

The Occupational Dimension of the UK Gender Pay Gap*

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Abstract

How much of the overall difference between male and female wages results from men and women working in different occupations and how much of it results from men and women being paid differently within occupations? This paper investigates this question and estimates the counterfactual distribution of the gender pay gap in the absence of the gender difference in occupations. The analysis finds that over half of the British gender pay gap results from within occupation differences in earnings rather than between occupation differences in gender mix. When the analysis is restricted to full-time employees an even larger proportion of the gender pay gap results from within occupation differences in earnings.

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1. Introduction

Men earn more than women in the UK on average (as they do in all OECD countries). There is also considerable difference between men and women in the occupational mix of the jobs that they do and also substantial variation in the gender pay gap across occupations. The gender pay gap is sometimes characterised as being primarily an occupations gap. That is to say that the observed differences between male and female wages are viewed as resulting to a significant degree from the differences in the occupations in which men and women work. This should not be viewed as an explanation for the magnitude of the gender pay gap – rather it would partially shift the emphasis, and need for an explanation, from the pay gap to the occupations gap. This paper examines how much of the overall difference between male and female wages results from men and women working in different occupations and how much of it results from men and women being paid differently within occupations.

The Office for National Statistics (ONS) headline gender pay gap is currently around 10%, although this varies with various aspects of the definition used and other measures of the gap tend to give a higher figure. Taking an occupations perspective, the overall or aggregate gender pay gap can then be viewed as being driven by two factors. On the one hand it is driven by differences in occupational mix between the sexes and the extent to which women are under-represented in higher-paying occupations and over-represented in lower-paying occupations. On the other hand and additionally it is driven by the magnitudes of within-occupation gender pay gaps. This paper presents the evidence on these two factors for the UK and examines their relative importance.

To measure the impact of occupations on the gender pay gap this paper asks the following counterfactual question: what would be the size of the aggregate gender pay gap if the occupational mix was the same for men and women, but average male and female pay within each occupation remained as they are? The converse counterfactual is what would be the size of the aggregate gender pay gap if men and women were paid the same as each other on average within each occupation, but the distribution of men and women across the occupations remained as it is?

The next section of the paper describes the overall UK gender pay gap and how it varies with various aspects of the definition used. Section 3 examines the extent to which women are

under-represented in higher-paying occupations and over-represented in lower-paying ones. Section 4 examines the magnitudes of within-occupation gender pay gaps and the variation therein. Section 5 then describes the methodology to be used to estimate the relative importance of gender occupational mix and within-occupation gender pay gaps and Section 6 presents the counterfactual estimates and assesses the relative importance of these two factors. Conclusions are presented in Section 7.

2. The overall gender pay gap

The headline ONS gender pay gap statistic for 2014, measured as the gap between women's and men's median hourly earnings (excluding overtime) for full-time employees, is 9.4%.¹ The ONS preferred headline measure of the gender pay gap is that in hourly earnings excluding overtime for full-time employees because it is seen as providing the most appropriate comparison (Hicks and Thomas, 2009). The choice is motivated by the fact that women are far more likely to work part-time than men and that men work more overtime hours than women. Hourly earnings is chosen over weekly earnings since, even among full-timers, women work fewer hours per week than men. The gap in the median is preferred for the headline figure by ONS because it is less susceptible to the influence of a relatively small number of very high earners and the skewed distribution of earnings than the mean and therefore gives a better indication of typical pay than the mean.

The most accurate and comprehensive data source for data on earnings in Britain is the Annual Survey of Hours and Earnings (ASHE). Most of the earnings statistics used in the gender pay gap debate are based on this data source and its predecessor, the New Earnings Survey (NES). These provide the most accurate information on individual earnings available for Britain. The ASHE, developed from the earlier NES, is conducted in April of each year. It surveys all employees with a particular final two digits to their National Insurance numbers who are in employment and hence aims to provide a random sample of employees in employment. The ASHE is based on a sample of employees taken from HM Revenue and Customs PAYE records. Information on earnings and paid hours is obtained in confidence from employers, usually downloaded directly from their payroll computer records. It

¹ Office for National Statistics, Statistical Bulletin, "Annual Survey of Hours and Earnings, 2014 Provisional Results", 19 November 2014 (http://www.ons.gov.uk/ons/dcp171778_385428.pdf).

therefore provides very accurate information on earnings and paid hours. Indeed providing accurate information to the survey is a statutory requirement on employers under the Statistics of Trade Act.²

The median gross hourly earnings (excluding overtime) of male full-time employees in April 2014, from the ASHE, was £13.59, while that for female full-time employees was £12.31.³ Thus, considering full-time employees only, women earn £1.28 per hour or 9.4% less than men. This percentage differential is commonly known as the gender wage differential, gender wage gap or gender pay gap. The figure is for a particular pay measure and particularly defined group.

Other ways of measuring the gender gap in pay are also sometimes used. The gap is typically wider than the headline figure of 9.4% for these other measures, for example if part-timers are included or if means are compared rather than medians. The gender pay gaps based on the 2014 ASHE for these alternative measures are given in Table 1. Use of the mean rather than the median raises the gender pay gap in hourly earnings (excluding overtime) for full-time employees from 9.4% to 14.2%.

Among full-time employees, women work fewer hours per week than men on average. The mean weekly paid hours of work of full-time employees is 40.2 for men and 37.5 for women, a difference of nearly three hours per week.⁴ As a result, even if attention is restricted to full-time employees, the gender gap in weekly earnings is greater than that in hourly earnings. It is 17.2% for the gross weekly earnings of full-time employees in 2014.⁵

However women work part-time far more than men and part-time employees receive lower hourly pay than full-time employees. 43% of female employees worked part-time compared to 14% of men, and median hourly earnings, excluding overtime, of part-time employees was

² Technical details of the Annual Survey of Hours and Earnings are given in Bird (2004).

³ These are based on employees on adult rates whose pay was unaffected by absence. This is the standard sample definition for ONS headline earnings figures. Full-time employees are defined as those who work more than 30 paid hours per week or those in teaching professions who work more than 25 paid hours per week.

⁴ Office for National Statistics, 2014 Annual Survey of Hours and Earnings, Table 1.9a.

⁵ Part of this increase is due to moving from hourly to weekly earnings and part from the incorporation of overtime pay. The gender pay gap in gross hourly earnings (including overtime) is 10.3%. The gap in weekly earnings if overtime is excluded from it is 13.8%. The gap in weekly basic pay, which also excludes shift premia, payment by results, etc., is 12.9%. (All of these figures are for full-time employees only.) [Tables 1.5a, 1.2a and 1.3a respectively.]

