GENDER GAPS ACROSS THE EARNINGS DISTRIBUTION FOR FULL-TIME EMPLOYEES IN BRITAIN: ALLOWING FOR SAMPLE SELECTION*

Yekaterina Chzhen[1,2] and Karen Mumford[1,3]

[1]Department of Economics
University of York
[2]Department of Social Policy
University of York
[3]IZA, Institute for the Study of Labour.

February 26, 2010.

This paper investigates gender differences across the log wage distributions of British employees working full-time in 2005. The raw gender wage gap shows a tendency to increase across the distribution with a glass ceiling effect indicated. A strong relationship between high skilled, white-collar occupations and carrying out managerial duties with the glass ceiling effect is indicated in the data. After allowing for positive selection into full-time employment by British women, a substantially larger gender earning gaps is found: the selection corrected gender wage gap is close to twice the raw gap across most of the earnings distribution. This selection corrected gap is found to be predominantly related to women receiving lower rewards for their characteristics than men. Indeed, the results suggest the gender earnings gap would all but disappear across the earnings distribution if women working full-time received the same returns to their characteristics as men working full-time in Britain do.

Key words: gender, earnings, wage-gap, selection, quantile, distribution. JEL J3, J7

* We thank the BHPS sponsors - the Economic and Social Research Council, the ISER and the Data Archive (both at the University of Essex) - for allowing access to the data. We are also grateful for helpful advice and/or comments from Jim Albrecht, Olivier Bargain, Jonathan Bradshaw, Kath Kiernan, Blaise Melly, Catia Nicodemo, Steve Palmer, Peter N. Smith, Susan Vroman, Aico van Vuuren and from participants at the December WPEG meeting 2008. They are not responsible for any of the findings or claims made in the paper.

Corresponding author: Yekaterina Chzhen, yc535@york.ac.uk. Department of Economics and Related Studies/Department of Social Policy and Social Work, University of York. Heslington York YO10 5DD, UK.

In the last decade, researchers have begun to make use of quantile regression methods to analyse the gender gap across the entire wage distribution (rather than at just the mean or the median)[1]. These studies provide a more detailed insight into the gender earnings gap and special emphasis has been placed on the findings of relatively larger gender gaps amongst higher earners (the so called 'glass ceiling effect') and amongst low earners (the 'sticky floors effect'). Similar to the familiar Oaxaca (1973) and Blinder (1973) decomposition of the gender earning gap at the mean into the portion attributable to the differences in individual characteristics and the portion attributable to the differences in returns to these characteristics, the quantile regression framework has been employed to enable analogous decompositions across the wage distribution (Machado and Mata, 2005).

In an early study, Albrecht et al. (2003) find a strong glass ceiling effect for Sweden; the gender wage gap is increasing along the distribution, particularly so amongst the highest earners. They show that gender differences in returns to labour market characteristics play an important role in explaining the wage gap. At the top end of the earnings distribution, about half of the gender gap is attributable to these unexplained gender differences in returns to labour market characteristics.

Using pooled data for 1995-2001 from the European Community Household Panel (ECHP), Arulampalam et al. (2007) study gender gaps across the earnings distribution in eleven countries. Their results show that the raw gender wage gap in Britain is relatively constant across the distribution (at around 20%); however, the portion of the gap due to differences in returns to characteristics is increasing across the wage distribution. Glass ceilings were noted in most of the countries in their analysis, including Britain (Arulampalam et al., 2007).

De la Rica et al. (2008) examine gender wage gaps in Spain across the distribution of earnings for full-time workers in 1999 using the quantile regression framework. Given the relatively low labour market participation rate of Spanish women, they sub-divide their sample by education. They find evidence of a glass ceiling effect for the highly educated and a glass floor for the lowly educated.

[1] The literature on gender wage inequality at the mean is well established (see surveys by Altonji and Blank, 1999; Weichselbaumer and Winter-Ebmer, 2005). For examples of studies across the wage distribution see Albrecht et al., (2003) for Sweden; de la Rica et al., (2008) for Spain; and Arulampalam et al., (2007) for Europe including Britain.

The possibility of a relationship between the probability of women working and their having characteristics associated with higher wages (such as higher education found in De la Rica et al., (2008)) has been long recognised in the literature (Heckman 1979; Buchinsky 1998; Melly, 2006; Blundell et al., 2007; Albrecht et al., 2009). Olivetti and Petrongolo (2008) recently explore the non random presentation of women into employment and gender wage gaps (measured at the median of the distribution) for the US and a range of European countries (including the UK). They find consistent evidence of positive selection of women into employment and conclude that it is essential to correct for this selection effect when estimating gender wage gaps.

The Machado-Mata (MM) decomposition across the wage distribution methodology is further developed to account for sample selection by Albrecht et al., (2009) who decompose the gender gap among full-time workers in the Netherlands. They document the presence of a glass ceiling effect; the gender gap is positive across the distribution but is largest at the highest quantiles. If all women worked full-time, the average log wage gap between male and female workers would have been higher in the Netherlands; with the majority of the positive selection effect being associated with full-time working women's observed characteristics. They conclude that the majority of the selection corrected gender pay gap in their study is attributed to differences in rewards to the labour market characteristics of male and female workers.

In a related study, Nicodemo (2009) decomposes the pay gap between husbands and wives across the earnings distribution after allowing for self-selection of married women into employment in five Mediterranean countries[2], using data from the ECHP 2001 and the EU Statistics on Income and Living Conditions (EU-SILC) 2006. She finds positive self selection effects for working women and substantial selection corrected wage gaps in each country, with the greatest portion of the gap being due to differences in rewards. Britain is not included in her study.

In this paper, we use the quantile regression decomposition method (Machado and Mata, 2005) to study the gender wage gap in log average hourly earnings across the distribution for full-time workers in Britain including allowance for possible non-random selection of women into full-time employment (Albrecht et al., 2009). Our results can be seen as building on the quantile regression analysis (without sample

[2] Spain, France, Greece, Italy and Portugal.

selection) of Arulampalam et al., (2007) and the estimation of the gender earning gap with sample selection but only at the median of Olivetti and Petrongolo (2008) for British employees. In the process, we will apply the selection correction technique developed in Albrecht et al., (2009).

Data and variable selection are discussed in the next section, estimation methods and sample selection are considered in section 2, results for the earnings functions estimations are presented and discussed in section 3, and conclusions are presented in section 4.

