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EXECUTIVE SUMMARY

The wage gap between male and female workers has narrowed in both the US and the UK over the past twenty five years. At the same time, employment rates for men and women have converged. This paper examines the relationship between these two facts by analysing the role played by labour market experience in explaining the narrowing gender wage gap.

We analyse the relationships between male and female levels of experience and relative wages in the US and the UK over the period 1978 to 2000. The estimation procedure is based on pseudo panels created from cross-sectional data (Current Population Survey (CPS) for the US and Family Expenditure Survey (FES) for the UK). Possible biases from unobserved heterogeneity and the endogeneity of experience are addressed by using an “imputed” measure of experience based on grouped data and by estimating the wage regressions in first differences.

Differences in levels of experience are found to explain 39 percent of the gender wage gap in the US and 37 percent in the UK, and failure to control for unobserved heterogeneity is found to understate the role played by total experience in explaining the gap. The gender wage gap has diminished over recent successive cohorts of workers. However, the evidence suggests that the improvements in relative female wages can’t be attributed to changes in relative levels of experience. For each of the successive cohorts we examine, total experience increases the gender wage ratio by a constant 8 to 9 percentage points in the US and the UK. We find that the average experience for female workers relative to male workers has increased over successive cohorts. However, this has either been insufficient to lead to a noticeable effect on relative wages, or changes in the returns to experience have altered affecting female relative earnings unfavourably.

I. INTRODUCTION

The wage gap between men and women has narrowed over the past twenty-five years in both the US and the UK. Yet a sizeable discrepancy in earnings capacity remains between male and female workers in both countries. The average hourly earnings for a female worker amounted to 80 percent of the average for male workers in the US in 2000 (compared to 66 percent in 1979), while the ratio for full-time workers in the UK was 76 percent in 2000 (compared to 69 percent in 1979). At the same time, employment rates for men and women have converged in both countries. In 2000, 85 percent of men and 72 percent of women or working age were in employment in the US (compared to 87 percent and 61 percent in 1979), while 76 percent of men and 71 percent of women were working in the UK (compared to 88 percent and 65 percent in 1979).[1] A natural corollary of these trends is to ask how much of the gender wage gap can be attributed to differences in experience levels between male and female workers and whether the narrowing in the gender wage gap is a result of the convergence in employment rates.[2]

Previous research on the US has shown that changes in relative experience levels have been influential in explaining trends in the gender wage gap. Increasing years of work experience for women during 1900-1940 account for about half of the increase in the ratio of female to male earnings over this period ((Goldin & Polachek (1987), Goldin (1989)). On the other hand, the stagnation in women's relative wages between 1940 and the mid 1970s has been accredited to a relative decline in average experience and education levels among female workers due to the entry into the labour market of women with little labour market experience and lower than average education (Goldin (1989), Smith & Ward (1989), O'Neil (1985)). A substantial proportion of the closing in the gender wage gap between the mid-1970s and 1990 has been explained by changes in experience levels and other work history variables (Sorensen (1991), O'Neil & Polachek (1993), Wellington (1993), Blau & Kahn (1997), Blau & Kahn (1999)).[3]

[1] Wage and employment figures are calculated from the Current Population Survey for the US and from the Family Expenditure Survey for the UK.

[2] Research exploring a variety of explanations for the gender wage gap has been extensive. A summary can be found in Blau (1998) (section III) for the US and in Anderson et al. (2001) or Joshi & Paci (1998) (pages 32-34) for the UK. International comparisons of the gender wage gap can be found in Blau & Kahn (1996, 2000) and Grimshaw & Rubery (2001).

[3] For example, O'Neil & Polachek (1993) find that the increase in women's experience relative to men's accounted for one-quarter of the narrowing of the gap between 1976 and 1990, while Blau & Kahn (1997) report that 42 percent of the 10 percentage point rise in the gender wage ratio between 1979 and 1988 can be explained by a convergence in experience levels between men and women.

Other studies examining the gender wage gap have included experience in the set of explanatory variables for both the US and UK, but only a handful have allowed the effect of experience to be isolated from other factors.[4,5] Controlling for experience is reported to raise the gender wage ratio in the US by between 1 and 4 percentage points in several studies (Oaxaca (1973), Gronau (1988), Waldfogel (1997, 1998)) and by 14 percentage points in Corcoran & Duncan (1979).[6] Waldfogel (1998) finds that controlling for experience raises the gender wage ratio by 5 percentage points in the UK.

This paper analyses the relationships between male and female employment and relative wages in both the US and UK for the 1978 to 2000 period. The econometric approach seeks to improve on previous studies by attempting to address two potential biases: first differences are used in the wage regression to control for unobserved heterogeneity and an "imputed" measure of experience based on grouped data is employed to control for the endogeneity of experience. In addition, a flexible specification of experience in the wage regressions allows the model to capture the relationship more accurately. Using grouped cross-sectional data implies relatively simple data requirements, allowing direct comparisons between the two countries as well as the possibility of easy extension of the method to other countries.

Allowing for differences in total experience levels between female and male workers raises the estimated gender wage ratio by 9 percentage points in both countries, explaining 39 percent of the average gender wage gap in the US and 37 percent in the UK. Somewhat surprisingly, decomposing the total experience variable into full-time and part-time adds little to the aggregate explanatory power in either country. Although the raw gender wage gap has declined over successive cohorts of workers aged under 30, differences in total experience have continued to explain roughly the same size of gap, implying that a rising proportion of the diminishing 'raw' gap can be attributed to differences in total experience levels. Hence, while differences in experience levels between male and female workers play an important role in explaining the gender wage

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[4] Studies for the US include Mincer & Polachek (1974), Oaxaca (1973), Corcoran & Duncan (1979), Gronau (1988), Polachek & Kim (1994), Hersch & Stratton (1997), Waldfogel (1997), Brown & Corcoran (1997) and Waldfogel (1998).

[5] Studies for the UK include Greenhalgh (1980), Zabalza & Arrufat (1985), Miller (1987), Wright & Ermisch (1991), Joshi & Paci (1998), Makepeace et al. (1999), Waldfogel (1995), Waldfogel (1998), Black et al. (1999), Harkness (1996), Lissenburgh (2000) and Swaffield (2000).

[6] Throughout the reporting of previous work, wage ratios are calculated from the reported wage gaps using the formula $w_f/w_m=1/(\exp(\ln w_m - \ln w_f)$.

gap, recent improvements in relative female wages cannot be attributed to changes in relative levels of experience.

The next section describes the econometric issues involved in the estimation of the wage returns to experience. The third section describes the data sources and the construction of the experience variable. The following section presents the results from the wage regressions and gender wage gap decompositions, while the final section concludes.

II. ECONOMETRIC ISSUES

A. Experience as an Explanatory Variable

Several theories support the hypothesis that experience influences wage levels and can therefore explain some of the gender differential in wages. According to human capital models, higher levels of experience lead to higher wages by improving workers' productivity. The accumulation of experience may be also related to wages because longer time in the labour market facilitates better job matches. It is also correlated with higher employer tenure, generating returns either through the accumulation of employer-specific human capital or from wage contracts designed to reduce employee turnover.[7] More specific to the gender issue, other theories suggest that the lower expected number of years in work for women reduce their incentives to invest in education and training and thereby reduce their earnings capacity (Polachek (1975), Weiss & Gronau (1981)). Finally, career interruptions for women may result in human capital depreciation during time out of formal employment or expected interruptions may reduce earnings by lowering the reservation wage for job acceptance (Bowlus (1997)).

