al*., 2003a).

An alternative explanation of the increase in the GPG with age is that the events that take place over the lifecycle, such as marriage and childbearing, might have different impact on women's and men's pay (Harkness, 2005; Rubery, 2008). It is well-documented that men experience a 'marriage premium' (see, for recent reviews, Ribar, 2004; Rodgers and Stratton, 2010).[12,13] On the other hand, there is less consensus in the literature regarding the effect of marital status on women's pay.[14] The findings of empirical studies for the UK are mixed, and even sometimes contradictory (see, for example, Dolton and Makepeace, 1987; Waldfogel, 1997; 1998; Budig and England, 2001). However, empirical studies tend to agree that the impact of marriage on women's pay, if there is any, is at least partly connected to having children. In fact, the presence/the number of dependent children itself has previously been identified as one of the key contributors to the UK GPG (e.g. Waldfogel, 1998; Joshi *et al*., 1999; Viitanen, 2014). A potential explanation is that women move out of paid work after childbirth, which results in depreciation of human capital during this period. Consistent with this argument, a recent study by Costa Dias *et al*. (2018), using data from the BHPS and the Understanding Society (hereinafter, USoc), shows that until the arrival of the first child, the GPG is relatively small and fairly stable (around 7-12 per cent), but gradually increases over the following years, until it reaches around 33 per cent. Costa Dias *et al*. (2018) also find that the steady increase in the gap after childbirth is not only driven by women's tendency to move out of paid work but also to move to part-time work. Differences in cumulative work-experience therefore provide an important explanation for the increasing GPG over the lifecycle.

Previous research has also shown that other personal characteristics, such as ethnicity also play a role in determining a worker's pay. The evidence for the UK suggests that, with only few exceptions, on average, men from ethnic minorities tend to earn less, overall, than White men, while women in ethnic minorities do not to face a double disadvantage in the labour market from gender and ethnicity (Longhi and Brynin, 2017). In fact, using the QLFS data for the period 2002-2014, Longhi and Brynin (2017) find that many ethnic minority women actually experience a pay advantage relative to White British women and men of the same ethnicity, and this is mainly due to higher qualifications of ethnic minority women as well as their concentration in occupations and regions, where pay is comparatively higher.

Although most of the empirical studies on the GPG account for regional differences in earnings, only few explicitly deal with its regional dimension. Notable exceptions include Phimister (2005) who studies differences in urban wage premia by gender and Robinson (2005) who analyses the effect of the National Minimum Wage (NMW) on the GPG across

[12] The explanations put forward to explain the marriage premium for men include positive selection of men into marriage on the basis of wages or wage enhancing characteristics (Becker, 1981; Cornwell and Rupert, 1997), employer favouritism (Hill, 1979; Bartlett and Callahan, 1984) and the argument that marriage makes men more productive (Becker, 1981; Korenman and Neumark, 1991; Loh, 1996; Ginther and Zavodny, 2001).

[13] Cross-sectional evidence for men in Britain reports a 'marriage premium' ranging from 10 per cent to 14 per cent (see, for a review, Bardasi and Taylor, 2008). On the other hand, using panel data from the BHPS, covering the period 1991-2003, Bardasi and Taylor (2008) find that more than half of the 'marriage premium' for men in Britain is explained by unobserved individual-specific heterogeneity and/or selection effects. Nevertheless, a small but statistically significant marriage premium remains even after controlling for a wide range of characteristics including time-invariant individual specific unobserved characteristics. Their further analysis suggests that intra-household specialisation is in fact an important explanation of the wage premium observed for married men in Britain.

[14] See, for example, Ginther and Sundström (2008), Hill (1979), Korenman and Neumark (1991), Killewald and Gough (2013) and Loughran and Zissimopoulos (2009).

regions. A more recent example is the paper by Stewart (2014b) which investigates the geographic variation in GPGs by focusing on the difference between London (or the south-eastern corner more generally) and the rest of Great Britain. Stewart (2014b) uses region of employment information from the 2012 ASHE data and finds that London has a higher GPG compared to the rest of Great Britain in the upper half of the wage distribution. At the median the entire regional difference in GPG is due to differences in individual and work-related characteristics between London and the rest of Great Britain, and it is only in the top one-third of the wage distribution that the higher GPG in London is not a consequence of characteristics. Using region of residence and 1995-1997 and 2004-2007 BHPS data, Olsen *et al*. (2010) also show that inner and outer London and the South East have larger GPGs. Their findings, however, suggest that the contribution of the regional differences on the size of the overall GPG is negligible.

The empirical evidence for the UK consistently suggests that disabled workers experience a pay penalty relative their non-disabled counterparts (see, for a review, Jones, 2008). Moreover, evidence suggests that gender and disability, when combined, create a double pay disadvantage for disabled women. Further, using data from the QLFS and focusing on gender differences in disability effects, Jones *et al*. (2006) find that the gender gap in 2003 was larger for the disabled compared with 1997, indicating the worsening position of disabled women in the UK labour market. Using regression-based decomposition techniques discussed above, they also find that the 'unexplained' component of the GPG was greatest for those whose disability is work-limiting. Using data from the QLFS between 2004-2007, Longhi and Platt (2008) also show that disabled men and disabled women are disadvantaged compared to non-disabled men. They find that disabled men (women) had a pay gap of 11 (22) per cent relative to non-disabled men.[15]

Recent studies also highlight the role of gender differences in individual characteristics that are not usually available in standard datasets, such as personality traits, including labour market motivation, attitudes and aspirations, on pay gaps. Gender differences in personality traits may arise due to perceptions of men and women with respect to gender roles shaped by cultural values, which may be imposed by society and reflect a form of pre-labour market discrimination. There is some evidence suggesting that differences in perceptions of gender roles influence the negotiation skills of men and women which are crucial in determining the starting salaries and pay rises (Babcock and Laschever, 2003). In the UK, although earlier studies find an effect of personality traits on GPG (Chevalier, 2002; Chevalier, 2007; Swaffield, 2000), Manning and Swaffield (2008) highlight that this effect is only marginal. Swaffield (2007) also shows that although the differences between women in gender role values have an impact on female wages, these attitudes are not a main component of the UK GPG.

*Work-related characteristics*

Pay is not entirely determined by personal characteristics but has also been found to depend on the characteristics of the individual's job and employer. Previous research has consistently demonstrated that part-time employment in the UK is associated with lower pay and inferior quality work relative to full-time jobs (e.g. Connolly and Gregory, 2008; Grimshaw and Rubery, 2007; Manning and Petrongolo, 2008). As such, part-time employment contributes to occupational downgrading and occupational segregation (see below). Moreover, due to difference in hours of work, over the same period of employment, part-time workers accumulate less human capital through work experience than full-time workers (Kunze, 2018). There is also evidence that part-time work experience has either no

[15] There is a further literature on wage gaps relating to sexual orientation which find the results vary by gender (see, for example, Bryson, 2017).

or even a negative effect on pay (Joshi *et al.*, 2007; Olsen and Walby, 2004) and it is only full-time work experience that has substantial benefits in terms of human capital accumulation (Costa Dias *et al*., 2018). On the other hand, recent evidence by Olsen *et al*. (2018) suggests that part-time experience may be a new protective factor of the GPG in the UK, as they find that part-time work experience decreases the GPG. They partly attribute this to an increasing proportion of female workers having negotiated part-time employment as a form of job retention with more comparable job quality to that of their previously full-time positions.

In addition to full-time/part-time employment, the type of employment contract is also found to play a role on determining a worker's pay, with workers on temporary contracts earning less than their counterparts in permanent employment. As argued by Arulampalam *et al*. (2007), if the prevalence of temporary contracts varies between men and women, it could be an important determinant of the GPG. In fact, for Britain, there is evidence that women are more likely than men to be on temporary contracts, and workers on temporary contracts receive lower wages than their permanent counterparts (Booth *et al.*, 2002, 2003b). However, although temporary work affects the pay of men and women negatively and the effect is much larger on men than women (Booth *et al*., 2003b), it has only a small effect on the overall GPG (Brynin, 2017).

In addition to general skills acquired through work experience, firm-specific skills also have a positive impact on pay and promotion opportunities (see, for an overview, Evertsson, 2004). Tenure, measured by the number of years an employee has been working for the same employer or in the same job, is considered to capture the firm/job specific training of the worker (see, among others, Abraham and Farber, 1987; Altonji and Williams, 2005; Mincer and Jovanovic, 1981; Topel, 1991). Recent evidence for the UK indicates that women have shorter job tenure relative to men, mainly due to child-rearing, however, this has only a small impact on the size of the GPG (Brynin, 2017; Olsen *et al.*, 2018).

Occupational segregation by gender is a key feature of the UK labour market and another established determinant of the GPG (Blau and Kahn, 2000), with women being concentrated in lower paying occupations such as caring, leisure and other service occupations. Although there is much debate over whether to control for occupation in estimating the GPG, most empirical studies include occupational dummies in order to take into account occupational segregation.[16] On the other hand, Mumford and Smith (2007) suggest a more direct measure of occupational segregation based on the number of females in any given occupation, known as the 'femaleness' of the occupation.[17] In fact, using a similar measure (the percentage of males in the occupation), Olsen *et al*. (2010) find that occupational segregation, accounted for 15 per cent of the GPG in 1997, 17 per cent in 2007, and 19 per cent in 2014/2015 (Olsen *et al*., 2018) while Mumford and Smith (2009) show that combined with workplace segregation (see below for further discussion), occupational segregation, makes a significant contribution to the GPG between male and female part-time employees but not for full-time workers.

Gender differences in the type of tasks performed within occupations, and work responsibilities may also influence the GPG. In relation to the former, evidence for the UK shows that gender inequality with respect to tasks remains substantial within occupations (Lindley, 2012). Using data from the UK Skills Surveys and the EU KLEMS database, Lindley (2012) finds that within broad industries men undertake a range of numeracy tasks

[16] As occupational segregation itself might be partly due to discrimination, controlling for it will underestimate the unexplained component of the GPG that is taken to reflect inequality in treatment. On the other hand, if occupational segregation is driven by individual choices, not controlling for it will overstate discrimination (see, for a further discussion, Blau and Kahn, 2000).

[17] As noted by Mumford and Smith (2007), the impact of occupation on the GPG might be wider than the one captured by the 'femaleness' of the occupation.

that are positively correlated with the technical change, while women do not. Similarly, Felstead *et al.* (2002) show that in Britain men are more likely to work in jobs that require complex and advanced computer applications than women. Regarding responsibilities, Drolet (2011) argues that if men have more opportunities than women to undertake managerial or supervisory responsibilities or work-related tasks such as budgeting and/or staffing decisions, or if men receive higher returns to these responsibilities and tasks than women, then the GPG will persist.

Similar to gender differences in occupational distribution, there exist significant differences in the concentration of women and men across industries. By controlling for broad categories of industry in wage regressions, Olsen *et al*. (2018) find that 29 per cent of the UK GPG in 2014/2015 could be attributed to the industry allocation of men and women, while the contribution of specific industries to the gap ranged from 0.6 per cent (financial sector) to 16.8 per cent (manufacturing). The variation across industries is mainly driven by gender segregation, with females dominating industries where the pay is lower (e.g. human, health and social work). However, similar to occupation (see discussion above), including controls for industry in analysing the GPG is debated as it is not obvious whether gender segregation by industry is a result of individual choices or discrimination (Blau and Kahn, 2000).

It is well-established in the empirical literature that working in large firms leads to a significant wage premium (see, for a review, Troske, 1999), however, the link between firm size and GPG is less clear. In relation to the latter, the empirical evidence is mixed, and even sometimes contradictory (see, Mitra, 2003 for the US; Akar *et al*., 2013 for Turkey; Heinze and Wolf, 2010 for Germany). For Britain, using data from three different sources (the BHPS of 1991, the General Household Survey of 1983, and the establishment-level Workplace Industrial Relations Surveys of 1984 and 1990), Green *et al*. (1996) find that there are larger firm size effects for women in the private sector than men, and in particular the wage penalty for working in smaller establishments is much larger for women.

Working in the public sector and being a trade union member are two institutional factors that are considered to favour women (Olsen *et al*., 2010). In relation to the former, the probability of working in the public sector is higher for women (Jones *et al*., 2018). It is also well established that there exists a public sector wage premium which is greater for women (Blackaby *et al*., 2012; Bozio and Disney, 2011). As a result, the GPG, both raw and unexplained, is lower in the public sector (see, for example, Olsen *et al*., 2010; Chatterji *et al*., 2011; Jones *et al*., 2018). Recent evidence by Jones *et al*. (2018) also shows that the main determinant of the national GPG is within sector gender pay differentials rather than the different gender sector allocations. In fact, Jones *et al*. (2018) find that in the absence of within sector GPGs, women would earn more than men, on average.

In relation to union membership, women now are more likely to be members than men and the membership rates are much higher in the public sector than in the private sector (Chatterji *et al*., 2011). Similar to the public sector wage premium, the empirical studies for the UK have shown that there exists a union membership wage premium which is around 10 per cent (Bryson, 2014). Although recent studies show that the premium has declined over time (see, for example, Forth and Bryson, 2015), it continues to be sizeable both in the public and private sectors, being much larger in the former than in the latter (Blanchflower and Bryson, 2010). In terms of gender differences, the evidence suggests that the union wage premium in Britain is larger for women than men, and as a result, it narrows the GPG. A recent study by Blanchflower and Bryson (2010) also confirms that unions have a larger positive impact on pay for women, both in the public and private sector. However, its role in determining the overall GPG is found to be relatively small (Olsen *et al*., 2010, 2018).

*Workplace characteristics*

While previous studies focus mainly on personal and work-related characteristics, the availability of nationally representative linked employee-employer datasets, has shifted the attention to the role of firm and workplace in driving the GPG. In relation to the workplace, Chatterji *et al*. (2011) use data from the British Workplace Employee Relations Survey (hereinafter, WERS) 2004 and show that characteristics, including the presence of PRP schemes, company pension schemes and family-friendly work policies play an important role in the determination of individual earnings. However, their results indicate that the major component of the earnings gap between full-time male and female employees in Britain remains unexplained even after accounting for workplace in addition to individual and work-related characteristics. Similarly, a recent study by Jewell *et al.* (2018) uses data from the ASHE and explores how much of the UK GPG between years 2002-2016 was due to the distribution of workers across firms, i.e. which workers were employed by which firms. However, their findings suggest that the contribution of the differences between men and women in whom they work for on GPG is small (less than 1 percentage point), pointing to the importance of within-firm gender wage inequality. Interestingly, they also find that despite the significant variation across occupations in terms of pay, the contribution of gender-occupational segregation was only 1 percentage point to the overall UK GPG. Consistent with this result, Mumford and Smith (2009) find that segregation at the workplace level is in fact even more important than occupational segregation in determining the GPG in Britain. Their analysis of the WERS data suggest that only 2.6 per cent of the GPG in 1998 was related to occupational segregation, compared to the 29.1 per cent that was related to workplace segregation.

### 2.3.2 UK GPG across the earnings distribution

Although attention on the GPG tends to focus at the middle of the earnings distribution, making comparisons between the average man and woman, international evidence is increasingly concerned with the entire distribution (see Albrecht *et al*., 2003 for Sweden; de la Rica *et al*., 2008 for Spain; Jellal *et al*., 2008 for France; Arulampalam *et al*., 2007 for a comparison of eleven European countries including Britain).

In the UK, Olsen *et al*. (2010) show that male and female wages diverge over the pay distribution. Although the drivers of the GPG are found to be largely similar over the distribution, their results show that education has a larger positive effect on pay at the top of the wage distribution. Based on the latter, they argue that, women's relative improvements in education will have a more equalising effects on the GPG at the middle or top of the pay distribution. A recent study by Chzhen and Mumford (2011) also find that the GPG increases across the pay distribution indicating the presence of a 'glass ceiling' effect, or vertical segregation, among British full-time employees. They show that high skilled, white-collar occupations and carrying out managerial duties are strongly associated with the glass ceiling effect. Another recent contribution by Fortin *et al.* (2017) documents the under-representation of women at the top of the annual earnings distribution using data from the ASHE. Their further analysis based on the QLFS reveal that under-representation of women among top earners accounts for the half of the average hourly GPG in 2015. Focusing at the other end of the wage distribution, Bargain *et al*. (2018) find surprisingly little impact of the NMW on the UK GPG.

### 2.3.3 The role of the public sector

There has been considerable interest in quantifying the size of the UK public-private pay differential and tracking its movements over time, with a consistent finding being a greater public sector pay premium for women (see, for example, Blackaby, *et al.* 2012; Cribb *et al.*,

2014a). A recent contribution to this strand of the literature by Singleton (2018) uses data from the ASHE for the years 2002-2016. Interestingly, he finds that women working in the public sector received an average premium of 4 per cent compared with those working in private sector, while there was no significant public sector premium for men. Consistent with this result, analysis of the GPG by sector finds smaller gaps within the public than the private sector (see, for example, Chatterji *et al*., 2011; Stewart, 2014a; Jones *et al*., 2018).[18] The recent study by Jones *et al*. (2018), for example, documents an average GPG of 36.5 per cent in the private sector, while the gap is 24.5 per cent in the public sector. In terms of employment, women are also concentrated in the public sector, which accounts for about 30 per cent of employment for women, about double that for men (Millard and Machin, 2007; Matthews, 2010). In the UK, therefore the public sector makes an important narrowing contribution to the national GPG, particularly through a lower within sector GPG but also through the presence of a relative concentration of women in the public sector, which on average offers a pay premium relative to the private sector (Jones *et al*., 2018).

Given the existence of gender differences in sectoral employment, it might be important to account for possible selection of workers into sectors, that is the extent to which workers with certain characteristics are likely to be employed in the public versus the private sector, in analysing the wage differentials. In fact, an earlier study by Blank (1985) provides evidence that wages for public and private sector workers in the US are affected by the selection of workers into sectors. Moreover, she finds that workers' sectoral choice itself is influenced by wage differences across sectors. Using data from the BHPS of 2000, Heitmueller (2006) quantify this effect for Scotland and finds evidence of gender differences. He finds that a 1 per cent increase in expected pay increases the probability of employment in the public sector by 1.3 per cent for men and 2.9 per cent for women. He also finds that the public sector wage premium is 10 per cent for males and 24 per cent for females, however, after controlling for double sample selection from participation and sector choice, there exists a male private sector wage premium, while there is no evidence of a sample selection bias for females. In contrast, Disney and Gosling (2003) find that the public sector premia in Britain is robust to selection of workers into sectors. As part of exploring the contribution of the public sector to the UK GPG, Jones *et al*. (2018) model sector choice separately for males and females and find that the higher probability of public sector employment for females is largely unexplained by personal and work-related characteristics. Although controlling for occupation has a critical role, about half of the gender gap in the probability of public sector employment remains unexplained and may therefore reflect gender differences in individual preferences and/or different barriers to entry.

The wage distribution has also been identified as important in terms of the public-private sector pay premium, with a greater premium evident at the lower tail of the distribution, and that a premium for women exists throughout the majority of the distribution except the top, while the public-private pay differential is negative at the top of the earnings distribution for men (Blackaby *et al*., 2012). Stewart (2014a) finds a greater GPG in the private sector for full-time workers regardless of the point on the distribution at which it is measured, but also that the wage gap increases throughout the distribution in both sectors. This is consistent with previous evidence of a 'glass ceiling' in the public sector in Britain (Arulampalam *et al*., 2007).

Although smaller in magnitude, a significant 'unexplained' pay gap is also found within the public sector, a potential indicator of gender pay inequality. Several arguments have been put forward to explain why this is lower in the public relative to the private sector (Chatterji *et al*., 2011). These include distinctive nature of the public sector in embracing cultural values

[18] This is not confined to the UK (see, for example, Arulampalam *et al*., 2007 and Cai and Lui, 2011).

as a 'fair' employer (Beaumont, 1981; Blanchflower and Bryson, 2010)[19] and more highly developed equality practices (Hoque and Noon, 2004), including greater provision of flexible working and family friendly practices (Chatterji *et al*., 2011). There may also be indirect effects arising from centralised pay-setting and collective bargaining in compressing the earnings distribution (Grimshaw, 2000) as well as an influence of unions on equality practices (Hoque and Bacon, 2014). Stewart (2014a) also highlights the role of more transparent and structured pay systems within the public sector.

Stricter regulatory controls also apply to public sector pay, for example the Single Status Agreement (1997) and the NHS Agenda for Change (2004) impose common pay structures for employees in local government and the health sector (outside top clinical grades), and additional statutory duties require all public service organisations to take proactive action to redress patterns of disadvantage, to promote equality and to eliminate discrimination in employment and recruitment practices. Indeed, in terms of pay this has tended to include formal job evaluations as part of equal pay assessments. More recently, as part of the Equality Act 2010, the Public Sector Equality Duty 2011 requires that public authorities take additional steps to "advance equality of opportunity". However, in contrast to the narrowing trend since the 1970s following the Equal Pay Act, Jones *et al*. (2018) show that the GPG across both sectors has been unchanged since 2010. Further, the unexplained gap has been stable for two decades suggesting such policies have not influenced the treatment of women in the public sector.

### 2.3.4 The role of occupation

In a similar manner to sector, occupational segregation affects the GPG in two ways (see Brown *et al*., 1980) and, as such, the overall GPG can be broken down into within occupation and between occupation components, where the latter arise from gender differences in the occupational distribution.[20] Occupational segregation is an established driver of the overall GPG (see above discussion). An important issue is therefore why women tend to be concentrated in different occupations to men and, whether this itself is a function of personal characteristics or unexplained, potentially reflecting discrimination or gender differences in preferences in terms of the nature of jobs (see, for example, Lordan and Pischke, 2016), in particular the ability to combine work and family. Despite the evidence of occupational segregation, few studies have explored the role of occupational selection on the UK GPG. A notable exception is an early study by Dolton *et al*. (1989) which uses a sample of British college graduates in arts and social science and provides evidence of sample selection effects on earnings from both the female participation decision and the occupational choice decision. More recently, Lekfuangfu and Lordan (2018) use data from three cohorts (1958, 1970 and 2000) and find a decline in the extent of occupational segregation by gender which they attribute to societal change. However, they find much less progress among the most male dominated occupations, such as engineering, and that males remain unlikely to select into traditionally female occupations, including some important public sector occupations such as social work, nursing and primary school teaching. Similarly, Brynin (2017) finds that the effect of occupational segregation has become a less important determinant of the UK GPG over time and that this is true, but to a lesser extent, for the within occupation GPG, increasing the relative importance of the latter. Indeed, recent analysis by Stewart (2015) shows that, in Britain, about half of the GPG can be attributed to differences within occupations, which are found to be pronounced (see also Goldin, 2014 for a similar discussion relating to the US). Moreover, he finds that the within occupation GPG is

[19] This is consistent with recent reference by Jeremy Hunt to the NHS as a "shining beacon of equality among all" being a particular motivator to reduce the GPG in medicine (May 2018).

[20] There is an argument that low wages arise in female dominated occupations because pay practices are 'socially constructed' (Brynin, 2017) and undervalue women's labour.

typically larger in higher paid occupations and lower in occupations with a higher proportion of female employees.

While within occupation analysis of GPGs has made an important contribution to the recent literature, particularly in identifying the pre-requisites for greater gender pay equality, almost all evidence on within occupation gender differences comes from the US. Further, although comparisons between occupations have provided important insights, for example, into the detrimental role of long hours on the GPG (see Goldin, 2014), studies often focus on individual case study occupations. For example, Goldin and Katz (2016) examine the GPG among pharmacists in the US and find a gender earnings gap of about 25 log points for annual earnings controlling for productivity-related characteristics. However, a majority of the gap among pharmacists can be explained by the gender differences in hours of work. They find that conditional on hours of work, female pharmacists earn 4-7 log points less than comparable male pharmacists. An earlier study by Reyes (2007a) also focuses on the US gender pay differentials among obstetricians and gynaecologists. He finds that in 2002, the gender pay differential of 18 per cent can largely be explained by female physicians choosing to see fewer patients, perform fewer surgical procedures, or practice in less financially rewarding settings. Using data from a staff survey in 1994, Pudney and Shields (2000a and 2000b) analyse gender differences in promotion among the registered nurses working in the UK NHS. They find that estimates of the impact on life-time earnings are sensitive to the methodology applied, but that gender has a minimal impact.[21] Turnbull and Williams (1974) provide a rare exception in relation to teachers and find that gender differences in length of service largely explain the gender difference in earnings, particularly in secondary schools.[22]

Within the public sector, PRBs cover occupations with pronounced gender segregation (e.g. nurses and the armed forces) and substantial variation in pay (e.g. nurses compared to medical practitioners and dental practitioners). Despite the increasing literature on workforce composition in the UK public sector (Millard and Machin, 2007; Matthews, 2010; Cribb *et al.*, 2014b), there has been limited consideration of differences across occupations. Nevertheless, as Cribb *et al*. (2014b) note, there are important gender differences in employment composition within the public sector. For example, 75 per cent of women in the public sector are employed in health or education, compared with just 43 per cent of men, who are more likely to work in public administration and defence. Moreover, changes in the composition of public sector employment over time, and the relative protection of some areas during austerity, has led to an increase in the concentration of women. While studies have considered the influence of sector (Jones *et al*., 2018) and occupation (Stewart, 2015) on the GPG, the interaction between these, and therefore evidence relating to the occupational contribution to the public sector GPG, has been overlooked.[23] The only UK exception, by Stewart (2014a), considers how the GPG varies within the public sector, particularly between central government and local authorities, where interestingly he finds a pronounced difference, with it being lower in local authorities.[24]

On the other hand, there is a long-standing evidence from the US medical studies that explore GPG among physicians (Apaydin *et al*., 2018; Baker, 1996; Jagsi *et al*., 2012;

[21] The exception being when career history and training are assumed to be endogenous in a model of promotion with constant thresholds, which is subsequently rejected by these data (Pudney and Shields, 2000b).
[22] McNabb and Wass (1997) use unique personnel data on academic staff in old universities (1975-1992) and find that a significant part, but certainly not all, of the 15 per cent wage differential is explained gender differences in seniority. Wass and McNabb (2006) also consider the GPG among solicitors in the UK. Also, historically for the UK, Siebert and Young (1983) consider librarians.
[23] This is despite international evidence which highlights the interaction between occupation and sector (see for example, Baron and Cobb-Clark, 2010 for analysis of Australia).
[24] Brynin (2017) also provides descriptive evidence of a smaller GPG in the public sector for graduates.

Ohsfeldt and Culler, 1986; Weaver *et al*., 2015), obstetricians and gynaecologists (Reyes, 2007b), and nurse practitioners (Greene *et al*., 2017; Muench *et al*., 2016). Evidence from a non-US study for the male and female GPs in England reports an 11 per cent pay differential in log hourly wage which is much smaller than the difference in average annual earnings of 45 per cent (Gravelle *et al.*, 2011). After controlling for personal and workplace (practice) characteristics as well as area characteristics, the study finds that the unexplained portion of the GPG is around 6 per cent for hourly wages and 30 per cent for annual pay suggesting that there are significant gender differences in hours of work between male and female GPs but also that hours worked have different effects on pay for male and female GPs. By contrast, even the international evidence on other public sector occupations such as teachers or the armed forces is scarce.[25] Lee and Smith (1990) and Verdugo and Schneider (1994) provide notable exceptions for the US. Lee and Smith (1990) focus on differences between public, Catholic, and other private secondary schools and find a significant female penalty after controlling for personal and work-related characteristics which is largest in private schools (12 per cent compared to 5 per cent in the public sector). While Carroll *et al*. (2018) highlight the importance of occupational segregation within teaching, with women dominating primary education, Verdugo and Schneider (1994) find a relatively small influence of the level of education and subject taught on the GPG among teachers. Indeed, similar to Lee and Smith (1990), they find a 5 per cent earnings penalty for females after adjusting for personal and work-related characteristics.