1. Wage Data and the Earnings Function

Data are taken from the British Household Panel Survey (BHPS) which is a nationally representative, annual sample of private British households. Individual adult members of households are interviewed over a broad range of socioeconomic topics resulting in a rich and relevant data set. The 2005 wave of data in particular is used as attitudinal questions were introduced in that wave (and not repeated since) that are important in the estimation of the selection effect below.

To focus on the full-time employed (and those least likely to be in full-time education or retirement) the sample is restricted to individuals in the 25 to 55 age bracket. Non-working and part-time employed men[3] and are excluded from the sample as are the self-employed; the minority of workers with no expected weekly working hours; those reporting working more than 75 hours per week; and those with missing data on any of the important labour market or personal characteristics. Due to differences in sampling, individuals from Northern Ireland were not included. The final sample contains observations for 4,223 individuals, of whom 3,695 are waged or salaried workers (1,747 male and 1,948 female) with a further 528 non-working women. Variable definitions and summary statistics for the sub-samples of interest are presented in Table 1 (summary statistics for selected deciles are provided in Table A1 of the Appendix).

[3] There were only 46 men employed part-time in the 25 to 55 age bracket in the data, most of whom have missing data on at least one of the important labour market or personal characteristics used in the analysis.

1.1 The distribution of wages in the BHPS

The wage measure used in the analysis is the natural logarithm of average gross hourly earnings. It is derived from gross monthly pay at last payment and total weekly hours (both measures include paid overtime). Men's average hourly wages are substantially higher than women's in Britain (see Table 1): the mean gender earnings gap amongst full-time workers is 16 log wage points.

The mean log wage gap may, however, hide important differences across the wage distribution, such as those between low earners and high earners. The distribution of earnings is considered in greater detail in Figure 1 which plots the estimated kernel densities of wages for men and women working full-time. The distribution of male wages is essentially symmetric, while the corresponding female distribution is unsurprisingly somewhat skewed to the left. Figure 2 plots the differences in the distributions shown in Figure 1; this is the raw (unadjusted) gap in log hourly wages between male and female full-time employees at each quantile of the distribution[4]. There is some notable decline between the 5th and 7th deciles and subsequent increases across the highest 3 deciles suggesting the presence of a glass ceiling[5]. There does not, however, appear to be a notable sticky floor effect in the raw data.[6] Focussing the analysis on a single point in the wage distribution (such as the mean or median) would mask these changes in the gender wage gap that occur across the earnings distribution.

1.2 The determinants of wages

Most authors have adopted the human capital model as the theoretical basis for the earnings function (Becker, 1962 and 1964; Mincer, 1958). This approach is also used here. At the individual employee level, it is assumed that wages increase with measures of accumulated skills such as education and work experience. Education is measured by the highest educational qualification level achieved (see Table 1). Work experience is the accumulated years of actual labour market work experience using

[4] The 95% confidence interval is estimated via bootstrapping with 100 repetitions (see Melly, 2006).
[5] The gap is 17 log wage points at the 75th centile; 18 log wage points at the 90th centile; and 20 log wage points at the 95th centile.
[6] The gap at the 1st, 5th and 10th centiles is 15 log wage points, whilst the gap at the 25th centile is 16 log wage points.

the individual's employment history since first leaving full-time education[7] (Halpin, 2006). This is a superior measure than the commonly used proxies of potential lifetime work experience (Polacheck, 2006; Regan and Oaxaca, 2008). The earnings function is augmented by the inclusion of further explanatory variables: marital status; occupation; having managerial supervisory duties; firm size; private sector employment; and region. (Variable definitions and summary statistics are provided in Table 1, similar information for the allocation of characteristics across the earnings distribution for men and women are presented in Table A1 of the Appendix.)

Considering the characteristics in more detail, the full-time workforce in Britain is typically well educated: with 75% of both men and women having a qualification at A-level or above. However, men have more years of accumulated work experience and are disproportionately represented in the managerial occupation as well as skilled trades and operatives. In contrast, women are over-represented in administrative/secretarial occupations and in personal services.

Occupation has been shown to be an important determinant of wages for full-time women relative to part-time women in Britain (Connolly and Gregory, 2008; Manning and Petrongolo, 2008; Olsen et al., 2010) and for the pay of full-time men relative to part-time women (Mumford and Smith, 2007 and 2009). Responsibility for managerial duties may also be an important determinant of relative pay. Men are increasingly more likely to carry out managerial duties at the higher end of the earnings distribution (74% of men in the 9th decile do compared to 51% of the women in this decile)[8]. Being a manager is also relatively increasingly common for men across the earnings distribution (38% of men in the 9th decile are, whilst only 12% of the women are).

Supporting evidence of the relative scarcity of senior women in managerial positions in high skilled, white-collar occupations is shown by the Equal Opportunity Commission (2005), who found that women in Britain make up just 8% of the senior judiciary, 8% of senior police officers, 10% of top business leaders and 9% of national newspaper editors. Similar results are found for lawyers in the U.S. with only

[7] Work experience includes both full-time and part-time experience. A more detailed analysis of work-history in the BHPS by Olsen et al. (2010) finds a positive net effect of full-time work experience on wages and no net effect of part-time work experience on wages.

[8] The correlation coefficient between being a manager and having managerial duties is 0.47 in the combined sample of full-time employees (0.50 amongst the men and 0.42 amongst the women).

some 6% of law firms having managing partners who are female (National Association of Women Lawyers, 2008; pages 2-7).

Table 1 also includes summary statistics for part-time and non-working women in the sample. These women are clearly less likely on average to have observed characteristics typically associated with greater earnings potential, such as higher levels of education and more years of work experience. They are considerably more likely to be married and to have a pre-school aged child. The high-skilled white-collar occupations (manager, professional) are also generally less common amongst women working part-time than full-time.

Allowance for possible non-random selection of women into full-time employment is included in the estimation of the earnings functions below. To identify the selection effect, additional information on the age of children present in the household and on the worker's response to the attitudinal statement "the family suffers if the mother works full-time" are included in the analysis. Fortin (2005) and Albrecht et al., (2009) both stress the importance of including attitudinal (or belief) measures in the analysis of women's employment decisions. This may be particular important for beliefs that vary across individuals and cultural groups (such as the relationship between working hours and the perceived ability to be a successful mother). Full-time working women in Britain are less likely to have young children in the household and they are more likely to have positive attitudes to the acceptability of mothers working full-time.