The empirical specification for the wage regressions estimated in this paper is purposefully very simple, with the lone explanatory variable being experience in order to address the question of how large the difference in wages would be if male and female

[7] For example, see Abraham & Farber (1987), Altonji & Shakotko (1987), Topel (1991) or Williams (1991).

workers, for whatever reason, had identical levels of experience.[8] Most studies of the gender wage gap have modeled wages as a quadratic function of accumulated experience (or as a simple linear relationship or with linear segments), but the evidence suggests that alternative specifications may fit the data better. Murphy & Welch (1990) find that a quartic specification provides a better fit for men in the US, while Light & Ureta (1995) and Robinson (2000) reach a similar conclusion for men and women in the US and UK respectively. Manning (1998) finds that experience variables up to the powers of 8 are statistically different from zero for both male and female workers in the UK. Therefore, in order to allow maximum flexibility in the wage-experience profile estimated below, a series of dummy variables for each year of experience were initially included and combined into linear segments where there were no significant differences in the corresponding coefficients.[9] The experience variable was also divided into full-time and part-time experience in a comparative specification.[10]

B. Unobserved Heterogeneity and the Endogeneity of Experience

In estimating the wage returns to experience, it is necessary to address the potential biases arising from unobserved heterogeneity and endogenous experience. A wage equation of the following form is typically estimated:

$$(1) \qquad w_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \exp_{it} + \nu_{it}$$

where w_i is the natural log of the wage for individual '*i*' at time '*t*', X_{it} includes a vector of control factors, $\exp_{it}$ is a set of experience variables, ν_{it} is a stochastic normally distributed error uncorrelated with X_{it}, and β_0, β_1 and β_2 are coefficients to be estimated. Biases in these estimated coefficients may arise if the likelihood of employment in any period is correlated with the offered wage in that period. As women's employment is much more responsive to the wage than men's, the bias is more likely to affect female workers than their male counterparts. The biases may arise through serial correlation in

[8] No claim is made about measuring discrimination. Indeed, the unexplained residual left by this simple model may be argued to understate discrimination because it ignores any discrimination in educational or past labour market choices or it could be argued to overstate discrimination because it ignores the explanatory power of other factors such as occupational choice or hours of work which might compensate for the wage differential.

[9] The wage model did not include any variables for time out of employment, implicitly assuming no depreciation of human capital during time out of work. Some studies have included variables for time out of work, but the evidence on their importance is mixed. Light & Ureta (1995) found that a substantial additional part of the wage gender gap can be explained by including an array of time out of work variables, but Corcoran & Duncan (1979) and Wellington (1993) found no significant impact of years out of work on wages.

[10] Experience is divided into full-time and part-time for women in the British NCDS in Waldfogel (1995) and separately for men and women in the British Household Panel Survey in Harkness (1996), Swaffield (2000) and Lissenburgh (2000).

the error term ν_{it} either because of a time-invariant individual unobserved component (unobserved heterogeneity bias) or through serial correlation in the shock (endogenous experience bias). This can be shown using:

(2) $\nu_{it} = A_i + \varepsilon_{it}$

where A_i is an unobserved individual fixed effect and ε_{it} is a stochastic normally distributed white noise error term. Because experience is a sum of past employment, any serial correlation in the wage error term (due to either unobserved heterogeneity in the fixed element A_i or to serial correlation in the time-dependent shock ε_{it}) will generate a spurious contemporaneous correlation between experience and wages and lead to a bias in the estimate of the coefficient β_2. Intuitively, if individuals with higher wages are more likely to work, those who have benefited from higher wages in the past are more likely to have higher experience and a higher wage in the present, but not because the higher experience *causes* a higher current wage.

The issues of unobserved heterogeneity and the endogeneity of experience have not often been addressed in the literature on the gender wage gap, but the evidence suggests that they may be important. Polachek & Kim (1994) show that controlling for unobserved heterogeneity using a variety of random and fixed effects models can substantially reduce the size of the unexplained wage gap in the US,[11] while Waldfogel (1995) reports that the returns to experience for women increase considerably when first differences and fixed effects models are used and Macpherson & Hirsch (1995) find that part of the reason that wages are lower in female dominated occupations is due to person specific labour quality or preferences. On the other hand, Swaffield (2000) finds that using fixed effects and random effects models for UK data produces very similar results to the cross-section OLS estimator, although this may be due to the inclusion of aspiration, constraint and motivation variables in the model controlling for otherwise unobserved heterogeneity. Direct tests have generally failed to reject the hypothesis of the exogeneity of experience for female workers (Neumark & Korenman (1994), Waldfogel (1995), Black et al. (1999)), but Gronau (1988) explicitly derives a

[11] They conclude that about half of the unexplained gap is due to unmeasured individual differences, although their model includes a limited number of explanatory variables, increasing the potential for unobserved heterogeneity to be influential They also find little difference between individual-specific intercept and individual-specific slope specifications and conclude that "assuming common experience gradients in correcting for heterogeneity does not prove to affect estimates of unexplained gender wage differences appreciably" (page 25).

simultaneous equation model to control for the endogeneity of experience that has considerable impact on the gender wage ratio.

In the absence of any serial correlation in the wage shock, unobserved heterogeneity can be addressed with panel data using either first differences or a fixed effects model. However, as pointed out in Neumark & Korenman (1994), the correction for *both* biases requires an instrumental variable or set of instruments (denoted Z_{it}) for experience such that:

(3) $\exp_{it} = \gamma_1 X_{it} + \gamma_2 Z_{it} + \gamma_3 A_i + \upsilon_{it}$

where υ_{it} satisfies the standard assumptions and Z_{it} is correlated with $\exp_{it}$, does not itself enter the wage equation and is uncorrelated with the fixed individual effect A_i. Neumark and Korenman argue that instruments with such demanding conditions are unlikely to exist in practice other than in the case of "natural experiments".[12] Several studies in the UK have used "imputed" experience as a means of addressing the biases. Zabalza & Arrufat (1985) impute experience as the sum of past participation probabilities, estimated using a probit model based on a vector of family characteristics. Very similar models are used in Miller (1987), Wright & Ermisch (1991) and Black et al. (1999). The implicit assumption for this imputation of experience to address both biases is that at least some of the variables used in the imputation model fulfill the conditions for the instrumental variables defined in equation (3), that is, that they are both exogenous to the wage and are unrelated to any unobserved fixed effect on wages.

In this paper, experience is imputed using grouped data defined by education and family variables. It is assumed that these variables are not related to time-specific shocks in wages, but may be related to an unobserved fixed component in the wage. The justification for this assumption is that while time-specific shocks tend to be related to job characteristics such as occupation or industry, unobserved heterogeneity such as the taste for work or employment motivation are likely to be related to individual education and family characteristics used in the imputation method. Under this assumption, using imputed experience alone does not address the unobserved heterogeneity bias. Replacing the individual subscript '*i*' with a group subscript '*g*' and noting that the experience

[12] See pages 383 and 386. Neumark & Korenman use a natural experiment with data on siblings to estimate a wage equation for women in the US, but find that the estimated returns to experience alter little with their controls for heterogeneity and endogeneity bias.

variable is now the imputed measure, the wage equation (1) can be rewritten in terms of group means:

(1') $w_{gt} = \beta_0 + \beta_1 X_{gt} + \beta_2 \exp_{gt} + \nu_{gt}$

Incorporating the assumption that time-specific shocks affect all groups equally allows the wage error equation (2) to be rewritten in terms of group means as:

(2') $\nu_{gt} = A_g + \varepsilon_t$

Inserting equation (2') into equation (1') generates the wage equation:

(4) $w_{gt} = \beta_0 + \beta_1 X_{gt} + \beta_2 \exp_{gt} + A_g + \varepsilon_t$

As the error term ε_t is not group-specific, there is no potential correlation with the experience variable and no potential bias from the endogeneity of experience.[13] However, the unobserved term A_g may be correlated with experience $\exp_{gt}$ and the potential bias from unobserved heterogeneity remains. To address this, first differences in the wage regression are used so that the time-invariant A_g term drops out:

(5) $(w_{gt} - w_{gt-1}) = \beta_1 (X_{gt} - X_{gt-1}) + \beta_2 (\exp_{gt} - \exp_{gt-1}) + (\varepsilon_t - \varepsilon_{t-1})$

Hence, by using both imputed experience and first differences, this regression addresses both issues of unobserved heterogeneity and the endogeneity of experience.[14] Wage regressions (4) and (5) are presented below as the "levels" and the "first difference" regressions respectively.[15] Differences in the resulting conclusions indicate the importance of the assumption that there may be unobserved heterogeneity between the groups used in the imputation of experience.[16]

[13] It should be noted that assuming zero correlation in the time-specific shocks would also remove any bias from the endogeneity of experience even if the shocks were group-related. In this case, the error term would still be ε_{gt}, but it would be unrelated to any shocks prior to period t and hence unrelated to past employment participation and to $\exp_{gt}$.