### 2.3.5 PRP

While the majority of evidence on the GPG relates to usual hourly pay, there is a growing body of literature that emphasises gender gaps in PRP, pay systems in which a part of remuneration is based on performance.[26] As Forth *et al.* (2016) argue, PRP schemes are more prevalent in some industries and occupations than others. For example, piecework is more common in manufacturing, while commission on sales is associated with retail and bonus payments in financial industries. Although it remains relatively limited (Work Foundation, 2014; Bryson *et al.*, 2017), there is also increasing emphasis on PRP in the public sector (e.g. Makinson Report, 2000; Winsor Review, 2011), which has seen a movement from automatic progression to PRP as an incentive for effort, including, from 2013, in relation to teachers' progression (STRB, 2013). The existing literature, however, has highlighted the challenges of using the PRP schemes in public sector due to the nature of its activities and objectives, where outcomes are complex, difficult to measure and potentially have a wide social impact, and the delivery of these outcomes requires involvement of a variety of agents working collaboratively (see, for a review, Bajorek and Bevan, 2015). A number of studies also suggest that public sector employees have 'public service motivation', that is the intrinsic motivation derived from the providing the service, rather than its financial reward, and question whether the implementation of PRP schemes in public sector is optimal (see, for reviews, Bajorek and Bevan, 2015; Lewin, 2003; Wright, 2001). Nevertheless, there are some examples of the PRP schemes in the UK public sector, such as the Quality and Outcomes Framework, which was introduced on 1 April 2004 for general practitioners, rewarding them for achievement of a range of targets across a range of domains (NHS Employers, 2014). Reviews by Prentice *et al.* (2007) and more recently by

[25] Rapaport (1995) uses public sector teachers in California to explore the role of non-discretionary contracts and Ransom and Lambson (2011) use Missouri school teachers to explore the predictions of a monopsony model. Both studies find evidence of a GPG after accounting for personal characteristics, despite the tight regulation over pay imposed by the contracts. Ransom and Lambson (2011) suggest that this might arise due to gender differences in additional responsibilities.

[26] The most common types of performance related pay are (i) piecework schemes, (ii) payment by results, (iii) plant or organisation wide incentives, (iv) performance related pay - bonus earnings or pay progression through a pay scale are based on an assessment or appraisal of an employee's (or team's) performance against previously set objectives, usually as part of a performance management system; (v) merit pay, (vi) competence based pay, and (vi) profit related pay (see, UNISON, 2017, for a detailed description of these pay schemes).

the Work Foundation (2014) also present evidence on PRP for civil servants, healthcare workers and teachers. While they found no evidence of applications of PRP systems in the armed forces, police or prison service, there is recent reference to performance related progression and pay awards by the PSPRB in their annual reports.

The few empirical studies that focus on gender differentials in PRP show that women are less likely than men to be employed in jobs in which compensation is based on performance (see Manning and Saidi, 2010 for the UK; McGee *et al*., 2015 for the US; Xiu and Gunderson, 2013 for China). Consistent with this, experimental evidence suggests that women are often more reluctant to enter competitive environments (see, for example, Niederle and Vesterlund, 2007). While gender differences in PRP might reflect differences in the preferences of women to enter competition, it is important to note that these preferences might be shaped by cultural values, which may reflect stereotypes or discrimination. In fact, evidence suggests that conditional on receipt of PRP, women receive a lower share of PRP in total compensation relative to males (Xiu and Gunderson, 2013), in particular among the highest paid employees (Albanesi *et al*., 2015). Moreover, gender gap in PRP is greater than the gap in base pay (Xiu and Gunderson, 2013) and displays a 'glass ceiling' pattern (de la Rica *et al*., 2015). Nevertheless, its role in determining the overall hourly GPG is found to be relatively small (Manning and Saidi, 2010).

## 3. Data and Methodology

### 3.1 Data sources and measures

The main source of data used in this project is ASHE, which is well-established to be the most reliable and largest source of information on individual pay in the UK (ONS, 2018). These data, which are based on mandatory reporting by employers to ONS, cover a 1 per cent sample of employee jobs from HMRC's PAYE system and are made available annually, with a reference date in April of each year.[27] Although these data are available 1997-2018, we focus on the 'current' (2018) period.[28,29]

In terms of achieving the aims of this project, ASHE has several benefits relative to other sources of data. Since information on sector is provided by the employer it is possible to identify public and private sector organisations accurately using information on legal status rather than employee perceptions. The latter may be subject to differences in information on, and interpretation of, the definition of sector. ASHE also contains detailed objective information on pay from payroll records which is less susceptible to individual non-response or, recall or measurement error, than self-reported information. It also contains a detailed range of measures of pay, including PRP. Further, the large sample size facilitates comparisons within the public sector, including across occupations, important given the distinct remit of the PRBs (see below).

*Sector and PRBs*

In ASHE, sector is classified based on the legal status of the enterprise from the Inter-Departmental Business Register (hereinafter, IDBR). According to this classification workers employed in public corporations and nationalised industries, central government or local authority are classified as public sector; those employed by a private company or are a sole proprietor or in a partnership are classified as private. Workers employed in non-profit bodies or mutual associations are classified as a separate category that we refer to as the non-profit sector throughout.[30]

Detailed occupation information is available using established measures (4-digit Standard Occupational Classification, hereinafter, SOC) within these data and has previously been used to identify public sector occupations including school teachers, doctors and dentists, police officers and prison service staff (see Bryson and Forth, 2017). As ONS considers some of the annual 4-digit estimates of the GPG as 'reasonable' or 'low quality', we pool data across 4-digit SOC groups to define PRB occupations and generate more reliable estimates.[31] For example, while detailed 4-digit occupations would enable 'medical practitioners' to be separated from 'dental practitioners', we pool these to form the DDRB PRB. It is important to note that ASHE is not able to provide a complete coverage of PRBs. For example, some General Practitioners covered by the DDRB are excluded from the

[27] ASHE is a mandatory survey; however non-response to the survey, particularly among small employers implies that the sample of employees is actually lower than 1 per cent. Nevertheless, the response rate in ASHE is known to be substantially higher than many household survey data sets in Britain (see, for a discussion, Cribb and Emerson, 2016). For more information, see ONS Information Paper (2013) on the coverage and non-response in the ASHE.
[28] The 2018 data is currently released as provisional but is routinely used, including by ONS, in this format. The robustness of the main findings from 2018 are, however, tested using the 2017 data.
[29] Since ASHE data are confidential and potentially disclosive, they are only available from the UK Data Archive (hereinafter, UKDA) via the Secure Data Service (hereinafter, SDS) for projects where the researchers are accredited and where there is a clear public benefit. This project was approved for the use of these data and all outputs have been subject to disclosure control.
[30] While the non-profit sector is often included as part of the private sector our preliminary analysis suggested a significantly lower GPG in the non-profit sector relative to the private sector. As such, we primarily focus on comparisons between the public and private sector (excluding non-profit sector) in our empirical analysis.
[31] See https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/datasets/annualsurveyofhoursandearningsashegenderpaygaptables.

analysis since the survey does not cover the self-employed.[32] The AFPRB, SSRB and NCARRB are also excluded from analysis as ASHE does not cover jobs within the AFPRB and the occupations relevant for the SSRB and the NCARRB cannot be identified separately due to their limited coverage and occupational composition.[33] We also make some further adjustments to match the coverage of PRBs more closely. For example, some PRBs only cover England and Wales while other PRBs extend to Scotland, but in these cases we also use regional information available to identify PRB remit employees.[34] Additionally, in some occupations (e.g. teachers), there are practitioners both within the PRB system (e.g. in state schools) and those outside it (e.g. private schools). In these cases, the public sector identifier is used to identify the remit group.[35] Some occupational codes also group jobs across different industrial activities (e.g. SOC 2010 code 1173 Senior officers in fire, ambulance, prison and related services). In these cases, industry information measured by the Standard Industrial Classification (hereinafter, SIC) 2007 is used to identify the remit group. Full details are provided in Appendix Table A.1, which is largely a replication of Bryson and Forth (2017), although we only focus on SOC 2010 and additionally define the AFPRB in the QLFS. We refer to the PRBs in aggregate as PRB occupations and, in a similar manner to Dolton *et al*. (2015), individuals employed within the public sector but outside these occupations are defined as non-PRB public sector workers throughout. This includes workers in central and local government such as the civil service and social workers.

*Pay*

ASHE contains detailed information on employee's earnings and hours during the pay period (the week or the month depending on whether the employee is paid weekly or monthly) that includes the survey reference date in April, as well as the gross annual earnings and PRP received during the preceding year. As such, it is possible to measure hourly pay in multiple ways. Our benchmark hourly pay measure is the ONS recommended measure based on gross hourly pay for the reference period, excluding overtime, but we also explore sensitivity of the analysis to the precise measure employed.[36] The alternative measures include hourly pay including overtime and, an hourly pay measure derived from annual gross earnings and annual PRP (following Bryson and Forth, 2017).[37] We also recode pay observations as missing if gross hourly pay (including overtime) is more than £99.[38] To explore gender gaps in PRP specifically, we use the amount of PRP received during the preceding year, in order not to exclude bonus payments that are not paid in the pay period covered by ASHE's April survey date.[39] PRP is measured in ASHE to include the amount paid to an employee as a

[32] More generally, information on earnings from the self-employed is well-established to suffer from considerable measurement error and is not typically available in survey data (including the QLFS).
[33] Analysis of the AFPRB is possible with the QLFS (see below) but is restricted by sample size. Based on the analysis of their own data the SSRB (2019) report the GPG in the Senior Civil Service as 5.1 per cent.
[34] Some PRBs also cover Northern Ireland, but the ASHE data in the SDS does not. We restrict analysis of the QLFS to Great Britain for comparability.
[35] As academy schools are classified by the IDBR as public sector, it is not possible to distinguish academy school teachers who are not within the STRB remit from teachers who are covered by the STRB. This might be important for our results since according to GPG Reporting 2018-2019 multi-academy trusts that run academy schools have among the largest GPGs within the public sector.
[36] Our benchmark measure of gross hourly pay is calculated as gross weekly earnings (basic weekly earnings + incentive pay that relates to this pay period + additional premium payments during the pay period for shift work and night or weekend work not treated as overtime + pay received in the pay period for other reasons) excluding overtime for the reference period divided by basic weekly paid hours worked. This measure is also aligned to the GPG Reporting measure of hourly pay.
[37] This measure divides gross annual earnings in the preceding year by an annualised measure of hours worked, based on working hours in the reference period. While in principle it better reflects total bonus payments made over the year (Bryson and Forth, 2017), it does not allow the separation of overtime payments from gross annual pay. It further assumes that working hours during the reference week are an accurate reflection of average working hours per week during the year which, using data from the Annual Population Survey, Bryson and Forth (2017) find is a reasonable assumption.
[38] This is for consistency with the QLFS, where this is the ONS recommended filter.
[39] This is consistent with that required by GPG reporting regulations. See http://www.acas.org.uk/media/pdf/m/4/Managing_gender_pay_reporting_04_12_17.pdf. The regression analysis which follows

result of meeting a performance or productivity objective, such as profit sharing, bonuses, piecework and commission payments.

Our analysis sample is restricted to adults in their main job who have valid individual and enterprise identifiers and whose earnings is not affected by absence. We further remove individuals who have missing information on any of the variables of interest.[40] ASHE provides calibration weights to adjust for sample selection and imputes for item non-response. We keep imputed cases and use calibration weights throughout our data analysis, so the estimates are representative of the population, but in each table, we also present the unweighted number of observations.

*Explanatory variables*

ASHE also contains detailed information on the nature of the job and employer, including firm size, location, tenure, coverage of collective agreements, permanent/temporary contract and contracted hours of work which are all important control variables in the analysis of pay and the GPG (see Section 2.3.1). Information on contracted hours of work will also enable comparisons between full and part-time employees, where it is well-established that the GPG differs considerably (Petrongolo and Manning, 2008).[41]

In terms of personal characteristics, ASHE contains information on gender (unless specified otherwise, a binary indicator that takes a value of 1 for females and 0 for males). Our control variables include other personal characteristics such as age (and age-squared) and (work) region, as well as work-related characteristics such as tenure measured by the total number of years in present organisation (and tenure-squared), part-time (a binary indicator that takes a value of 1 if the job is part-time and 0 otherwise), temporary employment (a binary indicator that takes a value of 1 if the job is temporary/casual and 0 otherwise), firm size measured by the number of employees in the enterprise on the IDBR (in logarithmic form), collective bargaining (a binary indicator that takes a value of 1 if the employee's pay is set with reference to a collective agreement and 0 otherwise), and occupation information measured by SOC 2010 code major groups.[42,43]

Table 1a presents summary sample statistics from ASHE for the explanatory variables employed in our analysis by sector for all employees and by gender. They confirm a number of key and well-established differences between public and private sector employment, in particular in terms of the more extensive coverage of collective bargaining and the prevalence of professional occupations within the public sector. As expected, gender differences in part-time employment are also pronounced in all sectors and there is evidence of occupational segregation, for example, females are disproportionately represented in 'Administrative and secretarial occupations' and 'Caring, leisure and other service occupations' and, in the private sector males are concentrated among 'Skilled trade occupations' and 'Process, plant and machine operatives'.

takes into account that there might be differences between full-time and part-time workers if, for example, bonuses are paid on a pro-rata basis.

[40] We retain 158,740 individuals from the initial sample of 178,942 observations.

[41] Although Dolton *et al*. (2015) focus on full-time employees in their analysis of the impact of PRBs, Bryson and Forth (2017) also consider part-time employees. We adopt the latter approach and explore the role of part-time employment, first by introducing a control for full-time/part-time employment within our analysis and then, sample sizes permitting, by estimating separate models for full-time workers as sensitivity analysis.

[42] ASHE defines full-time employees as those who work more than 30 paid hours per week or those in teaching professions working 25 paid hours or more per week.

[43] Since major groups do not vary within some PRBs (e.g. DDRB), within PRB analysis uses occupation information measured by the 4-digit SOC 2010 codes.

**Table 1a.** Sample statistics for explanatory variables, by sector

| | Public | | | Private | | | Non-profit | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female | All | Male | Female |
| Age | 43.50 | 43.22 | 43.63 | 40.17 | 40.47 | 39.75 | 43.57 | 43.48 | 43.63 |
| Work region (per cent) | | | | | | | | | |
| North East | 4.54 | 4.35 | 4.63 | 3.55 | 3.40 | 3.75 | 4.09 | 4.26 | 3.97 |
| North West | 12.05 | 11.50 | 12.32 | 10.84 | 10.81 | 10.89 | 9.21 | 9.21 | 9.22 |
| Yorkshire and Humber | 8.82 | 8.48 | 8.98 | 8.07 | 8.22 | 7.85 | 7.72 | 7.78 | 7.68 |
| East Midlands | 6.17 | 5.75 | 6.38 | 7.51 | 7.64 | 7.32 | 6.02 | 5.56 | 6.31 |
| West Midlands | 7.57 | 7.04 | 7.83 | 9.25 | 9.55 | 8.82 | 7.92 | 8.08 | 7.82 |
| South West | 7.75 | 7.29 | 7.97 | 8.67 | 8.60 | 8.76 | 8.89 | 8.11 | 9.39 |
| East | 7.63 | 6.92 | 7.98 | 9.50 | 9.36 | 9.69 | 8.88 | 8.58 | 9.08 |
| London | 14.69 | 18.32 | 12.91 | 16.24 | 16.06 | 16.50 | 17.54 | 19.47 | 16.30 |
| South East | 11.88 | 10.93 | 12.35 | 14.83 | 14.85 | 14.79 | 16.51 | 16.10 | 16.78 |
| Wales | 5.91 | 6.13 | 5.81 | 3.91 | 3.96 | 3.84 | 4.18 | 4.01 | 4.28 |
| Scotland | 12.99 | 13.29 | 12.84 | 7.64 | 7.53 | 7.78 | 9.04 | 8.84 | 9.18 |
| Tenure (years) | 9.80 | 10.44 | 9.48 | 6.97 | 7.44 | 6.30 | 7.15 | 7.57 | 6.88 |
| Contract type (per cent) | | | | | | | | | |
| Temporary employment | 8.25 | 7.77 | 8.48 | 5.58 | 4.99 | 6.42 | 13.49 | 14.34 | 12.95 |
| Part-time | 28.69 | 11.00 | 37.34 | 25.23 | 13.43 | 41.87 | 34.32 | 21.64 | 42.49 |
| Firm-size (number of employees) | 11,469 | 12,682 | 10,876 | 12,410 | 11,018 | 14,375 | 2,297 | 2,562 | 2,127 |
| Collective agreement (per cent) | 89.09 | 89.54 | 88.86 | 21.75 | 22.98 | 20.03 | 51.50 | 54.50 | 49.58 |
| Occupation | | | | | | | | | |
| Managers, directors and senior official | 4.12 | 6.47 | 2.98 | 12.54 | 14.52 | 9.74 | 8.90 | 9.29 | 8.64 |
| Professional occupations | 41.90 | 39.22 | 43.21 | 13.49 | 15.82 | 10.21 | 34.7 | 44.46 | 28.42 |
| Associate professional and technical occupations | 16.82 | 26.59 | 12.04 | 14.15 | 14.58 | 13.54 | 16.43 | 15.83 | 16.81 |
| Administrative and secretarial occupations | 12.99 | 8.76 | 15.06 | 11.24 | 4.95 | 20.10 | 11.60 | 6.16 | 15.11 |
| Skilled trades occupations | 1.73 | 3.71 | 0.76 | 9.44 | 14.56 | 2.22 | 3.11 | 6.14 | 1.16 |
| Caring, leisure and other service occupations | 15.25 | 7.40 | 19.09 | 6.11 | 2.18 | 11.65 | 16.23 | 9.43 | 20.60 |
| Sales and customer service occupations | 1.21 | 1.36 | 1.13 | 11.25 | 7.35 | 16.75 | 2.02 | 1.56 | 2.31 |
| Process, plant and machine operatives | 1.04 | 2.90 | 0.13 | 8.15 | 12.37 | 2.20 | 0.96 | 2.02 | 0.28 |
| Elementary occupations | 4.95 | 3.59 | 5.61 | 13.63 | 13.66 | 13.59 | 6.05 | 5.10 | 6.67 |
| Population size | 5,627,309 | 1,847,778 | 3,779,530 | 16,620,206 | 9,725,304 | 6,894,901 | 2,090,050 | 818,876 | 1,271,174 |
| Number of obs.(unweighted) | 35,841 | 10,717 | 25,124 | 109,713 | 60,689 | 49,024 | 13,186 | 4,683 | 8,503 |

Table 1b presents additional summary sample statistics for the same explanatory variables for employees within the public sector and by gender, but separately for PRB and non-PRB occupations. The main difference is in terms of occupation, with the majority (63 per cent) of PRB workers in 'Professional occupations' compared to 24 per cent in non-PRB

occupations. Conversely, 'Administrative and secretarial occupations' and 'Caring, leisure and other service occupations' account for a larger proportion of non-PRB workers.

**Table 1b.** Sample statistics for explanatory variables, within the public sector

| | Non-PRB public | | | PRB | | |
|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female |
| Age | 44.71 | 44.33 | 44.92 | 42.06 | 41.65 | 42.24 |
| Work region (per cent) | | | | | | |
| North East | 4.13 | 3.86 | 4.28 | 5.02 | 5.04 | 5.02 |
| North West | 11.24 | 10.39 | 11.71 | 13.01 | 13.08 | 12.97 |
| Yorkshire and Humber | 8.68 | 8.26 | 8.90 | 8.99 | 8.80 | 9.07 |
| East Midlands | 6.42 | 5.51 | 6.92 | 5.88 | 6.08 | 5.80 |
| West Midlands | 6.88 | 5.73 | 7.51 | 8.39 | 8.91 | 8.17 |
| South West | 7.59 | 7.46 | 7.66 | 7.93 | 7.06 | 8.30 |
| East | 6.80 | 5.58 | 7.47 | 8.62 | 8.81 | 8.54 |
| London | 15.52 | 19.45 | 13.35 | 13.70 | 16.72 | 12.44 |
| South East | 11.65 | 10.44 | 12.32 | 12.15 | 11.62 | 12.37 |
| Wales | 5.99 | 6.26 | 5.85 | 5.82 | 5.93 | 5.77 |
| Scotland | 15.11 | 17.07 | 14.03 | 10.48 | 7.94 | 11.55 |
| Tenure (years) | 10.59 | 11.50 | 10.09 | 8.85 | 8.92 | 8.82 |
| Contract type (per cent) | | | | | | |
| Temporary employment | 7.92 | 6.09 | 8.93 | 8.64 | 10.16 | 8.00 |
| Part-time | 31.20 | 11.50 | 42.06 | 25.73 | 10.29 | 32.23 |
| Firm-size (Number of employees) | 12,390 | 13,659 | 11,690 | 10,381 | 11,298 | 9,995 |
| Collective agreement (per cent) | 88.77 | 89.25 | 88.51 | 89.46 | 89.95 | 89.25 |
| Occupation | | | | | | |
| Managers, directors and senior official | 5.77 | 8.32 | 4.37 | 2.18 | 3.85 | 1.47 |
| Professional occupations | 23.73 | 27.47 | 21.68 | 63.35 | 55.86 | 66.50 |
| Associate professional and technical occupations | 19.94 | 27.14 | 15.97 | 13.13 | 25.80 | 7.78 |
| Administrative and secretarial occupations | 17.67 | 12.74 | 20.39 | 7.47 | 3.14 | 9.29 |
| Skilled trades occupations | 2.93 | 5.73 | 1.38 | 0.31 | -* | -* |
| Caring, leisure and other service occupations | 18.89 | 7.47 | 25.18 | 10.95 | 7.29 | 12.49 |
| Sales and customer service occupations | 1.97 | 2.19 | 1.86 | 0.30 | 0.19 | 0.34 |
| Process, plant and machine operatives | 1.69 | 4.34 | 0.23 | 0.27 | -* | -* |
| Elementary occupations | 7.40 | 4.60 | 8.94 | 2.05 | 2.14 | 2.01 |
| Population size | 3,046,955 | 1,082,841 | 1,964,113 | 2,580,354 | 764,936 | 1,815,417 |
| Number of obs.(unweighted) | 20,193 | 6,597 | 13,596 | 15,648 | 4,120 | 11,528 |

*Notes*: *Figure is not presented due to lack of sufficient number of observations.

*The QLFS*

Despite its advantages (see discussion above), ASHE does, however, have some weaknesses in the context of the literature on the GPG (see Section 2.3.1). Most importantly, it contains a fairly basic set of personal characteristics and while this includes key variables such as age and gender, an important omission, given the focus on human capital, is educational attainment, an important determinant of productivity and pay. While information on occupation can be used as a proxy (see Gibbons *et al*., 2014), this is inferior to information on highest qualification. Also excluded is information on marital status and the

presence/number of dependent children. The latter, in particular, has previously been identified as a key contributor to the UK GPG (see Costa Dias *et al*., 2018). In light of these limitations the robustness of the findings is explored by using supplementary data from the QLFS.

The QLFS is the largest household survey in the UK and is available for non-commercial use from the UKDA. It collects information on pay, sector and a comprehensive set of personal and work-related characteristics from individuals themselves in a largely consistent manner since 1998. Due to the smaller sample size within the QLFS, data from each of the four quarters in 2016/2017/2018 are pooled to construct a contemporary cross sectional data set.[44] These data have been extensively used to explore the public sector pay premium (Cribb *et al*., 2014a; Blackaby *et al*., 2012) and in recent analysis of the GPG in the public sector (Jones *et al*., 2018). We try to keep our analysis as comparable as possible to ASHE, and restrict our sample to adult personal interviews, and focus on employees in their main job.[45,46] Since we pool information from the QLFS over time to enhance the sample size we report unweighted figures throughout which, therefore reflect the composition of the sample, rather than population averages.

Unlike ASHE, information on sector is self-reported by the employee. 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).[47] Our definition of the private sector includes everything outside this excluding the non-profit sector defined to include 'charities, voluntary organisations or trusts'. The QLFS overestimates 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 non-profit and private sector respectively.[48] Descriptive statistics (see Table 2) suggest the QLFS definition of the non-profit sector might be narrower than that in ASHE.

Detailed information is collected on occupation from employees using the same classification as ASHE and from which we perform similar analysis within the public sector across PRBs. Within the QLFS some of the definitions are modified slightly given differences in data collection (see Appendix Table A.1). For example, Local Authority is defined using 'Local government or council (including police etc)'. Unlike ASHE, the QLFS contains observations from the AFPRB, which is defined following Dolton *et al*. (2015) to include 'Officers in UK armed forces' (SOC 1171) and 'COs and other ranks' (SOC 3311).

Information on gross hourly earnings is derived from employee self-reported information in the QLFS. There are two limitations with this, first it is subject to a more limited response

[44] It is standard academic practice to pool QLFS microdata across quarters and years to enhance the sample size (see, for example, Clark and Lindley, 2009). The LFS is a quarterly survey with 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. Since 1997, earnings data are collected in both waves 1 and 5. To avoid having repeated information on the same individual, our sample is restricted to individuals in wave 1. Individuals are retained from the following quarters: January - March, 2016 (7985), April - June, 2016 (8039), July – September, 2016 (8104), October - December, 2016 (8145), January - March, 2017 (8195), April - June, 2017 (8235), July – September, 2017 (8292), October - December, 2017 (8326), January - March, 2018 (8343), April - June, 2018 (8381), July - September, 2018 (8407), October - December, 2018 (8447). We acknowledge that the response rate within the QLFS has been declining overtime but note that it remains the largest household survey in the UK and is regularly used for examination of pay, including in relation to the GPG and sector. Due to the smaller sample size, however, we do not report all of the detailed estimates for PRBs that are presented for ASHE.

[45] Of the total sample, 56,805 individuals are employees and the maximum sample available for analysis of earnings is 49,695.

[46] About 36 per cent of employees provide information by proxy which is not utilised in this analysis.

[47] 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'.

[48] About 25 per cent of employees work in the public sector according to this definition, which is about 3 percentage points lower than the original QLFS definition.

rate than other questions in the survey and patterns of response may be non-random. Second, the self-reported information is subject to greater measurement error. However, the QLFS is recognised as being a high-quality source of earnings information and is used widely by ONS and in academic research (as noted above). Moreover, the GPG has been previously shown to be comparable between ASHE and the QLFS (Leaker, 2008). The reliability of the earnings information is also enhanced by eliminating outliers using the standard ONS recommended filter so that the maximum hourly wage is £99.

The standard QLFS measure of hourly pay is derived from gross weekly pay in the respondent's main job on the basis of total usual hours worked (including paid overtime).[49] This differs from the measure of hourly pay in ASHE, which excludes overtime. Since the amount of PRP is not available within the QLFS, sensitivity analysis cannot be undertaken with respect to this particular element of the analysis.[50]

Initially the personal and workplace characteristics used as control variables are selected to be as comparable as possible to ASHE.[51] However, the main reason for supplementing the analysis of ASHE is to enhance the earnings equations and decompositions to consider the robustness of the findings to the inclusion of education, marital status and dependent children. The analysis of the QLFS also enables us to control for other personal characteristics such as ethnicity and disability, important in the wider equalities literature. Highest qualification is classified into the following six aggregate groups: degree or equivalent; other higher education; A level or equivalent; O level or equivalent; other; none. Marital status is measured as a binary indicator (married/non-married) and a binary variable also records the presence of dependent children in the household under age 16. Ethnicity is measured as a binary variable (white/non-white) and disability is measured as a binary variable (disabled/non-disabled according to the Equality Act). All the specifications also include controls for quarter, year and their interaction given the data has been pooled across time. Throughout the analysis we provide supplementary figures from the QLFS as a comparator and to explore the sensitivity of qualitative patterns in the ASHE estimates. The corresponding summary statistics for the QLFS are included in Appendix Table A.2 (public compared to private) and A.3 (PRB occupations compared to non-PRB occupations). The sectoral and gender differences in occupational composition noted above are also evident within the QLFS. This is also reflected in the between and within sector comparisons in educational attainment, with employees in the public sector and in PRBs in particular holding higher level qualifications on average.