36% less than that of full-time employees in 2014.⁶ Thus when we compare the hourly earnings of all employees rather than just full-time ones the gender gap rises in this case also. It is 19.1% for the median hourly earnings of all employees (full-time and part-time together).

The gender pay gap in means rises by less than that in medians when part-time employees are included: from 14.2% to 17.6%. Thus whereas the use of the mean rather than the median raises the gender pay gap in hourly earnings (excluding overtime) for full-time employees, it reduces it when all employees (full-time and part-time together) are used in the comparison. There are therefore a variety of measures of the overall gender pay gap in use. This paper asks the question: how much of these gaps are due to differences in occupational mix?

3. The gender mix in high-paying and low-paying occupations

The occupational distributions of male and female employees differ considerably. To what extent are women under-represented in high-paying occupations and over-represented in low-paying ones? The occupational analysis in this paper is based on the 4-digit occupations in the Standard Occupational Classification 2010 (SOC2010). SOC2010 is the current classification of occupational information for the UK used by the ONS and more widely. It classifies occupations into 9 major groups, 25 sub-major groups, 90 minor groups and 369 unit groups (sometimes referred to as 4-digit occupations). In the classification “jobs are classified in terms of their skill level and skill content”. The major groups are “a set of broad occupational categories that are designed to be useful in bringing together unit groups which are similar in terms of the qualifications, training, skills and experience commonly associated with the competent performance of work tasks”. The analysis here is based on as many of the 369 4-digit occupations (or unit groups) for which usable information can be obtained from the ASHE tables published by the ONS. The 4-digit level is the most detailed occupational classification available.

Table 2 presents the hourly pay and gender mix of the 20 lowest paid occupations (defined at the 4-digit level), ranked by the median hourly earnings (excluding overtime) of full-time

⁶ Office for National Statistics, 2014 Annual Survey of Hours and Earnings. These factors are slightly offset by the fact that the median hourly earnings of women who work part-time (£8.44) is greater than that of men who work part-time (£8.00), meaning that the gender gap in hourly earnings among part-time employees is negative (-5.2%).

employees. Table 3 gives the equivalent information for the 20 highest paid occupations.⁷ The majority of the lowest paid occupations in Table 2 (11 out of the 20) are within major group (i.e. 1-digit occupation) 9 (i.e. their codes have first digit 9), which contains what are classified as elementary occupations. Of the remainder 5 are in major group 6 (Caring, leisure and other service occupations), 3 are in major group 7 (Sales and customer service occupations) and 1 in major group 8 (Process, plant and machine operatives).

The lowest paid occupation on the measure used for this table is waiters and waitresses (occupational code 9273). The full-time employees in this occupation have a median hourly earnings (excluding overtime) of £6.50 per hour. The adult national minimum wage at the time of the ASHE survey, April 2014, was £6.31 per hour. (It was raised to £6.50 per hour in October 2014). This occupation is disproportionately female: 57% of full-time employees in this occupation are women, whereas for full-time employees as a whole only 39% are female.

The 20 occupations in this table all have a median hourly earnings (excluding overtime) among full-time employees of £7.86 per hour or less, compared with an overall median for full-time employees of £13.08 per hour. Women are over-represented in the majority of occupations in Table 2. In only 3 of the occupations is the proportion female lower than that among all full-time employees. In the remaining 17 occupations the proportion of full-time employees in the occupation who are female exceeds the overall figure. For these 20 lowest paid occupations in combination 62% of the full-time employees in them are women, considerably higher than the 39% of all full-time employees.

Overall about 8% of full-time employment is in one of these 20 occupations. But this differs considerably by gender. About 13% of women working full-time work in one of these 20 occupations, whereas only 5% of men do. Thus women working full-time are more than twice as likely to work in one of these lowest paid occupations as men are.

The measure of pay used in this table is used as the starting point and reference specification since median hourly earnings (excluding overtime) of full-time employees is used for the

⁷ The analysis for the table excludes occupations for which there are too few employees in the ASHE sample to provide an accurate measure of median earnings for the occupation. ONS evaluates the quality of each estimate based on its coefficient of variation, i.e. the ratio of the standard error of the estimate to the estimate itself. The smaller the coefficient of variation the greater the accuracy of the estimate. Estimates with a coefficient of variation greater than 20% are suppressed from publication on quality grounds by ONS, along with those for which there is a risk of disclosure of individual employees or employers.

ONS headline measure of the gender pay gap. If either the mean is used instead of the median as the hourly pay measure or if all employees are included rather than just full-time ones, the composition and the ordering of the table change slightly, but not all that much.

If we conduct the ranking of occupations on the basis of the mean hourly earnings (excluding overtime) of full-time employees rather than the median, 17 of the 20 occupations are the same as those listed in Table 2 and the general picture is similar. For these 20 occupations in combination 63% of the full time employees are women compared to 39% of all full-time employees. Now women are over-represented in 15 of the occupations. About 10% of women working full-time work in one of these 20 occupations, whereas 4% of men do, so the ratio is about the same as before.

If we conduct the ranking of occupations on the basis of the median hourly earnings (excluding overtime) of all employees rather than just full-time ones, 14 of the 20 occupations are the same as those listed in Table 2. The general picture changes somewhat more but is still fairly similar. For these 20 occupations in combination 68% of the employees are women, but this is now viewed in comparison to 50% of all employees (full-time and part-time together). Now women are over-represented (i.e. more than 50%) in fewer occupations: 12 out of the 20. Finally, about 18% of women employees work in one of these 20 occupations, whereas about 9% of men do. The ratio is still slightly over 2, but lower than before.

Turning to the highest paid occupations, the 20 highest ranked by median hourly earnings (excluding overtime) of full-time employees are given in Table 3. Half of the 20 highest paid occupations (10 out of the 20) are within major group 1 (i.e. their codes have first digit 1), which contains occupations that are classified as managers, directors and senior officials. Of the remainder 6 are in major group 2 (professional occupations), 3 are in major group 3 (associate professional and technical occupations) and 1 in major group 8 (process, plant and machine operatives).

Women are under-represented in 14 of the 20 occupation in Table 3 (compared with their 39% of full-time jobs). For these 20 highest paid occupations in combination 37% of the full-time employees are women, not much below the 39% of all full-time employees. In contrast to the lowest paid occupations, the proportion of full-time employment that is in one

of these 20 occupations does not differ much by gender. 6.5% of women working full-time work in one of these 20 occupations and 7.2% of men do. So for both these aspects the picture is rather different from that for the lowest paid occupations.