[14] It is the need to take first differences which requires the use of grouped data in the wage regression rather than individual data with imputed experience as used in previous studies. If panel data were available, regression (5) could be estimated at the individual level.

[15] Since ν_{gt} is the group average error, its first moment will be zero, but the variance will be σ^2/n_g, where σ^2 is the variance of ν_{gt} and n_g is the number of observations in group g. To ensure homoskedasticity, regressions (4) and (5) must be weighted by the square root of the group size (Greene, 1997).

[16] An additional potential source of bias arises from the fact that the wage regression can only be estimated for individuals with an observed wage. Yet most US studies decomposing the gender wage gap have not considered selection bias a potential problem. Hersch & Stratton (1997) control for selection with no apparent significant effect (although the paper does not actually report the significance of the selection term), while related work has not found significant selection effects for the US (for example, Wellington (1993)). Studies of the UK considering selection effects in wage regressions for women have generated mixed results, with some reporting a positive effect (Zabalza & Arrufat (1985)), others finding a negative effect (Wright & Ermisch (1991), Lissenburgh (2000)) and some suggesting no significant effects (Waldfogel (1995), Joshi & Paci (1998), Makepeace et al. (1999), Black et al. (1999)). Even though Wright and Ermisch (1991) conclude that they have "confirmed the importance of controlling for sample selection bias when estimating women' wage equations" (page 519), the selection effect is only significant when actual rather than imputed experience is used in the wage regression.

C. Decomposition Method

In measuring the proportion of the gender wage gap that can be explained by average differences in attributes between men and women, there is a choice about how to "price" the value of these differences, most often discussed in terms of whether "male" or "female" coefficients should be used in the wage decomposition.[17] To summarize, the average gap in wages between male and female workers can be expressed:

$$(6) \qquad w_m - w_f = \beta_m X_m - \beta_f X_f$$

where w_m (w_f) is the average natural log of the wage for men (women), β_m (β_f) is a vector of estimated coefficients from the wage regression for men (women) and X_m (X_f) is a vector of average explanatory variables for men (women) (including a constant term). Rearranging generates the standard Oaxaca-Blinder decomposition:

$$(7) \qquad w_m - w_f = \beta_m (X_m - X_f) + (\beta_m - \beta_f) X_f$$

where the first term on the right-hand side measures the part of the wage gap that can be attributed to differences in explanatory characteristics, valued at the male return to these attributes, and the second term captures the part that is due to differences in returns to these characteristics, weighted by average female attributes.[18] The first term is, therefore, the "explained" part of the gap, while the second is the "unexplained residual" sometimes described as "discrimination". Most studies have used this decomposition with male coefficients to analyze the gender wage gap.[19]

In this paper, coefficients from a pooled wage regression of men and women are used, partly because there is no theoretical reason to suppose that the currently prevailing average returns to experience would alter under the scenario of equal experience levels for male and female workers. In addition, use of pooled coefficients greatly simplifies the estimation requirements. For the levels regressions, inclusion of a female dummy variable in the single pooled regression directly yields a coefficient that measures the

[17] More detailed discussions can be found in Blau & Ferber (1987), Goldin & Polachek (1987), Gunderson (1989) and Brown & Corcoran (1997). The debate surrounding the most appropriate coefficients to use in the decomposition has tended to focus on the estimation of the gender wage gap if discrimination were eliminated (for example, see Cotton (1988)).

[18] Oaxaca (1973) and Blinder (1973).

[19] An alternative decomposition would be to value the differences in attributes by the coefficients from the wage regression for women using $w_m - w_f = \beta_f (X_m - X_f) + (\beta_m - \beta_f) X_m$. Harkness (1996) uses female coefficients, while Greenhalgh (1980) uses an average of the male and female coefficients. Polachek & Kim (1994) and Brown & Corcoran (1997) use coefficients from a pooled regression of both men and women.

gender gap controlling for differences in experience level. To illustrate this, the pooled regression can be written:

(8) $w_i = \alpha\ fdum_i + \beta X_i$

where $fdum_i$ denotes the female dummy variable and α and β are the pooled regressions to be estimated. Using the estimated coefficients, the gender wage gap can be written as:

(9) $w_m - w_f = \beta X_m - \alpha - \beta X_f$

Rearranging yields:

(10) $-\alpha = (w_m - w_f) - \beta(X_m - X_f)$

Hence, the negative of the female dummy coefficient consists of the observed wage gap minus the effect of differences in the experience level, priced by the pooled return. If $(X_m - X_f)$, β and $(w_m - w_f)$ are all positive, $-\alpha$ will be positive (corresponding to a negative coefficient on the female dummy) but smaller than the observed wage gap.[20] When the wage regression is estimated using first differences, the method is more complicated as a dummy female variable cannot be included in the regressions. In this case, the estimated pooled coefficients for the returns to experience are used to subtract the experience-related element from the observed wage to calculate an "estimated wage without experience" variable (denoted ew) for each observation:

(11) $ew_i = w_i - \beta X_i$

The average wage gap controlling for differences in experience levels is then calculated as the average difference in this measure between male and female workers:

(12) $ew_m - ew_f = (w_m - w_f) - \beta(X_m - X_f)$

which is the same measure as in equation (10).

III. THE DATA

A. Data Sources

Data from the Current Population Survey (CPS) in the US and from the Family Expenditure Survey (FES) in the UK are used in the analysis. Both surveys are large,

[20] Substituting the gender specific explanatory terms from equation (6) into equation (10) for the average wages yields $-\alpha = \beta_m X_m - \beta_f X_f - \beta(X_m - X_f)$ and rearranging generates $-\alpha = (\beta_m - \beta)\ X_m + (\beta - \beta_f)\ X_f$. This shows that the coefficient is capturing the differences in returns to experience, weighted by a mixture of the male and female experience levels.

nationally representative surveys that have collected data on incomes, family structure, education and employment over several decades. The CPS currently surveys approximately 50,000 households each month, but only the March survey collects adequate information on family structure to be used in this analysis. In addition, only the outgoing rotation groups are asked questions on wages so that while employment information can be used from all households, wage data is only available from less than one quarter of the sample. The FES surveys around 7,000 households each year. The survey began in 1964, but education-leaving age was not recorded until 1978 and the period of analysis is therefore limited to 1978 to 2000. The initial sample consisted of 1,687,063 individuals in the CPS and 198,367 individuals in the FES aged 16-55 and not currently in full-time education.[21] Total usual hours including overtime and gross normal weekly wage/salary were used to calculate hourly wages. The hourly wage variable was indexed to the year 2000 and trimmed to positive values not exceeding $120 for the CPS data and to positive values not exceeding £75 for the FES data. Full-time employment is defined as employment of 30 hours or more each week, while individuals working between 1 and 29 hours are defined as part-time.