### 3.2 Statistical methodology

The statistical analysis has two core elements. First, an analysis of the GPG will be undertaken between the public and private sectors which will explore the determinants of public sector GPG across the distribution and in comparison to the private sector. This will be followed by a more detailed analysis of the drivers of the GPG within the public sector

[49] *What was your gross pay, that is your pay before any deductions, the last time you were paid?* It is adjusted for the pay period (week, month etc) and then usual paid hours (including overtime).

[50] Self-reported information on why the last pay varies from normal is used to construct a measure of PRP incidence (which includes a bonus, profit related pay and piecework payments or payments by results). However, the QLFS does not contain information from which to construct an annual measure of PRP. As such, the incidence of PRP is far lower in the QLFS than ASHE. Nevertheless, we find the same qualitative patterns, that is, PRP is less prevalent in the public relative to the private sector, and among male relative to female employees. However, given the very limited coverage of PRP (less than 1 per cent of public sector employees) this is not explored further using the QLFS.

[51] While it is possible to derive potential work experience using the QLFS, age is used to facilitate comparison with ASHE. The QLFS collects information on workplace size rather than firm size and this is collected in discrete bands. Union membership is only available in a single quarter (October-December each year) and so is not included as a control in the analysis of the QLFS. In many cases the precise definition of variables also differs between ASHE and the QLFS.

and across PRB occupations in particular. In both cases the focus will be on quantifying the determinants of the GPG through an established decomposition approach, which isolates the contribution of observable characteristics of workers and their jobs from unobserved influences, where the latter will include the influence of unequal treatment or pay discrimination in the labour market.

*Public and Private Sector GPGs*

Initially we estimate an Ordinary Least Squares (hereinafter, OLS) wage equation which pools observations from both male and female workers in the public and private sectors and explore whether there is a difference in the GPG by sector using an interaction term between gender and sector as follows:

$$ln\, E_i = \mu F_i + \boldsymbol{x_i\beta} + \alpha P_i + \gamma F_i P_i + \varepsilon_i \qquad i = 1,..,N; \tag{1}$$

where $i$ indexes the individual. The log of hourly pay ($E_i$) is regressed on a binary indicator of (female) gender ($F_i$), a set of control variables ($\boldsymbol{x_i}$), a binary indicator of (public) sector ($P_i$), and the interaction between gender and sector.[52] The GPG in the private sector is given by $\mu$, the public sector pay premium is given by $\alpha$ and $\gamma$ measures the difference in the GPG between the public and private sector. A constant is included in all specifications, but the control variables vary across specifications (and data sets). Personal characteristics include age (and age squared) and region of work, and work-related characteristics include temporary or part-time employment, occupation, tenure (and tenure squared) and firm size.[53] When these characteristics are excluded the coefficients provide information on the raw GPG. Their inclusion adjusts the GPG for differences in productivity-related characteristics between men and women.

Equation (1) assumes that the return to productivity-related characteristics ($\boldsymbol{\beta}$) is equal across sectors and genders. Relaxing both these assumptions, a within sector ($S$) gender ($G$) specific wage equation can be estimated:

$$ln\, E_i = \boldsymbol{x_i\beta_{G,S}} + \varepsilon_i \quad G = M,F;\ S = P,PR;\ \ i = 1,..,N_{G,S}; \tag{2}$$

and decomposition techniques (Oaxaca, 1973; Blinder, 1973) can be used to separate that part of within sector GPG due to differences in observed characteristics, or what is explained, from an unexplained component. The precise decomposition can take alternative forms, but an example is given below:

$$\overline{\ln E_{M,S}} - \overline{\ln E_{F,S}} = \left(\overline{\boldsymbol{x_{M,S}}} - \overline{\boldsymbol{x_{F,S}}}\right)\boldsymbol{b_{M,S}} + \overline{\boldsymbol{x_{F,S}}}\left(\boldsymbol{b_{M,S}} - \boldsymbol{b_{F,S}}\right) \tag{3}$$

where the bar denotes the mean value and, the coefficient $\boldsymbol{b}$ is the OLS estimate of $\boldsymbol{\beta}$, the 'return' to characteristics.[54] The decomposition separates the difference in earnings between the average male ($M$) and female ($F$) employee in sector $S$ into an explained and unexplained component. The former measures that part of the wage differential due to differences in the characteristics of men and women while the latter measures that part due to differences in the return to those attributes due to gender. The unexplained gap is typically interpreted as an upper bound measure of unequal treatment or discrimination since it includes the influence of unobserved gender differences in productivity or preferences. The

[52] In our first specification we exclude both the sector variable, the interaction term and the control variables. As such $\mu$ is then interpreted simply as the raw GPG across sectors.

[53] Unless otherwise stated occupation is defined by major SOC 2010 group but sensitivity analysis on the basis of more detailed occupation (4-digit group) is also performed.

[54] Equation (3) uses the coefficients for males from equation (2) under the assumption that these are equivalent to competitive returns. Since male-female differences in returns can also reflect discrimination, the use of male equation is intended to simulate a non-discriminatory labour market. Moreover, using male returns ameliorate the problems due to non-random selection into work since male employment rates are quite stable over time (Blau and Kahn, 1997; Kunze, 2008). The sensitivity of the results to using the female coefficients is, however, explored.

total explained gap can be further separated to identify the relative contribution of different personal and job-related characteristics to the explained component of the GPG. So, for example, the analysis can explore sectoral differences in the role of well-established drivers of the GPG such as part-time employment.

In a similar manner to Chatterji *et al*. (2011) and Jones *et al*. (2018) the above analysis focuses on average (mean) pay and does not take into account differences in the earnings distributions of each sector, with the pay distribution typically found to be narrower in the public sector. Moreover, the international academic literature on GPGs suggests that the gap is not constant across the wage distribution and an exclusive focus on the mean will neglect important insights offered by considering the distribution (see, for example, Albrecht *et al*., 2003; Arulampalam *et al*., 2007). Indeed, while analysis at the median provides a robustness test, analysis at the extremes of the distribution will identify where the GPG is most/least pronounced i.e. among low or high paid workers or, what are known as, 'sticky floors' and 'glass ceilings' in the context of the GPG (Albrecht *et al*., 2003; Arulampalam *et al*., 2007).

We repeat our analysis of the GPG at the mean using quantile regression methods (Koenker and Bassett, 1978) to estimate, in a similar manner to equation (1), sectoral differences in the GPGs at different points of the pay distribution (e.g. median, 25th and 75th percentiles). Formally, the $\theta^{\text{th}}$ $(0 < \theta < 1)$ conditional quantile of the log of hourly pay distribution is assumed to be linear in the set of covariates $\boldsymbol{x_i}$ along with the binary indicators of gender**,** sector and the interaction between gender and sector that is $q_\theta\big(\, ln\, E_i \big| F_i, \boldsymbol{x_i}, P_i, F_i P_i\big) = \mu(\theta)F_i + \boldsymbol{x_i}\boldsymbol{\beta}(\boldsymbol{\theta}) + \alpha(\theta)P_i + \gamma(\theta)F_i P_i$ implying:

$$ln\, E_i = \mu(\theta)F_i + \boldsymbol{x_i}\boldsymbol{\beta}(\boldsymbol{\theta}) + \alpha(\theta)P_i + \gamma(\theta)F_i P_i + \varepsilon_{\theta i} \qquad i = 1, .., N; \tag{4}$$

where $\varepsilon_{\theta i}$ satisfies $q_\theta\big(\varepsilon_{\theta i} | F_i, \boldsymbol{x_i}, P_i, F_i P_i\big) = 0$ and, in a similar manner to equation (1), the private sector GPG at the $\theta^{\text{th}}$ quantile is given by $\mu(\theta)$, and $\gamma(\theta)$ measures the difference in the GPG between the public and private sector at the $\theta^{\text{th}}$ quantile.

Equation (4) imposes the restriction that the return to productivity-related characteristics ($\boldsymbol{\beta}$) is equal across sector and gender. In a similar manner to above, relaxing both these assumptions, a version of equation (4) can be estimated by sector and gender:

$$ln\, E_i = \boldsymbol{x_i}\boldsymbol{\beta_{G,S}}(\boldsymbol{\theta}) + \varepsilon_{\theta i} \qquad G = M, F;\ S = P, PR;\ i = 1, .., N_{G,S} \tag{5}$$

where $q_\theta(\varepsilon_{\theta i} | \boldsymbol{x_i}) = 0$. Equation (5) can be estimated using the optimisation techniques described in Koenker and Bassett (1978) and the estimated vector of quantile regression coefficients, $\boldsymbol{b_{G,S}}(\boldsymbol{\theta})$, can be used to decompose the difference between males and females at different points of the log hourly pay distributions into an explained and unexplained component using a suitably adapted version of the decomposition method outlined in equation (3) by Machado and Mata (2005).[55,56] The GPG in sector $S$ at $\theta^{\text{th}}$ quantile can be decomposed as:

$$\boldsymbol{x_{M,S}}\boldsymbol{b_{M,S}}(\boldsymbol{\theta}) - \boldsymbol{x_{F,S}}\boldsymbol{b_{F,S}}(\boldsymbol{\theta}) = (\boldsymbol{x_{M,S}} - \boldsymbol{x_{F,S}})\boldsymbol{b_{M,S}}(\boldsymbol{\theta}) + \boldsymbol{x_{F,S}}(\boldsymbol{b_{M,S}}(\boldsymbol{\theta}) - \boldsymbol{b_{F,S}}(\boldsymbol{\theta})) \tag{6}$$

[55] The standard errors and confidence intervals for the quantile regression coefficient estimates are based on asymptotic standard errors (Koenker and Hallock, 2001).

[56] The precise steps of the decomposition can take alternative forms, but an example is given below:
(1) Generate a random sample of size $m$ from a uniform distribution $U[0,1]$: $\theta_1, \theta_2, \ldots, \theta_m$.
(2) For each $\theta$ estimate the vector of sector specific quantile regression coefficients $\boldsymbol{b_{F,S}}(\boldsymbol{\theta})$ and $\boldsymbol{b_{M,S}}(\boldsymbol{\theta})$ for females and males respectively.
(3) Generate for each gender from each sector a random sample of size $m$ (with replacement) and use their characteristics, $\boldsymbol{x_{G,S}}$ and the estimated vector of coefficients, $\boldsymbol{b_{G,S}}(\boldsymbol{\theta})$ to generate three sets of predicted earnings: (i) the simulated female pay distribution $\boldsymbol{x_{F,S}}\boldsymbol{b_{F,S}}(\boldsymbol{\theta})$, (ii) the simulated male pay distribution $\boldsymbol{x_{M,S}}\boldsymbol{b_{M,S}}(\boldsymbol{\theta})$, and (iii) the counterfactual pay distribution $\boldsymbol{x_{F,S}}\boldsymbol{b_{M,S}}(\boldsymbol{\theta})$ that is the pay distribution of females in sector $S$ that would have prevailed if women had been endowed with their own characteristics but were paid like men.
(4) Compare the counterfactual distribution in sector $S$ with the $\theta^{\text{th}}$ quantiles of the simulated male and female pay distributions.

where the first component is the contribution of differences in productivity-related characteristics and the second component is the contribution of differences in the coefficients to the difference between the $\theta^{th}$ quantile of the male and female pay distributions.

*Within Public Sector GPGs*

The GPG within the public sector is also explored in two ways. First between PRB and non-PRB occupations and then by occupations defined separately by each PRB (as outlined in Section 3.1 above), although it is recognised that occupations cannot be identified for all PRBs (see above). In a corresponding manner, differences in the GPG between PRB and non-PRB occupations are explored using the wage equations and decomposition methods set out above (equations (1)-(6)) but where the comparisons are undertaken within the public sector. A similar comparison will be undertaken at the mean and across the earnings distribution.

Given the smaller sample sizes within each PRB, the analysis of each PRB will be undertaken using a version of equation (1) and, by estimating an equation for each of the five PRBs separately which relaxes the assumption of constant returns to characteristics across PRBs but retains the assumption of constant returns to characteristics across gender.[57] In this case, the equations pool males and females as follows:

$$ln\, E_i = \mu_{RB} F_i + \boldsymbol{x_i \beta_{RB}} + \varepsilon_i \qquad RB = PRB1 - PRB5;\ i = 1, .., N_{RB}; \tag{7}$$

The PRB specific GPG is given by $\mu_{RB.}$ As above the inclusion of productivity-related characteristics adjusts the raw GPG for differences in observable characteristics between men and women, such that, in the most comprehensive model $\mu_{RB}$ can be interpreted in a similar manner to a within PRB unexplained GPG (see Elder *et al*., 2010). This serves as a proxy for gender inequality within each PRB and, in doing so, addresses an important evidence gap (see DDRB, 2017).

*Occupational choice*

As noted above, some of the PRB occupations are characterised by considerable gender segregation. As such, the public sector GPG will be determined by the allocation of men and women across occupations in addition to the GPG within occupations which is explored above. Using estimates of the probability of being employed in each public sector occupation (defined by PRBs) it is possible to separate the public sector GPG into the contribution of 'between' and 'within' occupation GPGs as follows:

$$\overline{\ln E_{M,P}} - \overline{\ln E_{F,P}} = \sum_{RB}(p_{M,RB} - p_{F,RB})\,\overline{\ln E_{M,RB}} + \sum_{P} p_{F,RB}\left(\overline{\ln E_{M,RB}} - \overline{\ln E_{F,RB}}\right) \tag{8}$$

The first and second terms on the right-hand side of equation (8) show, respectively, the 'between' occupation differential and the 'within' occupation differential, where the probability of being employed within each public sector occupation is $p_{M,RB}$ and $p_{F,RB}$ for men and women respectively. That is, it will quantify whether the GPG in the public sector stems from men and women working in different occupations ('between') or differences in pay within a given occupation ('within'). Within ASHE (QLFS) we consider 5 (6) PRBs and define the rest of the public sector as the non-PRB occupation.

We further explore the impact of gender on occupational choice as measured by the PRB and non-PRB public sector occupations using a multinomial logit model as follows:

[57] For those PRBs where the sample size permits, we also perform the full decomposition (equation (3)) by sector and gender but the results are qualitatively similar, so we present findings on the basis of a comparable approach across PRBs.

$$\Pr(Y_i = RB|F_i, \boldsymbol{x_i}) = \frac{\exp(\mu_{RB}F_i + \boldsymbol{x_i\beta_{RB}})}{\sum_{k=1}^{k=r}\exp(\mu_{RB}F_i + \boldsymbol{x_i\beta_{RB}})} \quad (9)$$

where $Y_i$ is a polychotomous variable indicating the occupation of individual $i$, conditional on public sector employment. In our case occupation is defined as one of the ($k$) PRBs (PRB1-PRB5) and the (non-PRB) public sector ($r = 6$). The latter is used as the reference group and all the coefficient estimates are estimated relative to this. A multinomial logit model is selected since occupation has more than two possible discrete outcomes that have no natural order. We build up the model such that the coefficient $\mu_{RB}$ identifies the influence of being female on working in each of the PRBs (relative to the rest of the (non-PRB) public sector) before and after accounting for other personal characteristics ($\boldsymbol{x_i}$). The model therefore assumes that individuals select an occupation which maximises their utility, conditional on their personal characteristics. As work-related characteristics are potentially outcomes of occupational choice rather than determinants, we do not control for them within this model. The narrow range of personal characteristics available in ASHE limits the set of control variables available. As such, we estimate an additional specification in the QLFS with an extended set of personal characteristics (as discussed in Section 3.1) but nevertheless acknowledge the omission of important influences such as subject choice or family background/parental occupation. An adjusted gender difference in the probability of working within PRBs would, however, be consistent with gender differences in occupational preferences or employer hiring and will capture the influence of occupational culture raised by the AFRB (2017). In order to quantify the estimates, we present average marginal effects (AMEs) which illustrate the percentage point change in the probability of being employed within each PRB, rather than coefficient estimates.

*PRP*

In terms of the final research objective, we investigate the gender gap in PRP between and within sectors. The former is motivated by recent attention on PRP within the public sector (Work Foundation, 2014; Bryson *et al*., 2017), evidence that women are often more reluctant to enter competitive environments (Niederle and Vesterlund, 2007) and widespread evidence of a gender bonus gap in organisational GPG reporting. While pronounced sectoral differences are evident within these data, the gender bonus gap is typically neglected in measures of hourly pay within the academic literature and in previous analysis of sectoral GPG differences. Consistent with national reporting measures, our analysis explores sectoral gender differences in the incidence of PRP and, the corresponding gender gap in the amount of PRP, based on the annual measure outlined in Section 3.1.

To explore the gender gaps in the incidence of PRP (see, for example, Jirjahn and Stephan, 2004; Xiu and Gunderson, 2013) in the public and private sector, we estimate a probit model of the form:

$$\Pr(\mathbf{I}(PRP_i > 0)|\, F_i, \boldsymbol{x_i}, P_i, F_iP_i) = \Phi(\mu F_i + \boldsymbol{x_i\beta} + \alpha P_i + \gamma F_iP_i) \qquad i = 1,..,N; \quad (10)$$

where the indicator function $\mathbf{I}(\cdot)$ takes the value 1 if individual $i$ received any incentive payments during the preceding year (i.e. $PRP_i > 0$) and is 0 otherwise, and $\Phi(\cdot)$ is the cumulative distribution function of the standardised normal distribution. In a similar manner to equation (1) the model pools workers across sectors and by gender so the effect of being female on the probability of receiving PRP in the private sector is given by $\mu$, and $\gamma$ measures the difference in the influence of gender between the public and private sector. The set of control variables $\boldsymbol{x_i}$ include the same set of personal and work-related characteristics outlined in Section 3.1 above. The empirical evidence suggests that women are less likely than men to be employed in jobs in which compensation is based on performance (see Manning and Saidi, 2010 for the UK; McGee *et al*., 2015 for the US) and

our analysis will establish whether there are sectoral differences in this regard. As with the multinomial logit model above, we present AMEs rather than coefficient estimates to quantify the influence of gender and sector on the probability of receipt of PRP. For ease of interpretation of the interaction terms, we also present the predicted probability of receipt of PRP by gender and sector.

Given the availability of the amount of PRP within ASHE, we also explore sectoral differences in the gender gap in the level of PRP, conditional on receipt of PRP, in a similar manner to Albanesi *et al*. (2015) and Xiu and Gunderson (2013), by estimating an analogous equation to equation (1) in which dependent variable is the log of PRP received during the preceding year:

$$\ln PRP_i = \mu F_i + \boldsymbol{x_i}\boldsymbol{\beta} + \alpha P_i + \gamma F_i P_i + \varepsilon_i \qquad i = 1,..,N_{PRP}; \tag{11}$$

In equation (11), the coefficient on the (female) gender dummy ($\mu$) can be interpreted as the GPG in PRP in the private sector and $\gamma$ measures the difference in this between the public and private sector. As above, the inclusion of productivity-related characteristics in this model means an adjusted GPG in PRP can also be estimated.[58]

[58] We also estimate a similar version of equations (10) and (11) on public sector employees to identify differences in gender gaps between PRB and non-PRB occupations.

## 4. Results

### 4.1 Descriptive statistics

#### 4.1.1 Employment

In Table 2 we present estimates of employment by PRBs, along with the percentage of employees in these occupations who are female. The second panel of Table 2 presents these figures for the rest of the (non-PRB) public sector and the final panel presents figures by sector for comparative purposes. The PRBs account for about 46 per cent of public sector employees, with the NHSPRB alone accounting for nearly 30 per cent (or 63 per cent of PRB employees). Consistent with Bryson and Forth (2017), relative to published estimates (OME Business Plan 2017-2018), the figures from ASHE over-estimate the coverage of the NHSPRB and PRRB and the extent of this is considerable, with OME estimates of 1,356,000 and 133,000 respectively. The latter in particular is difficult to explain given our estimates are based on the occupational codes for senior police officers and police officers.

In line with existing evidence, women are disproportionately represented in public sector employment, accounting for two-thirds of public sector employees. The concentration of women is slightly higher within PRBs and the differences across PRBs are stark, with females representing about 80 per cent of NHSPRB employees, compared to about 30-35 per cent in the PRRB and PSPRB.[59] Although the precise estimates vary, figures from the QLFS show the same qualitative patterns and additionally indicate that the prevalence of females in the AFPRB is even lower at 15 per cent.[60]

**Table 2.** Total number of employees and percentage female, by sector and within the public sector

| | ASHE | | | QLFS | | |
|---|---|---|---|---|---|---|
| | Employees | % | % female | Employees | % | % female |
| PRB | 2,580,354 (15,648) | 45.85 | 70.36 | - (4,997) | 40.17 | 74.86 |
| DDRB | 202,937 (1,077) | 3.61 | 44.55 | - (320) | 2.57 | 53.75 |
| NHSPRB | 1,632,783 (10,517) | 29.02 | 79.09 | - (2,965) | 23.84 | 82.83 |
| PRRB | 211,040 (1,122) | 3.75 | 29.91 | - (235) | 1.89 | 30.21 |
| PSPRB | 23,156 (120) | 0.41 | 34.43 | - (64) | 0.51 | 28.13 |
| STRB | 510,439 (2,812) | 9.07 | 71.03 | - (1,284) | 10.32 | 78.27 |
| AFPRB | - | - | - | - (129) | 1.04 | 14.73 |
| Non-PRB public | 3,046,955 (20,193) | 54.15 | 64.46 | - (7,442) | 59.83 | 68.46 |
| Public sector | 5,627,309 (35,841) | 23.12 | 67.16 | - (12,439) | 25.93 | 71.03 |
| Private sector | 16,620,206 (109,713) | 68.29 | 41.49 | - (32,362) | 67.46 | 49.42 |
| Non-profit sector | 2,090,050 (13,186) | 8.59 | 60.82 | - (3,168) | 6.60 | 68.43 |

*Notes*: (i) Number of observations (unweighted) is in parentheses. (ii) Figures within the public sector are expressed as a proportion of public sector employment. Sectoral figures are expressed as a proportion of total employment.

[59] In analysis of its own data the NHSPRB (2019) similarly reports that women account for about 80 per cent of the Agenda for Change workforce and the PRRB (2019) report that about 30 per cent of police offers are female.

[60] This is consistent with data from the Ministry of Defence which suggests 11 per cent of regular and 15 per cent of reserve service personnel are female (AFPRB, 2019). Figures from the QLFS are, however, based on small sample sizes.

### 4.1.2 Hourly pay

Table 3 presents the mean of our dependent variable, gross hourly pay for all, male and female employees by PRBs and other (non-PRB) public sector occupations. For comparison purposes, the mean hourly pay in the private and non-profit sectors are also included. We also explore hourly pay across the distribution in the analysis which follows, including at the median which is the preferred measure of the GPG in ASHE. Consistent with previous evidence, the raw GPG within the public sector (19 per cent) is narrower than that in the private sector (21 per cent). Within the public sector the GPG is similar between PRBs and non-PRB occupations. However, there is far greater variation between individual PRBs. The highest GPG is in the DDRB (19 per cent) and it is substantially greater than the 7-8 per cent gap in the NHSPRB and PRRB. The fact that the GPG for the PRBs in aggregate exceeds that within any individual PRB is a likely reflection of gender differences in the employment composition across PRBs, that is, women are more likely to be concentrated in PRBs with lower average hourly pay and we explore this further in Section 4.2.2. The data also exhibit a well-established raw public sector pay premium, which is proportionally larger for women. Within the public sector, and consistent with the occupational distribution noted earlier, employees are also paid more on average in PRB occupations than non-PRB occupations. The average wage is considerably higher in the DDRB than across the other PRBs.

As might be expected given differences in the sample, measures and data collection methodology, as discussed in Section 3.1, there are differences in the estimates of average hourly pay between ASHE and the QLFS.[61] The average hourly pay figures in the QLFS are consistently lower than ASHE but the sectoral GPGs have a similar pattern. The GPG within PRB occupations is, however, considerably narrower than non-PRB occupations in the QLFS and the patterns in the GPG across PRBs are not entirely consistent with ASHE, although the DDRB has the highest GPG. This might partly be a consequence of the small sample sizes for some PRBs in the QLFS.

**Table 3.** Mean gross hourly pay (£), by sector and within the public sector

| | ASHE | | | | QLFS | | | |
|---|---|---|---|---|---|---|---|---|
| | All | Male | Female | GPG (%) | All | Male | Female | GPG (%) |
| PRB | 19.43 | 22.47 | 18.15 | 19.23 | 16.66 | 18.72 | 15.95 | 14.80 |
| DDRB | 35.24 | 38.43 | 31.26 | 18.66 | 29.58 | 32.38 | 27.16 | 16.12 |
| NHSPRB | 15.89 | 16.87 | 15.64 | 7.29 | 14.49 | 15.17 | 14.35 | 5.41 |
| PRRB | 19.36 | 19.83 | 18.26 | 7.92 | 17.09 | 17.62 | 15.88 | 9.88 |
| PSPRB | 14.62 | 15.34 | 13.26 | 13.56 | 12.74 | 12.92 | -* | -* |
| STRB | 24.70 | 26.64 | 23.91 | 10.25 | 18.36 | 19.47 | 18.06 | 7.24 |
| AFPRB | - | - | - | - | 18.59 | 18.91 | -* | -* |
| Non-PRB public | 15.93 | 18.34 | 14.61 | 20.34 | 13.85 | 16.56 | 12.61 | 23.85 |
| Public sector | 17.54 | 20.05 | 16.31 | 18.65 | 14.98 | 17.31 | 14.03 | 18.95 |
| Private sector | 15.71 | 17.20 | 13.59 | 20.99 | 14.38 | 16.38 | 12.35 | 24.60 |
| Non-profit sector | 16.73 | 18.95 | 15.30 | 19.26 | 15.22 | 17.61 | 14.12 | 19.82 |

*Notes*: (i) The GPG is calculated as a percentage of the average male wage. *Figure not presented due to lack of sufficient number of observations.

In addition to presenting figures at the mean, Figures 1a and 1b present the percentiles of gross hourly pay in ASHE across the distribution by sector and by PRB and non-PRB public sector occupations, respectively.[62,63] These illustrate the hourly pay range within each

[61] Comparing data for 2018 only and using actual rather than usual hours in the QLFS narrows the differential but average hourly earnings remain below ASHE despite the inclusion of overtime pay. This might be a consequence of the measurement of pay or hours since the latter are contracted hours in ASHE reported by the employer.

[62] We do not present the corresponding information for each PRB due to the smaller sample sizes.

sector/occupation. That the distribution within the public sector tends to lie above that in the private sector in Figure 1a is consistent with a public-sector pay premium across most of the distribution. In both sectors the male distribution tends to lie above the female distribution consistent with a GPG across most of the distribution. Figure 1b is consistent with higher average pay within PRB occupations, but with the difference more pronounced towards the upper end of the wage distribution, consistent with the concentration of high-skilled professional occupations. The GPG also appears to widen considerably above the 70th percentile within PRB occupations.