As with the lowest paid occupations, if either the mean is used instead of the median as the hourly pay measure or if all employees are included rather than just full-time ones, the composition and ordering of Table 3 changes slightly, but not all that much. If we conduct the ranking of occupations on the basis of the mean hourly earnings (excluding overtime) of full-time employees rather than the median, 17 of the 20 occupations are the same as those listed in Table 3 and the general picture is similar. For these 20 occupations in combination 37% of the full time employees are women, the same as in Table 3, compared to 39% of all full-time employees. Now women are over-represented in 15 of the occupations.

If we conduct the ranking of occupations on the basis of the median hourly earnings (excluding overtime) of all employees rather than just full-time ones, 18 of the 20 occupations are the same as those listed in Table 3. The general picture changes somewhat more but is still fairly similar. For these 20 occupations in combination 40% of the employees are women, compared to 50% of all employees (full-time and part-time together). So women are somewhat more under-represented in these occupations when all employees are considered. They are under-represented (i.e. less than 50%) in 14 out of the 20 occupations in this case.

We can also look at this in terms of the median annual earnings of full-time full-year employees. In this case women are over-represented in 15 of the 16 occupations out of the lowest-paid 20 for which the gender pay gap can be calculated and under-represented in 15 of the 20 highest-paid occupations.

Comparing Tables 2 and 3, the proportion of full-time employees who are female in the lowest paid 20 occupations is considerably higher (62%) than in the highest paid 20 occupations (37%). However a scatter plot for all the 4-digit occupations of median hourly earnings against the proportion female shows little evidence of much of a relationship between them overall. Indeed the correlation coefficient between them is very weak at -0.07. The regression line has a slope that is negative but insignificantly different from zero (a t-ratio of -1.29). The fitted line falls from a predicted median hourly earnings of £14.46 in an

all-male occupation (i.e. proportion female = 0) to £12.91 in an all-female one (i.e. proportion female = 1). So while there is a negative relationship, it is a rather weak one.⁸

Interestingly the median hourly earnings of full-time employees has a much stronger relationship with the proportion part-time in the occupation than with the proportion female. The correlation coefficient between them is -0.32. The regression line has a negative slope that is highly statistically significant (a t-ratio of -6.13). The fitted line falls from a predicted median hourly earnings of full-time employees of £16.06 in an occupation with no part-time employees to £6.56 in one that is almost entirely part-time (97% part-time – the highest among the occupations – in school midday and crossing patrol occupations).

Returning to the lowest paid occupations in terms of median hourly pay of full-time employees, as listed in Table 2, 17 of these 20 occupations have an above average proportion part-time, i.e. the proportion in the occupation who are part-time exceeds the overall proportion (for all occupations together). Additionally, in 12 of the 20 occupations the majority of employees are part-time. For the highest paid occupations, as listed in Table 3, all 20 of them have a below average proportion part-time, i.e. a proportion part-time that is below the overall proportion for all occupations.

In summary, women are very over-represented in the very lowest paid occupations and slightly under-represented in the very highest paid ones. But when we look across all 4-digit occupations there is not a significant relationship between the level of pay in an occupation and the proportion female in it. In contrast there is a significant relationship between the level of pay (of full-time employees) and the proportion part-time.

⁸ This is also true when all employees (full- and part-time) are considered. The correlation coefficient is again weak at -0.09 and the slope of the regression line is again insignificantly different from zero.

4. The variation in within-occupation gender pay gaps

There is considerable variation in within-occupation gender pay gaps. Linking to the previous section, Tables 2 and 3 also report the within-occupation gender pay gaps for the 20 lowest and 20 highest paid occupations. The gender pay gaps in the lowest-paid occupations are typically smaller than that for all full-time employees (which is 9.4%). In 5 of the 20 occupations in Table 2 the gender pay gap is “negative”, i.e. women working full-time have a higher median hourly pay than men in those occupations. In 12 of the 20 occupations there is a “positive” gender pay gap (i.e. women paid less than men), but it is below the 9.4% overall figure. In only 3 occupations does the gap exceed this overall figure. The picture is rather different for the highest-paid occupations. In 3 of these the gender pay gap cannot be calculated accurately from the available figures (in 2 cases because there are almost no women in the sample in those occupations). In 11 of the 17 occupations for which a gender pay gap can be calculated it exceeds the 9.4% gap for all full-time employees, reaching as high as a gap of 40.3% among financial institution managers and directors.⁹

In combination Tables 2 and 3 suggest that within-occupation gender pay gaps are typically larger in the highest-paid occupations than they are in the lowest-paid ones. Looking at a scatter plot for all the occupations seems to confirm this, both when the combined (male and female) median of hourly earnings is used and when the male median is used (to avoid a circularity). In the latter case, the correlation coefficient across occupations between male median earnings and the gender pay gap is 0.29. The regression line has a positive slope that is strongly statistically significant (a t-ratio of 5.08). The fitted line rises from a predicted median gender pay gap for full-time employees of 3.6% in the lowest paid occupation to one of 23.5% in the highest paid occupation. The evidence across occupations is therefore that within-occupation gender pay gaps are higher in higher paid occupations.

Additionally we might ask whether the gender pay gap varies between high male density and high female density occupations. Gender pay gaps in the occupations with the lowest and highest proportion female are given in Tables 4 and 5 respectively. There is some evidence from these tables of a slight tendency for the gender pay gap (among full-time employees) to be lower where the proportion female is higher, but it is not very obvious. Looking across all

⁹ If the mean is used instead of the median or all employees instead of just full-time ones, the general picture is similar in both cases.

occupations for which both can be measured sufficiently accurately, the correlation coefficient between the median gender pay gap in hourly earnings (excluding overtime) among full-time employees and the proportion female in the occupation is -0.22. The regression line has a negative slope that is statistically significant (a t-ratio of -3.62). The fitted line falls from a predicted gender pay gap of 11.0% where the proportion female is virtually zero to one of 2.1% where the proportion female is virtually one. (Of course the gender pay gap is not defined if the proportion female is strictly 0 or 1.)

The gender pay gap differs considerably by occupation more generally. The ONS headline overall gender pay gap is currently around 10%. However, the gap is much larger than this in some occupations and much smaller, and even “negative”, in others. The 20 occupations with the highest gender pay gaps in terms of hourly earnings for full-time employees are given in Table 6. The gap is over 40% for two occupations: managers and proprietors in forestry, fishing and related services and financial institution managers and directors. Eight of the occupations in the table have gender pay gaps above 30%. 32 occupations have gender pay gaps above 20%, i.e. more than double the overall gender pay gap. The overall gender pay gap is exceeded in two-fifths of occupations.