B. Wages and Employment for Men and Women

The ratio of female to male average hourly wage has increased considerably in both countries over the 1979 to 2000 period. Figure 1 shows that female workers in the US and full-time female workers in the UK have experienced strikingly similar patterns in their relative wage over the period, with average relative wages rising from around 66-69 percent of the average male wage in 1980 to between 76-80 percent by 2000.[22] Prior to this period, the wage ratio had stagnated at around 60 percent for several decades in the US, while a similar stagnation had occurred in the UK until the early 1970s when there was a sudden and marked rise in women's wages relative to men's.[23] In addition,

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[21] Observations with missing sex, age, education or employment status were dropped as were those who had a child before the age of 16, those who reported leaving school before the age of 14 and those in a family where the children could not be identified.

[22] Similar trends for the US using official statistics and CPS data are evidenced in Blau (1998) (table 4) and Blau & Kahn (2000) (table 1). According to Blau & Kahn, the female/male wage ratio rose from 61 percent to 77 percent between 1978 and 1999. Similar trends for the UK are evidenced in Anderson et al. (2001) (figures 2.1 and 2.2) and Grimshaw & Rubery (2001) (figure 2.1), although use of data from the New Earnings Survey and Labour Force Survey generate slightly higher gender wage ratios than the data used here. Harkness (1996) (figure 1) presents very similar figures to those reported here when the same FES data source is applied and shows that the female/male wage ratio in the UK rose from 59 percent to 71 percent between 1973 and 1993.

[23] For longer term trends in the US, see Goldin (1989), O'Neil & Polachek (1993) and Blau & Kahn (2000). Longer-term trends for the UK are reported in Zabalza & Tzannatos (1985) and Joshi & Paci (1998).

while the wage ratio for all workers is very close to that for full-time workers in the US, the discrepancy between full-time and all workers in the UK is much more marked and appears to have widened over time.

Changes in employment rates for men and women over the same period are shown in figure 2. Employment rates among women have risen in both countries, although the increase in participation was stronger among women in the US than in the UK until the final two years. While 61 percent and 65 percent of women were in employment in 1979 in the US and UK respectively, around 72 percent of women in both countries were working in 2000.[24] But trends in male employment rates have been very different between the two countries. The employment rate for men in the US has cycled around 85 percent throughout the period, but male employment in the UK declined substantially from a high of 88 percent in 1979 to a low of 71 percent in 1993 and then recovered to 76 percent in 2000. Consequently, there has been a convergence in employment rates in both countries, but this has been due to increasing participation on the part of women in the US and to a decline in men's propensity to work in the UK.[25]

The gender difference in employment behaviour is most marked when considered over the individual's lifetime profile, as presented in figure 3. In the US, the gap in employment rate between men and women develops between the ages of 18 and 30, as the rate rises substantially with age for men, but shows a slight decline for women as they reach prime child-rearing age. The gap only narrows slightly as women become more likely to be in employment after the age of 40.[26] The pattern in the UK is quite different. Employment rates peak for men and women in their early 20s, with the male rate declining steadily thereafter. For women in the UK, employment rates decline substantially from the age of 20 to 30, but then rise quite substantially to the age of 40. Consequently, employment rates look very similar for men and women as they approach

[24] Prior to 1979, employment rates for women had risen substantially in both countries. For example, Goldin (1989) reports a seven-fold increase in the labour force participation rate of married women in the US between 1920 and 1980, while Borooah & Lee (1988) report that the relative employment of women rose by over 10 percentage points during the 1970-1980 period.

[25] Similar trends for the US during 1980 to 1995 are presented in Blau (1998) (tables 1A and 1B) and for 1979-2000 on the Bureau of Labor Statistics website (www.bls.gov/cps/home.htm#annual), table 2. The levels reported in these sources are not directly comparable with figure 2 as the rates are for different age groups and for labour force participation rather than the employment rate. Similar trends for the UK are presented in Twoney (2001) and Bower (2001), although, again, the levels are not directly comparable with figure 2 as the rates are for a different age group as well as from a different data source (the LFS).

[26] Blau (1998) reports a similar pattern in participation rates by age, with a slight increase in participation among men aged 35-44 relative to the earlier age group and a decline in participation at higher ages.

the age of 50, but female participation then declines more rapidly than that for men towards retirement.

One of the major differences in labour market behaviour between the US and UK is the propensity to work part-time. The contrast is starkest when considered across the age profile as presented in figures 4a and 4b. In the US, women are more likely to work part-time than men (particularly between the ages of 25 and 40), but the differences are not substantial. However, female workers in the UK are more likely to be in part-time employment than male workers even at very young ages and there is a substantial switch into part-time employment for women between the ages of 24 and 32, corresponding to the onset of the prime child-rearing age. Once in her 30s, a woman in the UK is more likely to be in part-time than full-time work and almost equally likely to be in either type of employment until the end of her working life.

Table 1 also shows that there are important distinctions in relative wages and employment across education group, number of dependent children and cohort.[27,28,29] In terms of relative wage, women in the highest education group fair better than those less educated in both countries, while their employment rate is also closer to men's than women's in the lower education groups. The gender wage ratio is also substantially higher for childless workers than for those with children and declines with the number of children. Men living with children are considerably more likely to be in employment than those without children in the US, but the difference is less marked in the UK, where men with three or more children are those least likely to be in employment. The employment patterns for women are similar in both countries: childless women are substantially more likely to be in employment than mothers, while the employment rate declines considerably with the number of children. In both countries, the gender wage ratio has risen with subsequent cohorts, but differences in employment rates have narrowed to a greater extent in the UK than in the US. Aggregating across all groups, the gender wage

[27] Three education groups are used in both countries, but the specific groups are not directly comparable across the countries. In the US, education group 1 corresponds to those who did not graduate from high school, group 2 to high school graduates and group 3 to those with some education beyond high school. Averaged across the period, 17 percent of men and 16 percent of women are in the lowest education group, 35 and 39 percent are in group 2 and 48 and 45 percent in the highest education group. In the UK, group 1 consists of those who left school at age 16 or before, group 2 contains those leaving full-time education aged 17 or 18, while those in education beyond the age of 18 are designated to group 3. Averaged over the period, 70 percent of men and 68 percent of women are in the lowest education group, 15 and 19 percent are in group 2 and 15 and 13 percent in the highest education group.

[28] Children include all biological, adopted, fostered and step children living in the same household under the age of 18 for the US and under the age of 16 or under the age of 18 and in full-time education for the UK.

[29] Table 1 presents the ratios and rates for three cohorts from the six used in the analysis and for those under the age of 30 in order to ensure a consistent age and education comparison.

ratio is slightly higher in the US than the UK: 73.8 percent compared to 70.2 percent. But the gap in employment rates between men and women is greater in the US.