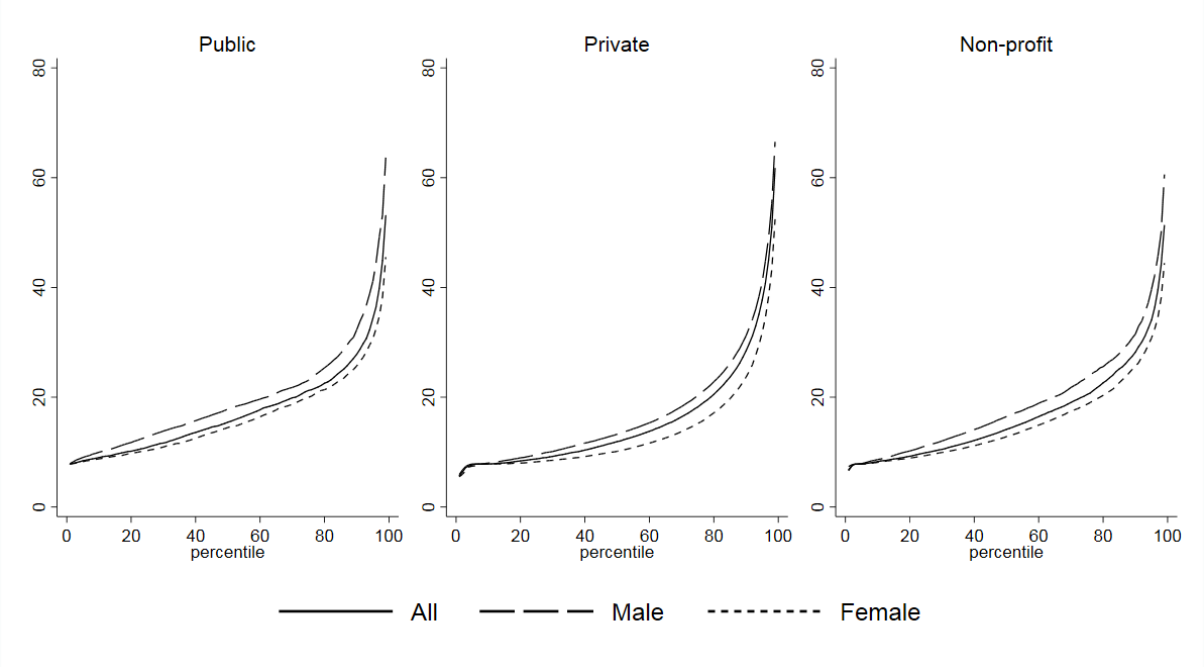


**Figure 1a.** Gross hourly pay (£) across the distribution, by sector

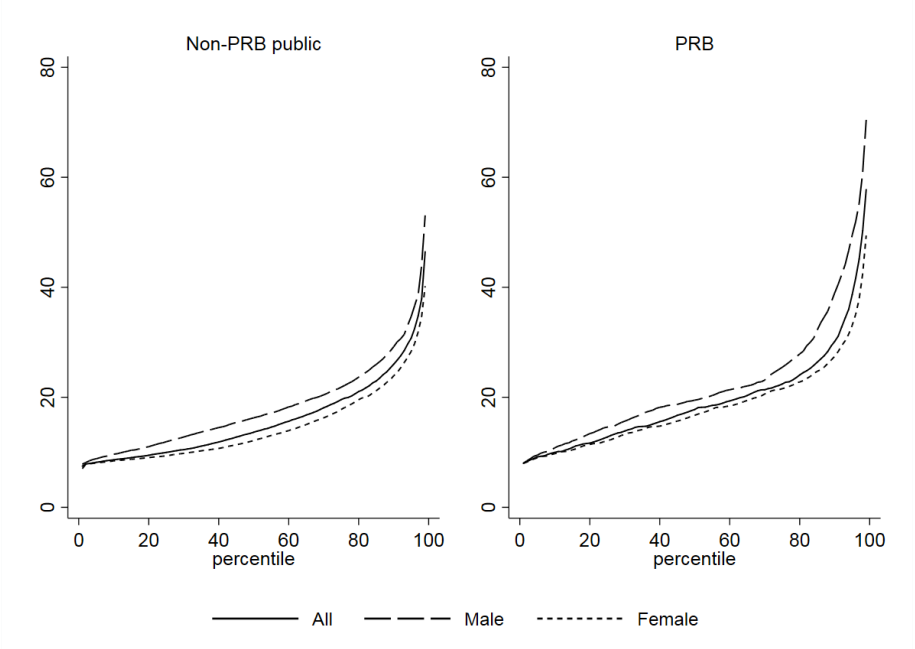


**Figure 1b.** Gross hourly pay (£) across the distribution, within the public sector

[63] Tables A.4 and A.5 report (rounded) values for gross hourly pay and an approximate pro-rata annual (salary) conversion at selected percentiles (10th, 25th, 50th, 75th and 90th) across sectors, and within the public sector, respectively.

Next, we explore pay progression by constructing the empirical age-earnings profiles of males and females over the lifecycle. Figure 2a presents the sectoral age-earnings profiles of male and female employees in ASHE by plotting the average gross hourly pay in each age-group (<30, 30-39, 40-49, 50-59, and 60+) for all employees and by gender, while in Figures 2b and 2c, we focus on PRB occupations.[64] Previous evidence suggests that there are significant differences between the lifecycle earning profiles of men and women (Manning, 2000). In general, the pattern is of a small initial gap which diverges by age, though less so in later years. While the dynamic effects of childbirth are important in explaining the gender differences in lifecycle patterns, pay structures and gender differences in progression between sectors may also play a role.

Figure 2a confirms that the raw GPG in the public sector differs by age group. Indeed, the raw gap is virtually non-existent for employees below age 30. Although average wages increase with age they do so to a lesser extent for women, giving rise to a GPG among those aged 30-39. After this point the average female wage declines with age, whereas for men the average wage increases and reaches a peak between age 40-49. The GPG thus increases with age within the public sector and then remains of a broadly comparable magnitude for those aged 50-59 and 60+. Although the GPG displays a similar pattern in the private sector, there appears to be a greater GPG for those aged less than 30. However, on the basis of these raw figures it is not possible to separate the influence of age, which might reflect gender differences in human capital accumulation as discussed in Section 2.3.1, from cohort (year of birth) effects, where it is generally assumed that younger cohorts experience greater gender equality.

Figures 2b and 2c present the same information within the public sector. The age-earnings profiles are more pronounced in PRB occupations, with higher initial wages and substantial wage growth until age 40-49. In both PRB and non-PRB occupations, wage growth is, however, more rapid for men giving rise to a GPG by age 30-39. While female wages continue to grow until age 40-49 in PRB occupations, the GPG widens in both PRB and non-PRB occupations. Indeed, since the average male wage continues to grow in PRB occupations until age 50-59, perhaps an indicator of opportunities for progression within these occupations, there is a further widening of the GPG with age, particularly after age 40-49. There is no evidence of a GPG for employees below age 30 in any of the separate PRBs considered (Figure 2c). The average wages of men and women in the NHSPRB and PRRB track each other closely across the age groups. Wage growth with age is more pronounced within the DDRB but is slower for women giving rise to an increasing GPG with age. In contrast, a GPG emerges within the STRB by age 30-39, but after widening, subsequently narrows for those aged 60+. It should, however, be noted that some of the figures for the PRBs, particularly for those aged 60+, are based on relatively small sample sizes.

[64] Due to lack of sufficient number of observations, the figures are not presented for PSPRB and the age group 60+ for PRRB.

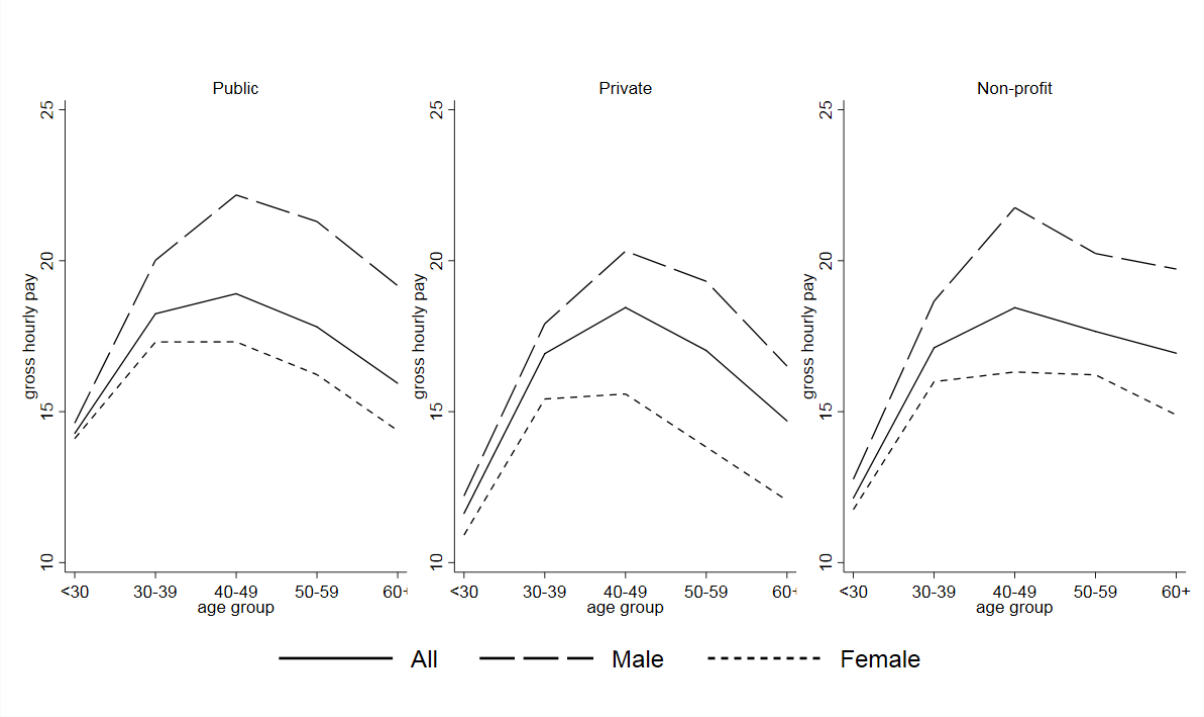


**Figure 2a.** Age-earning profiles, by sector

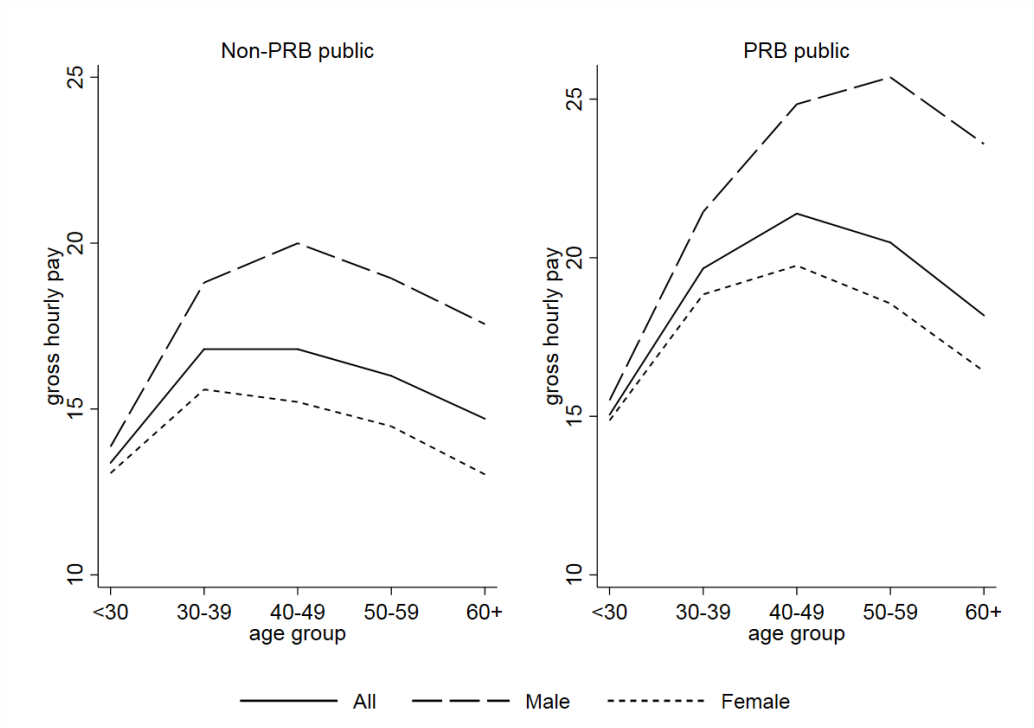


**Figure 2b.** Age-earning profiles, within the public sector

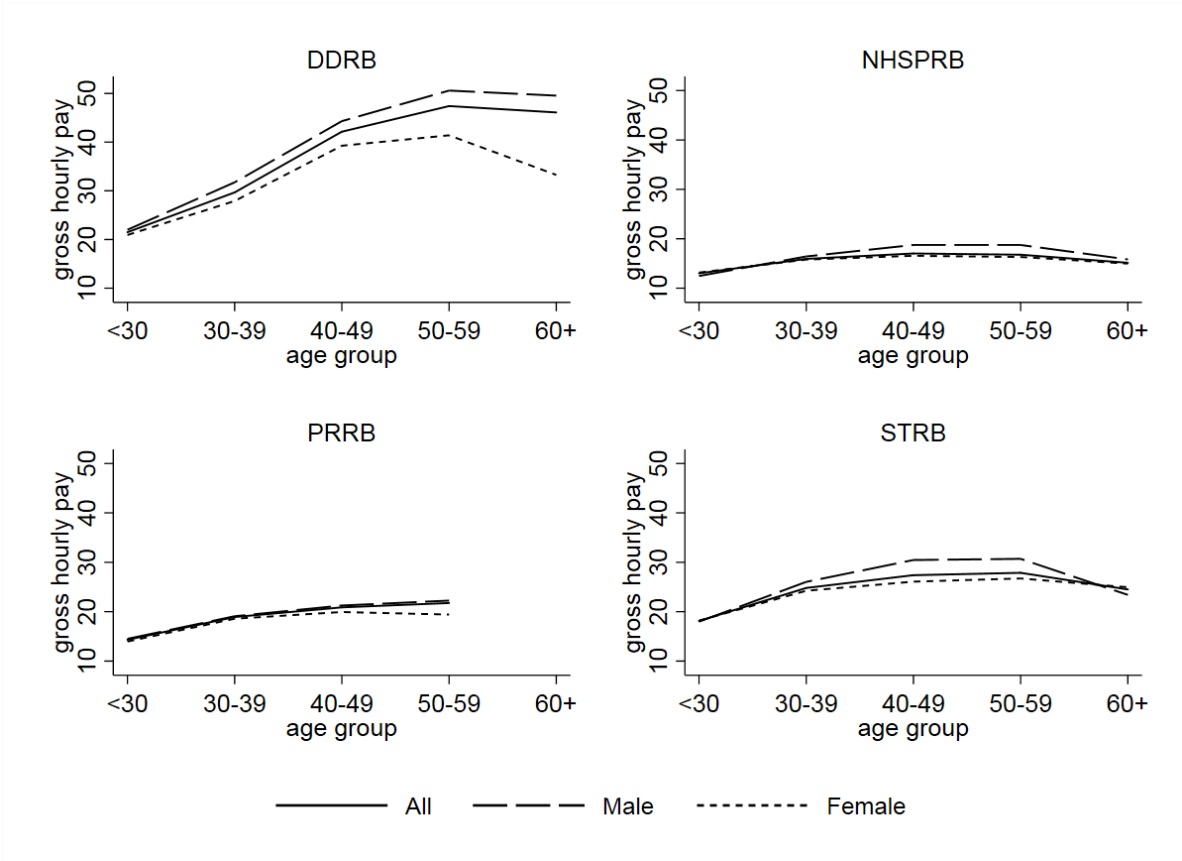


**Figure 2c.** Age-earning profiles, selected PRBs

### 4.1.3 PRP

Next we present descriptive statistics on PRP, measured as the component of gross annual earnings that comes from incentive payments. The figures show the incidence of PRP by gender and by sector, and then within the public sector (in Table 4a) and the average amount of annual PRP conditional on incidence (in Table 4b). However, in terms of the latter, the small sample sizes preclude meaningful investigation within separate PRBs.

In comparison to the private sector where over a third of workers receive PRP, there is a relatively low incidence of PRP in the public sector (5 per cent) and within PRB occupations in particular (2 per cent). Consistent with the existing evidence, females are less likely to be paid PRP, although in relative terms the gender differential is larger in the public sector (4 per cent of women compared to 9 per cent of men). Females are also less likely to be in receipt of PRP in most PRBs.[65] Conditional on receipt of PRP, workers in the public sector also earn a lower amount of PRP. The gender differential is, however, far narrower in the public sector at 8 per cent compared to more than 40 per cent in the private sector. The latter, which is larger than the GPG, is consistent with existing evidence and the sizeable gender bonus gaps noted in company GPG Reporting figures. Conditional on receipt, the level of PRP is higher in PRB than non-PRB occupations but the gender gap within each is similar at between 11-12 per cent. It should, however, be noted that gender comparisons in the annual measure of PRP might be sensitive to the composition of employment in terms of full-time and part-time workers, something which we consider in the econometric analysis which follows.

[65] The exception is the PSPRB, where the sample size is relatively small, although within the STRB the incidence is similar by gender.

**Table 4a.** Incidence of PRP (per cent), by sector and within the public sector

| | | All | Male | Female |
|---|---|---|---|---|
| PRB | | 1.83 | 2.98 | 1.35 |
| | | (15,648) | (4,120) | (11,528) |
| | DDRB | 2.69 | 3.06 | 2.22 |
| | | (1,077) | (543) | (534) |
| | NHSPRB | 1.09 | 2.06 | 0.84 |
| | | (10,517) | (2,012) | (8,505) |
| | PRRB | 5.08 | 5.39 | 4.35 |
| | | (1,122) | (788) | (334) |
| | PSPRB | 5.14 | 3.94 | 7.45 |
| | | (120) | (79) | (41) |
| | STRB | 2.37 | 2.51 | 2.31 |
| | | (2,812) | (698) | (2,114) |
| Non-PRB public | | 8.39 | 13.32 | 5.67 |
| | | (20,193) | (6,597) | (13,596) |
| Public sector | | 5.38 | 9.04 | 3.59 |
| | | (35,841) | (10,717) | (25,124) |
| Private sector | | 36.16 | 39.65 | 31.23 |
| | | (109,713) | (60,689) | (49,024) |
| Non-profit sector | | 8.16 | 8.80 | 7.75 |
| | | (13,186) | (4,683) | (8,503) |

*Notes*: Number of observations (unweighted) is in parentheses.

**Table 4b.** Average amount of annual PRP conditional on receipt, by sector and within the public sector

| | All | Male | Female | GPG (%) |
|---|---|---|---|---|
| PRB | 3,414.14 | 3,644.28 | 3,200.63 | 12.17 |
| | (273) | (125) | (148) | |
| Non-PRB public | 1,959.31 | 2,056.13 | 1,833.86 | 10.81 |
| | (1,604) | (862) | (742) | |
| Public sector | 2,186.66 | 2,272.75 | 2,080.84 | 8.44 |
| | (1,877) | (987) | (890) | |
| Private sector | 5,206.68 | 6,146.21 | 3,524.26 | 42.66 |
| | (38,124) | (23,439) | (14,685) | |
| Non-profit sector | 1,953.62 | 2,725.49 | 1,388.68 | 49.05 |
| | (1,078) | (419) | (659) | |

*Notes*: (i) Number of observations (unweighted) is in parentheses. (ii) The GPG is calculated as a percentage of the average male level of PRP.

### 4.2 Econometric analysis

#### 4.2.1 Between sector regression and decomposition analysis

*Regression analysis*

Table 5 reports the OLS pay regression estimates from various specifications of equation (1) which pool the sample of public and private sector employees. In the first specification, named as Model (1), the log gross hourly pay is regressed on a female dummy variable and a constant. The coefficient estimate of the female variable in this model provides a measure of the raw or unadjusted GPG that does not take into account any differences between men and women in terms of their sector of employment or other characteristics. In Model (2), we also control for sector and an interaction term between gender and sector. This facilitates comparison of sector raw GPGs. Then, we present three more specifications, Models (3)-(5), where we gradually add the personal characteristics, work-related characteristics and occupational controls discussed in Section 3.1. In this way, we adjust the GPG (measured by the estimate of the female dummy variable coefficient) for productivity-related characteristics between men and women. Appendix Table A.6, presents the coefficient

estimates on all other explanatory variables but here we focus on our key variables and only present the coefficient estimates on the female and sector indicators, and the interaction term.[66] The final two columns provide estimates from the QLFS, first on the basis of a comparable model to Model (5) and then from an enhanced specification (Model (6)) which additionally controls for highest qualification, marriage, dependent children, ethnicity and disability. The QLFS estimates also include controls for quarter, year and the interaction between them given the data is pooled across time.

The results from Model (1) suggest a significant overall raw GPG of 16 log points, which for simplicity and ease of interpretation, we refer to throughout as approximating the percentage difference.[67] Model (2) separates the raw GPG by sector and, relative to the private sector, there is a slightly narrower GPG in the public sector (approximately 2 per cent). The public sector also displays a sizeable raw wage premium relative to the private sector at just over 20 per cent for men. However, this declines and actually becomes a small penalty after the inclusion of a full set of control variables (Model (5)). The inclusion of work-related characteristics in Model (4) reduces the size of the GPG but it remains significantly narrower in the public sector. The inclusion of occupation in Model (5) narrows the adjusted GPG further but it now becomes insignificantly different from zero across sectors.[68] The adjusted GPG remains significant in Model (5), consistent with an unexplained GPG across sectors of approximately 11 per cent. The lack of sectoral differential is, however, in contrast to arguments of greater pay equality within the UK public sector (see Jones *et al*., 2018). In corresponding analysis of the QLFS, we observe a similar, but slightly larger, unexplained GPG which is approximately 2 per cent narrower in the public relative to the private sector. The public sector pay penalty evident in ASHE Model (5) is, however, more pronounced in the QLFS. Interestingly, the inclusion of additional personal characteristics in the QLFS appears to make little difference to the pattern of estimates between Models (5) and (6).

**Table 5.** OLS pay regression results, public and private sector

| | ASHE | | | | | QLFS | |
|---|---|---|---|---|---|---|---|
| Model | (1) | (2) | (3) | (4) | (5) | (5) | (6) |
| Female | -0.164*** | -0.211*** | -0.197*** | -0.132*** | -0.113*** | -0.147*** | -0.140*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) | (0.005) | (0.005) |
| Public | - | 0.205*** | 0.160*** | 0.159*** | -0.035*** | -0.080*** | -0.101*** |
| | | (0.005) | (0.005) | (0.005) | (0.005) | (0.008) | (0.008) |
| Female × Public | - | 0.020** | 0.017** | 0.016** | 0.003 | 0.025* | 0.022* |
| | | (0.006) | (0.006) | (0.006) | (0.005) | (0.010) | (0.010) |
| Personal characteristics | x | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ | ✓ | ✓ |
| Population size | | | 22,247,515 | | | - | |
| Number of observations (unweighted) | | | 145,554 | | | 44,801 | |
| $R^2$ | 0.03 | 0.06 | 0.20 | 0.25 | 0.50 | 0.43 | 0.46 |

*Notes*: (i) Sample includes public and private sector employees. (ii) Reference category for sector is private sector. (iii) Models (1)-(5) are as set out in the text. All models include a constant term. Model (6) includes the following additional characteristics available in the QLFS: highest qualification, marriage, dependent children, ethnicity and disability. All estimates based on QLFS additionally control for year, quarter and their interaction. (iv) Standard errors in parentheses. (v) * p < 0.05, ** p < 0.01, *** p < 0.001.

[66] The coefficient on the constant term is omitted as part of the UKDA's disclosure policy. The coefficient estimates generally conform to expectations with a positive but diminishing return to age and tenure, a part-time pay penalty and a premium which rises with the average skill level of the occupation.

[67] More accurately, a -0.164 difference in log points is equivalent to a $[exp(-0.164) - 1] = -15$ per cent differential.

[68] Interestingly it remains significant, if instead, more detailed (4-digit) occupational controls are included.

*Decomposition analysis*

The results presented in Table 5 are based on equations that assume each control variable has the same impact on earnings by gender and by sector (see Section 3.2). By estimating a version of these equations separately by gender and sector (see equation (2)), decomposition techniques (Oaxaca, 1973; Blinder, 1973) can be used to separate that part of within sector GPG due to differences in observed characteristics, or what is explained, from an unexplained component, which is closer to a measure of pay inequality. In Table 6, we present the decomposition analysis results performed by estimating a comprehensive specification including personal, work-related and occupation control variables, separately for males and females within each sector. The difference in earnings between the average male and female in each sector is presented in the first row ('Difference in mean log gross hourly pay between men and women'). 'Difference due to characteristics (explained)' is the first component obtained from the decomposition and measures that part of the wage differential due to differences in the characteristics of men and women. The second component, 'Difference due to coefficients (unexplained)', measures that part due to differences in the return to those characteristics attributed due to gender and is typically interpreted as an upper bound measure of unequal treatment.[69]

The results in Table 6 suggest only a relatively small amount of the public sector GPG (21 per cent) can be attributed to differences in personal and work-related characteristics between men and women.[70] The vast majority of the 19 per cent public sector GPG is due to differences in the coefficients which reflect the returns to these characteristics and is therefore unexplained or potentially attributable to unequal treatment or discrimination (see Section 2.2.2). Although the raw GPG is larger in the private sector, slightly more than half is explained in this sector, which leaves a smaller absolute unexplained GPG relative to the public sector. It is also confirmed by analysis of the QLFS, albeit the proportion of the public sector GPG which is explained is larger. Moreover, this qualitative pattern is robust to a range of sensitivity analysis, including the measurement of pay, different specifications in relation to occupation and restriction to full-time employees (see Appendix Tables A.8 and A.9). That the unexplained GPG is no narrower in the public relative to the private sector contrasts to previous analysis based on earlier data (see, for example, Jones *et al*., 2018). From the cross-sectional analysis here it is not possible to speculate whether this is a consequence of wage restraint in the public sector arising as a consequence of austerity or it reflects relative improvements within the private sector. Nevertheless, and in a similar manner to Jones *et al*. (2018) who found the unexplained GPG within the UK public sector to have been stable over time despite a range of measures to enhance pay equality, it questions the extent to which the more stringent equality requirements in the public sector are effective.

[69] In Appendix Tables A.8 and A.9, we explore the sensitivity of the results presented in Table 6 to the alternative definitions of hourly pay (Table A.8), to the exclusion of occupation from the specification, to the inclusion of detailed occupation, to the exclusion of part-time employees from the sample, to the decomposition method, and the year of analysis (Table A.9).

[70] In further analysis, occupation is found to be the most important factor driving the explained gap within both sectors, consistent with the occupational segregation by gender highlighted in the descriptive statistics. In absolute terms the influence of occupation is, however, greater in the private sector.

**Table 6.** Decomposition of the GPG, public and private sector

| | ASHE | | QLFS | | | |
|---|---|---|---|---|---|---|
| | Model (5) | | Model (5) | | Model (6) | |
| | Public | Private | Public | Private | Public | Private |
| Difference in mean log gross hourly pay between men and women | 0.191*** (0.005) | 0.211*** (0.003) | 0.199*** (0.010) | 0.267*** (0.006) | 0.199*** (0.010) | 0.267*** (0.006) |
| Difference due to characteristics (explained) | 0.041*** (0.005) [21.2%] | 0.118*** (0.003) [56.0%] | 0.080*** (0.010) [40.2%] | 0.160*** (0.007) [59.9%] | 0.091*** (0.010) [45.6%] | 0.168*** (0.007) [62.9%] |
| Difference due to coefficients (unexplained) | 0.150*** (0.006) [78.8%] | 0.093*** (0.003) [44.0%] | 0.119*** (0.011) [59.8%] | 0.107*** (0.008) [40.1%] | 0.108*** (0.011) [54.4%] | 0.099*** (0.007) [37.1%] |
| Population size | 5,627,309 | 16,620,206 | - | - | - | - |
| Number of obs. (unweighted) | 35,841 | 109,713 | 12,439 | 32,362 | 12,439 | 32,362 |

*Notes*: (i) Decompositions are calculated using the relevant male coefficients as the baseline. (ii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iii) * p < 0.05, ** p < 0.01, *** p < 0.001.