2. Estimation and selection

The quantile regression model of Koenker and Bassett (1978) is employed to estimate earnings functions for males *(m*) and females *(f)*:

$$w_{im} = x_{im}'\beta_{\theta m} + u_{\theta im} \quad \text{with} \quad Quant_{\theta}(w_{im}|x_{im}) = x_{im}'\beta_{\theta m} \qquad i=(1,\ldots, n) \qquad (1)$$

$$w_{if} = x_{if}'\beta_{\theta f} + u_{\theta if} \quad \text{with} \quad Quant_{\theta}(w_{if}|x_{if}) = x_{if}'\beta_{\theta f} \qquad i=(1,\ldots, n) \qquad (2)$$

where w_i is the natural log of the average hourly earnings of individual i; x_i is a Kx1 vector of regressors measuring a range of individual characteristics; and $u_{\theta i}$ is a residual term. The distribution of the residual term $u_{\theta i}$ is unspecified, but $u_{\theta i}$ satisfies $Quant_{\theta}(w_i|x_i)=0$ where $Quant_{\theta}(w_i|x_i)$ denotes the θth conditional quantile of w_i given

x_i. It can be shown that the estimates $\hat{\beta}$, the quantile regression coefficients, are consistent estimates of the rates of return to observed characteristics at different quantiles in the conditional wage distribution (see, for example, Machado and Mata, 2005; page 447).

The need to allow for sample selection when estimating an earnings function, such as the non-random probability of women being employed full-time, is well documented by Heckman (1979). Buchinsky (1998) proposes a semi-parametric estimator for selection correction in the quantile regression model and provides examples. Albrecht et al., (2009) employ the Buchinsky method and extend the Machado-Mata (2005) decomposition method to account for selection in the quantile regression framework, when estimating $\beta(\theta)$ for women working full-time (*ff*):

$$w_{iff} = x_{iff}' \beta_{\theta ff} + h_\theta(z_{iff}'\gamma) + u_{\theta iff} \quad \text{with} \quad \text{Quant}_\theta(w_{iff}|z_{iff} = x_{iff}) = x_{iff}' \beta_{\theta f} + h_\theta(z_{iff}'\gamma) \qquad (3)$$

where z_{ff} is the set of variables that influence the probability that a woman works full-time (including a selection of x_f) for individual *i*; and the term $h_\theta(z_{iff}'\gamma)$ is analogous to the Mill's ratio in the Heckman procedure with parameters γ. (For identification, z_{ff} also includes at least one continuous variable not included in x_f.) Table 2 provides results from standard probit and single index (Ichimura, 1993) estimation of the determinants of participating in full-time work by women (in columns 1 and 2, respectively)[9]. Unsurprisingly, women are found to be significantly more likely to be working full-time if they have more years of work experience and higher education qualifications. In contrast, being married and the presence of dependent children are both strongly negatively related to the probability of women participating in full-time employment. Women are also significantly more likely to work full-time if they disagree with the attitudinal statement "the family suffers if the mother works full-time".

Figure 3a plots the selection effect or, in other words, the difference between the selection-corrected distribution (simulated) and the actual distribution of full-time women's wages in Britain. The selection effect can be seen to be positive throughout, generally sitting between 10 and 20 log wage points; with a relative increase around

[9] The constant and the coefficient on the first continuous variable (years of work experience) are not identified in the single index model, they are normalised here by setting them equal to the corresponding values in the probit model, thereby making the results of the two models comparable.

the median and decrease around the 8th decile. There is also some evidence of greater sample selection into full-time employment by women in the highest decile of the earnings distribution. Figure 3a reveals that the women observed to be working full-time in Britain have higher earnings potential in this work than do British women in general; this is especially true for women in the lower two thirds of the earnings distribution.

The selection effect can be decomposed into the portion due to observable characteristics and the portion due to unobservable characteristics by modifying the algorithm and sampling from the empirical distribution of full-time women only (Albrecht et al., 2009). This produces a distribution of wages that would be observed if women who do not work full-time had the same distribution of observed characteristics as those who actually do work full-time. The difference between this distribution and the distribution obtained by sampling from data on all women gives the portion of the selection effect due to observables (see Figure 3b). The portion due to unobservables (Figure 3c) is the difference between the distribution of wages obtained by sampling from data on full-time women and the actual distribution of full-time women's wages.

The portion of the selection effect related to observable characteristics can be seen to be statistically significant for most of the earnings distribution until almost the 85th centile and generally sits below 10 log wage points, although there is some increase suggested in the 7th decile (Figure 3b). Some insight into this gap can be gained from Table A1 (in the Appendix) which provides summary statistics for selected deciles. For those in the 8th decile of the earnings distributions of full-time and part-time women (see columns 6 and 9), many of the observable characteristics included in the analysis are found to be more similar than they are at lower deciles. A characteristic that takes a very different value for these women with high average hourly earnings is, however, the presence a pre-school aged child: one in two of these women working part-time has a child of this age, less than one in six of these women working full-time does. It would appear that there is group of women who, given their observable characteristics, earn a high salary whilst working part-time. At lower level deciles of the earnings distribution, differences in the average observable characteristics of full-time and part-time working women become apparent. The portion of the selection effect related to unobservable characteristics is similar in size and shape across the distribution with a more obvious decline between the 7th and 9th

deciles (Figure 3c). These findings reveal that the positive selection effect of women into full-time employment shown in Figure 3a is related to similarly sized differences in observable and unobservable characteristics associated with higher earnings potential between those women who work full-time and all women.

Ignoring this substantial positive selection into employment for full-time working women could be expected to lead to incorrect estimates of the true extent of the gender earnings gaps in Britain. Allowance for selection is made accordingly in the estimation of the earnings functions for full-time working women below.

3. Earnings function results

Selected results for the quantile regressions for log average hourly earnings for men (equation 1) and women with Buchinsky selection correction (equation 3) [10] working full-time in Britain are presented in panels 1 and 2 of Table 3, respectively. (Additional estimation results are available from the authors upon request.)