C. Imputed Experience Variables

In order to impute an experience variable, each individual was assigned to a group that could be matched to a corresponding group of observations in all previous years since leaving full-time education. As education is included in the matching formula and education leaving age was not collected in the FES until 1978, experience could only be imputed for those entering the labour market from 1978 onwards. For comparability, the same restriction was applied to the US data. This limited the sample to those aged 44 or less with a maximum experience level of 22 years, but these early years are the most crucial time in the labour market for wage growth.[30,31] For each group in each year, the full-time and part-time employment rates were calculated. For each individual, full-time and part-time experience are the accumulated sums of these past employment rates since leaving full-time education and total experience is the sum of both types of experience.[32]

Three criteria were used to select the variables defining the groups. First, the variables need to be correlated with employment differences or the final experience variable will exhibit little variation. Second, the number of groups and cell sizes used to calculate employment rates need to balance a trade-off: fewer groups mean larger cells which gives greater precision in the employment rates and fewer empty cells, but on the other hand more groups increase the variance in the final experience measure. Finally, the group-defining variables must be time-invariant or such that the timing of changes can be deduced in order to match individuals with their corresponding counterparts in previous years. For example, age of the individual and the number and age of children can be mapped backwards, whereas previous marital status cannot be deduced from the current state alone. Consequently, the following variables were selected to define the employment groups: gender, cohort, age, three education groups, number of children (top

[30] Those leaving school at age 22 in 1978 will be 44 in the final data year of 2000. For those groups with younger school leaving ages, the maximum age in 2000 is correspondingly lower.
[31] Those reporting that they leave school at ages 14 or 15 are treated as though they enter the labour market at age 16.
[32] This imputation method is similar to that used in Zabalza & Arrafut (1985) and related studies, but uses non-parametric matching rather than a probit model to estimate past employment probabilities.

coded at 3), age of the youngest child and age of the second youngest child.[33,34] The division by cohort was included specifically to analyze the changes over different generations of workers. However, it was also useful in allowing for time effects in employment without including a variable for year, which would have resulted in much smaller cell sizes and a higher proportion of empty cells. Similarly, in order to reduce the proportion of empty cells, age bands defined as 0-4, 5-10 and 11-19 were used to match the youngest children's ages.[35]

The final samples of grouped wage observations with a valid imputed experience variable include 11,411 male groups and 12,677 female groups in the US and 4,809 male groups and 5,636 female groups in the UK.[36] The experience variable takes values ranging from 0.1 to 20.2 (table 2). Average experience is greater for men than for women in both countries and is slightly lower in the US than in the UK for both men and women: 6.0 and 5.3 years for men and women in the US compared to 6.2 and 5.9 years for men and women in the UK.[37] Average part-time experience is greatest among US women (1.2 years), closely followed by both men in the US and women in the UK (0.9 years).[38]

[33] Six cohorts were used: those born during 1956-60 (cohort 1), 1961-65 (cohort 2), 1966-70 (cohort 3), 1971-75 (cohort 4), 1976-1980 (cohort 5) and 1981-1985 (cohort 6).

[34] The probit model for the UK in Zabalza & Arrafut (1985) includes unearned income, husband's earnings (with the rate of change predicted over time as a function of husband's wage, education and occupation), wife's wage (predicted as a function of age, education, father's occupation, race and health), number of children by age group, wife's age, race and health. There is also an adjustment for cohort effects. Miller (1987) and Wright & Ermisch (1991) use the same approach, while Black et al. (1999) uses probit regressions based on age, education, children, regions and non-employment income. Wright & Ermisch find a high degree of correlation between their imputed measure of experience and actual experience recorded in the data, with similar means but a smaller variance for the imputed measure. Mincer & Polachek (1974), using US data, find that actual experience and an estimated experience variable (based on years since school, education of wife and husband and number of children) generated very similar earnings functions for women. On the other hand, Blackaby et al. (1997) use a much simpler imputation method based on summing participation rates over age, year and sex cells and find that the resulting experience measure has little impact on the wage decompositions.

[35] The FES does not report whether children are biological, adopted or step children. It was assumed for both datasets that people recorded as parents had cared for the children since birth. Since most children stay with their mother upon relationship separation, this may overestimate the duration of the presence of children for stepfathers, but family structure is not such an important determinant of employment for men as it is for women.

[36] In the US data, 297,894 men and 314,131 women reported an employment status, while 50,443 men and 47,736 women recorded wage information. Men reporting an employment status were divided into 2,330 groups with an average cell size of 121.7, while women were divided into 2,491 groups with an average cell size of 119.2. In the UK data, 28,073 men and 30,895 women reported an employment status, while 21,760 men and 21,215 women recorded wage information. Men reporting an employment status were divided into 1,388 groups with an average cell size of 21.0 and women into 1,589 groups with an average cell size of 19.4.

[37] Given that the sample is heavily weighted towards younger workers (for example, 17-years-olds are present in all years from 1979 to 2000, but 40 year-olds will only appear in years 1996 to 2000), this is broadly consistent with the picture in figure 3 which shows generally higher employment rates for the UK than the US up to the age of 27 for men and up to the age of 23 for women.

[38] Given the balance of the sample towards younger workers, this is consistent with the rates presented in figures 4a and 4b which show the relative prevalence of part-time employment among US workers up until the age of 25.

IV. RESULTS

A. Wage Regressions

Wage regressions were estimated for three specifications. The first specification simply includes dummy variables for year and, in the case of the levels regression, a dummy variable for female. The year dummy variables are included to remove cyclical effects in employment and wages. The second specification adds piecewise linear total experience variables. This takes the form of dummy variables for each of the first six years of experience and linear segments for higher years, grouped on the basis of similar (and not significantly different) coefficients. This piecewise linear form allows a great deal of flexibility, which is particularly important given that the estimates for higher levels of experience will only be drawing on the data for older cohorts.[39] The third specification replaces the total experience variables with a similar set of variables divided into full-time and part-time experience, allowing for potential differences in the impact of full-time and part-time employment on future wage levels. Both the levels and first difference regressions were estimated using a sample with complete experience and wage variables for the previous year.[40]

The regression results for the total experience specification are presented in tables 3a and 3b. For the US, the returns to experience using the levels regression are initially very high (some 29 percent in the first year) and trend steadily downwards as the level of experience increases, but the decline is by no means smooth. Using first differences generates generally smaller returns, although three of the coefficients are larger than for the levels regressions, reflecting a much smoother decline in the returns to experience. In addition, using first differences generates significantly negative coefficients beyond 11 years of experience.[41] The smaller coefficients for the first difference regression suggests that unobserved group heterogeneity includes an element which is positively related both to higher wages and to a higher propensity to work, generating an overestimate of the

[39] The analysis was also performed using a quadratic specification for experience. The explanatory power of the experience variables was generally lower (lower R^2 values) with the quadratic specification, but the estimated wage ratios were similar to those reported for the piecewise linear specification.
[40] The levels regressions were also estimated including those with missing prior year information. The sample sizes were only slightly larger with little difference in the regression results.
[41] When the first difference regression is estimated separately for cohort 1, the negative coefficients remain, indicating that the negative returns are not a cohort effect resulting from only the older cohorts reporting experience at the highest levels.

return to experience in the levels regressions. The levels regression for the UK presents a similar picture to that for the US. However, in the UK case, the coefficients from the first difference regressions are not generally substantially smaller than those for the levels regressions (for years 2 to 8, the returns are even slightly higher), suggesting that unobserved heterogeneity may not be so important in the UK case. The estimates using first differences are generally higher in the UK than in the US with a smaller downturn at high levels of experience, indicating greater returns to experience in the UK.

Estimates separating the returns by full-time and part-time experience are presented in tables 4a and 4b. In the US, the returns to full-time experience closely mirror those for total experience except that the coefficients are generally smaller when first differences are used, indicating that unobserved heterogeneity is even more important when the full-time/part-time distinction is made. For part-time experience, there is a substantial positive return in the first year followed by significant negative returns in later years, a pattern which is more distinct in the first difference regression. While one year or less of part-time work is beneficial to future wage levels, much longer in part-time work is highly detrimental. Referring back to figure 4, this may be related to the propensity of very young US workers to be in part-time work: there may be positive returns to shorter periods of part-time employment early in the career but high penalties if it stretches beyond those initial years or if there is a return to shorter hours in later years.