*Quantile regression and decomposition analysis*

The above analysis focuses on average (mean) pay and does not take into account differences in the earnings distributions of each sector, with the pay distribution typically found to be narrower in the public sector. To explore whether the GPG and the difference in GPG between the public and private sectors differ across the wage distribution, we use quantile regression methods (Koenker and Bassett, 1978) and estimate the GPG across the pay distribution (see Section 3.2). Table 7 presents these results using the five models presented above for selected percentiles. In this table, we again focus our attention on the coefficients of interest and present the estimates for gender, sector and the interaction term.

The results in Table 7 confirm a narrower raw GPG (Model (1)) at the lower end of the wage distribution, which is approximately 3 per cent at the 10th percentile. This increases to approximately 24 per cent at the 90th percentile of the wage distribution, consistent with the presence of a 'glass ceiling' i.e. greater gender inequality among high earners. In contrast, the male public sector wage premium (Model (2)) is more pronounced below the median. However, consistent with analysis at the mean this raw premium diminishes with the inclusion of personal and work-related characteristics, particularly occupation. Indeed, after accounting for occupation (Model (5)) there is a public sector pay penalty above the median. Relative to the private sector, the GPG in the public sector is larger below the median and, although the magnitude of this effect is smaller after the inclusion of personal and work-related characteristics, it remains statistically significant. Above the median, the GPG is narrower in the public relative to the private sector, although the effect becomes smaller after the inclusion of personal and work-related characteristics. In the most comprehensive specification (Model (5)), the narrowing only remains significant at the 75th percentile. Even after adjusting for a comprehensive range of characteristics, the adjusted GPG remains significant across the wage distribution consistent with an unexplained wage penalty for women. This increases in magnitude across the wage distribution to approximately 16 per cent at the 90th percentile. Although the unexplained GPG is narrower at the bottom end of the wage distribution, it is here where it is significantly larger in the public relative to the private sector. In terms of the GPG the patterns are similar, although less pronounced in the QLFS, with a widening unexplained GPG moving up the wage distribution but starting from a more pronounced GPG at the 10th percentile. Consistent with the analysis at the mean, the adjusted public sector pay penalty is larger in magnitude in the QLFS. The relatively narrower GPG in the public compared to the private sector is also evident at the 50th and 75th percentiles in Model (5) and, additionally at the 25th and 90th percentiles in Model (6).

**Table 7.** Quantile pay regression results, public and private sector

| | Percentile of the conditional pay distribution | | | | |
|---|---|---|---|---|---|
| | 10th | 25th | 50th | 75th | 90th |
| ASHE (Model (1)) | | | | | |
| Female | -0.032*** | -0.128*** | -0.196*** | -0.185*** | -0.237*** |
| | (0.002) | (0.002) | (0.004) | (0.005) | (0.006) |
| Personal characteristics | x | x | x | x | x |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.00 | 0.01 | 0.02 | 0.01 | 0.02 |
| ASHE (Model (2)) | | | | | |
| Female | -0.021 | -0.144*** | -0.267*** | -0.286*** | -0.277*** |
| | (0.013) | (0.003) | (0.004) | (0.006) | (0.008) |
| Public | 0.221*** | 0.297*** | 0.296*** | 0.130*** | 0.035* |
| | (0.011) | (0.008) | (0.007) | (0.008) | (0.015) |
| Female × Public | -0.108 | -0.076*** | 0.060*** | 0.142*** | 0.048** |
| | (.) | (0.008) | (0.008) | (0.009) | (0.017) |
| Personal characteristics | x | x | x | x | x |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.03 | 0.05 | 0.05 | 0.03 | 0.02 |
| ASHE (Model (3)) | | | | | |
| Female | -0.075*** | -0.143*** | -0.204*** | -0.239*** | -0.219*** |
| | (0.002) | (0.002) | (0.003) | (0.004) | (0.006) |
| Public | 0.196*** | 0.253*** | 0.220*** | 0.086*** | 0.038*** |
| | (0.004) | (0.006) | (0.005) | (0.006) | (0.009) |
| Female × Public | -0.072*** | -0.071*** | 0.039*** | 0.126*** | 0.056*** |
| | (0.005) | (0.007) | (0.007) | (0.008) | (0.012) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.07 | 0.10 | 0.13 | 0.13 | 0.14 |
| ASHE (Model (4)) | | | | | |
| Female | -0.045*** | -0.068*** | -0.112*** | -0.175*** | -0.180*** |
| | (0.002) | (0.002) | (0.003) | (0.004) | (0.007) |
| Public | 0.149*** | 0.200*** | 0.186*** | 0.107*** | 0.099*** |
| | (0.005) | (0.005) | (0.005) | (0.007) | (0.012) |
| Female × Public | -0.050*** | -0.069*** | 0.025*** | 0.106*** | 0.037** |
| | (0.005) | (0.006) | (0.006) | (0.008) | (0.013) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.11 | 0.15 | 0.17 | 0.16 | 0.15 |
| ASHE (Model (5)) | | | | | |
| Female | -0.044*** | -0.069*** | -0.098*** | -0.125*** | -0.160*** |
| | (0.002) | (0.002) | (0.002) | (0.003) | (0.005) |
| Public | 0.058*** | 0.016*** | -0.026*** | -0.090*** | -0.091*** |
| | (0.005) | (0.004) | (0.004) | (0.006) | (0.010) |
| Female × Public | -0.026*** | -0.010* | -0.001 | 0.022*** | -0.002 |
| | (0.005) | (0.004) | (0.004) | (0.006) | (0.010) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.22 | 0.31 | 0.36 | 0.36 | 0.33 |
| Population size | | | 22,247,515 | | |
| Number of obs. (unweighted) | | | 145,554 | | |
| QLFS (Model (5)) | | | | | |
| Female | -0.107*** | -0.114*** | -0.134*** | -0.177*** | -0.205*** |
| | (0.008) | (0.005) | (0.005) | (0.006) | (0.009) |

| | | | | | |
|---|---|---|---|---|---|
| Public | 0.013 | -0.020* | -0.072*** | -0.124*** | -0.146*** |
| | (0.008) | (0.008) | (0.007) | (0.010) | (0.013) |
| Female × Public | -0.005 | 0.009 | 0.032*** | 0.054*** | 0.029 |
| | (0.011) | (0.009) | (0.008) | (0.011) | (0.015) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.18 | 0.25 | 0.32 | 0.33 | 0.31 |
| QLFS (Model (6)) | | | | | |
| Female | -0.101*** | -0.112*** | -0.126*** | -0.165*** | -0.189*** |
| | (0.008) | (0.005) | (0.005) | (0.006) | (0.008) |
| Public | -0.006 | -0.050*** | -0.092*** | -0.145*** | -0.170*** |
| | (0.009) | (0.008) | (0.007) | (0.009) | (0.010) |
| Female × Public | -0.002 | 0.018* | 0.028** | 0.046*** | 0.027* |
| | (0.011) | (0.009) | (0.008) | (0.010) | (0.013) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.19 | 0.27 | 0.34 | 0.35 | 0.34 |
| Number of obs. (unweighted) | | | 44,801 | | |

*Notes*: See notes to Table 5.

Similar to analysis at the mean, the models presented in Table 7 impose the restriction that men and women in both sectors have the same rewards to their characteristics. To examine the extent to which the returns to characteristics differ by gender and by sector, we estimate the most comprehensive specification, separately for males and females within each sector and decompose the difference between men and women at different points of the log pay distributions into an explained and unexplained component following the method proposed by Machado and Mata (2005). These decomposition results are presented in Figure 3.[71] The corresponding figures from the QLFS (Model (6)) are presented in the Appendix Figure A.1 and exhibit the same qualitative patterns.

The results in Figure 3 suggest that the raw GPG tends to increase across the wage distribution in the private sector, at least until the 80th percentile. At the bottom end of the distribution the GPG is largely due to the differences in coefficients or the returns to characteristics (i.e. unexplained), consistent with unequal treatment. Observable personal and work-related characteristics play a more important role above the median, but the majority of the GPG remains unexplained even at the top of the wage distribution. In contrast, the pattern within the public sector is quite different. The GPG increases sharply until about the 40th percentile, after which it narrows until about the 80th percentile, beyond which there is a further sharp increase. Characteristics are a more important explanation for the public sector GPG at the bottom of the wage distribution, but their influence diminishes after the 40th percentile. As such, the public sector GPG above the 80th percentile is virtually entirely unexplained. The higher unexplained gap at the 90th percentile (at 19 per cent) relative to the 50th or 75th percentile (at 11 and 13 per cent respectively) is consistent with the presence of a 'glass ceiling' within the public sector.[72] This is consistent with previous evidence of 'glass ceiling' effects among more educated women (Chzhen and Mumford, 2011) and within the UK public sector (Arulampalam *et al*., 2007; Stewart, 2014a). The analysis also highlights the importance of considering the wage distribution in the comparison across sectors. At the median, for example, and in contrast to the mean, the unexplained GPG is larger in the private relative to the public sector. This pattern changes,

[71] The key patterns are not sensitive to alternative definitions of hourly pay, the exclusion of occupation, the exclusion of part-time employees from the sample, to the decomposition method or year of analysis. The full-time GPG is, however, narrower in both sectors and virtually entirely unexplained.

[72] Arulampalam *et al*. (2007) define a glass ceiling as a 2 percentage point larger unexplained wage gap at the 90th percentile relative to a reference point of the distribution (e.g. median).

however, at the top end of the wage distribution given the pronounced glass ceiling in the public sector.[73]

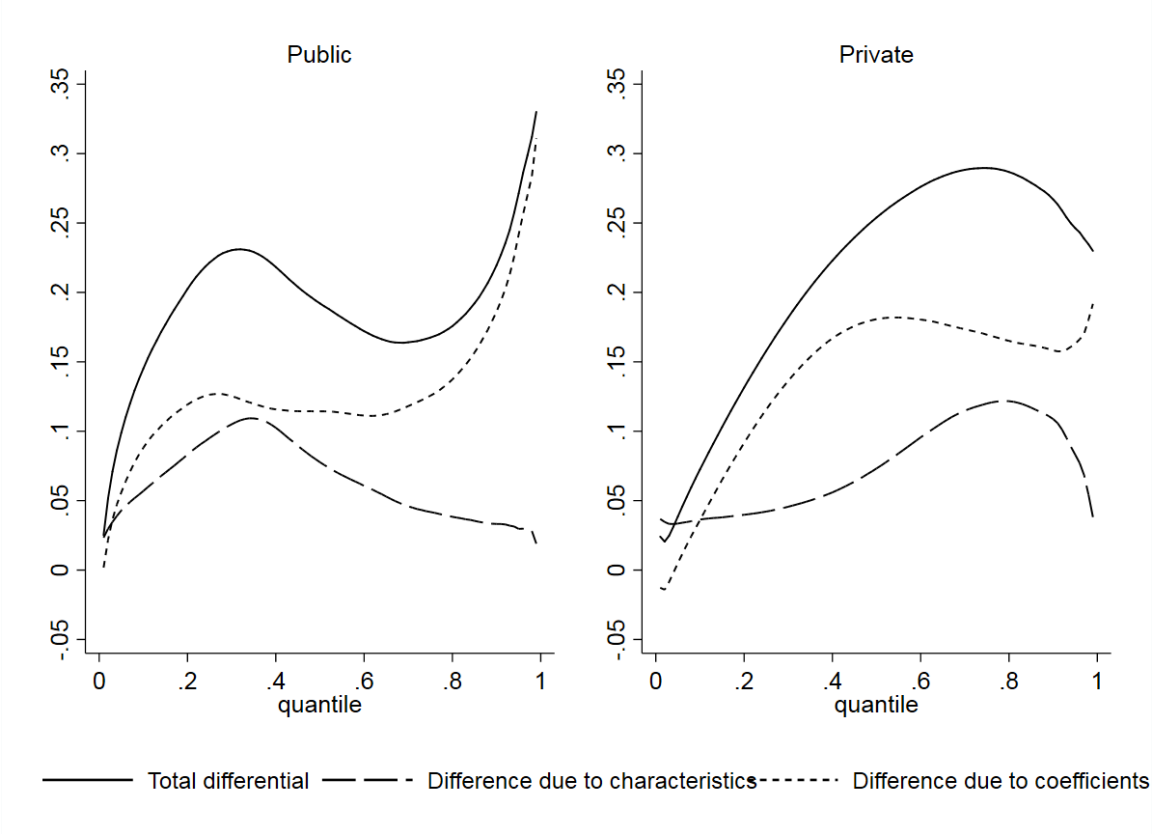


**Figure 3.** Decomposition of the GPG across the distribution, public and private sector

### 4.2.2 Within public sector regression and decomposition analysis

*PRB versus non-PRB occupations*

Now we turn our attention to the GPG within the public sector to analyse GPGs across PRB occupations. For this purpose, Table 8 presents the OLS pay regression estimates from five different models, which are similar to the ones described above. Differently, Models (1)-(5) in Table 8 control for public sector PRB occupations (instead of sector) and the interaction between gender and PRB occupations (instead of the interaction between gender and sector). In this way, we identify differences between the GPGs within the public sector, in particular the GPG in PRB occupations relative to the other (non-PRB) public sector occupations.

The results in Table 8 confirm a raw (22 per cent – Model (2)) and unexplained (11 per cent – Model (5)) GPG in the part of the public sector that is not covered by PRBs. The latter is considerably narrower after the inclusion of occupation. The results also confirm a raw pay premium to PRB relative to non-PRB workers, although the magnitude of this diminishes with the inclusion of occupation in particular it remains statistically significant at 8 per cent (Model (5)). The raw GPG is approximately 4 per cent narrower in PRB relative to non-PRB occupations (Model (2)) but the inclusion of occupation in Model (5) reverses this trend, with the adjusted GPG now approximately 6 per cent larger within PRB occupations. In contrast to ASHE, and despite a narrower raw GPG in PRB occupations (see Table 2), the results from the QLFS suggest the adjusted GPG (at approximately 13 per cent) is similar across

[73] This may be an important driver of the large unexplained gap at the mean identified in Table 6.

PRB and non-PRB occupations. There is also no evidence of a PRB pay premium after accounting for personal, work-related and occupational controls in the QLFS.

**Table 8.** OLS pay regression results, public sector

| | ASHE | | | | | QLFS | |
|---|---|---|---|---|---|---|---|
| Model | (1) | (2) | (3) | (4) | (5) | (5) | (6) |
| Female | -0.191*** | -0.224*** | -0.216*** | -0.174*** | -0.107*** | -0.135*** | -0.129*** |
| | (0.005) | (0.007) | (0.006) | (0.006) | (0.005) | (0.010) | (0.010) |
| PRB | - | 0.183*** | 0.187*** | 0.201*** | 0.078*** | 0.015 | 0.018 |
| | | (0.009) | (0.009) | (0.009) | (0.007) | (0.014) | (0.014) |
| Female × PRB | - | 0.044*** | 0.050*** | 0.036*** | -0.058*** | 0.009 | 0.012 |
| | | (0.011) | (0.010) | (0.010) | (0.008) | (0.016) | (0.015) |
| Personal characteristics | x | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ | ✓ | ✓ |
| Population size | | | 5,627,309 | | | - | |
| Number of obs. (unweighted) | | | 35,841 | | | 12,310 | |
| $R^2$ | 0.04 | 0.10 | 0.18 | 0.22 | 0.51 | 0.42 | 0.44 |

*Notes*: (i) Sample is restricted to public sector employees. (ii) Reference category for PRB is non-PRB public. PRBs are defined to exclude the AFPRB in the QLFS for comparability. (iii) Models (1)-(5) are as set out in the text. All models include a constant term. Model (6) includes the following additional characteristics: highest qualification, marriage, dependent children, ethnicity and disability. All estimates based on QLFS additionally control for year, quarter and their interaction. (iv) Standard errors in parentheses. (v) * p < 0.05, ** p < 0.01, *** p < 0.001.

Similar to our sectoral analysis, in Table 9, we present Oaxaca-Blinder decomposition results for the PRB occupations and non-PRB public sector occupations. The model used in the decomposition analysis is the most expanded specification (similar to Model (5) in Table 8) but estimated separately for males and females and by sector.[74] Consistent with the descriptive statistics the raw GPG is larger in non-PRB than PRB occupations. However, while nearly half of the GPG is explained by the productivity-related characteristics within non-PRB occupations, the gap is entirely unexplained in PRB occupations.[75] This results in the unexplained GPG being larger in PRB occupations. Moreover, the same qualitative pattern, that the PRB GPG is typically largely unexplained and at least of comparable magnitude in absolute terms to non-PRB occupations is robust to a range of sensitivity analysis, including in relation to the measure of pay, decomposition methodology and restriction to full-time employees.[76] The results, however, appear more sensitive to whether and how occupation is included in the models (see Appendix Tables A.10 and A.11) and, in particular suggests that gender segregation by occupation defined in narrow as opposed to broad groups is important in explaining the GPG within PRB occupations. While the magnitudes vary, the same patterns are evident in the QLFS, with the entire GPG being unexplained within the PRB occupations (Model (5)). This means that, on average, women have comparable productivity-related characteristics to men in PRB occupations and these narrow the overall raw GPG in PRB relative to non-PRB occupations.[77]

[74] In Appendix Tables A.10 and A.11, we explore the sensitivity of the results presented in Table 9 to the alternative definitions of hourly pay (Table A.10), to the exclusion of occupation from the specification, to the inclusion of more detailed controls for occupation, to the exclusion of part-time employees from the sample, to the decomposition method, and the year of analysis (Table A.11).

[75] In further analysis gender differences in occupation are found to have a dominant role in explaining the GPG in non-PRB occupations but this has no role in PRB occupations.

[76] The full-time raw GPG is, however, much narrower in non-PRB occupations.

[77] Although not significant in our analysis the negative explained component evident in Table 9 is consistent with females having greater productivity-related characteristics than males such that the unexplained gap is more than 100 per cent of the entire GPG i.e. gender differences in characteristics serve to narrow the raw GPG relative to our measure of wage inequality.

**Table 9.** Decomposition of the GPG, public sector

| | ASHE | | QLFS | | | |
|---|---|---|---|---|---|---|
| | Model (5) | | Model (5) | | Model (6) | |
| | Non-PRB | PRB | Non-PRB | PRB | Non-PRB | PRB |
| Difference in mean log gross hourly pay between men and women | 0.224*** (0.007) | 0.180*** (0.008) | 0.266*** (0.012) | 0.125*** (0.016) | 0.266*** (0.012) | 0.125*** (0.016) |
| Difference due to characteristics (explained) | 0.109*** (0.007) [48.7%] | -0.002 (0.008) [-1.0%] | 0.145*** (0.013) [54.5%] | -0.023 (0.018) [-18.2%] | 0.153*** (0.013) [57.4%] | 0.001 (0.019) [1.0%] |
| Difference due to coefficients (unexplained) | 0.115*** (0.008) [51.3%] | 0.182*** (0.009) [101.0%] | 0.121*** (0.014) [45.5%] | 0.147*** (0.020) [118.2%] | 0.113*** (0.014) [42.6%] | 0.123*** (0.020) [99.0%] |
| Population size | 3,046,955 | 2,580,354 | - | - | - | - |
| Number of obs. (unweighted) | 20,193 | 15,648 | 7,442 | 4,868 | 7,285 | 4,868 |

*Notes*: (i) Decompositions are calculated using the relevant male coefficients as the baseline. (ii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iii) * p < 0.05, ** p < 0.01, *** p < 0.001.

To explore whether the GPG differs across the wage distribution within the public sector, we estimate the GPG at different points of the pay distribution using the quantile regression methods as above. Table 10 presents estimation results using five different specifications for selected percentiles. We again focus our attention to the coefficients of interest and present only the estimates for coefficients of gender, PRB and the interaction term. There is evidence of a consistent raw PRB wage premium across the wage distribution, although this is most pronounced at the 90$^{th}$ percentile at approximately 28 per cent (Model (2)). The magnitude of this narrows however, particularly after the inclusion of occupation. The raw GPG is narrower in PRB relative to non-PRB occupations across most of the distribution (Model (2)) but is actually significantly greater (approximately 15 per cent) at the 90$^{th}$ percentile. Consistent with analysis at the mean, controlling for occupation has a large impact on the results, with the adjusted GPG being significantly greater in PRB occupations, although the differential remains most pronounced at the 90$^{th}$ percentile. In contrast to ASHE, but consistent with the analysis relating to the mean, the results relating to the QLFS suggest the adjusted or unexplained GPG is not significantly different between PRB and non-PRB occupations.

**Table 10.** Quantile pay regression results, public sector

| | Percentile of the conditional pay distribution | | | | |
|---|---|---|---|---|---|
| | 10th | 25th | 50th | 75th | 90th |
| ASHE (Model (1)) | | | | | |
| Female | -0.130*** | -0.220*** | -0.208*** | -0.144*** | -0.229*** |
| | (0.006) | (0.008) | (0.007) | (0.008) | (0.015) |
| Personal characteristics | x | x | x | x | x |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.02 | 0.03 | 0.02 | 0.01 | 0.02 |
| ASHE (Model (2)) | | | | | |
| Female | -0.134*** | -0.242*** | -0.294*** | -0.205*** | -0.199*** |
| | (0.007) | (0.009) | (0.009) | (0.010) | (0.013) |
| PRB | 0.114*** | 0.201*** | 0.180*** | 0.153*** | 0.289*** |
| | (0.017) | (0.011) | (0.009) | (0.014) | (0.023) |
| Female × PRB | 0.031 | 0.056*** | 0.142*** | 0.040* | -0.151*** |
| | (0.017) | (0.013) | (0.013) | (0.016) | (0.025) |
| Personal characteristics | x | x | x | x | x |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.04 | 0.07 | 0.07 | 0.03 | 0.04 |
| ASHE (Model (3)) | | | | | |
| Female | -0.155*** | -0.223*** | -0.255*** | -0.171*** | -0.148*** |
| | (0.006) | (0.006) | (0.008) | (0.010) | (0.010) |
| PRB | 0.098*** | 0.182*** | 0.171*** | 0.170*** | 0.284*** |
| | (0.015) | (0.014) | (0.008) | (0.013) | (0.019) |
| Female × PRB | 0.056*** | 0.067*** | 0.143*** | 0.017 | -0.135*** |
| | (0.015) | (0.015) | (0.011) | (0.015) | (0.022) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | x | x |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.08 | 0.11 | 0.12 | 0.09 | 0.10 |
| ASHE (Model (4)) | | | | | |
| Female | -0.108*** | -0.138*** | -0.195*** | -0.156*** | -0.143*** |
| | (0.005) | (0.006) | (0.007) | (0.010) | (0.010) |
| PRB | 0.098*** | 0.192*** | 0.167*** | 0.159*** | 0.290*** |
| | (0.013) | (0.011) | (0.008) | (0.013) | (0.020) |
| Female × PRB | 0.026 | 0.028* | 0.133*** | 0.039** | -0.148*** |
| | (0.014) | (0.013) | (0.010) | (0.015) | (0.022) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | x | x | x | x | x |
| Pseudo $R^2$ | 0.11 | 0.15 | 0.15 | 0.10 | 0.11 |
| ASHE (Model (5)) | | | | | |
| Female | -0.081*** | -0.077*** | -0.097*** | -0.127*** | -0.140*** |
| | (0.005) | (0.004) | (0.006) | (0.007) | (0.010) |
| PRB | 0.023* | 0.045*** | 0.065*** | 0.064*** | 0.166*** |
| | (0.010) | (0.008) | (0.007) | (0.009) | (0.019) |
| Female × PRB | 0.015 | -0.028** | -0.049*** | -0.035*** | -0.120*** |
| | (0.010) | (0.008) | (0.008) | (0.010) | (0.021) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.28 | 0.36 | 0.38 | 0.32 | 0.28 |
| Population size | | | 5,627,309 | | |
| Number of obs. (unweighted) | | | 35,841 | | |
| QLFS (Model (5)) | | | | | |
| Female | -0.119*** | -0.114*** | -0.119*** | -0.148*** | -0.191*** |

| | | | | | |
|---|---|---|---|---|---|
| | (0.011) | (0.008) | (0.010) | (0.012) | (0.016) |
| PRB | 0.003 | -0.000 | 0.002 | -0.011 | 0.047 |
| | (0.019) | (0.014) | (0.014) | (0.018) | (0.025) |
| Female × PRB | 0.030 | 0.028 | 0.023 | 0.030 | -0.033 |
| | (0.022) | (0.015) | (0.015) | (0.019) | (0.027) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.22 | 0.29 | 0.32 | 0.29 | 0.25 |
| QLFS (Model (6)) | | | | | |
| Female | -0.099*** | -0.102*** | -0.119*** | -0.145*** | -0.176*** |
| | (0.011) | (0.008) | (0.009) | (0.011) | (0.012) |
| PRB | -0.006 | -0.001 | 0.010 | 0.001 | 0.064* |
| | (0.012) | (0.015) | (0.011) | (0.018) | (0.025) |
| Female × PRB | 0.031 | 0.031 | 0.019 | 0.030 | -0.036 |
| | (0.016) | (0.017) | (0.013) | (0.020) | (0.027) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | ✓ | ✓ | ✓ | ✓ | ✓ |
| Occupation | ✓ | ✓ | ✓ | ✓ | ✓ |
| Pseudo $R^2$ | 0.24 | 0.31 | 0.35 | 0.32 | 0.28 |
| Number of obs. (unweighted) | | | 12,310 | | |

*Notes*: See notes to Table 7.

In a similar manner to Figure 3, Figure 4 presents the Machado and Mata (2005) decomposition results using our most expanded specification (similar to Model (5) in Table 10) separately for males and females and for PRB and non-PRB public sector occupations.[78] The corresponding figures from the QLFS (Model (6)) are presented in Appendix Figure A.2 and exhibit the same qualitative patterns, albeit the entire GPG is unexplained across the distribution in PRB occupations.

The patterns between PRB occupations and non-PRB occupations are quite different. The raw GPG gap increases but then peaks at the median for non-PRB occupations. For PRB occupations, there are sharp increases below the bottom 20$^{th}$ percentile and again above the 70$^{th}$ percentile so the largest GPG is among the highest paid workers. In non-PRB occupations characteristics play an important role and contribute more to the GPG than coefficients except at the very top end of the wage distribution. Consistent with the analysis at the mean, among PRB occupations characteristics have a limited role and this diminishes across the wage distribution. Indeed, characteristics have virtually no role above the median and, as such, the entire GPG in PRB occupations is unexplained above the median. The substantial increase in the unexplained component across the wage distribution is consistent with a pronounced glass ceiling within PRB occupations which is not evident for non-PRB occupations. While it is not possible to identify the cause of this difference it is consistent with unequal treatment of men and women in senior roles and/or unexplained differences in progression between men and women in PRB occupations in particular. The latter may stem, for example, from differences in motivation for seniority between men and women in PRB occupations or differences in specialism or promotion opportunities.[79] The findings also suggest that PRBs need to pay particular attention to pay rise methods, as for instance, in contrast to absolute increases, across-the-board pro-rata proportional increases in pay would work to maintain the GPG across the distribution, and hence the glass-ceiling effect.

[78] The key patterns are not sensitive to alternative definitions of hourly pay, the exclusion of occupation, the exclusion of part-time employees from the sample, to the decomposition method or year of analysis. The full-time raw GPG is, however, much narrower (and relatively more is unexplained) than the GPG among all workers in non-PRB occupations.