However there are also a considerable number of occupations in which women earn more than men on average. Of the 369 4-digit occupations the median gender pay gap for full-time employees cannot be calculated accurately in 91 occupations (due mainly to too few men or women in that occupation in the sample). Women have a higher median hourly earnings for full-time employees in 49 of the remaining 278 occupations, i.e. more than 1 in 6 of these occupations.¹⁰ Mostly these gaps are rather small, but in a few occupations they are quite large. The 20 occupations with the highest pay gap in favour of women are given in Table 7. There are 13 occupations where women out-earn men by more than 10%.

It would seem that the position in this regard is somewhat different in the UK to that in the US. A recent article in the Washington Post had the headline "Women out-earn men in just 9 of 342 occupations".¹¹ The article, by Catherine Rampell, commented on a recently released table by the US Census Bureau showing median earnings by detailed occupation for the US

¹⁰ When the hourly earnings of all employees is considered, women have a higher median in 52 out of 292 occupations, a similar proportion.

¹¹ <http://www.washingtonpost.com/news/rampage/wp/2015/03/18/women-out-earn-men-in-just-9-of-342-occupations/>

for 2013. The table gives median earnings for full-time, year round workers in the past twelve months, and also includes the ratio of women's earnings to men's earnings by occupation, in cases where enough data were available for a reliable comparison, and the percentage of women in an occupation.¹² So this comparison for the US is for annual earnings. The nearest comparable figure available from the ASHE is also restricted to those who have been in the same job for more than a year. For this group the 2014 ASHE indicates that women in the UK out-earn men in 24 out of 220 occupations in terms of the gross annual pay of full-time employees. So while this is much lower than that for hourly pay measures, the UK figures for annual earnings would seem to be much higher than that for the US. Rampell notes that the 9 occupations in which women out-earned men in 2013 in the US are a pretty mixed bunch. Some of these occupations are female-dominated, but most are not. Some are low-income, and some are not. The occupations in Table 7 also are a pretty mixed bunch.

In summary, there is considerable variation in within-occupations gender pay gaps in the UK. There is a tendency for them to be higher in higher paid occupations and lower in occupations with a high proportion female. They are over 40% in some occupations and they exceed the overall gender pay gap in two-fifths of occupations. Offsetting this women out-earn men in more than 1 in 6 occupations.

5. Estimation of adjusted wage differentials

Wage differentials are often decomposed into a part that is “explained” by a set of factors and a part that is left “unexplained” by these factors. The latter can also be viewed as the “adjusted” wage differential, after removal of the effect of the specified set of factors. Suitable econometric decomposition methods are discussed in the survey by Fortin et al (2011). The classic regression-based decomposition proposed by Oaxaca (1973) and Blinder (1973) is now a standard technique in many areas of applied economics. It provides a method for decomposing the difference in the *mean* of an outcome variable between two groups or between two time periods and has been applied in a vast array of studies. Most studies that decompose wage differentials analyse the mean differential only and apply the

¹² <http://census.gov/newsroom/press-releases/2015/cb15-tps22.html>,
http://www.census.gov/people/io/publications/table_packages.html

Oaxaca-Blinder decomposition. The analysis in this paper also focuses on median differentials and those at other distributional points.

The “unexplained” component of an Oaxaca-Blinder decomposition, which can also be viewed as an “adjusted wage gap”, can also be interpreted as a “treatment effect” of the type that has been extensively studied in the program evaluation literature. (Specifically it is the average treatment effect on the treated.) Fortin et al (2011) stress the usefulness of this link “to (i) clarify the assumptions underneath popular decomposition methods, (ii) propose estimators for some of the elements of the decomposition, and (iii) obtain formal results on the statistical properties of the various decomposition terms”.

A useful way of viewing this decomposition and resulting adjusted wage gap in the case of comparing the wages of women with those of men is that it estimates the counterfactual average if women were still paid according to the female wage structure, but had the same average characteristics as men, and compares this with the actual male average wage. So the adjusted mean wage gap is an estimate of what the mean gap would be if the two groups had the same average characteristics.

Adjusted wage gaps can be constructed more generally using simple re-weighting estimators (also known as inverse probability weighting, inverse propensity weighting or propensity score weighting). For performing a decomposition for distributional statistics, such as here, Fortin et al (2011) in their survey argue that “reweighting is the method of choice” (page 74) because first it is simple to implement and second there are well established results in the program evaluation literature that show that the method is asymptotically efficient (Hirano et al., 2003; Firpo, 2007). The Oaxaca-Blinder estimator of the counterfactual mean can be shown to be a propensity score reweighting estimator based on a linear model for the conditional odds of being “treated”, i.e. in this case of a particular observation being female (Kline, 2011).

Using a reweighting estimator to estimate the counterfactual median and the adjusted median wage gap, the focus is on cumulative distributions, since the median can then be obtained by inversion. The approach constructs a counterfactual distribution which combines the sample characteristics of men with the female wage structure. It estimates the hypothetical wage

distribution that women would have if they had the same distribution of characteristics as men.

The method replaces the distribution of the vector of characteristics, x , of group A (women) with the distribution of x of group B (men) by using the re-weighting factor $\Psi(x)$ defined as follows. Construct a dummy variable D_B that takes the value 1 in group B (men) and the value 0 in group A (women). The re-weighting factor can then be written as

$$\Psi(x) = \frac{\Pr(x | D_B = 1)}{\Pr(x | D_B = 0)} = \frac{\Pr(D_B = 1 | x) / \Pr(D_B = 1)}{\Pr(D_B = 0 | x) / \Pr(D_B = 0)}$$

In the case where the adjustment is for a single discrete factor such as occupation, as in this paper, the procedure can be simplified. In this case the predicted conditional probabilities are simply the within-occupation relative frequencies.

$$\begin{aligned} \Psi(x) &= \frac{\text{Proportion of occupation } x \text{ who are male} / \text{Overall proportion male}}{\text{Proportion of occupation } x \text{ who are female} / \text{Overall proportion female}} \\ &= \frac{\# \text{ in occupation } x \text{ who are male} / \text{Overall } \# \text{ male}}{\# \text{ in occupation } x \text{ who are female} / \text{Overall } \# \text{ female}} \end{aligned}$$

Practical implementation involves the following steps: (1) Estimate the reweighting factor $\Psi(x)$ for observations in group A (i.e. women). (2) Compute the counterfactual statistic of interest, such as the median, using observations in the female sample reweighted using $\Psi(x)$. (3) The adjusted median wage gap, for example, is then the difference between this estimated counterfactual median for women and the actual median for group B , i.e. men. Adjusted versions of other summary statistics can be calculated equivalently.