The human capital measures (education, experience and experience squared) are typically found to be significant across the wage distribution and to have the expected relationship with earnings for men (Table 3, panel 1). In particular, there are substantial gains associated with higher education qualifications, and the total returns to work experience peak at 13 years and begin to become negative (starting with the lowest earnings deciles) at 27 years. Being married is positively related to higher wages whilst working in a small workplace (less than 25 employees) is negatively associated with wages. These relationships are generally found to be similar across the distribution. In contrast, having a skilled occupation (especially managerial, professional or associate professional) and carrying out managerial duties are associated with increasing returns for higher income earning males.

The results are similar although less precisely estimated for full-time women (with the exception of being married). The rising returns associated with having a more skilled occupation are clear amongst higher earning women (for example, the returns to being a manager at the 8th decile of the earnings distribution are more than double that of a manager at the 2nd decile). These are substantially larger returns than those found for high earning male managers; the positive impact on earnings related to being a manager is some 20% larger for men at the 8th relative to the 2nd decile.

[10] The function $h_\theta(z_{ff}'\hat{\gamma})$ is a cubic function of the filtered single index selection probability (column 2 of Table 2).

However, unlike males, the returns associated with carrying out managerial duties are not rising for higher waged females.

Figure 4 plots the gender wage gap between full-time men and full-time women after adjusting for the selection of women into employment in Britain. This is the difference between the male and female log wage distributions among full-time workers if all women had worked full-time. Compared with the raw gender earnings gap in Figure 2, the selection adjusted gender earnings gap is approximately twice as large overall and there is again some evidence of a glass ceiling effect. The comparatively lower gender wage gap around the 8^{th} decile is now also more clearly visible.

Finally, Figure 5 provides the counterfactual distribution of the gap between men's wages and the wages that women would earn if women working full-time retain their own distribution of characteristics but are rewarded for them like men working full-time. This gap is not statistically significant from zero throughout the distribution indicating that the gender gap would essentially disappear if women's returns to their observed characteristics were equal to men's.

5. Conclusion

Our results support the use of the quantile regression decomposition method (Machado and Mata, 2005), including allowance for possible non-random selection of women into full-time employment (Albrecht et al., 2009), to study the gender wage gap in log average hourly earnings across the earnings distribution of full-time workers in Britain.

The mean log gender wage gap between full-time workers in Britain is found to be substantial at 16 log wage points in 2005. Taking the log wage gap at each quantile of the male and female distributions, however, reveals a more complex picture: the raw gender wage gap shows a tendency to increase across the distribution with a glass ceiling effect indicated. A strong relationship between high skilled, white-collar occupations and carrying out managerial duties with the glass ceiling effect is indicated in the data. The data also reveal sizeable differences in the observed characteristics of women working full-time relative to those working part-time or those not in the labour force. Women working full-time are substantially more likely to have average observed characteristics typically associated with greater earnings potential.

The possibility of selection into full-time work for women is found to be to be significant and positive across the earnings distribution apart from the section between about the 85th and 95th centiles. Decomposing the selection effect reveals similarly sized portions related to both the observed and unobserved characteristics of women working full-time.

After allowing for the positive selection into full-time employment by British women, a considerably larger gender earning gaps is found for full-time workers: the selection corrected gender wage gap is close to twice the raw gap for women in the first 6 deciles of the earnings distribution. The extent of the adjusted gender gap is relatively lower between the 7th and 9th deciles as there are some women who, given their observable characteristics, are able to earn a high salary whilst working part-time. The gender gap is also increasing across the highest decile of the earnings distribution, providing some evidence of a glass ceiling.

The selection corrected gender wage gap is found to be predominantly related to women receiving lower rewards for their characteristics than men. Indeed, the results suggest the gender wage gap between men and women working full-time in Britain would all but disappear across the earnings distribution if these women received the same returns to their characteristics as men working full-time do.

References

Albrecht, J. Bjorkland, A. and Vroman, S. (2003). "Is there a glass ceiling over Sweden?" *Journal of Labor Economics* 21; 145-177.

Albrecht, J. van Vuuren, A. and Vroman, S. (2009). "Counterfactual distributions with sample selection adjustments: Econometric theory and an application to the Netherlands Labour Economics." *Labour Economics* 16(4); 383-396.

Altonji, J.G. and Blank, R. (1999). 'Race and gender in the labor market' in Ashenfelter, O. and Card, D. (eds) *Handbook of Labor Economics*. Elsevier Science B.V, Amsterdam.

Arulampalam, W. Booth, A.L. and Bryan, M. (2007). "Is there a glass ceiling over Europe: An exploration of asymmetries in the gender pay gap across the wage distributions." *Industrial and Labor Relations Review* 60(2); 163-186.

Becker, G.S. (1962). "Investment in human capital: A theoretical analysis', *Journal of Political Economy* 70; 9-49.

Becker, G.S. (1964). *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education* (The University of Chicago Press, Chicago).

Blinder, A. (1973). "Wage discrimination: Reduced form and structural estimates." *Journal of Human Resources* 8; 436-55.

Buchinsky, M. (1998). "The dynamics of change in the female wage distribution in the USA: A quantile regression approach." *Journal of Applied Econometrics* 13; 1-30.

Connolly, S. and Gregory, M. (2008). 'Moving down? Women's part-time work and occupational change in Britain 1991-2001.' *Economic Journal* 118, F52-76

de la Rica, S. Dolado, J.J. and Llorens, V. (2008). "Ceilings and floors: Gender wage gaps by education in Spain." *Journal of Population Economics* 21(3); 751-776.

Equal Opportunity Commission (2005). *Sex and Power: Who Runs Britain?*

Fortin, N. (2005). "Gender role attitudes and the labour market outcomes of women across OECD countries." *Oxford Review of Economic Policy* 21(3); 416-438.

Halpin, B. (2006). "BHPS Work-life history files, version 2," mimeo, ISER, University of Essex, Colchester. Available online at UKDA (documentation for study 3954)

Heckman, J. (1979). "Sample selection bias as a specification error". *Econometrica* 47; 153-161.

Ichimura, H. (1993) "Semiparametric least squares (SLS) and weighted SLS estimation of single index models". *Journal of Econometrics* 58; 71-120.

Koenker, R. and Bassett, G. (1978). "Regression quantiles." *Econometrica* 46; 33-50.

Machado, J.A. and Mata, J. (2005). "Counterfactual decomposition of changes in wage distributions using quantile regression." *Journal of Applied Econometrics* 20; 445-465.

Manning, A. and Petrongolo, B. (2008). 'The part-time pay penalty for women in Britain.' *Economic Journal* 118, F28-51.