[79] In further analysis (not reported) there is evidence of a glass ceiling in the DDRB and the NHSPRB.

Figure 4 can also be used to make comparisons across PRB and non-PRB occupations, but in a similar manner to the findings at the mean, the raw GPG is larger within non-PRB occupations across most of the distribution, with the exception of at the very top. The unexplained GPG is, however, generally larger in PRB occupations, particularly above the 40th percentile, and this difference widens at the top end of the earnings distribution.

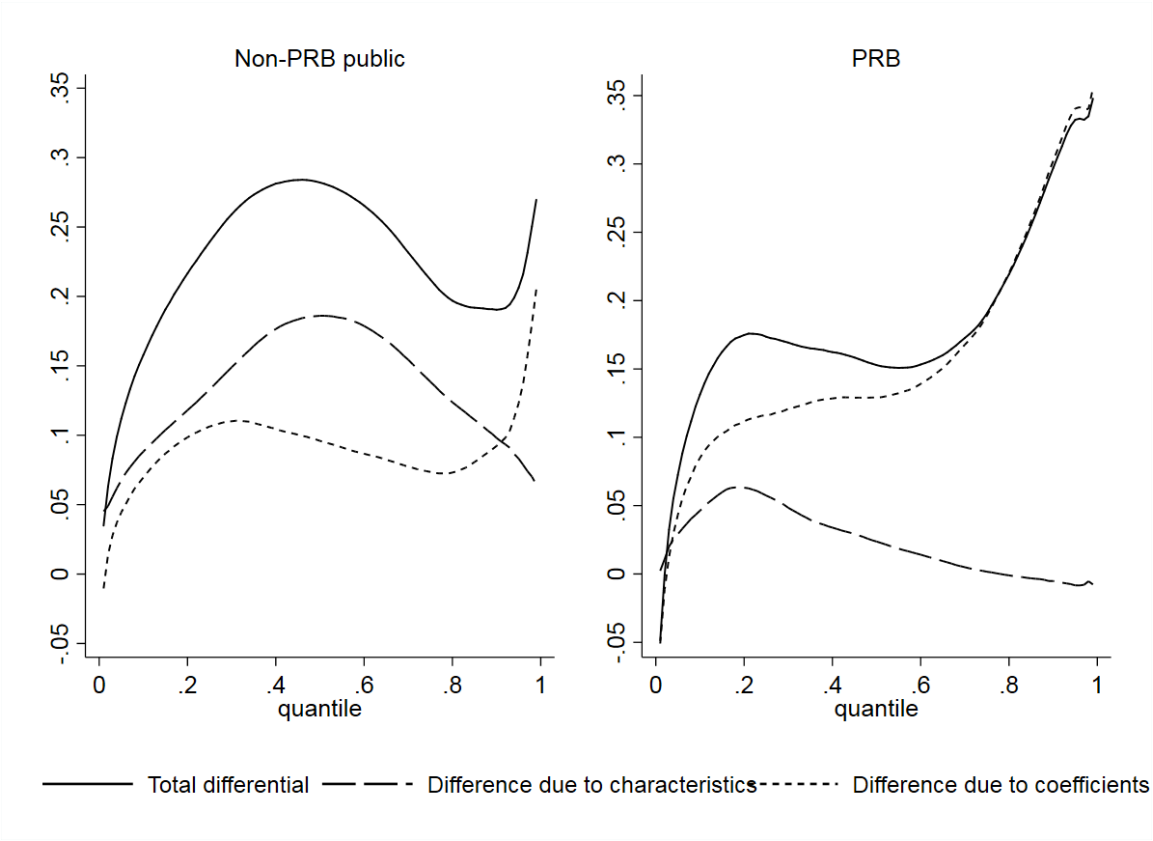


**Figure 4.** Decomposition of the GPG across the distribution, public sector

*Across PRB occupations*

Next we explore the GPG across the separate PRBs. For this purpose, Table 11 presents the OLS pay regression estimates from five different specifications which are similar to the ones discussed above but, we now disaggregate the PRBs to identify the differences between the GPG within each PRB relative to non-PRB public sector occupations. As expected, there is substantial variation in average pay across PRBs even after accounting for broad occupational groups (Model (5)), with the average male wage in PRBs both above (e.g. DDRB, STRB, PRRB) and below the rest of the public sector (e.g. PSPRB, NHSPRB). The GPG also varies significantly across PRBs, being narrower than the non-PRB in the NHSPRB, PRRB and STRB even after controlling for personal and work-related characteristics (Models (2)-(4)). Indeed, the magnitude of the narrowing is large for the NHSPRB and PRRB (and to a lesser extent the STRB), such that the unexplained GPG within these PRB is small in magnitude and considerably smaller than the rest of the public sector (Model (4)). The inclusion of occupation in Model (5) reduces the adjusted GPG in non-PRB occupations and narrows the differential with PRB occupations, particularly for the STRB. Although, consistent with Table 2, some of the magnitudes vary, the patterns are qualitatively similar in the QLFS and do not differ between Model (5) and (6).[80] In addition,

[80] The PRRB no longer has a significantly narrower adjusted GPG than non-PRB occupations in Model (6). The narrower GPG in the STRB, however, remains significant in the QLFS, even after accounting for occupation.

while figures relating to the AFPRB should be treated with caution given the small sample size, the results from the QLFS show no wage premium or penalty associated with the AFPRB relative to non-PRB occupations and, no significant difference in the GPG in the AFPRB relative to non-PRB occupations.

**Table 11.** OLS pay regression results, within the public sector

| | ASHE | | | | | QLFS | |
|---|---|---|---|---|---|---|---|
| Model | (1) | (2) | (3) | (4) | (5) | (5) | (6) |
| Female | -0.191*** | -0.224*** | -0.216*** | -0.173*** | -0.114*** | -0.138*** | -0.133*** |
| | (0.005) | (0.007) | (0.006) | (0.006) | (0.005) | (0.010) | (0.010) |
| DDRB | - | 0.735*** | 0.749*** | 0.802*** | 0.546*** | 0.466*** | 0.462*** |
| | | (0.021) | (0.019) | (0.019) | (0.018) | (0.038) | (0.039) |
| NHSPRB | - | -0.071*** | -0.050*** | -0.031** | -0.086*** | -0.083*** | -0.080*** |
| | | (0.011) | (0.010) | (0.010) | (0.008) | (0.018) | (0.017) |
| PRRB | - | 0.152*** | 0.120*** | 0.085*** | 0.108*** | 0.026 | 0.057** |
| | | (0.010) | (0.009) | (0.008) | (0.008) | (0.020) | (0.021) |
| PSPRB | - | -0.106*** | -0.124*** | -0.159*** | -0.156*** | -0.305*** | -0.235*** |
| | | (0.026) | (0.027) | (0.027) | (0.022) | (0.069) | (0.069) |
| STRB | - | 0.411*** | 0.434*** | 0.461*** | 0.203*** | 0.057* | 0.035 |
| | | (0.015) | (0.013) | (0.014) | (0.013) | (0.026) | (0.026) |
| AFPRB | - | - | - | - | - | -0.016 | 0.010 |
| | | | | | | (0.039) | (0.037) |
| Female × DDRB | - | 0.028 | 0.019 | -0.016 | -0.075** | -0.018 | -0.026 |
| | | (0.029) | (0.026) | (0.026) | (0.025) | (0.052) | (0.052) |
| Female × NHSPRB | - | 0.172*** | 0.164*** | 0.141*** | 0.049*** | 0.066** | 0.078*** |
| | | (0.012) | (0.011) | (0.011) | (0.009) | (0.020) | (0.019) |
| Female × PRRB | - | 0.147*** | 0.169*** | 0.137*** | 0.078*** | 0.084* | 0.055 |
| | | (0.016) | (0.013) | (0.012) | (0.011) | (0.037) | (0.040) |
| Female × PSPRB | - | 0.076 | 0.105* | 0.096* | 0.012 | 0.099 | 0.101 |
| | | (0.045) | (0.047) | (0.044) | (0.040) | (0.103) | (0.101) |
| Female × STRB | - | 0.122*** | 0.122*** | 0.083*** | 0.012 | 0.076** | 0.072** |
| | | (0.017) | (0.015) | (0.015) | (0.014) | (0.028) | (0.027) |
| Female x AFPRB | - | - | - | - | - | -0.045 | -0.046 |
| | | | | | | (0.143) | (0.141) |
| Personal characteristics | x | x | ✓ | ✓ | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ | ✓ | ✓ |
| Population size | | | 5,627,309 | | | - | |
| Number of obs. (unweighted) | | | 35,841 | | | 12,439 | |
| $R^2$ | 0.04 | 0.23 | 0.31 | 0.34 | 0.57 | 0.44 | 0.47 |

*Notes*: (i) Sample is restricted to public sector employees. (ii) Reference category for PRBs is non-PRB public sector. (iii) Models (1)-(5) are as set out in the text. All models include a constant term. Model (6) includes the following additional characteristics: highest qualification, marriage, dependent children, ethnicity and disability. All estimates based on QLFS additionally control for year, quarter and their interaction. (iv) Robust standard errors in parentheses. (v) * p < 0.05, ** p < 0.01, *** p < 0.001. (vi) In the QLFS, estimates are based on a particularly small sample of females in the PSPRB and AFPRB.

Due to the small sample sizes within some of the PRB occupations when analysed separately and by gender we do not present the Oaxaca-Blinder decomposition results for each PRB occupation.[81] Instead, for the ASHE, Table 12 presents within PRB GPGs calculated on the basis of OLS regression models, estimated separately for each PRB occupation but where the sample pools males and females and the unexplained gaps are given by coefficient estimates on the gender indicator variable. For consistency with the

[81] These estimates are, however, very comparable to those presented in Table 12 consistent with evidence from Elder *et al*. (2010) which suggests using the pooled model and gender dummy variable provides a reliable measure of the unexplained gap.

decomposition results presented earlier, we present the results such that a positive gap indicates that, on average, men are paid more than women. The raw GPG is presented in the first row using the basic model without any additional control variables, while the adjusted GPG shows the GPG between men and women with similar productivity characteristics. We do this adjustment gradually by adding personal characteristics (in row a), plus work-related characteristics (in row b), and plus occupation (in row c) to the basic model. It is worth noting that as there is no variation in major occupation groups for some of the PRBs (e.g. DDRB) here we control for detailed occupation information measured by the 4-digit SOC 2010 code. This facilitates a detailed comparison within PRB occupations, for example, within specialisms in the NHSPRB and in relation to seniority in the PRRB, PSPRB and STRB (see Appendix Table A.1 for details).

Consistent with the above analysis, the raw GPG varies considerably across PRBs from approximately 5 per cent in the NHSPRB to nearer 20 per cent in the DDRB. The latter is consistent with evidence from Stewart (2015) who found that the within occupation GPG is typically larger in higher paid occupations. Adjusting for personal characteristics tends to narrow the GPG across the PRBs. The exception is the STRB where, in total contrast to Turnbull and Williams (1974), none of the raw GPG can be explained by the productivity-related characteristics in our model. This is particularly surprising given the inclusion of detailed occupational controls which account for primary and secondary education and seniority, which are thought to determine the GPG among teachers. As for the decompositions of PRB occupations as a whole, the extent to which the GPG can be explained is much less than for the non-PRB occupations. As such, despite having a narrower raw GPG, the adjusted or unexplained GPG across several PRB is larger than in the non-PRB occupations. The adjusted GPG remains statistically significant across all PRB and is most pronounced in the DDRB and PSPRB, and smallest in the NHSPRB and PRRB.[82] The low unexplained GPG in occupations with a relatively high (NHSPRB) and low (PRRB) concentration of females is interesting since it is often thought that occupations with a high concentration of females are more likely to have a lower GPG (Stewart, 2015).

While, as noted above, an unexplained gap does not necessarily imply wage discrimination given the potentially important unobserved variables in our analysis, it does point to the need for further investigation of GPGs by PRBs, possibly using more detailed administrative payroll data, as part of their commitment to relevant legal anti-discrimination obligations.

[82] For those PRBs with sufficient observations we perform Machado-Mata quantile decompositions. These confirm the patterns described above but also suggest a 'glass ceiling' effect in the DDRB, NHSPRB and the STRB (but not the PRRB).

**Table 12.** GPG within the public sector, by PRBs

| | DDRB | NHSPRB | PRRB | PSPRB | STRB | Non-PRB public |
|---|---|---|---|---|---|---|
| (1) Raw GPG | 0.196*** | 0.052*** | 0.077*** | 0.148** | 0.102*** | 0.224*** |
| | (0.028) | (0.010) | (0.014) | (0.045) | (0.015) | (0.007) |
| $R^2$ | 0.04 | 0.00 | 0.02 | 0.09 | 0.02 | 0.06 |
| (2) Adjusted GPG | | | | | | |
| (a) Control for personal characteristics | 0.144*** | 0.051*** | 0.040*** | 0.126** | 0.090*** | 0.208*** |
| | (0.022) | (0.009) | (0.010) | (0.048) | (0.013) | (0.006) |
| $R^2$ | 0.45 | 0.11 | 0.46 | 0.16 | 0.27 | 0.16 |
| (b) plus work-related characteristics | 0.154*** | 0.047*** | 0.046*** | 0.082 | 0.115*** | 0.136*** |
| | (0.022) | (0.009) | (0.010) | (0.049) | (0.013) | (0.007) |
| $R^2$ | 0.47 | 0.14 | 0.57 | 0.26 | 0.34 | 0.23 |
| (c) plus occupation | 0.153*** | 0.034*** | 0.042*** | 0.122** | 0.101*** | 0.079*** |
| | (0.022) | (0.008) | (0.010) | (0.040) | (0.012) | (0.005) |
| $R^2$ | 0.47 | 0.55 | 0.62 | 0.52 | 0.39 | 0.61 |
| Population size | 202,936 | 1,632,783 | 211,039 | 23,155 | 510,438 | 3,046,955 |
| Number of obs. (unweighted) | 1,077 | 10,517 | 1,122 | 120 | 2,812 | 20,193 |

*Notes*: (i) Each cell presents the OLS coefficient estimate on the gender indicator variable (male 1 and female 0) from separate log hourly pay regression for five PRBs and the non-PRB public sector occupations. (ii) Raw GPG includes a male dummy variable and a constant term without any additional control variables. (iii) Occupation is measured by the 4-digit SOC 2010 code. (iv) Standard errors in parentheses. (v)* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. (v) Each $R^2$ refers to the specification above. (vi) Estimates are not presented for the QLFS due to the small sample sizes for some PRBs.

*PRB occupations*

Since some of the PRB occupations are characterised by considerable gender segregation, in what follows we explore the gender differences in occupation, prior to exploring the contribution of 'between' and 'within' PRB occupation GPGs to the public sector GPG.

In Table 13, we present Multinomial Logit Model results of the within public sector occupational choice model, where the influence of gender on public sector occupation before (Model (1)) and after accounting for other personal characteristics (Model (2)) can be identified. As noted above, we do not control for work-related characteristics since these are potential outcomes of occupational choices. For the QLFS we are also able to estimate a specification with an enhanced set of personal characteristics relative to ASHE (Model (3)). We only present the marginal effects on the female dummy variable as they are the estimates of interest.

Women have a significantly higher probability of working in the NHSPRB (16 percentage points) and, to a far lesser extent, the STRB than non-PRB occupations. In contrast, men have a higher probability than women of working in the DDRB, the PRRB and to a lesser extent the PSPRB. The marginal effects are largely unchanged after controlling for personal characteristics, which suggests the gender differences in occupational selection are largely unexplained by our model, that is, they are not a consequence of gender differences in age or geographical location. Similar raw patterns by PRB are observed when using data from the QLFS, where females are also found to be less likely to work in the AFPRB. These are also robust to the inclusion of an enhanced set of personal controls consistent with PRB occupational choice being largely unexplained by our models.

**Table 13.** Public sector occupational choice model (multinomial logit marginal effects)

| ASHE | DDRB | NHSPRB | PRRB | PSPRB | STRB | AFPRB |
|---|---|---|---|---|---|---|
| Model (1) | -0.033*** | 0.161*** | -0.056*** | -0.005*** | 0.013*** | - |
| Female | (0.002) | (0.005) | (0.003) | (0.001) | (0.004) | |
| Personal characteristics | x | x | x | x | x | - |
| Model (2) | -0.033*** | 0.158*** | -0.054*** | -0.006*** | 0.012*** | - |
| Female | (0.002) | (0.005) | (0.003) | (0.001) | (0.004) | |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ | - |
| Population size | | | 5,627,309 | | | |
| Number of obs. (unweighted) | | | 35,841 | | | |
| QLFS | DDRB | NHSPRB | PRRB | PSPRB | STRB | AFPRB |
| Model (1) | -0.019*** | 0.144*** | -0.031*** | -0.009*** | 0.033*** | -0.026*** |
| Female | (0.003) | (0.009) | (0.003) | (0.002) | (0.006) | (0.003) |
| Personal characteristics | X | x | x | x | x | x |
| Model (2) | -0.019*** | 0.141*** | -0.032*** | -0.009*** | 0.030*** | -0.025*** |
| Female | (0.003) | (0.009) | (0.003) | (0.002) | (0.006) | (0.003) |
| Personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Model (3) | -0.016*** | 0.137*** | -0.032*** | -0.009*** | 0.033*** | -0.024*** |
| Female | (0.003) | (0.009) | (0.003) | (0.002) | (0.006) | (0.003) |
| Enhanced personal characteristics | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Number of obs. (unweighted) | | | 12,439 | | | |

*Notes:* (i) Sample includes only public sector employees. (ii) Figures presented are Average Marginal Effects. (ii) Reference group is public sector employees working in non-PRB occupations. (iii) Model (3) additionally controls for marriage, highest qualification, ethnicity and disability using data from the QLFS. All estimates based on QLFS additionally control for year, quarter and their interaction. (iv) Estimates for the AFPRB are only available from the QLFS. (v) Delta-method standard errors in parentheses. (vi)* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

In Table 14, we quantify whether the GPG in the public sector stems from men and women working in different occupations ('between') or differences in pay within a given occupation ('within') using the decomposition approach proposed by Brown *et al*. (1980). The same patterns are evident using data from ASHE or the QLFS, that is, the majority of the public sector GPG is driven by GPGs within public sector occupations rather than between occupations. Gender differences in the allocation of women into and between PRB occupations act to increase the public sector GPG but this influence is small in magnitude relative to the within occupation effect.[83] So, even with an equal probability of men and women working across PRBs, when the GPG would be driven entirely by the GPG within occupations, it would remain at about 15-17 per cent (or more than 75 per cent of the raw public sector GPG). This is consistent with recent emphasis in the literature on analysing GPGs within occupations to understand pay inequality. Of course, this analysis only looks at public sector occupations. Nevertheless, it is complementary to recent evidence from Jones *et al*. (2018) which found that it is the GPG within each sector that is the main driver of the overall UK GPG, rather than the allocation of males and females across sectors. Further, as the above analysis in Table 12 demonstrates, and particularly for PRB occupations we are unable to explain much of the within PRB GPGs consistent with these raw gaps illustrating an important element of pay inequality rather than reflecting gender differences in the productivity-related characteristics of men and women within PRBs. The evidence of a positive between-occupation gap, nevertheless, indicates that even if the GPG within each occupation was zero there would be a GPG within the public sector of 3 to 4 per cent (or less than 25 per cent of the current raw public sector GPG). The latter would arise from the concentration of females in relatively low paying public sector occupations which, as Table 13 shows, we are largely unable to explain by gender differences in personal characteristics.

[83] There may, however, be other reasons for PRBs to focus on gender diversity within occupations other than as a determinant of the GPG.

**Table 14.** Within and between decomposition of the public sector GPG

| | ASHE | QLFS |
|---|---|---|
| Raw public sector GPG | 0.191 | 0.199 |
| Within public sector occupations | 0.150 | 0.174 |
| | [78.6%] | [87.1%] |
| Between public sector occupations | 0.041 | 0.025 |
| | [21.4%] | [12.5%] |
| Population size | 5,627,309 | - |
| Number of obs. (unweighted) | 35,841 | 12,439 |

*Notes*: (i) Figures in [ ] are proportions of overall GPG. (ii) Analysis of ASHE (QLFS) is based on 5 (6) PRB and non-PRB occupations as defined above.

### 4.2.3 PRP regression analysis

In this section we turn to a brief analysis of PRP to supplement the more comprehensive analysis of hourly pay. To explore gender reward gaps more generally, we estimate a probit model of the incidence of PRP (see, for example, Jirjahn and Stephan, 2004; Xiu and Gunderson, 2013) for each sector and present our estimation results in Table 15a. The empirical evidence suggests that women are less likely than men to be employed in jobs in which compensation is based on performance (see Manning and Said, 2010 for the UK; McGee *et al*., 2015 for the US) and we explore whether there are sectoral differences in this regard. Our dependent variable takes the value of 1 if the individual received any incentive payment during the preceding year (i.e. the amount of PRP>0) and is 0 otherwise. We estimate five different models, starting from the basic model, where we control for the gender indicator and a constant without any additional control variables. The marginal effect of being female on the probability of receiving PRP is given by the female indicator (Model (1)). To adjust the gender gap in the incidence of PRP for productivity-related characteristics, then we gradually add controls to the basic model, such as a sector dummy and the interaction between female and sector (Model (2)), as well as personal characteristics (Model (3)), plus work-related characteristics (Model (4)), plus occupation (Model (5)). In Table 15a, we simply focus on our estimate of interest and present only the marginal effects of the gender and sector indicators. For ease of interpretation of the interaction terms the predicted probability of the incidence of PRP by gender and sector is also reported.

Consistent with the descriptive statistics we find that women are about 13 percentage points less likely to receive PRP (Model (1)) but that there is a considerable sectoral difference with workers in the public sector about 30 percentage points less likely to receive PRP. While the influence of gender diminishes with the inclusion of work-related characteristics (Model (4)), suggesting part of the differential is due to differences in the jobs men and women hold, the effect of sector remains pronounced, consistent with a differential sectoral reward system for similar jobs. Even in the most comprehensive specification an unexplained gender gap remains evident consistent with gender differences in preferences for PRP or employer differences in the use of PRP as a reward strategy by gender. In terms of the interaction between gender and sector, the predicted probabilities in the lower panel of Table 15a (Model (2)) confirm the descriptive statistics presented in Table 4a. In the public sector, the gender gap in the incidence of PRP is about 5 percentage points (or 60 per cent).[84] The corresponding figure for the private sector, in which the probability of PRP is considerably higher, is about 9 percentage points (or 21 per cent). The inclusion of personal, work-related characteristic and occupation has a narrowing effect on both the public and private sector gender gap in PRP consistent with it partly being a consequence of gender differences in personal and work-related characteristics in both sectors. In relative terms the unexplained

[84] The (absolute) percentage point gender gap is calculated on the basis of the difference in the predicted probability for males and females within a given sector. It is divided by the relevant predicted probability for men to generate the (relative) different in per cent.

gender gap (Model (5)) remains far larger in the public (40 per cent) compared to the private (10 percent) sector.

**Table 15a.** Gender gap in the incidence of PRP, public and private sector (probit model)

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.133*** | -0.077*** | -0.073*** | -0.030*** | -0.035*** |
| | (0.002) | (0.002) | (0.002) | (0.002) | (0.002) |
| Public | | -0.292*** | -0.297*** | -0.327*** | -0.331*** |
| | - | (0.002) | (0.002) | (0.002) | (0.002) |
| Female × public | x | ✓ | ✓ | ✓ | ✓ |
| Personal characteristics | x | x | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ |
| Male private | - | 0.397*** | 0.397*** | 0.390*** | 0.395*** |
| | | (0.002) | (0.002) | (0.002) | (0.002) |
| Male public | - | 0.090*** | 0.086*** | 0.062*** | 0.057*** |
| | | (0.003) | (0.003) | (0.002) | (0.002) |
| Female private | - | 0.312*** | 0.318*** | 0.361*** | 0.357*** |
| | | (0.002) | (0.002) | (0.002) | (0.002) |
| Female public | - | 0.036*** | 0.035*** | 0.033*** | 0.034*** |
| | | (0.001) | (0.001) | (0.001) | (0.001) |
| Population size | | | 22,247,515 | | |
| Number of obs. (unweighted) | | | 145,554 | | |

*Notes*: (i) Figures presented in the upper and lower panels are Average Marginal Effects and predicted probabilities by gender and sector respectively. (ii) Delta-method standard errors in parentheses. (ii) * p < 0.05, ** p < 0.01, *** p < 0.001.

Given the availability of the amount of PRP within ASHE, we also explore within sector gender differences in the absolute level of PRP, conditional on receipt of PRP (i.e. if the amount of PRP>0). For this purpose, in a similar manner to Albanesi *et al*. (2015) and Xiu and Gunderson (2013), we estimate an OLS regression in which the dependent variable is the log of PRP received during the preceding year. The coefficient estimates of the interaction term presented in Table 15b can be interpreted as the sectoral differences in GPG in PRP adjusted for the productivity-related characteristics included in each model.

The raw gender gap in the amount of PRP is nearly 50 per cent (Model (1)). The sectoral differences in reward are also evident and reflected in a lower amount of PRP conditional on receipt in the public sector. The raw GPG in PRP is significantly lower in the public relative to the private sector at approximately 14 per cent (Model (2)).[85] The inclusion of work-related characteristics in particular narrows the gender gap in the private sector but the difference in the GPG between sectors remains evident. Indeed, in Models (4) and (5), conditional on personal and work-related characteristics, women in the public sector actually earn more PRP than men, suggesting there is no evidence of discrimination against women in relation to the level of PRP in the public sector conditional on receipt. It should, however, be noted that due to the low incidence of PRP within the public sector these estimates are likely to be based on a particularly selective sample of workers.

[85] This is calculated by the sum of the coefficient estimate on female and female x public i.e. -0.507+0.370 = -0.137.

**Table 15b.** GPG in PRP, public and private sector (OLS regression results)

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.497*** | -0.507*** | -0.472*** | -0.201*** | -0.267*** |
| | (0.018) | (0.018) | (0.017) | (0.017) | (0.018) |
| Public | | -0.658*** | -0.905*** | -0.661*** | -0.873*** |
| | - | (0.055) | (0.057) | (0.058) | (0.057) |
| Female × public | - | 0.370*** | 0.389*** | 0.383*** | 0.422*** |
| | | (0.084) | (0.087) | (0.086) | (0.084) |
| Personal characteristics | x | x | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ |
| Population size | | | 6,312,603 | | |
| Number of obs. (unweighted) | | | 40,001 | | |
| $R^2$ | 0.02 | 0.02 | 0.12 | 0.20 | 0.31 |

*Notes:* (i) Reference category for public is private sector. (ii) Standard errors in parentheses. (iii) * p < 0.05, ** p < 0.01, *** p < 0.001.

We undertake a similar analysis within the public sector by exploring gender differences in the incidence of PRP and the amount of PRP within the public sector. Parallel to our analysis of the public and private sector, in Table 16a we present the marginal effect of being female on the probability of receiving PRP within the public sector from a probit model, as well as the predicted probability of receiving PRP by gender and PRB occupation, and in Table 16b we display the OLS coefficient estimates of the PRP regression within the public sector from alternative specifications. Table 16a confirms that there is a gender gap in the incidence of PRP within the public sector, with women about 5 percentage point less likely to be in receipt of PRP (Model (1)). Workers in PRB (relative to non-PRB) occupations are also about 6 percentage points less likely to be in receipt of PRP (Model (2)). While the gender gap narrows, both of these features remain evident after accounting for productivity-related characteristics suggesting they are only partly driven by differences in the nature of jobs between men and women or by PRB occupation. The predicted probabilities of being in receipt of PRP are presented by gender and PRB occupation in the lower panels of Table 16a. In Model (2) the gender gap in the predicted probability of PRP is about 8 percentage points (57 per cent) in non-PRP occupations compared to 2 percentage points (53 per cent) in PRP occupations, where the prevalence of PRP is far lower. Accounting for personal and work-related characteristics has a modest narrowing impact on the gender gap in PRP in both PRB and non-PRB occupations, consistent with the gaps largely being unexplained.