6. The contribution of differences in occupational mix to gender pay gaps

By how much does the overall gender pay gap fall if we adjust it for the extent to which women work in different (4-digit) occupations to men? i.e. how much of the gender pay gap can be attributed to the difference in occupational mix between men and women? This section uses the methodology described in the previous section to address this counterfactual question for Great Britain (GB) in 2013. Such counterfactual analysis requires use of the

restricted-access ASHE individual-level microdata available in the Secure Lab within the UK Data Service. The analysis in this section is based on this microdata. This necessitates two changes compared with the statistics in the earlier sections. First, the most recent ASHE microdata deposited in the Secure Lab are those for 2013. Second, the Secure Lab ASHE microdata are for GB (i.e. the UK less Northern Ireland) rather than the whole of the UK.

Both these differences raise the calculated overall gender pay gap slightly. For example, for 2014 the UK median gender pay gaps in hourly pay excluding overtime, as quoted above in section 2, are 9.4% for full-time employees and 19.1% when all employees are considered. The corresponding figures for the UK for 2013 were slightly higher at 10.0% for full-time employees and 19.8% for all employees. When attention is restricted to GB these figures for 2013 are slightly higher again, at 10.3% for full-time employees and 20.0% when all employees are considered.

For expositional purposes it is useful to start by discussing the estimates for all employees, i.e. full-time and part-time together, although the ONS headline gap is for full-time employees only. Counterfactual gender pay gaps adjusted for the gender difference in occupational mix, for all employees in GB in 2013, are reported in Table 8 and Figure 1. The first row of the table gives the actual median and mean male and female wage and the gender gaps. The full distribution is shown in Figure 1. When the counterfactual is constructed a small number of individuals who are employed in occupations for which the sample is non-mixed (i.e. it is either all male or all female) get excluded.¹³ The second row of the table therefore gives the equivalent unadjusted figures when these individuals are excluded. This has very little effect. The corresponding distribution is also shown in Figure 1.

The third row of the table then gives the counterfactual gender pay gaps, median and mean, with the full distribution again shown in Figure 1. These are the gender pay gaps adjusted for the gender difference in occupational mix. When the comparison is for all employees, the counterfactual reduces the median gender pay gap on a comparable basis from 20.2% to 10.4%, i.e. by just under half. The mean gender pay gap is reduced from 22.1% to 13.8%, i.e.

¹³ For the 2013 ASHE these are all in occupations for which the sample is all male. 670 individuals out of 167,522 (or 0.4%) get excluded.

by just over one third.¹⁴ The counterfactual reduction is at its largest in proportional terms around the median. Below the median it reduces the gap by about a third at the lower quartile and about a quarter at the bottom decile. Above the median it reduces the gap by about two-fifths at the upper quartile and about a third at the top decile. Thus, the majority of the gender pay gap comes from *within* occupational differences rather than from between occupation differences in the gender mix.

An interesting comparison with the United States can be made. Claudia Goldin has recently reported, in her Presidential Address to the January 2014 meeting of the American Economic Association (Goldin, 2014), that “the majority of the current earnings gap comes from *within* occupational differences in earnings rather than from between occupation differences” (in the gender mix). She estimates that the gender difference in occupation mix contributes less than one-third of the *mean* gender pay gap in the US. (She looks at the mean gap only and uses an Oaxaca-Blinder decomposition.) Equalizing pay within each occupation is found to have a much larger effect on the aggregate gender pay gap than equalizing the proportion female by occupation. “[W]hat is going on within occupations ... is far more important to the gender gap in earnings than is the distribution of men and women by occupations” (Goldin, 2014). Thus the findings for GB when all employees are considered are broadly similar in this regard to those for the US. In fact for the mean gender pay gap, which is the only one for which a direct comparison can be made, the proportional reduction is almost identical to that found by Goldin for the US. Interestingly Goldin’s estimates for the US of the relative importance of within and between differences are very similar whether the focus is on all employees or on full-time employees only. This is not the case for Britain.

Table 9 and Figure 2 report the corresponding counterfactual gender pay gaps when the analysis is restricted to full-time employees. (Recall that the ONS’s headline gender pay gap is calculated for full-time employees only.) In this case the occupational mix plays a smaller role than when all employees are considered. The median gender pay gap is reduced from 10.6% to 7.9%, i.e. by about a quarter, by equalizing the occupational mix. The mean gender pay gap is reduced from 16.5% to 12.9%, i.e. by about one fifth, by equalizing the

¹⁴ Very large weights can sometimes be a problem with this methodology, giving undue influence to a very small subset of observations, but this is not the case here. Trimming the weights of individuals with very large weights (greater than 100 – about 1% of the sample) in the counterfactual reduces the median gender pay gap from 10.4% to 10.3% and the mean gender pay gap from 13.8% to 13.6%, i.e. very little change.

occupational mix.¹⁵ Again the counterfactual reduction is at its largest in proportional terms around the median. In fact below the median the counterfactual adjustment increases the gap, very slightly at the lower quartile and by about a quarter at the bottom decile. Above the median it reduces the gap by between a fifth and a quarter at both the upper quartile and the top decile points.

Thus the slightly larger impact of the difference in occupation mix found above when all employees are considered rather than just full-time ones comes in part not from the impact on the hourly pay of full-time employees, but rather from the impact on the proportion of employees who are full-time. For all employees, as used in Table 8 and Figure 1, the proportion of employees who are full-time is 0.86 for men and 0.57 for women, a difference of about 30 percentage points. The counterfactual estimate, adjusting for the different occupational mix, is 0.71 for women, a difference of 15 percentage points. So the counterfactual reduces the difference by about half.

In summary, when all employees are compared, re-weighting for differences in occupational mix reduces the median gender pay gap by just under half. But when the focus is restricted to full-time employees only, it reduces it by only a quarter. The reduction when all employees are compared comes in part through a reduction in the gender difference in the proportion working full-time. In both cases the majority of the gender pay gap results from within occupation differences in earnings rather than from between occupation differences in gender mix.