Melly, B. (2006). "Estimation of counterfactual distributions using quantile regression" *Review of Labor Economics* 68; 543-572.

Mincer, J. (1958). "Investment in human capital and personal income distribution." *Journal of Political Economy* 66(4); 281-302;

Mumford, K. and Smith, P.N. (2007). "The gender earnings gap in Britain: Including the workplace." *Manchester School,* 75, 653-72.

Mumford, K.A. and Smith, P.N. (2009). "What determines the part-time and gender earnings gaps in Britain: Evidence from the workplace." *Oxford Economic Papers* 61: 56-75.

National Association of Women Lawyers (2008). *Report on the Third Annual Survey*.

Nicodemo, C. (2009). "Gender gap and quantile regression in European families." *IZA Discussion Paper* No. 3978.

Oaxaca, R.L. (1973). "Male female wage differentials in urban labor markets." *International Economic Review* 14(3); 693-709.

Olivetti, C. and Petrongolo, B. (2008). "Unequal pay or unequal employment? A cross-country analysis of gender gaps." *Journal of Labor Economics* 26(4); 621-654.

Olsen, W., Gash, V., Vandecasteele, L., Walthery, P., and Heuvelman, H. (2010). "The gender pay gap in the UK: 1995-2007." Government Equalities Office.

Polachek, S. (2006). "How the human capital model explains why the gender wage gap narrowed." Published in: F. Blau, M. Brinton, and D. Grusky, (eds.) *The Declining Significance of Gender?* (New York: Russell Sage Foundation).

Regan, T.L. and Oaxaca, R.L. (2008). 'Work experience as a source of specification error in earnings models: Implications for gender wage decompositions.' *Journal of Population Economics,* forthcoming.

Weichselbaumer, D., and Winter-Ebmer, R. (2005). 'A meta-analysis of the international gender wage gap.' *Journal of Economic Surveys* 9, 479-511.

Table 1

Variable Definitions and Means (BHPS Wave 15)

Definitions (1)	Full-time men (2)	Full-time women (3)	Part-time women (4)	Non working women (5)
Gross hourly wage	13.50	11.48	8.88	-
Log of gross hourly wage	**2.47**	**2.31**	**2.04**	**-**
Accumulated years of work experience	13.05	11.61	10.60	3.86
Age (years)	39.97	39.94	40.83	40.48
Highest level of education				
Degree	0.23	0.29	0.16	0.15
Other higher	0.42	0.36	0.37	0.23
A-levels	0.10	0.10	0.11	0.13
O-levels	0.15	0.15	0.19	0.21
Other secondary	0.05	0.05	0.07	0.11
Minimal (no formal secondary or higher qualification)	0.05	0.04	0.08	0.18
Married (or living in a de facto relationship)	0.63	0.52	0.76	0.62
Disagree that family suffers if mother works full-time	0.40	0.54	0.33	0.30
Dependent Child(ren) present in the household	0.45	0.33	0.70	0.63
Age of youngest child in household				
5 years or younger	0.51	0.31	0.45	0.58
6-11 years	0.31	0.37	0.35	0.29
12-15 years	0.18	0.32	0.20	0.12
Region				
South of England	0.29	0.27	0.30	0.30
London	0.08	0.10	0.07	0.09
East Midlands	0.23	0.21	0.24	0.24
North of England	0.25	0.26	0.27	0.26
Wales	0.05	0.05	0.05	0.03
Scotland	0.09	0.11	0.08	0.08
Managerial duties	0.47	0.45	0.16	-
Size of firm				
Less than 25	0.27	0.29	0.42	-
25-199	0.38	0.41	0.33	-
200 or over	0.36	0.30	0.25	-
Private sector	0.78	0.51	0.53	-
Occupational category				
Managers	0.21	0.15	0.05	-
Professionals	0.14	0.18	0.09	-
Assoc Professionals	0.16	0.19	0.10	-
Admin/Secretarial	0.05	0.23	0.23	-
Skilled Trades	0.18	0.02	0.02	-
Personal Services	0.01	0.10	0.18	-
Sales and Customer Services	0.02	0.06	0.19	-
Operatives	0.14	0.03	0.01	-
Elementary	0.09	0.04	0.14	-
Number of observations	1747	1283	665	528

Source: British Household Panel Survey, Wave 15. Cross-sectional weights used.