**Table 16a.** Gender gap in the incidence of PRP within the public sector (probit model)

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.054*** | -0.049*** | -0.045*** | -0.033*** | -0.028*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.002) |
| PRB | - | -0.063*** | -0.063*** | -0.061*** | -0.058*** |
| | | (0.002) | (0.002) | (0.002) | (0.003) |
| Female × PRB | x | ✓ | ✓ | ✓ | ✓ |
| Personal characteristics | x | x | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ |
| Male non-PRB public | - | 0.133*** | 0.130*** | 0.113*** | 0.105*** |
| | | (0.004) | (0.004) | (0.004) | (0.004) |
| Male PRB | - | 0.030*** | 0.029*** | 0.027*** | 0.028*** |
| | | (0.003) | (0.003) | (0.002) | (0.002) |
| Female non-PRB public | - | 0.057*** | 0.058*** | 0.062*** | 0.063*** |
| | | (0.002) | (0.002) | (0.002) | (0.002) |
| Female PRB | - | 0.014*** | 0.014*** | 0.015*** | 0.016*** |
| | | (0.001) | (0.001) | (0.001) | (0.001) |
| Population size | | | 5,627,309 | | |
| Number of obs. (unweighted) | | | 35,841 | | |

*Notes*: (i) Sample is restricted to public sector workers. (ii) Figures presented in the upper and lower panels are Average Marginal Effects and predicted probabilities by gender and sector respectively. (iii) Delta-method standard errors in parentheses. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 16b suggests there is a raw gender gap in the amount of PRP, conditional on incidence of PRP, in non-PRB occupations. In contrast, there is no evidence of a gender gap in the amount of PRP in non-PRB occupations after controlling for other productivity-related factors. There is also no significant difference in the level of PRP between PRB and non-PRB occupations and, the interaction between gender and PRB occupations is also insignificant, suggesting there is no unexplained gender gap in the amount of PRP within either part of the public sector.

**Table 16b.** GPG in PRP within the public sector (OLS regression results)

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.137 | -0.199* | -0.198* | -0.050 | -0.002 |
| | (0.082) | (0.079) | (0.077) | (0.074) | (0.075) |
| PRB | - | -0.202 | -0.167 | -0.177 | -0.224 |
| | | (0.242) | (0.257) | (0.255) | (0.249) |
| Female × PRB | - | 0.392 | 0.311 | 0.309 | 0.144 |
| | | (0.322) | (0.325) | (0.321) | (0.317) |
| Personal characteristics | x | x | ✓ | ✓ | ✓ |
| Work-related characteristics | x | x | x | ✓ | ✓ |
| Occupation | x | x | x | x | ✓ |
| Population size | | | 302,869 | | |
| Number of obs. (unweighted) | | | 1,877 | | |
| $R^2$ | 0.00 | 0.00 | 0.05 | 0.09 | 0.14 |

*Notes*: (i) Sample is restricted to public sector workers. (ii) Reference category for PRB is non-PRB public sector occupations. (iii) Standard errors in parentheses. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.

## 5. Conclusion

Using large scale, nationally representative data from ASHE 2018 this project applies well-established econometric and decomposition methods to comprehensively investigate the contemporary drivers of the public sector GPG in the UK. In order to do this, our analysis undertakes comparisons with the private sector and, within the public sector on the basis of the coverage of five PRBs. In this respect it integrates and contributes to two important but largely separate strands of evidence within the extensive literature on the GPG, on sector and occupation respectively. Our focus is on separating the contribution of observable personal and work-related characteristics as productivity-related drivers of the GPG and we do this both at the mean of the distribution, which is typically the focus, but also across the wage distribution to consider differences in the GPG among high and low earners. We further explore the robustness of the findings using a series of alternative specifications within ASHE and to pooled data from the QLFS 2016-2018.

### 5.1 Key findings

Consistent with previous evidence the raw mean GPG in the public sector is slightly narrower than that in the private sector. However, analysis using the Oaxaca–Blinder decomposition method shows that while about half of the private sector GPG can be explained by the personal and work-related characteristics in our model, this is true for less than half of the public sector GPG. As such, the unexplained GPG, which is typically taken to be a measure of unequal treatment in the labour market, is at least as large within the public as the private sector. This appears to contrast with earlier evidence which finds a narrower unexplained GPG in the public sector (see, for example, Jones *et al*., 2018) but is robust to sensitivity analysis, including using data from the QLFS, and provides a possible indication of a worsening of the relative position of the public sector in terms of gender equality. While it is not possible to identify the reasons for this without further analysis over time to track changes in the GPG within each sector, it does perhaps question the effectiveness of more stringent equality legislation within the public sector and highlights the importance of renewed emphasis on gender equality.

Further exploration of sectoral differences across the wage distribution confirms that the raw GPG widens across the wage distribution in both sectors. However, in the public sector the GPG is particularly pronounced at the top end of the wage distribution. The role of characteristics in explaining the GPG also varies by sector. In the public sector characteristics become a less important explanation for the GPG across the distribution, whereas in the private sector a greater proportion of the GPG is explained at the top of the wage distribution. The residual or unexplained gap, our indicator of unequal treatment, is thus particularly prominent at the top end of the wage distribution in the public sector consistent with a ‘glass ceiling’, or greater gender inequality among higher earners. Focusing on the mean GPG thus hides considerable heterogeneity, particularly within the public sector, and the evidence would suggest public sector employers need to pay particular attention on exploring and addressing earnings inequality at the top end of the distribution. Future research comparing the GPG between the public and private sector should also explore the robustness of findings to the point in the earnings distribution at which it is measured.

This report further examines the GPG within the public sector in two main ways. First the GPG is compared between PRB and non-PRB occupations, and then each PRB is considered separately. As such, it provides new evidence on GPGs within PRB occupations and some of the first evidence internationally in relation to GPGs in occupations such as the police and prison service. Although the raw GPG is significantly narrower in PRB occupations, a larger proportion of the GPG is explained, particularly by broad occupational

groups, in non-PRB occupations. As a result, the unexplained GPG is actually at least as large in PRB occupations as non-PRB occupations and again reinforces the important distinction between the GPG and the adjusted or unexplained GPG as a measure of earnings inequality. Controlling for personal and work-related characteristics is also important in analysis across the earnings distribution, with the adjusted GPG being significantly greater in PRB occupations above the median and particularly at the top end of the earnings distribution. Indeed, PRB occupations exhibit a pronounced 'glass ceiling' effect. This has important implications for each PRB when considering their GPG but would also seem to be particularly important for future investigation by the SSRB which we are not able to consider here.

Examination across the individual PRBs highlights substantial heterogeneity in the magnitude of the GPG and reinforces the need to consider the diversity of public sector employment when considering the GPG, something which is often neglected in the literature. The raw gap is largest in the DDRB at 20 per cent and considerably smaller in the NHSPRB and the PRRB at 5 and 8 per cent, respectively. Consistent with the analysis of PRB occupations in aggregate, the element of the GPGs within PRBs which can be explained is typically relatively small. Indeed, for the STRB virtually none of the GPG can be attributed to the personal and work-related characteristics within our model. This is particularly surprising given the detailed nature of the occupational controls available within ASHE, which account for elements of specialism and seniority within PRBs. As such, an unexplained GPG is evident across all of the PRBs, although heterogeneity remains with an unexplained GPG in the DDRB of 15 per cent nearly four times that found in the NHSPRB and PRRB. This suggests particular investigation is required among certain PRBs and that the current complementary review of the GPG in medicine is particularly timely. That the NHSPRB and PRRB have the narrowest unexplained GPGs is interesting given the stark gender differences in workforce composition among these occupations (see below). They are, however, both characterised by fairly flat age-earnings profiles for both men and women, which might indicate fewer opportunities for career progression, which in relative terms, will advantage women.

The analysis confirms the concentration of females in the UK public sector and the PRBs in particular. It also highlights more substantial gender differences in workforce composition across PRBs, with the NHSPRB predominately female (80 per cent) and the PSPRB and PRRB predominately male (about 65-70 per cent). Despite this, the contribution of gender differences in the allocation of women across PRBs plays a relatively minor role to the public sector GPG, consistent with the importance of within occupation GPGs (see Stewart, 2015 for example). Indeed, the raw GPG would be 15 per cent if there was no gender difference in the probability of working across PRBs whereas it would only be 4 per cent if there were no GPGs within public sector occupations. Nevertheless, personal characteristics also appear to have a limited role in explaining gender differences in occupation within the public sector which suggests a potentially important role for unobservable characteristics such as preferences and/or societal or employer barriers to entry into certain occupations.

Consistent with the existing evidence, PRP is a much less prevalent form of reward in the public relative to the private sector (Bryson *et al*., 2017). While about 36 per cent of workers in the private sector received PRP in the last year the comparable figure for the public sector was 5 per cent. The prevalence is even smaller in PRBs at about 2 per cent. There is also an unexplained gender gap in the incidence of PRP across sectors, but, in relative terms, this is more pronounced in the public sector. Conditional on receipt of PRP, there is a gender gap in the amount of PRP, but this is considerably larger within the private sector. In this respect the evidence suggests sector is an important but neglected influence on the gender

gap in PRP that needs to be further considered in the international literature. PRB occupations are less likely to use PRP and while there remains a gender gap in incidence after accounting for work-related characteristics there is no unexplained gap in reward conditional on incidence in the public sector. As such, our evidence suggests that in terms of gender equality, the OME should focus on the incidence, or who receives PRP, when considering introducing payment systems relating reward to performance.

### 5.2 Limitations and extensions

Despite using rich data from multiple large-scale national surveys certain characteristics of individuals and their employment cannot be observed and measured. In particular, we rely on age as a proxy for actual labour market experience. Although the latter is rarely observed in survey data, based on evidence from studies where it is available, it tends to serve to narrow the unexplained GPG since age is likely to overestimate the actual labour market experience of women in particular. It may also be the case that the influence of gender on experience differs by sector. While the QLFS is able to supplement the information in ASHE, including by providing information on highest qualification, we do not explore the nature of education in more detail. For skilled occupations, like those in the PRBs, subject choice within higher education is likely to be an important driver of both occupation and pay, and in this regard gender differences are well-established and may further explain some of the differences observed.

Moreover, some characteristics of individuals are inherently unobservable, including personality traits, preferences for risk and motivation for public sector work. These are potential determinants of both selection into public sector and PRB employment, and earnings. They have also previously been shown to differ considerably by gender and may therefore serve to further explain the public sector GPG. More generally, there might be unobserved characteristics which determine selection into the labour market, sector and occupation which are correlated with our explanatory variables and therefore potentially bias our OLS estimates of the GPG. While, given the increasing emphasis on within occupation pay gaps in the literature, it is not unusual to focus on the GPG within a particular occupation, as we have done, and future research by the OME might want to explore these selection processes in detail.

The analysis of national data in this report has the advantage of facilitating the comparison across sectors and PRBs. However, complementary analysis of the separate PRB occupations could be undertaken using more specialised administrative payroll data, as we understand is currently being undertaken as part of the review of the GPG in medicine. Although the 4-digit occupation codes enable us to control for aspects of specialism and seniority within PRB occupations, administrative data would facilitate a more detailed examination of gender differences within occupations such as in terms of roles/job tasks (see, Reyes, 2007a, for example) and progression within specific occupations (see, McNabb and Wass, 1997). Analysis of specific PRBs would also facilitate more detailed examination of the impact of pay scales and pay awards on the GPG.[86] This approach may also permit examination of PRBs with limited coverage such as the SSRB, which we are unable to consider but where the evidence of a ‘glass ceiling’ suggests a particular focus on gender equality might be important.

While ASHE contains detailed information on work-related characteristics relating to the job, information on the company is relatively limited. As such, much of the information about the company or workplace is unobserved, including detailed information about equality policies and practices, such as flexible working which is identified as important to the GPG by

[86] The PRRB (2019), for example, highlights the range of GPGs by police force.

Chatterji *et al*. (2011). The use of company or workplace payroll information might also help in this regard and would appear complementary to, and enhance the value of, the publication of organisational GPGs and their exploration as part of the annual requirements of GPG reporting.

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## Appendices

**Table A.1.** Defining PRB Occupations

| Review Body[i] | National coverage | Occupation | SOC 2010 code | ASHE Region[ii] | IDBR Legal status[iii] | SIC 2007 code[iv] |
|---|---|---|---|---|---|---|
| Review Body on Doctors' and Dentists' Remuneration[v] | United Kingdom | Medical practitioners | 2211 | Great Britain | Public | |
| | | Dental practitioners | 2215 | Great Britain | Public | |
| NHS Pay Review Body | United Kingdom | Psychologists | 2212 | Great Britain | Public | |
| | | Pharmacists | 2213 | Great Britain | Public | |
| | | Ophthalmic opticians | 2214 | Great Britain | Public | |
| | | Medical radiographers | 2217 | Great Britain | Public | |
| | | Podiatrists | 2218 | Great Britain | Public | |
| | | Health professionals n.e.c. | 2219 | Great Britain | Public | |
| | | Physiotherapists | 2221 | Great Britain | Public | |
| | | Occupational therapists | 2222 | Great Britain | Public | |
| | | Speech and language therapists | 2223 | Great Britain | Public | |
| | | Therapy professionals n.e.c. | 2229 | Great Britain | Public | |
| | | Nurses | 2231 | Great Britain | Public | |
| | | Midwives | 2232 | Great Britain | Public | |
| | | Paramedics | 3213 | Great Britain | Public | |
| | | Medical and dental technicians | 3218 | Great Britain | Public | |
| | | Nursing auxiliaries and HCAs | 6141 | Great Britain | Public | |
| | | Ambulance staff | 6142 | Great Britain | Public | |
| | | Dental nurses | 6143 | Great Britain | Public | |
| | | Non-medical staff: Managers | 1000s | Great Britain | Public | 86.10/1 Hospital activities[vi] |
| | | Non-medical staff: Professionals | 2000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Assoc Prof and Technical | 3000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Admin and clerical | 4000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Skilled trades | 5000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Personal and protective service | 6000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Sales | 7000s | Great Britain | Public | 86.10/1 Hospital |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | activities |
| | | Non-medical staff: Routine operatives and drivers | 8000s | Great Britain | Public | 86.10/1 Hospital activities |
| | | Non-medical staff: Elementary | 9000s | Great Britain | Public | 86.10/1 Hospital activities |
| Police Remuneration Review Body | England, Wales and Northern Ireland | Senior police officers | 1172 | England and Wales | Local authority only | |
| | | Police officers (sergeant and below) | 3312 | England and Wales | Local authority only[vii] | |
| Prison Service Pay Review Body | England, Wales and Northern Ireland | Operational managers | 1173 | England and Wales | Public | 84.23 Justice and judicial activities |
| | | Prison officers | 3314 | England and Wales | Public | |
| School Teachers' Pay Review Body[viii] | England and Wales | Secondary education teaching professionals | 2314 | England and Wales | Public | 85.3 Secondary education |
| | | Primary and nursery education teaching professionals | 2315 | England and Wales | Public | 85.2 Primary education |
| | | Special needs education teaching professionals | 2316 | England and Wales | Public | 85.2 or 85.3 Primary or Secondary education |
| | | Senior professionals of educational establishments | 2317 | England and Wales | Public | 85.2 or 85.3 Primary or Secondary education |
| Armed Forces' Pay Review Body | United Kingdom | Officers in UK armed forces | 1171 | Great Britain | Public | |
| | | COs and other ranks, UK armed forces | 3311 | Great Britain | Public | |

*Notes*: (i) The SSPRB and the NCARRB are excluded from the table as the relevant occupations cannot be identified separately. The AFPRB is not defined by Bryson and Forth (2017) as ASHE does not cover the Armed Forces. They are, however, included in the QLFS. (ii) Some PRBs only cover England and Wales while other PRBs extend to Scotland. Region information can be used to identify PRB remit employees. Note that the ASHE dataset available in the SDS only includes workplaces in Great Britain. (iii) In some occupations (e.g. teachers), there are practitioners both within the PRB system (e.g. in state schools) and those outside it (e.g. private schools). In these cases, the public sector identifier in ASHE, which is taken from the IDBR, can be used to identify the remit group. (iv) Some occupation codes capture a group of jobs across different industrial activities (e.g. SOC 2010=1173 Senior officers in fire, ambulance, prison and related services). In this case, the SIC (2007) can be used to identify the remit group. (v) Some General Practitioners covered by the DDRB are excluded from the analysis as ASHE does not cover the self-employed, and earnings information for the self-employed is not collected within the QLFS. (vi) In the QLFS, it is not possible to separate 86.10/1 Hospital activities from 86.10/2 Medical nursing home activities. Hence, for QLFS, the classification is based on class 86.10 Hospital activities instead of sub-class 86.10/1. (vii) In the QLFS this is defined as 'Local gov or council (inc police etc)'. (viii) As academy schools are classified by the IDBR as public sector, in ASHE it is not possible to distinguish academy school teachers who are not within the STRB's remit from teachers who are covered by the STRB.

**Table A.2.** QLFS sample statistics for explanatory variables, by sector

| | Public | | | Private | | | Non-profit | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female | All | Male | Female |
| Age | 44.70 | 45.09 | 44.53 | 42.40 | 43.16 | 41.62 | 45.03 | 45.99 | 44.58 |
| Work region (per cent) | | | | | | | | | |
| North East | 4.64 | 4.58 | 4.66 | 4.30 | 3.97 | 4.64 | 3.72 | 3.70 | 3.74 |
| North West | 12.97 | 11.63 | 13.51 | 11.99 | 11.86 | 12.12 | 9.82 | 11.30 | 9.13 |
| Yorkshire and Humber | 10.40 | 9.13 | 10.92 | 9.63 | 9.43 | 9.85 | 9.28 | 9.90 | 8.99 |
| East Midlands | 6.94 | 6.55 | 7.10 | 8.17 | 8.33 | 8.01 | 7.17 | 6.80 | 7.33 |
| West Midlands | 7.77 | 7.11 | 8.04 | 8.54 | 8.88 | 8.20 | 7.80 | 8.70 | 7.38 |
| South West | 8.31 | 8.08 | 8.41 | 9.39 | 9.35 | 9.43 | 7.48 | 6.80 | 7.80 |
| East | 10.78 | 12.85 | 9.94 | 13.15 | 13.61 | 12.69 | 13.70 | 14.20 | 13.47 |
| London | 11.80 | 11.71 | 11.84 | 13.61 | 13.57 | 13.64 | 14.33 | 14.90 | 14.07 |
| South East | 10.16 | 11.43 | 9.64 | 9.55 | 9.45 | 9.65 | 13.83 | 10.90 | 15.18 |
| Wales | 6.10 | 6.47 | 5.95 | 4.02 | 3.87 | 4.16 | 4.10 | 3.90 | 4.20 |
| Scotland | 10.13 | 10.46 | 9.99 | 7.65 | 7.69 | 7.61 | 8.78 | 8.90 | 8.72 |
| Tenure (years) | 11.38 | 12.14 | 11.07 | 8.03 | 8.72 | 7.32 | 7.75 | 8.16 | 7.56 |
| Contract type (per cent) | | | | | | | | | |
| Temporary employment | 3.87 | 3.69 | 3.95 | 3.65 | 3.44 | 3.87 | 11.36 | 11.90 | 11.12 |
| Part-time | 31.67 | 10.96 | 40.12 | 27.03 | 10.73 | 43.70 | 34.94 | 20.90 | 31.67 |
| Workplace size (number of employees) | | | | | | | | | |
| Less than 25 | 17.65 | 16.57 | 18.09 | 39.06 | 34.48 | 43.74 | 30.18 | 28.80 | 17.65 |
| 25-49 | 15.23 | 9.60 | 17.53 | 13.32 | 12.85 | 13.79 | 12.63 | 8.80 | 15.23 |
| 50-249 | 27.05 | 28.23 | 26.57 | 24.76 | 26.71 | 22.76 | 24.21 | 22.30 | 27.05 |
| 250-499 | 6.72 | 8.85 | 5.85 | 7.94 | 8.46 | 7.40 | 6.16 | 5.60 | 6.72 |
| 500+ | 33.35 | 36.75 | 31.96 | 14.93 | 17.51 | 12.30 | 26.83 | 34.50 | 33.35 |
| Occupation | | | | | | | | | |
| Managers, directors and senior official | 4.91 | 8.13 | 3.60 | 11.61 | 14.50 | 8.65 | 9.66 | 11.90 | 4.91 |
| Professional occupations | 38.82 | 35.00 | 40.38 | 15.11 | 18.33 | 11.82 | 37.91 | 46.10 | 38.82 |
| Associate professional and technical occupations | 15.98 | 26.20 | 11.82 | 13.84 | 14.85 | 12.81 | 17.80 | 16.70 | 15.98 |
| Administrative and secretarial occupations | 13.84 | 7.80 | 16.31 | 11.97 | 4.57 | 19.55 | 11.33 | 4.80 | 13.84 |
| Skilled trades occupations | 1.90 | 4.41 | 0.87 | 8.32 | 14.35 | 2.16 | 1.86 | 3.20 | 1.90 |
| Caring, leisure and other service occupations | 15.66 | 7.38 | 19.04 | 8.44 | 2.72 | 14.28 | 14.24 | 10.70 | 15.66 |
| Sales and customer service occupations | 1.71 | 1.64 | 1.74 | 11.07 | 6.35 | 15.91 | 2.27 | 1.50 | 1.71 |
| Process, plant and machine operatives | 1.13 | 3.55 | 0.14 | 7.64 | 12.77 | 2.39 | -* | -* | -* |
| Elementary occupations | 6.05 | 5.88 | 6.11 | 11.99 | 11.55 | 12.43 | 4.36 | 3.50 | 6.05 |
| Qualifications | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Degree | 46.53 | 48.15 | 45.87 | 27.89 | 28.92 | 26.85 | 59.50 | 66.60 | 56.23 |
| Other higher education | 13.70 | 11.16 | 14.74 | 9.45 | 9.87 | 9.02 | 10.13 | 8.40 | 10.93 |
| A level | 18.75 | 21.18 | 17.76 | 25.23 | 26.91 | 23.52 | 15.31 | 13.60 | 16.10 |
| O level | 15.03 | 12.74 | 15.96 | 23.10 | 19.65 | 26.63 | 10.23 | 6.90 | 11.76 |
| Other | 3.60 | 4.02 | 3.43 | 8.35 | 9.05 | 7.64 | 2.84 | 2.10 | 3.18 |
| None | 2.40 | 2.75 | 2.25 | 5.98 | 5.61 | 6.35 | 1.99 | 2.40 | 1.80 |
| Married | 56.81 | 61.12 | 55.06 | 48.59 | 52.91 | 44.17 | 53.54 | 58.30 | 51.34 |
| Disabled | 16.28 | 14.07 | 17.18 | 14.85 | 12.33 | 17.43 | 17.52 | 14.40 | 18.96 |
| White | 90.63 | 89.56 | 91.06 | 89.61 | 88.87 | 90.37 | 91.45 | 89.10 | 92.53 |
| Dependent child | 40.02 | 34.25 | 42.37 | 36.68 | 32.94 | 40.50 | 34.12 | 29.30 | 36.35 |
| Year | | | | | | | | | |
| 2016 | 33.49 | 33.36 | 33.54 | 32.75 | 33.20 | 32.29 | 32.48 | 32.90 | 32.29 |
| 2017 | 33.14 | 33.36 | 33.05 | 33.89 | 33.75 | 34.04 | 33.14 | 33.50 | 32.98 |
| 2018 | 33.37 | 33.28 | 33.41 | 33.36 | 33.05 | 33.67 | 34.38 | 33.60 | 34.73 |
| Quarter | | | | | | | | | |
| January - March | 24.68 | 23.84 | 25.02 | 24.22 | 24.20 | 24.24 | 23.14 | 22.40 | 23.48 |
| April - June | 24.96 | 25.92 | 24.57 | 25.04 | 25.02 | 25.05 | 25.25 | 26.40 | 24.72 |
| July-September | 25.54 | 24.59 | 25.93 | 25.00 | 24.96 | 25.05 | 26.36 | 27.50 | 25.83 |
| October-December | 24.82 | 25.65 | 24.48 | 25.74 | 25.82 | 25.65 | 25.25 | 23.70 | 25.97 |
| Number of obs.(unweighted) | 12,439 | 3,603 | 8,836 | 32,362 | 16,368 | 15,994 | 3,168 | 1,000 | 2,168 |

*Notes*: Individuals in Wave 1 are pooled across quarters from 2016/2017/2018. *Figure not presented due to lack of sufficient number of observations.

**Table A.3.** QLFS sample statistics for explanatory variables, within the public sector

| | Non-PRB Public | | | PRB | | |
|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female |
| Age | 46.05 | 46.56 | 45.81 | 42.68 | 42.35 | 42.80 |
| Work region (per cent) | | | | | | |
| North East | 4.45 | 4.30 | 4.51 | 4.92 | 5.10 | 4.87 |
| North West | 12.32 | 10.40 | 13.21 | 13.93 | 13.93 | 13.93 |
| Yorkshire and Humber | 9.77 | 8.44 | 10.38 | 11.35 | 10.43 | 11.65 |
| East Midlands | 6.49 | 5.92 | 6.75 | 7.60 | 7.72 | 7.56 |
| West Midlands | 7.28 | 6.35 | 7.71 | 8.49 | 8.52 | 8.47 |
| South West | 8.10 | 8.44 | 7.95 | 8.63 | 7.40 | 9.04 |
| East | 11.30 | 13.63 | 10.23 | 10.01 | 11.39 | 9.54 |
| London | 11.52 | 11.29 | 11.62 | 12.23 | 12.50 | 12.14 |
| South East | 9.58 | 10.48 | 9.17 | 11.03 | 13.22 | 10.29 |
| Wales | 6.46 | 7.20 | 6.12 | 5.56 | 5.10 | 5.72 |
| Scotland | 12.73 | 13.55 | 12.35 | 6.26 | 4.70 | 6.79 |
| Tenure (years) | 11.54 | 12.64 | 11.04 | 11.14 | 11.20 | 11.12 |
| Contract type (per cent) | | | | | | |
| Temporary employment | 4.19 | 3.83 | 4.36 | 3.40 | 3.42 | 3.39 |
| Part-time | 33.79 | 13.00 | 43.38 | 28.52 | 7.17 | 35.69 |
| Workplace size (number of employees) | | | | | | |
| Less than 25 | 21.63 | 19.81 | 22.47 | 11.71 | 10.51 | 12.11 |
| 25-49 | 16.55 | 9.97 | 19.59 | 13.27 | 8.92 | 14.73 |
| 50-249 | 28.53 | 27.74 | 28.89 | 24.85 | 29.14 | 23.42 |
| 250-499 | 8.09 | 10.06 | 7.18 | 4.68 | 6.61 | 4.04 |
| 500+ | 25.19 | 32.42 | 21.86 | 45.49 | 44.82 | 45.71 |
| Occupation | | | | | | |
| Managers, directors and senior official | 6.44 | 9.12 | 5.20 | 2.64 | 6.29 | 1.42 |
| Professional occupations | 20.21 | 25.82 | 17.63 | 66.54 | 52.15 | 71.37 |
| Associate professional and technical occupations | 18.77 | 25.65 | 15.60 | 11.83 | 27.23 | 6.66 |
| Administrative and secretarial occupations | 19.94 | 10.78 | 24.16 | 4.76 | 2.23 | 5.61 |
| Skilled trades occupations | 3.00 | 6.43 | 1.41 | -* | -* | -* |
| Caring, leisure and other service occupations | 18.41 | 7.46 | 23.45 | 11.57 | 7.25 | 13.02 |
| Sales and customer service occupations | 2.65 | 2.26 | 2.83 | -* | -* | -* |
| Process, plant and machine operatives | 1.80 | 5.20 | -* | -* | -* | -* |
| Elementary occupations | 8.79 | 7.29 | 9.48 | 1.96 | 3.26 | 1.52 |
| Qualifications | | | | | | |
| Degree | 37.29 | 41.84 | 35.19 | 60.30 | 59.95 | 60.41 |
| Other higher education | 12.43 | 11.42 | 12.90 | 15.59 | 10.67 | 17.24 |
| A level | 23.57 | 24.54 | 23.12 | 11.57 | 14.89 | 10.45 |
| O level | 19.24 | 14.32 | 21.51 | 8.75 | 9.79 | 8.39 |
| Other | 4.35 | 4.56 | 4.26 | 2.48 | 3.03 | 2.30 |
| None | 3.12 | 3.32 | 3.02 | 1.32 | 1.67 | 1.20 |
| Married | 55.71 | 59.82 | 53.82 | 58.46 | 63.54 | 56.75 |
| Disabled | 17.01 | 14.49 | 18.17 | 15.19 | 13.30 | 15.82 |
| White | 92.30 | 92.29 | 92.31 | 88.13 | 84.47 | 89.36 |
| Dependent child | 37.32 | 30.04 | 40.67 | 44.05 | 42.12 | 44.69 |
| Year | | | | | | |
| 2016 | 33.24 | 32.00 | 33.82 | 33.86 | 35.91 | 33.17 |
| 2017 | 33.14 | 33.66 | 32.90 | 33.14 | 32.80 | 33.25 |
| 2018 | 33.62 | 34.34 | 33.29 | 33.00 | 31.29 | 33.57 |
| Quarter | | | | | | |
| January - March | 24.42 | 24.12 | 24.55 | 25.08 | 23.33 | 25.66 |
| April - June | 24.93 | 26.20 | 24.34 | 25.02 | 25.40 | 24.89 |
| July-September | 25.89 | 24.37 | 26.59 | 25.02 | 25.00 | 25.02 |
| October-December | 24.76 | 25.31 | 24.51 | 24.89 | 26.27 | 24.43 |
| Number of obs.(unweighted) | 7,442 | 2,347 | 5,095 | 4,997 | 1,256 | 3,741 |

*Notes*: Individuals in Wave 1 are pooled across quarters from 2016/2017/2018. *Figure not presented due to lack of sufficient number of observations.