In the UK, the returns to full-time experience are also similar to those for total experience, but are generally slightly higher in the levels regression and slightly lower in the first difference estimates, suggesting that unobserved heterogeneity may be generating an upward bias in the levels estimates. Unobserved heterogeneity is also important in estimating the returns to part-time experience. The levels regression indicates high negative returns to initial years of part-time experience and positive returns to later years, but using first differences generates generally smaller negative returns. This suggests that while part-time work does have a negative impact on future wages, it is also the case that individuals who spend shorter periods (less than 4 years) in part-time work are particularly likely to have lower wages, while those who remain in part-time work for longer periods tend to be higher earners.

B. How Much Does Experience Explain the Gender Wage Gap ?

The estimated returns to experience were used to calculate the gender wage ratio under the scenario that male and female workers have equal average levels of experience (corresponding to equation (10) for the levels regressions and to equation (12) for the first difference regressions). These gender wage ratios are presented in table 5, together with the base ratio (from specification 1 with an adjustment for year effects) in the first row. The percentage of the wage gap explained by experience is the proportional decline in the gap when experience measures are added to the wage regression (where the wage gap is defined as 100 – base ratio).

Without any allowance for differences in experience levels, the gender wage ratio is 77.2 percent in the US and 75.1 percent in the UK. Using the first difference regressions to include controls for total experience increases the gender wage ratio to 86.0 percent in the US and to 84.4 percent in the UK: a reduction in the gender wage gap of approximately 9 percentage points in both countries (a 39 percent reduction in the gap in the US and 37 percent in the UK).[42] Intuitively, allowing for experience reduces the gender wage gap because the positive returns to experience and the higher average levels of experience for male workers mean that they should be expected to earn more than female workers on average. The proportion of the gap explained by experience is remarkably similar in both countries: the higher returns in the UK are offset by a smaller difference in average experience levels between men and women than in the US.[43]

Somewhat surprisingly, replacing the total experience variables with those for full-time and part-time experience in the first difference regressions has relatively little impact on the gender wage ratio: the ratio rises by 3.3 percentage points in the US to 89.3

[42] The 9 percentage point increase is consistent with previous estimates. Work using less detailed experience measures have found a smaller explanatory role for experience: Oaxaca (1973) reports that controlling for experience in the US using quadratic potential experience raises the gender wage ratio by 1 percentage point; Gronau (1988) reports a 2 percentage point increase for the US using quadratics in actual experience, employer tenure, job tenure and time out (plus years of schooling); Waldfogel (1997) finds a 2-3 percentage point increase for the US using actual linear experience (plus age); and Waldfogel (1998) reports a 4 percentage point increase for the US and a 5 percentage point increase for the UK using actual linear experience. Studies using experience variables with greater detail have reported greater impacts: Duncan & Corcoran (1979) find a 14 percentage point increase in the gender wage ratio for the US using quadratic actual experience prior to current employer, years with current employer (divided by previous job, training and post-training) and percentage of years in full-time employment.

[43] The analysis was also performed using wage information only for full-time workers. For the US, using only full-time workers reduced the number of wage observations (groups) from 24,088 to 21,806 and had little impact on the regression results with most of the estimated wage ratios very slightly higher than those for the complete sample. For the UK, using only full-time workers reduced the number of wage observations (groups) from 10,325 to 7,565 and had a much greater impact on the results. In the first difference wage regressions, the estimated returns to total and full-time experience were considerably lower than for the complete sample, but the returns to part-time experience were significantly positive and large (13 percent for the first year, 19 percent for years 2 and 3 and 24 percent for years 4 to 7 of part-time experience). The wage ratio without experience controls is higher for the sample of full-timers than the complete sample (82.4 percent compared to 75.1 percent) and experience explains less of the gender wage gap.

percent, but by only 0.7 percentage points in the UK to 85.1 percent. Several counterbalancing factors explain the small impact. In both countries, although the gender difference in average full-time experience is greater than for total experience (leading to greater explanatory power for experience), the returns to full-time experience are lower than for total experience (reducing explanatory power). In the US, although there are large negative returns to part-time experience (enhancing explanatory power), the gender difference in levels of part-time experience is not large (reducing explanatory power). In the UK, the gender differences in average levels of part-time experience are large, but the negative returns are much smaller.

Comparing the gender wage ratios estimated from the levels regressions with those from the first difference regressions shows the importance of controlling for unobserved heterogeneity. Using levels for the total experience regressions leads to a smaller rise in the gender wage ratio than using first differences: the ratio rises to 82.9 percent rather than 86.0 percent in the US,[44] while the ratio increases only to 77.6 percent rather than 84.4 percent in the UK. However, when experience is divided into full-time and part-time, using levels regressions generates a greater increase in the gender wage ratio than when first differences are used: the ratio rises to 91.4 percent rather than 89.3 percent in the US and to 100.8 percent rather than 85.1 percent in the UK. Hence, failure to control for unobserved heterogeneity *under*states the role of total experience in explaining the gender wage gap and *over*states the role of full-time and part-time experience in both countries, and the biases are much greater in the case of the UK.

C. By Education Level

The wage ratios by education level, estimated from separate first difference regressions for each education group, are presented in table 6. The base ratios are very similar across education groups in the US, but female workers in the lowest education group in the UK command lower wages than those in the higher two groups (relative to male workers in corresponding education groups). Allowing for differences in total experience between men and women raises the gender wage ratio by between 7 and 9

[44] This is consistent with the findings for the US in Polachek & Kim (1994). Using data from the PSID for 1976-1987, the raw gender wage ratio is 58 percent. When controls are included for number of children, SMSA size, years of schooling, linear actual experience and linear time out, the ratio rises to 66 percent using a levels regression and to 80 percent and 86 percent when fixed effects and first differences are used respectively.

percentage points for all three groups in the US, but has a much larger impact on the ratio at lower levels of education in the UK, raising the ratio by 10.1 percentage points for the lowest educated and by 6.0 and 4.7 percentage points for the middle and highest groups respectively. Decomposing experience into full-time and part-time generates greater variation in the role of experience across the education groups. In the US, this specification of experience explains less of the gender wage gap than total experience for the lowest education group, but has a greater role for the higher two groups, raising the wage ratio by 11.2 percentage points and 14.1 percentage points for the middle and upper groups respectively. Consequently, while full and part-time experience explain only 25 percent of the gender wage gap for the lowest educated, it explains over 60 percent for the most highly educated.[45] In the UK, it is the least educated group for whom this decomposition is most important, raising the ratio by 13.4 percentage points. Hence, while experience is most important in explaining the gender wage gap for the highest education group in the US, it is the least educated group in the UK for whom gender differences in experience offer the greatest explanation for the wage gap.

D. By Cohort

In order to ensure comparability between the cohorts, it was necessary to restrict the analysis to cohorts covering identical age periods. This was achieved by restricting the sample to those groups aged under 30 and using only cohorts 2 to 4. Cohorts 5 and 6 could not be used because the truncation of the data in the year 2000 meant that they did not contain groups up to the age of 30, while cohort 1 was excluded because it consists mostly of those in the highest education group. As a result, the cohort analysis compares individuals under the age of 30 who were 16 years old in 1978-1981 (cohort 2) with those who were aged 16 in 1982-1986 (cohort 3) and those aged 16 in 1987-1991 (cohort 4). Table 7 presents the wage ratios derived from separate regressions for each cohort.