Figure1. Kernel density earnings estimates for full-time men and women

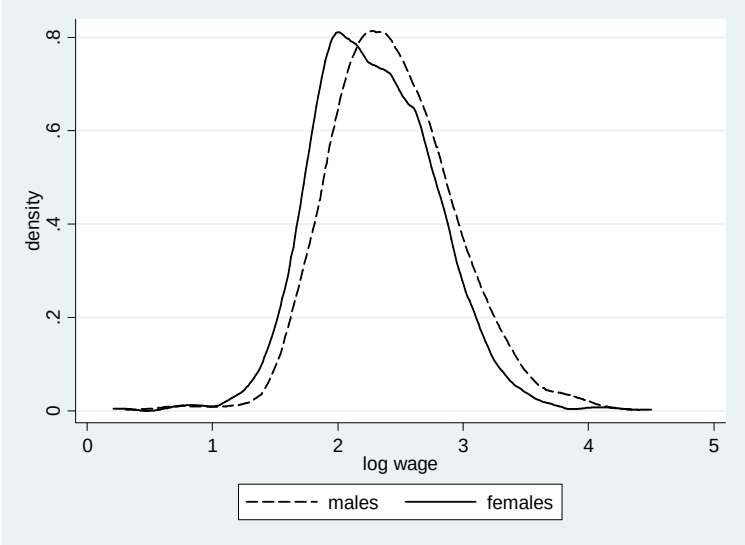


Figure 2: Unadjusted gender log wage gap

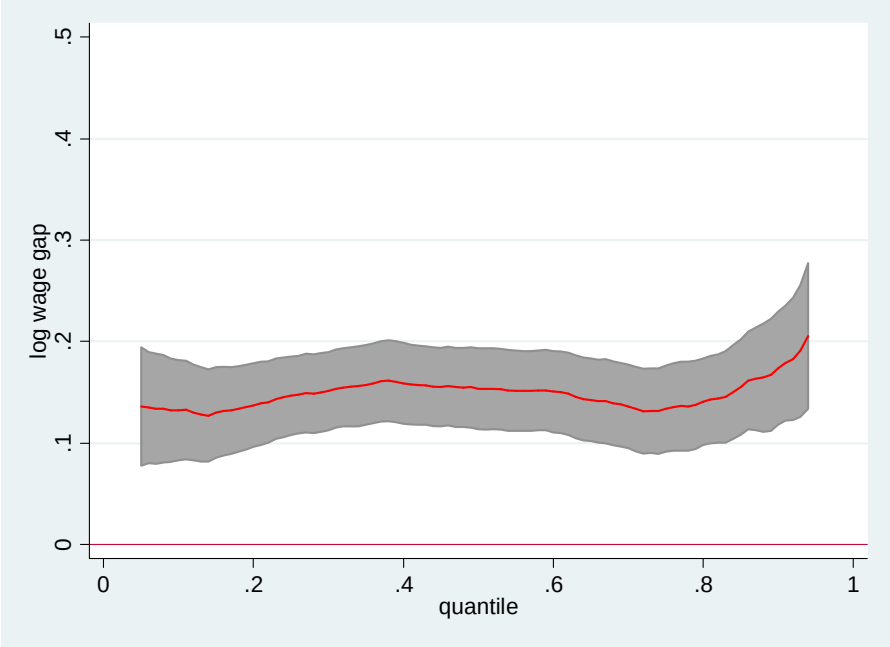


Table 2.

Estimates of the incidence of full-time work amongst women.

	Probit (1)		Single Index (2)	
	B	SE	B	SE
Constant	0.54*	0.22	0.54	-
Work experience (years)	0.18***	0.01	0.18	-
Work experience squared (x 100)	-0.46***	0.00	-0.30***	0.00
Age	-0.04***	0.00	-0.04***	0.00
Married	-0.30***	0.06	-0.16***	0.03
Positive working mother attitude	0.30***	0.07	0.33***	0.04
Youngest child aged 0-5	-1.50***	0.11	-1.74***	0.08
Youngest child aged 6-11	-0.95***	0.11	-1.17***	0.06
Positive working mother attitude x Youngest child age 0-5	0.38*	0.15	0.25**	0.07
Positive working mother attitude x Youngest child age 6-11	0.27	0.16	0.29***	0.08
Highest level of education (ref: none)				
Degree	0.94***	0.12	0.67***	0.06
Other higher	0.53***	0.12	0.36***	0.06
A-levels	0.43**	0.13	0.32***	0.06
O-levels	0.34**	0.13	0.19**	0.06
Other	0.18	0.15	-0.12	0.07
Number of observations	2476		2476	

Source: British Household Panel Survey, Wave 15. Significant at *p<0.05 ** p<0.01 ***p<0.001. The constant and work experience coefficients in the single index model are normalised. Controls are included for region.

Figure 3a. Log wage gap between full-time women before and after allowing for sample selection