7. Conclusions

This paper examines the occupational dimension of the UK gender pay gap. It asks how much of the overall difference between male and female wages results from men and women working in different occupations and how much it results from men and women being paid differently within occupations. Using data from the ASHE it finds that the correlation across (4-digit) occupations between the median hourly earnings (excluding overtime) of full-time

¹⁵ As when all employees are considered, trimming the weights of individuals with very large weights (greater than 100 – here about 1.5% of the sample) has very little effect. The mean counterfactual gender pay gap is reduced from 12.9% to 12.7% and the median is in fact slightly increased: from 7.9% to 8.3%.

employees in an occupation and the proportion of those employees that is female is extremely weak (and statistically insignificantly different from zero). The paper finds that the gender pay gap differs hugely by occupation. On the one hand there are occupations where the gender pay gap exceeds 40%. On the other hand in more than one-sixth of the occupations in which it can be measured the gender pay gap is “negative”, i.e. women earn more than men on average. Within-occupation gender pay gaps tend to be higher in higher paid occupations and the correlation here is strongly statistically significant.

This paper uses an inverse-propensity reweighting estimator to estimate the counterfactual distribution of the gender pay gap if women were distributed across occupations as men are, i.e. to adjust for the gender difference in occupational mix. The analysis finds that the majority of the gender pay gap results from within-occupation differences in earnings rather than between-occupation differences in gender mix. When all employees are compared, estimating the counterfactual gender pay gap adjusted for the gender difference in occupational mix reduces the mean gender pay gap by just over a third and the median gender pay gap by just under a half. However, much of this reduction is found to result from the counterfactual reduction in the gender difference in the proportion working full-time. When full-time employees only are compared the counterfactual reduces the mean gender pay gap by only about a fifth and the median gender pay gap by only about a quarter. Three quarters of the gender pay gap in this case comes from *within* occupational differences in earnings rather than from between occupation differences in mix.

Table 1
Alternative measures of the UK gender pay gap, 2014
Hourly earnings (excluding overtime)

	Median Male Pay	Median Female Pay	Median Gender Pay Gap	Mean Male Pay	Mean Female Pay	Mean Gender Pay Gap
Full-time jobs	£13.59	£12.31	9.4%	£16.77	£14.39	14.2%
All employee jobs	£12.82	£10.37	19.1%	£16.44	£13.54	17.6%

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 1.6a.

[<http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tc%3A77-337425>]

Notes: Hourly earnings figures are for employees on adult rates whose pay was unaffected by absence.

Table 2
Lowest paid occupations by median hourly pay (excluding overtime) of full-time employees, United Kingdom, 2014.

Occupation	Code	Male Median (£)	Female Median (£)	Overall Median (£)	Proportion Female	Gender pay gap (%)
Waiters and waitresses	9273	6.52	6.50	6.50	0.57	0.3
Bar staff	9274	6.69	6.51	6.57	0.51	2.7
Launderers, dry cleaners and pressers	9234	6.68	6.47	6.59	0.58	3.1
Kitchen and catering assistants	9272	6.65	6.86	6.78	0.54	-3.2
Leisure and theme park attendants	9275	7.11	6.66	6.94	0.50	6.3
Other elementary services occupations n.e.c.	9279	7.16	6.52	6.94	0.38	8.9
Vehicle valeters and cleaners	9236	6.92	7.22	6.99	0.10	-4.3
Hairdressers and barbers	6221	7.45	7.10	7.20	0.81	4.7
Fishing & other elementary agriculture occs	9119	7.50	6.58	7.23	0.19	12.3
Elementary administration occupations n.e.c.	9219	7.47	7.14	7.23	0.48	4.4
Cleaners and domestics	9233	7.41	7.03	7.23	0.54	5.1
Nursery nurses and assistants	6121	7.01	7.25	7.25	0.98	-3.4
Retail cashiers and check-out operators	7112	7.42	7.21	7.34	0.57	2.8
Packers, bottlers, canners and fillers	9134	7.68	7.00	7.45	0.40	8.9
Sales and retail assistants	7111	7.71	7.36	7.50	0.51	4.5
Sewing machinists	8137	9.13	7.43	7.51	0.80	18.6
Housekeepers and related occupations	6231	7.07	7.86	7.68	0.83	-11.2
Beauticians and related occupations	6222	10.31	7.74	7.85	0.93	24.9
Care workers and home carers	6145	8.12	7.80	7.86	0.79	3.9
Pharmacy and other dispensing assistants	7114	7.67	7.86	7.86	0.84	-2.5
Lowest paid 20 occupations (by overall median)					0.62	
All full-time employees		13.59	12.31	13.08	0.39	9.4

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 3
Highest paid occupations by median hourly pay (excluding overtime) of full-time employees, United Kingdom, 2014.

Occupation	Code	Male Median (£)	Female Median (£)	Overall Median (£)	Proportion Female	Gender pay gap (%)
Aircraft pilots and flight engineers	3512	46.70		46.70	0.00	
Chief executives and senior officials	1115	44.89	32.30	42.66	0.25	28.0
Marketing and sales directors	1132	34.99	33.17	34.24	0.24	5.2
Legal professionals n.e.c.	2419	37.38	30.02	34.04	0.52	19.7
Information technology & telecoms directors	1136	32.85	33.02	33.11	0.17	-0.5
Financial managers and directors	1131	33.95	25.36	30.57	0.34	25.3
Brokers	3532			30.16	0.25	
Medical practitioners	2211	32.71	24.33	28.97	0.40	25.6
Senior professionals of educational estabs	2317	32.34	26.05	28.42	0.61	19.4
Financial institution managers and directors	1150	34.78	20.75	28.32	0.37	40.3
Senior police officers	1172	27.69	26.65	27.53	0.15	3.8
Functional managers and directors n.e.c.	1139	26.99	23.93	25.58	0.36	11.3
Train and tram drivers	8231	24.84	23.42	24.83	0.08	5.7
Higher education teaching professionals	2311	26.09	23.34	24.75	0.37	10.5
IT project and programme managers	2134	25.96	21.34	24.64	0.24	17.8
Human resource managers and directors	1135	25.23	23.03	24.00	0.57	8.7
Taxation experts	3535	23.80	23.01	23.82	0.47	3.3
Prod. managers & directors in mining & energy	1123	23.77		23.60	0.00	
Health services & public health managers & dirs	1181	24.36	21.57	23.32	0.59	11.5
Actuaries, economists and statisticians	2425	23.71	20.14	23.01	0.26	15.1
Highest paid 20 occupations (by overall median)					0.37	
All full-time employees		13.59	12.31	13.08	0.39	9.4

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 4
Occupations with low proportion female (among full-time employees)