Successive generations of women have received higher wages relative to men, although the difference is greatest between cohorts 2 and 3 in both countries. Yet

[45] Brown & Corcoran (1997) analyse the importance of full-time and part-time experience in explaining the gender wage ratio for the three education groups similar to those used here. Using data from the 1984 SIPP, their findings indicate that controlling for a collection of variables (quadratics in actual full-time and part-time experience, tenure and time out; number of interruptions, training, veteran status and whether part-time) raises the gender wage ratio from 70 to 76 percent for those who did not graduate high school, from 69 to 79 percent for high school graduates and from 71 to 82 percent for college graduates. Hence, they also find a greater role for experience at higher levels of education.

allowing for differences in total experience increases the gender wage ratio by a constant 8 to 9 percentage points across all cohorts in both countries. Average experience for female workers relative to male workers has risen slightly over these three cohorts[46], but this relative improvement in experience has either been insufficient to lead to a noticeable impact on relative wages or changes in the returns to experience have altered in a way that has been unfavorable to female relative wages. Overall, little of the improvement in the relative position of women can be attributed to experience. This is highlighted by the fact that total experience explains a larger proportion of the diminishing gender wage gap, rising from 43 percent of the gap for the oldest cohort to 60 percent for the most recent cohort in the US and increasing from 37 percent to 46 percent across cohorts in the UK.

However, decomposing experience into full-time and part-time suggests that experience has become more influential over time in a negative direction. The increases in the gender wage ratio from allowing for differences in full-time and part-time experience rise with each successive cohort: from 7.3 to 8.4 percentage points in the US and from 10.4 to 16.8 percentage points in the UK. Relative levels of full-time and part-time experience between male and female workers have altered little across the three cohorts[47], suggesting that changes in the returns to full-time and part-time experience have served to widen the gender wage gap. Given the overall improvement in the gender wage ratio, this implies that developments in other factors must have more than offset this adverse effect. Consequently, the proportion of the gender wage gap explained by full and part-time experience has risen substantially: from 35 percent of the gap to 56 percent in the US and from 46 percent to 97 percent in the UK.

E. How Does the Gender Wage Gap Evolve with Experience ?

In order to consider how the gender wage gap develops over the experience profile, female interaction terms for the total experience variables were added to the first

[46] The average experience level for female workers in the US, weighted by group size, fell from 3.3 years for cohorts 2 and 3 to 3.0 years for cohort 4, compared to a decline from 3.8 to 3.4 for male workers. In the UK, the average experience levels for female workers were 4.7, 4.6 and 3.9 for cohorts 2, 3 and 4 compared to 4.9, 4.5 and 3.8 for male workers. The unweighted ratio of male to female average experience declined more dramatically: from 1.6 for cohort 2 to 1.4 and 1.3 for cohorts 3 and 4 in the US and from 1.2 for cohort 2 to 1.0 and 0.7 for cohorts 3 and 4 in the UK.

[47] The unweighted ratio of male to female average full-time experience for workers under the age of 30 was 1.6, 1.5 and 1.6 for cohorts 2, 3 and 4in the US and 1.4 for all three cohorts in the UK. For part-time experience, the ratios were 0.8, 0.9 and 0.8 in the US and 0.3, 0.4 and 0.3 in the UK.

difference regressions.[48] This allowed wage-experience profiles to be estimated separately for men and women.

The regression results are presented in table 10. For the US, all coefficients for the experience variables (with the exception of year 3) are slightly higher than in the regression without interaction terms, while the coefficients for the female interaction terms (bar, again, year 3) are negative, showing lower returns for women than for men on average. This suggests a steady divergence in wage levels between male and female workers over the entire experience profile, although the only significant differences are for the interaction terms in years 2, 4 and 9 through 17. The results are very similar for the UK, although the coefficients on the female interaction terms are generally smaller than those for the US and are generally not significant. Hence, caution should be exercised in interpreting conclusions from these regressions as representing statistically significant gender differences.

In order to appreciate the magnitude of the coefficients on the female interaction terms and how the differences accumulate with experience, figure 5 presents the estimated gender wage ratio by experience level. The profiles are similar in both countries for the first 10 years of experience: women initially enter employment on fairly equal terms with men, but their relative position declines steadily as experience increases with the gender wage ratio dropping below 80 percent by year 10 in both countries. Beyond 10 years of experience, the gender wage ratio drops dramatically in the US, but remains relatively stable in the UK until years 18 and 19.

Figures 6a and 6b present the profiles by education group. These profiles are plotted only for experience levels observed in the data. For the US, the wage ratios are distinctly ranked as being higher for the higher education groups, although relative wages for those in the highest education group decline at a rapid pace after 11 years of experience. In the UK, it is the least educated female workers who fair best relative to male workers on employment entry, with a wage ratio of almost 109 percent compared to 84 percent for those in the highest education group. These relative positions change rapidly over the first four years of work and, by year 7, have reversed.

[48] Wage-experience profiles were not estimated for the full-time and part-time experience specification for two reasons. First, this would require an excessive number of interaction terms in the wage regression. Second, it is not straight-forward to graphically present the results with two sets of explanatory variables.

Finally, figures 7a and 7b present the profiles from separate regressions for each cohort.[49] For the US, more recent cohorts of women command higher wages relative to men than older cohorts but only for the initial 2 to 3 years of employment. At higher levels of experience, successive cohorts of female workers fair worse relative to men than the older generations. This suggests a "tilting" of the profile over time in the US, with greater equality upon employment entry but a greater discrepancy in the returns to experience for more recent cohorts of workers. In the UK, the patterns across cohorts are much weaker. Cohorts (other than 5) have a consistent ranking for the first 3 years, suggesting that more recent generations of female workers may command higher wages relative to men during the initial years of working than the older cohorts.

V. CONCLUSIONS

This paper has explored the relationship between experience and wages for men and women over two decades in the US and the UK. In estimating the wage returns to experience, the potential biases from unobserved heterogeneity and the endogeneity of experience are addressed using first differences in the wage regression combined with an "imputed" measure of experience based on group data. The relatively light data demands of this approach, requiring only a time series of cross-sectional data, means that the method could easily be extended to other countries. It is shown that failure to allow for unobserved heterogeneity can lead to an underestimate of the importance of differences in total levels of experience in explaining the gender wage.

A substantial proportion of the gender wage gap can be attributed to differences in experience levels between male and female workers. In the case of the US, average female wages as a proportion of average male wages rises from 77 percent to 86 percent when allowance is made for differences in experience levels, while the ratio increases from 75 percent to 84 percent in the UK. Hence, experience explains 39 percent of the wage gap in the US and 37 percent in the UK. Yet the convergence in employment rates does not appear to have been a dominant factor in the recent narrowing in the gender

[49] We limit this analysis to cohorts 2-5 because cohort 1 consists mainly of individuals from the highest education group.

wage gap. Although the raw gender wage ratio for workers under the age of 30 has risen considerably over recent successive cohorts, experience continues to explain roughly the same size of gap. Indeed, the analysis suggests that the returns to experience may have altered in such a way that the existing differences in experience levels have come to have a larger adverse impact on relative female wages.

An examination of the wage gap over the experience profile reveals that female workers initially enter the labour market on equal terms with their male counterparts and it is only as experience accumulates that the gender wage gap develops. This timing is consistent with explanations of the gender wage gap that emphasize the role of family development and the adverse effects of career interruptions and household responsibilities, while it less supportive of theories based on differences in formal education or occupational choice. The pattern could also reflect a greater effectiveness of antidiscrimination legislation for workers with shorter employment histories and greater similarities in their qualifications and experience than older workers.

Recent policy developments in the US and UK have focused on encouraging women, particularly mothers, to participate in formal employment with a view, at least in part, to enhancing the labour market position and earning power of female workers relative to their male counterparts. The evidence presented here supports such an approach by confirming that labour market experience plays a major and increasingly important role in explaining the gender wage gap. Not only are differences in the levels of experience between male and female workers a major explanation of the wage difference, but changes in the returns to experience may also have substantial repercussions for the relative position of women in the labour market.