**Table A.4.** Gross hourly pay (£) at selected percentiles, by sector

| | 10th | 25th | 50th | 75th | 90th |
|---|---|---|---|---|---|
| Public | | | | | |
| All | 9 (17,550) | 11 (21,450) | 15 (29,250) | 21 (40,950) | 28 (54,600) |
| Male | 10 (19,500) | 13 (25,350) | 18 (35,100) | 23 (44,850) | 32 (62,400) |
| Female | 9 (17,550) | 10 (19,500) | 14 (27,300) | 20 (39,000) | 26 (50,700) |
| Private | | | | | |
| All | 8 (15,600) | 9 (17,550) | 12 (23,400) | 18 (35,100) | 28 (54,600) |
| Male | 8 (15,600) | 10 (19,500) | 13 (25,350) | 20 (39,000) | 31 (60,450) |
| Female | 8 (15,600) | 8 (15,600) | 10 (19,500) | 15 (29,250) | 24 (46,800) |
| Non-profit | | | | | |
| All | 8 (15,600) | 10 (19,500) | 14 (27,300) | 20 (39,000) | 28 (54,600) |
| Male | 9 (17,550) | 11 (21,450) | 16 (31,200) | 24 (46,800) | 31 (60,450) |
| Female | 8 (15,600) | 9 (17,550) | 13 (25,350) | 19 (37,050) | 26 (50,700) |

*Notes*: Figure 1a presents gross hourly pay across the entire distribution rather than at select percentiles. Hourly pay is rounded to the nearest pound as required by the UKDA's disclosure policy. Approximate pro-rata annual salary levels are reported in parenthesis and are calculated on the basis of 37.5 hours a week x 52 weeks for all workers.

**Table A.5.** Gross hourly pay (£) at selected percentiles, public sector

| | 10th | 25th | 50th | 75th | 90th |
|---|---|---|---|---|---|
| Non-PRB public | | | | | |
| All | 9 (17,550) | 10 (19,500) | 14 (27,300) | 20 (39,000) | 26 (50,700) |
| Male | 10 (19,500) | 12 (23,400) | 16 (31,200) | 22 (42,900) | 29 (56,550) |
| Female | 8 (15,600) | 9 (17,550) | 12 (23,400) | 18 (35,100) | 24 (46,800) |
| PRB | | | | | |
| All | 10 (19,500) | 13 (25,350) | 18 (35,100) | 22 (42,900) | 30 (58,500) |
| Male | 11 (21,450) | 15 (29,250) | 19 (37,050) | 25 (48,750) | 39 (76,050) |
| Female | 10 (19,500) | 12 (23,400) | 17 (33,150) | 22 (42,900) | 27 (52,650) |

*Notes*: Figure 1b presents gross hourly pay across the entire distribution rather than at select percentiles. Hourly pay is rounded to the nearest pound as required by the UKDA's disclosure policy. Approximate pro-rata annual salary levels are reported in parenthesis and are calculated on the basis of 37.5 hours a week x 52 weeks for all workers.

**Table A.6.** Full ASHE OLS pay regression results, public and private sector

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.164*** | -0.211*** | -0.197*** | -0.132*** | -0.113*** |
| | (0.003) | (0.003) | (0.003) | (0.003) | (0.003) |
| Public | - | 0.205*** | 0.160*** | 0.159*** | -0.035*** |
| | | (0.005) | (0.005) | (0.005) | (0.005) |
| Female × Public | - | 0.020** | 0.017** | 0.016** | 0.003 |
| | | (0.006) | (0.006) | (0.006) | (0.005) |
| Age | - | - | 0.067*** | 0.054*** | 0.037*** |
| | | | (0.001) | (0.001) | (0.001) |
| Age squared | - | - | -0.001*** | -0.001*** | -0.000*** |
| | | | (0.000) | (0.000) | (0.000) |
| North West | - | - | 0.041*** | 0.045*** | 0.025*** |
| | | | (0.007) | (0.007) | (0.005) |
| Yorkshire and Humber | - | - | 0.007 | 0.014* | 0.006 |
| | | | (0.007) | (0.007) | (0.006) |
| East Midlands | - | - | 0.007 | 0.014* | 0.009 |
| | | | (0.007) | (0.007) | (0.006) |
| West Midlands | - | - | 0.046*** | 0.049*** | 0.027*** |
| | | | (0.007) | (0.007) | (0.006) |
| South West | - | - | 0.048*** | 0.061*** | 0.027*** |
| | | | (0.007) | (0.007) | (0.006) |
| East | - | - | 0.081*** | 0.091*** | 0.060*** |
| | | | (0.007) | (0.007) | (0.006) |
| London | - | - | 0.352*** | 0.347*** | 0.244*** |
| | | | (0.007) | (0.007) | (0.006) |
| South East | - | - | 0.141*** | 0.148*** | 0.087*** |
| | | | (0.007) | (0.007) | (0.005) |
| Wales | - | - | -0.023** | -0.022** | -0.014* |
| | | | (0.008) | (0.008) | (0.006) |
| Scotland | - | - | 0.072*** | 0.068*** | 0.039*** |
| | | | (0.007) | (0.007) | (0.006) |
| Tenure (years) | - | - | - | 0.014*** | 0.010*** |
| | | | | (0.000) | (0.000) |
| Tenure squared | - | - | - | -0.000*** | -0.000*** |
| | | | | (0.000) | (0.000) |
| Part-time | - | - | - | -0.211*** | -0.064*** |
| | | | | (0.003) | (0.003) |
| Temporary contract | - | - | - | -0.011* | -0.006 |
| | | | | (0.005) | (0.004) |
| Firm size (log) | - | - | - | 0.005*** | 0.013*** |
| | | | | (0.000) | (0.000) |
| Collective agreement | - | - | - | -0.052*** | 0.008** |
| | | | | (0.003) | (0.003) |
| Professional occupations | - | - | - | - | 0.026*** |
| | | | | | (0.006) |
| Associate professional and technical occupations | - | - | - | - | -0.209*** |
| | | | | | (0.006) |
| Administrative and secretarial occupations | - | - | - | - | -0.452*** |
| | | | | | (0.006) |
| Skilled trades occupations | - | - | - | - | -0.490*** |
| | | | | | (0.006) |
| Caring, leisure and other service occupations | - | - | - | - | -0.616*** |
| | | | | | (0.006) |
| Sales and customer service occupations | - | - | - | - | -0.662*** |
| | | | | | (0.006) |
| Process, plant and machine operatives | - | - | - | - | -0.606*** |
| | | | | | (0.006) |
| Elementary occupations | - | - | - | - | -0.712*** |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | (0.005) |
| Population size | | | 22,247,515 | | |
| Number of obs. (unweighted) | | | 145,554 | | |
| $R^2$ | 0.03 | 0.06 | 0.20 | 0.25 | 0.50 |

*Notes*: (i) Reference category for sector is private sector; for work region North East; and for occupation Managers, directors and senior officials. (ii) Each column also includes a constant term. (iii) Standard errors in parentheses. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

**Table A.7.** Full ASHE OLS pay regression results, public sector

| Model | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Female | -0.191*** | -0.224*** | -0.216*** | -0.174*** | -0.107*** |
| | (0.005) | (0.007) | (0.006) | (0.006) | (0.005) |
| PRB | - | 0.183*** | 0.187*** | 0.201*** | 0.078*** |
| | | (0.009) | (0.009) | (0.009) | (0.007) |
| Female × PRB | - | 0.044*** | 0.050*** | 0.036*** | -0.058*** |
| | | (0.011) | (0.010) | (0.010) | (0.008) |
| Age | - | - | 0.055*** | 0.047*** | 0.036*** |
| | | | (0.001) | (0.001) | (0.001) |
| Age squared | - | - | -0.001*** | -0.001*** | -0.000*** |
| | | | (0.000) | (0.000) | (0.000) |
| North West | - | - | 0.035** | 0.043*** | 0.030** |
| | | | (0.012) | (0.012) | (0.009) |
| Yorkshire and Humber | - | - | -0.016 | -0.004 | -0.008 |
| | | | (0.012) | (0.012) | (0.010) |
| East Midlands | - | - | 0.012 | 0.022 | 0.008 |
| | | | (0.013) | (0.013) | (0.010) |
| West Midlands | - | - | 0.019 | 0.025* | 0.019 |
| | | | (0.013) | (0.013) | (0.010) |
| South West | - | - | 0.019 | 0.034** | 0.003 |
| | | | (0.012) | (0.013) | (0.010) |
| East | - | - | 0.015 | 0.029* | 0.024* |
| | | | (0.013) | (0.013) | (0.010) |
| London | - | - | 0.269*** | 0.272*** | 0.211*** |
| | | | (0.012) | (0.012) | (0.009) |
| South East | - | - | 0.043*** | 0.059*** | 0.024* |
| | | | (0.012) | (0.012) | (0.009) |
| Wales | - | - | -0.012 | -0.010 | -0.007 |
| | | | (0.013) | (0.013) | (0.010) |
| Scotland | - | - | 0.079*** | 0.092*** | 0.032*** |
| | | | (0.012) | (0.012) | (0.009) |
| Tenure (years) | - | - | - | 0.011*** | 0.012*** |
| | | | | (0.001) | (0.001) |
| Tenure squared | - | - | - | -0.000*** | -0.000*** |
| | | | | (0.000) | (0.000) |
| Part-time | - | - | - | -0.117*** | -0.012** |
| | | | | (0.005) | (0.004) |
| Temporary contract | - | - | - | 0.052*** | 0.029*** |
| | | | | (0.009) | (0.007) |
| Firm size (log) | - | - | - | -0.020*** | -0.007*** |
| | | | | (0.001) | (0.001) |
| Collective agreement | - | - | - | -0.020* | -0.009 |
| | | | | (0.008) | (0.006) |
| Professional occupations | - | - | - | - | -0.058*** |
| | | | | | (0.013) |
| Associate professional and technical occupations | - | - | - | - | -0.372*** |
| | | | | | (0.013) |
| Administrative and secretarial occupations | - | - | - | - | -0.559*** |
| | | | | | (0.013) |
| Skilled trades occupations | - | - | - | - | -0.588*** |
| | | | | | (0.018) |
| Caring, leisure and other service occupations | - | - | - | - | -0.688*** |
| | | | | | (0.013) |
| Sales and customer service occupations | - | - | - | - | -0.482*** |
| | | | | | (0.018) |
| Process, plant and machine operatives | - | - | - | - | -0.579*** |
| | | | | | (0.021) |
| Elementary occupations | - | - | - | - | -0.771*** |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | (0.014) |
| Population size | | | 5,627,309 | | |
| Number of obs. (unweighted) | | | 35,841 | | |
| $R^2$ | 0.04 | 0.10 | 0.18 | 0.22 | 0.51 |

*Notes*: (i) Reference category for PRB is non-PRB public; for work region North East; and for occupation Managers, directors and senior officials. (ii) Each column also includes a constant term. (iii) Standard errors in parentheses. (iv) * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

**Table A.8.** Decomposition of the GPG, public and private sector, sensitivity analysis to hourly pay measures

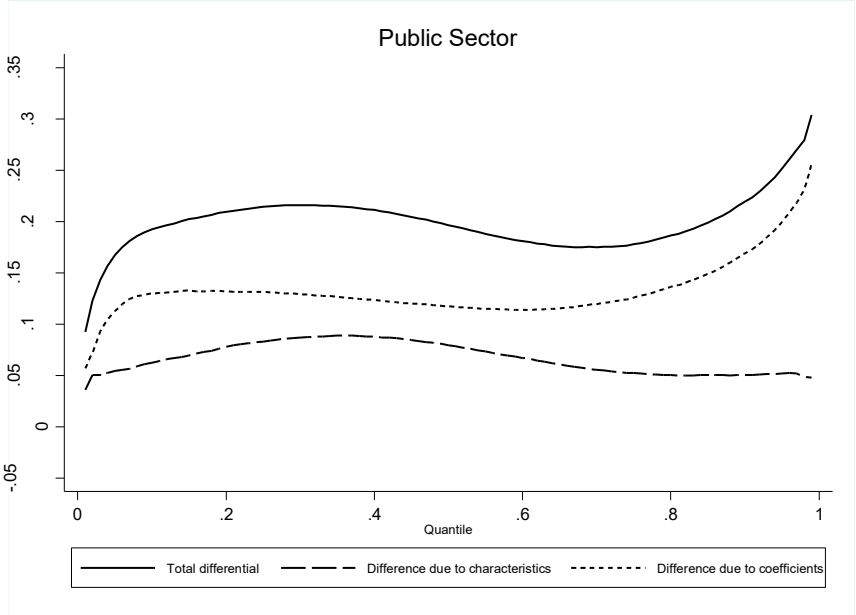
| | Including overtime pay | | Annual earnings | |
|---|---|---|---|---|
| | Public | Private | Public | Private |
| Difference in mean log gross hourly pay | 0.194*** | 0.216*** | 0.222*** | 0.257*** |
| between men and women | (0.005) | (0.003) | (0.008) | (0.006) |
| Difference due to characteristics (explained) | 0.043*** | 0.123*** | 0.049*** | 0.150*** |
| | (0.005) | (0.003) | (0.008) | (0.006) |
| | [22.14%] | [56.70%] | [22.03%] | [58.17%] |
| Difference due to coefficients (unexplained) | 0.151*** | 0.094*** | 0.173*** | 0.108*** |
| | (0.006) | (0.003) | (0.010) | (0.006) |
| | [77.86%] | [43.30%] | [77.97%] | [41.83%] |
| Population size | 5,627,309 | 16,620,206 | 5,627,309 | 16,620,206 |
| Number of obs. (unweighted) | 35,841 | 109,713 | 35,841 | 109,713 |

*Notes:* (i) Decomposition analysis is performed using ASHE and Model (5). (ii) Decompositions are calculated using the relevant male coefficients as the baseline. (iii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.

**Table A.9.** Decomposition of the GPG, public and private sector, sensitivity analysis

| | Excluding occupation | | Including detailed (4-digit) occupation | | Full-time only | | Decomposition method (female coefficients) | | 2017 data | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Public | Private | Public | Private | Public | Private | Public | Private | Public | Private |
| Difference in mean log gross hourly pay between men and women | 0.191*** | 0.211*** | 0.191*** | 0.211*** | 0.129*** | 0.147*** | 0.191*** | 0.211*** | 0.197*** | 0.221*** |
| | (0.005) | (0.003) | (0.005) | (0.003) | (0.006) | (0.004) | (0.005) | (0.003) | (0.005) | (0.003) |
| Difference due to characteristics (explained) | 0.005 | 0.092*** | 0.084*** | 0.132*** | 0.012*** | 0.037*** | 0.063*** | 0.076*** | 0.056*** | 0.134*** |
| | (0.005) | (0.002) | (0.006) | (0.004) | (0.004) | (0.003) | (0.004) | (0.003) | (0.005) | (0.003) |
| | [2.78%] | [43.72%] | [44.0%] | [62.6%] | [9.29%] | [25.15%] | [33.18%] | [35.93%] | [28.21%] | [60.58%] |
| Difference due to coefficients (unexplained) | 0.185*** | 0.119*** | 0.107*** | 0.079*** | 0.117*** | 0.110*** | 0.127*** | 0.135*** | 0.142*** | 0.087*** |
| | (0.007) | (0.003) | (0.006) | (0.003) | (0.005) | (0.003) | (0.005) | (0.003) | (0.006) | (0.003) |
| | [97.22%] | [56.28%] | [56.0%] | [37.4%] | [90.71%] | [74.85%] | [66.82%] | [64.07%] | [71.76%] | [39.42%] |
| Population size | 5,627,309 | 16,620,206 | 5,627,309 | 16,620,206 | 4,012,797 | 12,427,054 | 5,627,309 | 16,620,206 | 5,683,481 | 16,383,111 |
| Number of obs. (unweighted) | 35,841 | 109,713 | 35,841 | 109,713 | 24,673 | 78,841 | 35,841 | 109,713 | 37,602 | 109,588 |

*Notes:* (i) Decomposition analysis is performed using ASHE and Model (5) unless otherwise stated. (ii) Decompositions are calculated using the relevant male coefficients as the baseline unless otherwise stated. (iii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.



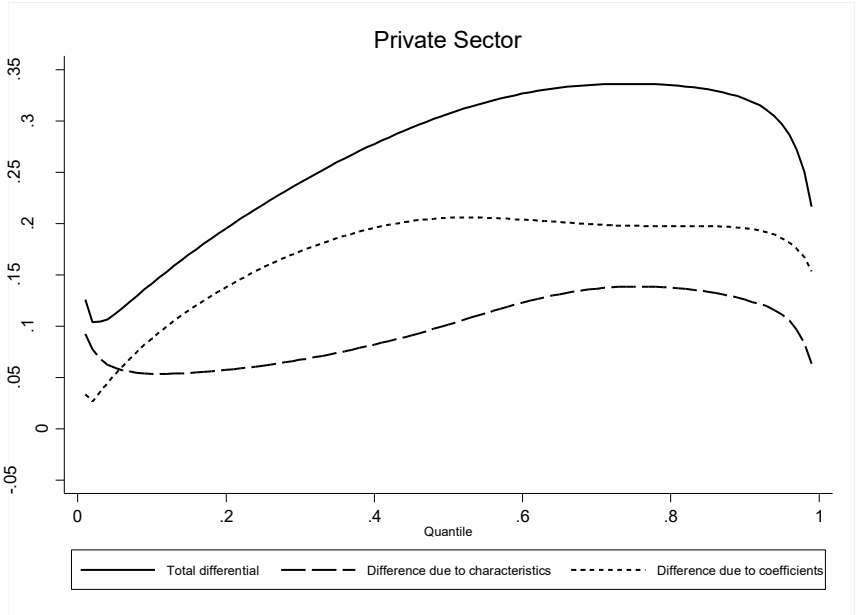




**Figure A.1.** QLFS decomposition of the GPG across the distribution, public and private sector (Model (6))

**Table A.10.** Decomposition of the GPG, public sector, sensitivity analysis to hourly pay measures

| | Including overtime pay | | Annual earnings | |
|---|---|---|---|---|
| | Non-PRB | PRB | Non-PRB | PRB |
| Difference in mean log gross hourly pay | 0.226*** | 0.186*** | 0.259*** | 0.204*** |
| between men and women | (0.007) | (0.008) | (0.010) | (0.013) |
| Difference due to characteristics (explained) | 0.111*** | 0.002 | 0.127*** | -0.004 |
| | (0.007) | (0.008) | (0.011) | (0.012) |
| | [48.92%] | [0.85%] | [49.10%] | [-2.00%] |
| Difference due to coefficients (unexplained) | 0.116*** | 0.184*** | 0.132*** | 0.208*** |
| | (0.007) | (0.010) | (0.013) | (0.015) |
| | [51.08%] | [99.15%] | [50.90%] | [102.00%] |
| Population size | 3,046,955 | 2,580,354 | 3,046,955 | 2,580,354 |
| Number of obs. (unweighted) | 20,193 | 15,648 | 20,193 | 15,648 |

*Notes*: (i) Decomposition analysis is performed using ASHE and Model (5). (ii) Decompositions are calculated using the relevant male coefficients as the baseline. (iii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.

**Table A.11.** Decomposition of the GPG, public sector, sensitivity analysis

| | Excluding occupation | | Including detailed (4-digit) occupation | | Full-time only | | Decomposition method (female coefficients) | | 2017 data | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Non-PRB | PRB | Non-PRB | PRB | Non-PRB | PRB | Non-PRB | PRB | Non-PRB | PRB |
| Difference in mean log gross hourly pay between men and women | 0.224*** | 0.180*** | 0.224*** | 0.180*** | 0.126*** | 0.162*** | 0.224*** | 0.180*** | 0.232*** | 0.190*** |
| | (0.007) | (0.008) | (0.007) | (0.008) | (0.007) | (0.009) | (0.007) | (0.008) | (0.006) | (0.008) |
| Difference due to characteristics (explained) | 0.030*** | -0.002 | 0.108*** | 0.087*** | 0.053*** | 0.004 | 0.135*** | 0.024 | 0.127*** | 0.008 |
| | (0.007) | (0.007) | (0.008) | (0.010) | (0.006) | (0.007) | (0.006) | (0.005) | (0.007) | (0.008) |
| | [13.27%] | [-0.90%] | [48.2%] | [48.3%] | [42.12%] | [2.74%] | [60.43%] | [13.55%] | [54.89%] | [4.10%] |
| Difference due to coefficients (unexplained) | 0.194*** | 0.182*** | 0.116*** | 0.093*** | 0.073*** | 0.157*** | 0.089*** | 0.156*** | 0.104*** | 0.183*** |
| | (0.010) | (0.010) | (0.008) | (0.009) | (0.006) | (0.008) | (0.006) | (0.007) | (0.007) | (0.009) |
| | [86.73%] | [100.90%] | [51.8%] | [51.7%] | [57.88%] | [97.23%] | [39.57%] | [86.45%] | [45.11%] | [95.90%] |
| Population size | 3,046,955 | 2,580,354 | 3,046,955 | 2,580,354 | 2,096,283 | 1,916,514 | 3,046,955 | 2,580,354 | 3,150,517 | 2,532,964 |
| Number of obs. (unweighted) | 20,193 | 15,648 | 20,193 | 15,648 | 13,296 | 11,377 | 20,193 | 15,648 | 21,839 | 15,763 |

*Notes:* (i) Decomposition analysis is performed using ASHE and Model (5) unless otherwise stated. (ii) Decompositions are calculated using the relevant male coefficients as the baseline unless otherwise stated. (iii) Figures in ( ) are standard errors; figures in [ ] are proportions of overall GPG. (iv) * p < 0.05, ** p < 0.01, *** p < 0.001.

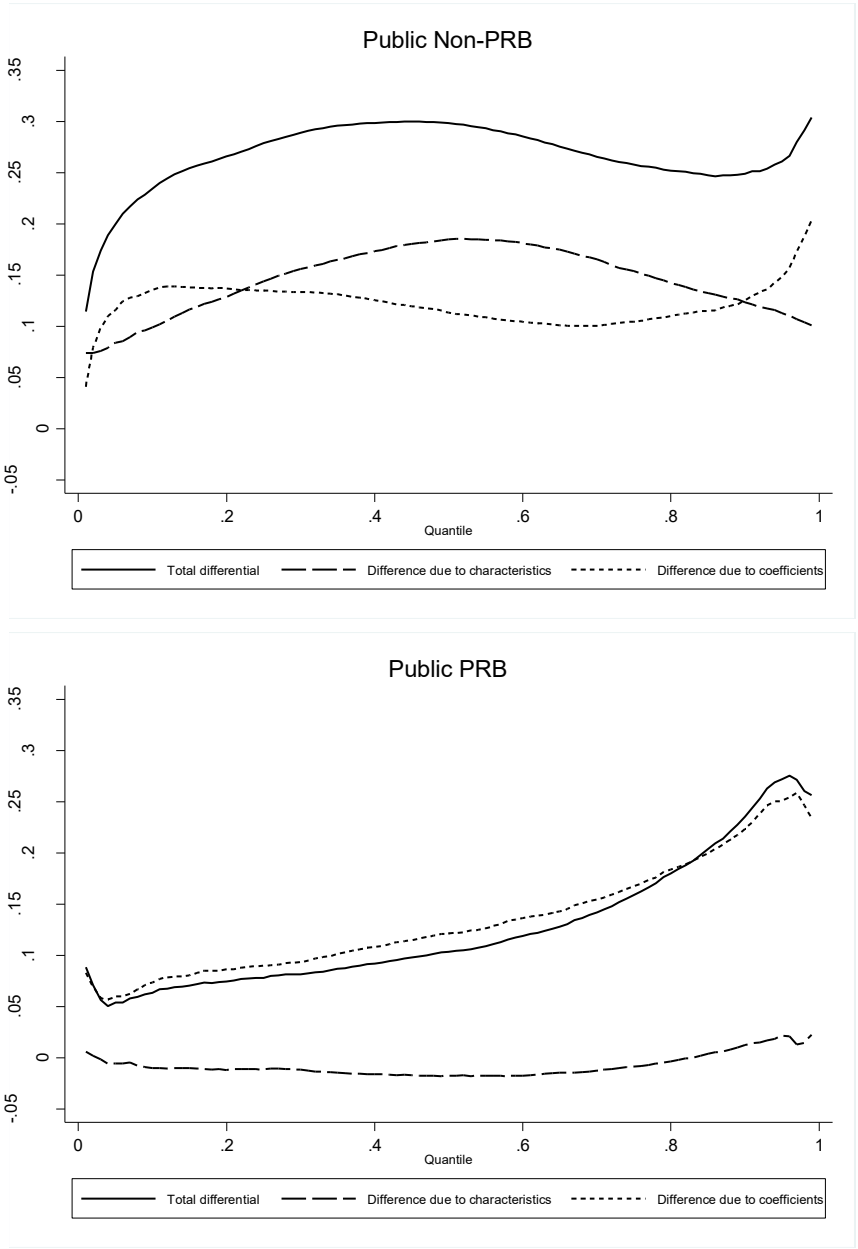



**Figure A.2.** QLFS decomposition of the GPG across the distribution, public sector (Model (6))