Median hourly earnings (excluding overtime) of full-time employees

Occupation	code	Prop female	Med female wage (£)	Med male wage (£)	Med gen gap (%)
Elementary construction occupations	9120	0.00	8.10	9.25	12.4
Painters and decorators	5323	0.00	8.01	10.52	23.9
Construction and building trades supervisors	5330	0.00	10.18	14.29	28.8
Hospital porters	9271	0.00	8.91	9.37	4.9
Vehicle technicians, mechanics and electricians	5231	0.01	8.69	10.88	20.1
Large goods vehicle drivers	8211	0.01	9.29	10.20	8.9
Electricians and electrical fitters	5241	0.02	12.69	13.55	6.3
Groundsmen and greenkeepers	5114	0.02	8.20	8.55	4.1
Mobile machine drivers and operatives n.e.c.	8229	0.03	6.76	10.29	34.3
Plumbers and heating and ventilating engineers	5314	0.04	10.84	13.00	16.6
Butchers	5431	0.04	8.30	8.37	0.8
Fork-lift truck drivers	8222	0.04	10.80	8.91	-21.2
Skilled metal, electrical & electronic trades supervisors	5250	0.04	14.49	14.80	2.1
Van drivers	8212	0.04	7.20	8.75	17.7
Refuse and salvage occupations	9235	0.04	9.74	9.00	-8.2
Electrical and electronic trades n.e.c.	5249	0.04	14.21	13.50	-5.3
Electrical engineers	2123	0.05	22.81	20.85	-9.4
Printers	5422	0.05	8.48	12.64	32.9
Telecommunications engineers	5242	0.05	13.25	14.04	5.6
Construction operatives n.e.c.	8149	0.06	9.56	10.00	4.4

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 5
Occupations with high proportion female (among full-time employees)

Median hourly earnings (excluding overtime) of full-time employees

Occupation	code	Prop female	Med female wage (£)	Med male wage (£)	Med gen gap (%)
Veterinary nurses	6131	1.00	9.20	7.51	-22.5
Nursery nurses and assistants	6121	0.98	7.25	7.01	-3.4
Dental nurses	6143	0.95	9.09	8.61	-5.6
Personal assistants and other secretaries	4215	0.94	12.89	11.78	-9.4
School secretaries	4213	0.93	10.42	12.16	14.3
Beauticians and related occupations	6222	0.93	7.74	10.31	24.9
Teaching assistants	6125	0.88	8.84	8.45	-4.6
Receptionists	4216	0.87	8.47	7.66	-10.6
Pharmaceutical technicians	3217	0.86	10.18	12.10	15.9
Pharmacy and other dispensing assistants	7114	0.84	7.86	7.67	-2.5
Senior care workers	6146	0.84	8.22	8.98	8.5
Housekeepers and related occupations	6231	0.83	7.86	7.07	-11.2
Nurses	2231	0.82	16.23	16.80	3.4
Educational support assistants	6126	0.82	8.52	8.77	2.9
Human resources administrative occupations	4138	0.81	10.56	9.61	-9.9
Hairdressers and barbers	6221	0.81	7.10	7.45	4.7
Health care practice managers	1241	0.80	15.71	19.46	19.3
Sewing machinists	8137	0.80	7.43	9.13	18.6
Residential, day & domiciliary care mngrs. & prprtrs.	1242	0.80	15.41	17.00	9.4
Occupational therapists	2222	0.79	16.04	15.60	-2.8

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 6
Occupations with the largest gender pay gaps
Median hourly earnings (excluding overtime) of full-time employees

Occupation	Code	Median female wage (£)	Median male wage (£)	Median gender pay gap (%)
Managers & proprietors in forestry, fishing & related servs.	1213	7.24	12.14	40.4
Financial institution managers and directors	1150	20.75	34.78	40.3
Assemblers (vehicles and metal goods)	8132	9.39	15.19	38.2
Mobile machine drivers and operatives n.e.c.	8229	6.76	10.29	34.3
Printers	5422	8.48	12.64	32.9
Construction project managers and related professionals	2436	11.85	17.49	32.2
Chemical and related process operatives	8114	8.11	11.76	31.0
Financial and accounting technicians	3537	16.26	23.55	31.0
Construction and building trades supervisors	5330	10.18	14.29	28.8
Plant and machine operatives n.e.c.	8129	7.36	10.27	28.3
Chief executives and senior officials	1115	32.30	44.89	28.0
Importers and exporters	3536	11.11	15.35	27.6
Medical practitioners	2211	24.33	32.71	25.6
Librarians	2451	12.65	16.94	25.3
Financial managers and directors	1131	25.36	33.95	25.3
Aircraft maintenance and related trades	5235	12.94	17.24	24.9
Beauticians and related occupations	6222	7.74	10.31	24.9
Prison service officers (below principal officer)	3314	10.95	14.50	24.5
Process operatives n.e.c.	8119	7.89	10.37	23.9
Painters and decorators	5323	8.01	10.52	23.9

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 7
Occupations with the most “negative” gender pay gaps,
i.e. in which women out-earn men by the most

Median hourly earnings (excluding overtime) of full-time employees

Occupation	code	Median female wage (£)	Median male wage (£)	Median gender pay gap (%)
Fitness instructors	3443	9.91	7.68	-29.0
Veterinary nurses	6131	9.20	7.51	-22.5
Playworkers	6123	8.67	7.11	-21.9
Fork-lift truck drivers	8222	10.80	8.91	-21.2
Therapy professionals n.e.c.	2229	20.78	17.66	-17.7
Security guards and related occupations	9241	9.95	8.52	-16.8
Undertakers, mortuary and crematorium assistants	6148	12.06	10.56	-14.2
Merchandisers and window dressers	7125	10.76	9.43	-14.1
Archivists and curators	2452	14.77	13.13	-12.5
Housekeepers and related occupations	6231	7.86	7.07	-11.2
Parking and civil enforcement occupations	9242	10.10	9.09	-11.1
Library clerks and assistants	4135	10.22	9.22	-10.8
Receptionists	4216	8.47	7.66	-10.6
Human resources administrative occupations	4138	10.56	9.61	-9.9
Personal assistants and other secretaries	4215	12.89	11.78	-9.4
Electrical engineers	2123	22.81	20.85	-9.4
Refuse and salvage occupations	9235	9.74	9.00	-8.2
Tailors and dressmakers	5414	9.10	8.43	-7.9
Protective service associate professionals n.e.c.	3319	16.34	15.16	-7.8
Elementary sales occupations n.e.c.	9259	8.13	7.56	-7.5

Source: Annual Survey of Hours and Earnings, 2014 (provisional), Table 14.6a.

Notes: See Table 1.