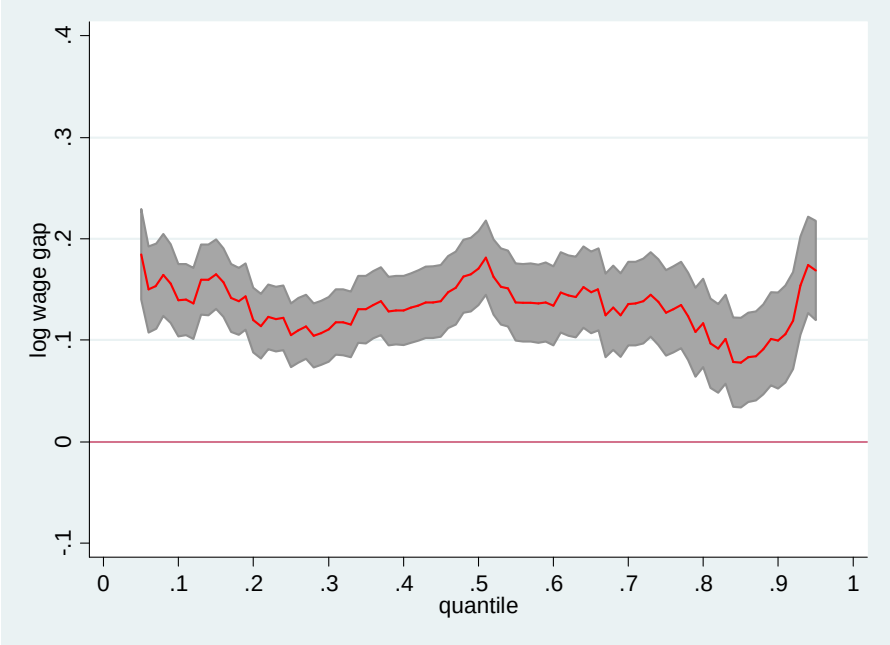


Figure 3b. Selection on observables

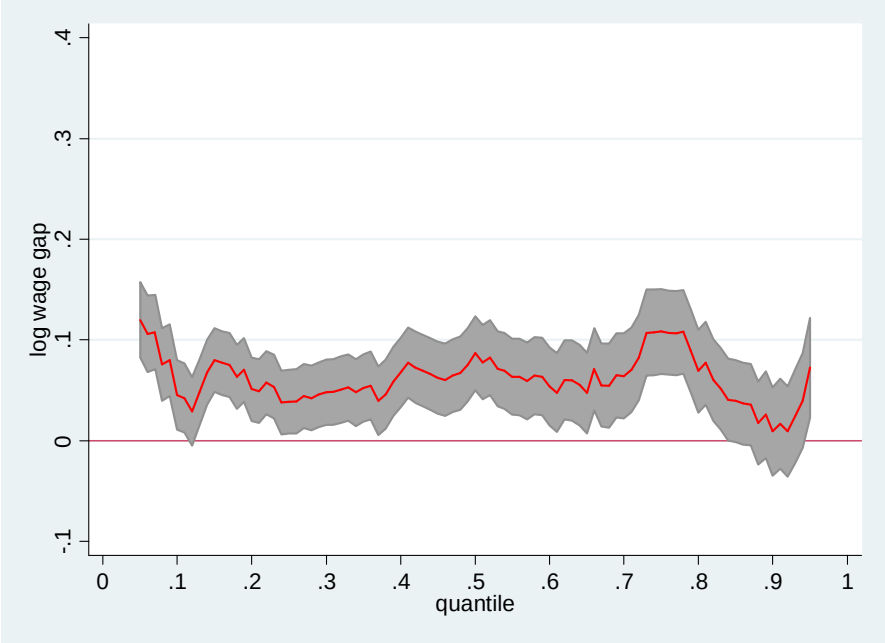


Figure 3c. Selection on unobservables

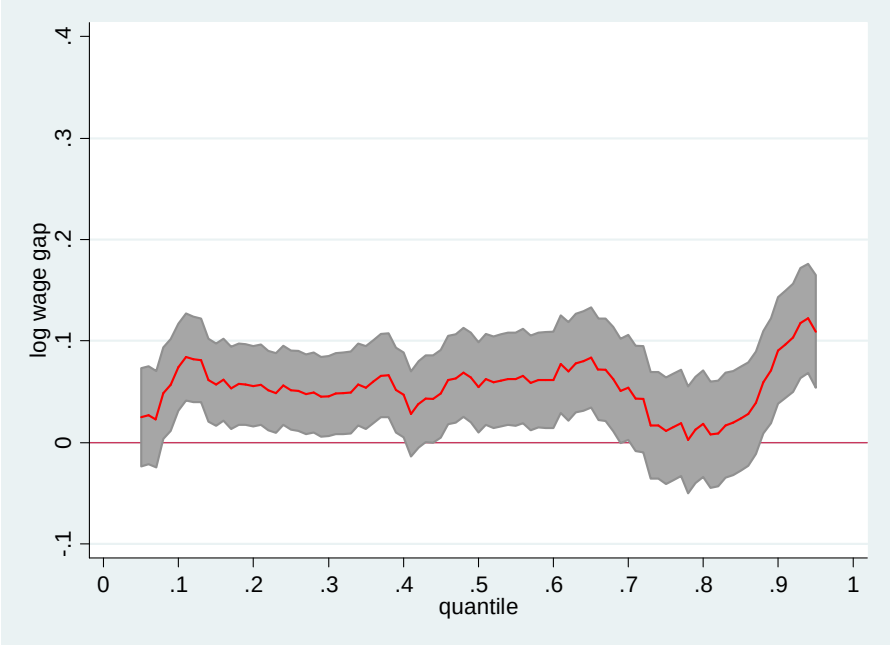


Table 3.

Selected quantile earnings regression results for full-time men and women

	Men			**Women**		
centile	20	50	80	20	50	80
Constant						
Work experience (years)	0.04***	0.04***	0.04***	0.03***	0.02***	0.02**
Work exp squared (x 100)	-0.10***	-0.11***	-0.12***	-0.08**	-0.02	-0.05
Highest level of education (ref: minimal)						
Degree	0.39***	0.40***	0.36***	0.29**	0.31***	0.27**
Other higher	0.21***	0.20***	0.15*	0.13	0.15***	0.14
A-levels	0.19**	0.22***	0.17*	0.08	0.12**	0.06
O-levels	0.11	0.12**	0.07	0.06	0.10*	-0.01
Other secondary	0.06	0.11	0.04	0.02	0.04	0.08
Married	0.08**	0.09***	0.09**	-0.01	0.01	-0.04
Managerial duties	0.10***	0.15***	0.20***	0.15***	0.12***	0.14***
Size of firm (ref: 200 or over)						
Under 25	-0.19***	-0.19***	-0.16***	-0.09*	-0.13***	-0.13***
25-199	-0.07**	-0.08***	-0.06	-0.03	-0.02	-0.04
Private sector	-0.00	0.02	0.06*	-0.06	-0.01	-0.01
Occupational category (ref: elementary)						
Managers	0.42***	0.47***	0.48***	0.30***	0.47***	0.68***
Professionals	0.49***	0.52***	0.54***	0.63***	0.75***	0.72***
Assoc Professionals	0.34***	0.34***	0.37***	0.41***	0.52***	0.52***
Admin/Secretarial	0.15*	0.16***	0.22**	0.26***	0.27***	0.28***
Skilled Trades	0.18***	0.17***	0.19***	-0.01	0.06	0.06
Personal Services	0.09	0.10	0.14	0.10	0.13*	0.15
Sales and customer serv.	0.02	-0.01	0.07	0.06	0.11	0.17
Operatives	0.12***	0.10*	0.13**	0.15	0.12*	0.15
Pseudo R-Square	0.25	0.31	0.31	0.28	0.35	0.35
Number of observations	1747			1283		

Source: British Household Panel Survey, Wave 15. Significant at * p<0.10 ** p<0.05 ***p<0.01.
Controls are included for region.

Figure 4. Gender log wage gap between full-time men's wages and the wages that would be observed if all women worked full-time