Table 8
Counterfactual gender pay gaps adjusted for the gender difference in
occupational mix – All employees
 Hourly pay (excluding overtime), GB, 2013

	Median Male Wage (£)	Median Female Wage (£)	Median Gender Pay Gap (%)	Mean Male Wage (£)	Mean Female Wage (£)	Mean Gender Pay Gap (%)
Unadjusted	12.93	10.35	20.0	16.65	12.98	22.0
Excluding Non-mixed occupations	12.96	10.35	20.2	16.67	12.98	22.1
Counterfactual		11.61	10.4		14.37	13.8

Source: Author's calculations using Annual Survey of Hours and Earnings, 2013.

Table 9
Counterfactual gender pay gaps adjusted for the gender difference in
occupational mix – Full-time employees
 Hourly pay (excluding overtime), GB, 2013

	Median Male Wage (£)	Median Female Wage (£)	Median Gender Pay Gap (%)	Mean Male Wage (£)	Mean Female Wage (£)	Mean Gender Pay Gap (%)
Unadjusted	13.66	12.26	10.3	17.27	14.43	16.5
Excluding Non-mixed occupations	13.71	12.26	10.6	17.27	14.43	16.5
Counterfactual		12.62	7.9		15.05	12.9

Source: Author's calculations using Annual Survey of Hours and Earnings, 2013.

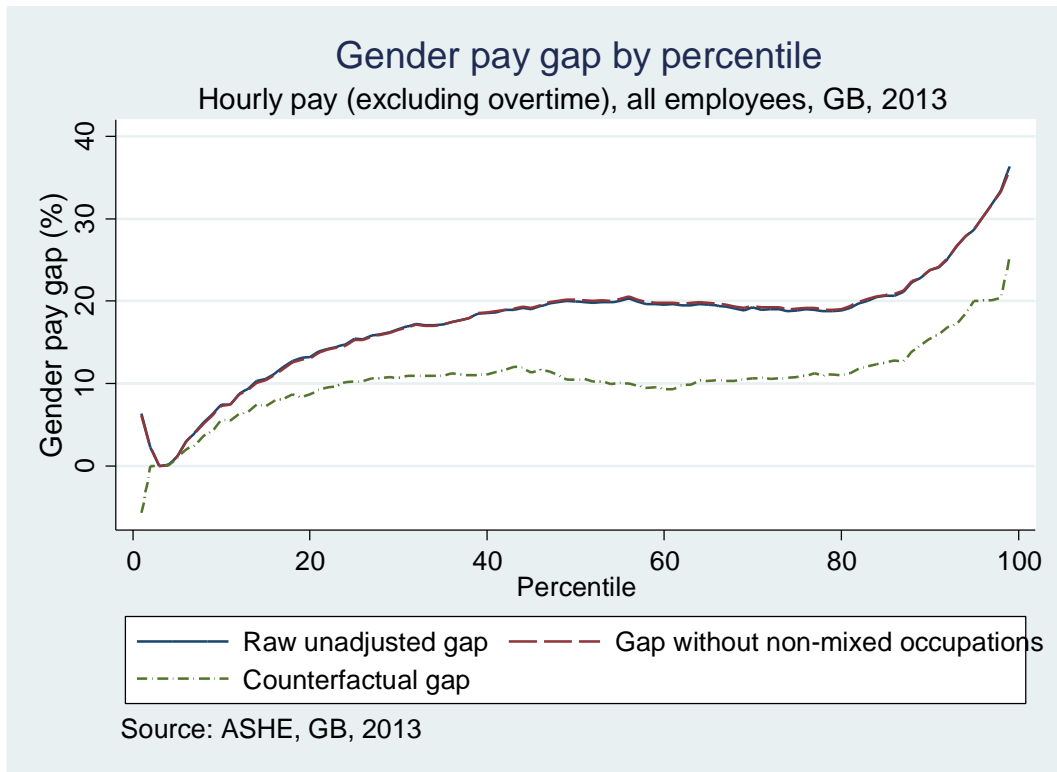


Figure 1: Counterfactual gender pay gaps adjusted for the gender difference in occupational mix – All employees

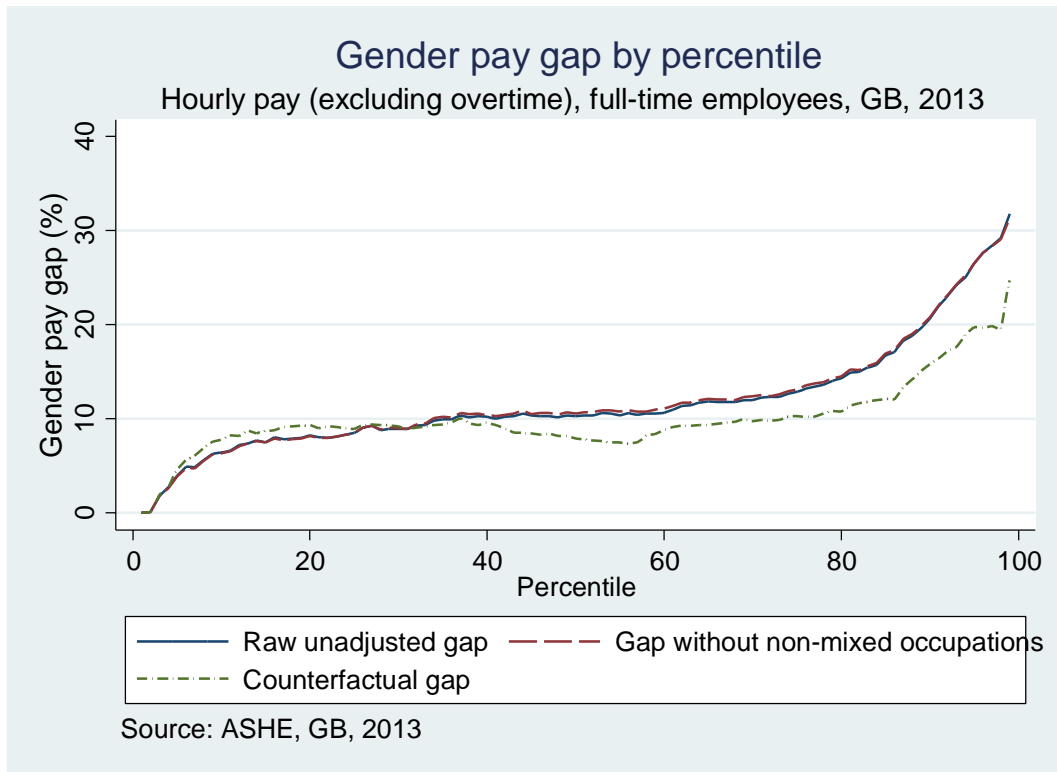


Figure 2: Counterfactual gender pay gaps adjusted for the gender difference in occupational mix – Full-time employees

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