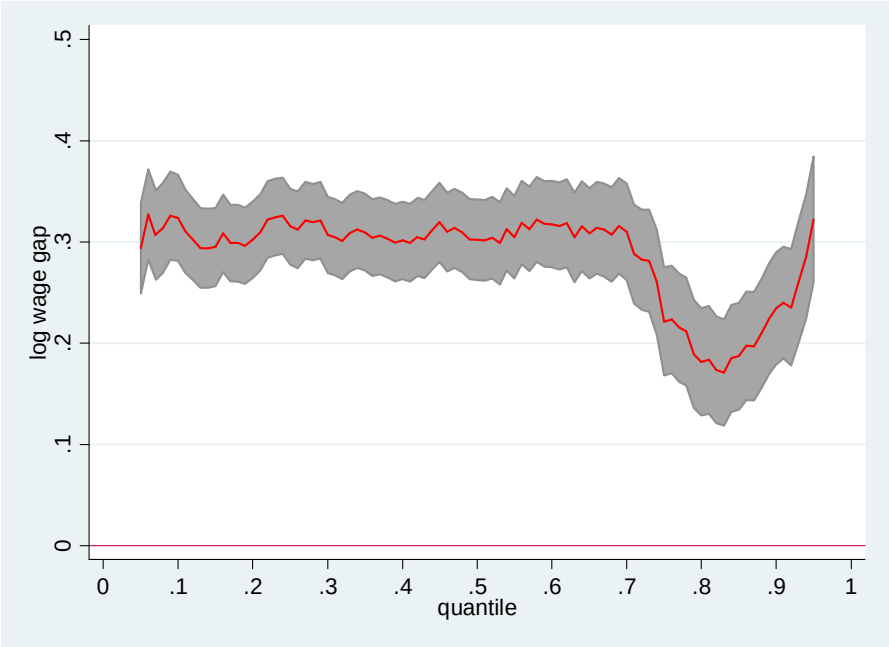
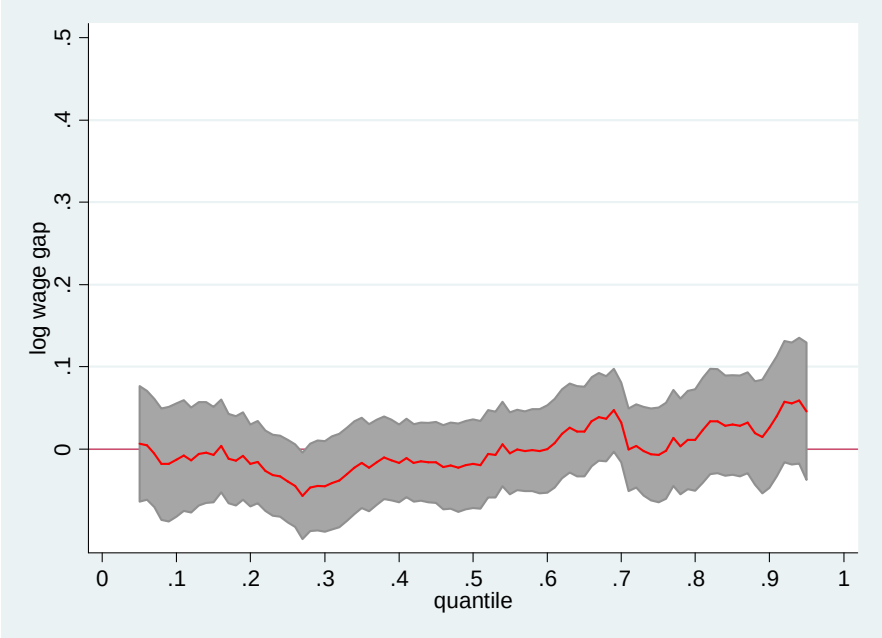


Figure 5. Log wage gap between full-time men and full-time women paid like men



Appendix.

Table A1.

Descriptive statistics for selected deciles of women's and men's earnings distributions (column %)

	Full-time men			Full-time women			Part-time women		
deciles	2nd	5th	8th	2nd	5th	8th	2nd	5th	8th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Hourly wage (Mean, SD)	5.23 (0.99)	10.34 (0.34)	18.98 (1.39)	4.61 (0.90)	8.82 (0.35)	16.09 (1.01)	3.71 (0.75)	6.47 (0.20)	13.26 (1.24)
Work experience, years (Mean, SD)	9.90 (6.53)	12.43 (6.32)	12.35 (5.67)	10.06 (5.81)	10.54 (5.26)	10.00 (5.26)	7.86 (5.43)	10.27 (5.99)	10.11 (4.98)
Highest level of education									
Degree	8.00	14.94	47.43	10.08	16.41	65.89	7.46	8.96	41.79
Other higher	26.29	47.13	41.14	31.01	45.31	24.03	31.34	37.31	32.84
A-levels	16.00	11.49	8.57	11.63	10.16	3.10	17.91	11.94	8.96
O-levels	23.43	18.97	1.71	20.93	17.19	6.20	17.91	25.37	13.43
Other secondary	9.14	5.75	0.57	8.53	10.16	0.78	10.45	7.46	1.49
Minimal	17.14	1.72	0.57	17.83	0.78	0.00	14.93	8.96	1.49
Married	45.14	56.90	67.43	62.79	53.91	55.81	64.18	76.12	74.63
Child(ren) present	35.43	46.55	49.71	36.43	30.47	36.43	64.18	61.19	77.61
Age of youngest child in household									
5 years or younger	21.71	24.14	25.71	10.08	8.59	15.50	23.88	22.39	49.25
6-11 years	11.43	13.79	14.29	14.73	10.94	10.85	28.36	22.39	16.42
12-15 years	6.45	18.52	19.54	31.91	35.90	27.66	18.60	26.83	15.38
Disagree that family suffers if mother works full-time	41.14	43.68	39.43	46.51	54.69	58.14	38.81	31.34	32.84
Region									
South	14.29	22.41	28.57	13.18	21.09	23.26	25.37	23.88	11.94
London	1.71	2.87	8.57	0.78	3.91	8.53	5.97	2.99	7.46
East Midlands	16.57	17.82	15.43	17.05	19.53	11.63	16.42	14.93	22.39
North	15.43	18.97	18.86	16.28	15.63	17.05	17.91	25.37	20.90
Wales	26.86	18.39	5.71	24.03	17.19	12.40	19.40	13.43	13.43
Scotland	25.14	19.54	22.86	28.68	22.66	27.13	14.93	19.40	23.88
Managerial duties	24.00	40.23	73.71	24.81	37.50	51.16	5.97	19.40	34.33
Size of firm									
Under 25	43.43	27.59	20.57	51.94	31.25	14.73	53.73	44.78	29.85
25-199	33.14	38.51	35.43	33.33	43.75	52.71	29.85	35.82	26.87
200 or over	23.43	33.91	44.00	14.73	25.00	32.56	16.42	19.40	43.28
Private sector	90.29	78.16	67.43	72.87	51.56	19.38	74.63	53.73	35.82
Occupational category									
Managers	6.86	12.07	37.71	8.53	14.84	11.63	1.49	4.48	8.96
Professionals	2.86	6.90	32.00	0.00	10.16	54.26	1.49	1.49	23.88
Technicians and Associate Professionals	5.71	20.11	18.29	3.10	14.06	27.13	5.97	5.97	28.36
Admin/Secretarial	3.43	8.05	3.43	15.50	32.03	4.65	8.96	29.85	25.37
Skilled Trades	20.00	31.03	3.43	6.20	1.56	0.00	2.99	1.49	0.00
Personal Services	3.43	1.15	0.57	24.03	15.63	0.78	26.87	25.37	10.45
Sales and Customer Services	7.43	3.45	0.57	19.38	6.25	0.78	31.34	16.42	0.00
Operatives	23.43	12.64	3.43	9.30	3.13	0.78	0.00	1.49	1.49
Elementary	26.86	4.60	0.57	13.95	2.34	0.00	20.90	13.43	1.49
No. observations	175	174	175	129	128	129	67	67	67

Source: British Household Panel Survey, Wave 15.