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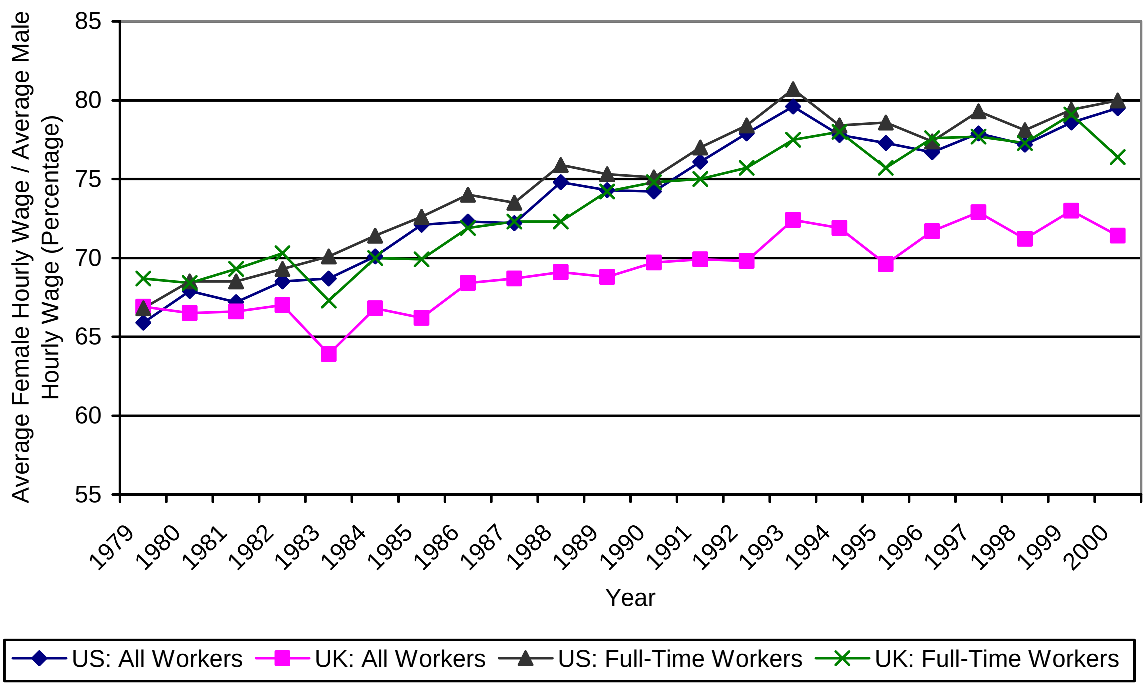
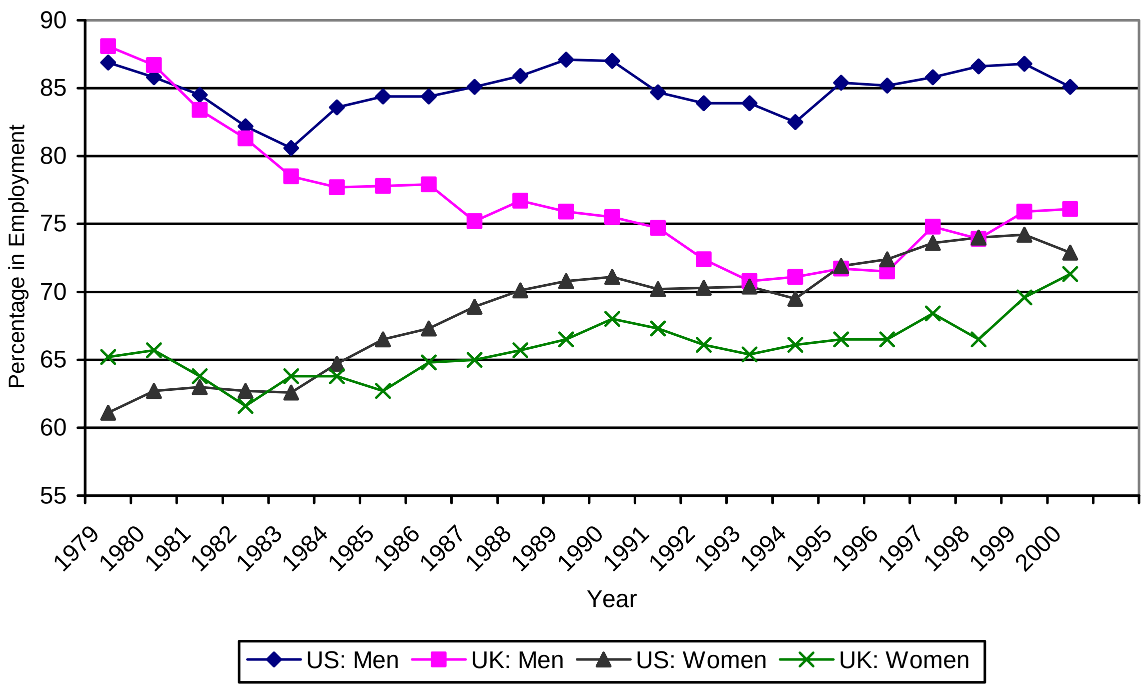
Figure 1: Gender Wage Ratio: 1979-2000



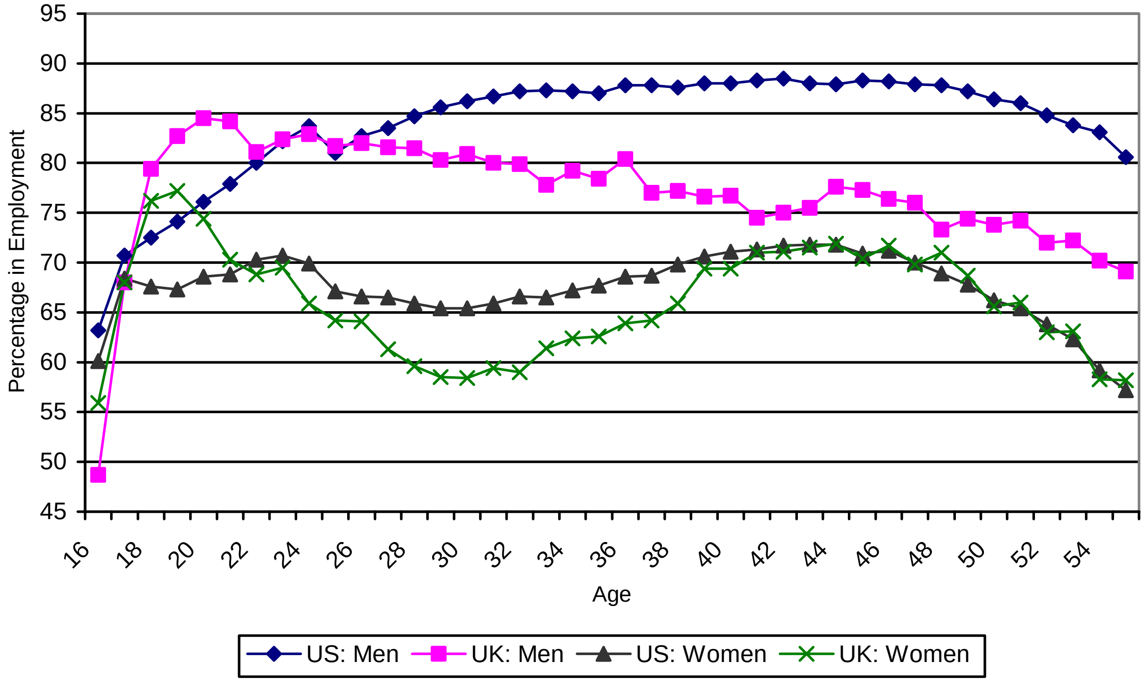
Notes: Figures are calculated from the Current Population Survey for the US and from the Family Expenditure Survey for the UK. Full-time workers are those working 30 or more hours each week.

Figure 2: Employment Rates by Gender: 1979-2000



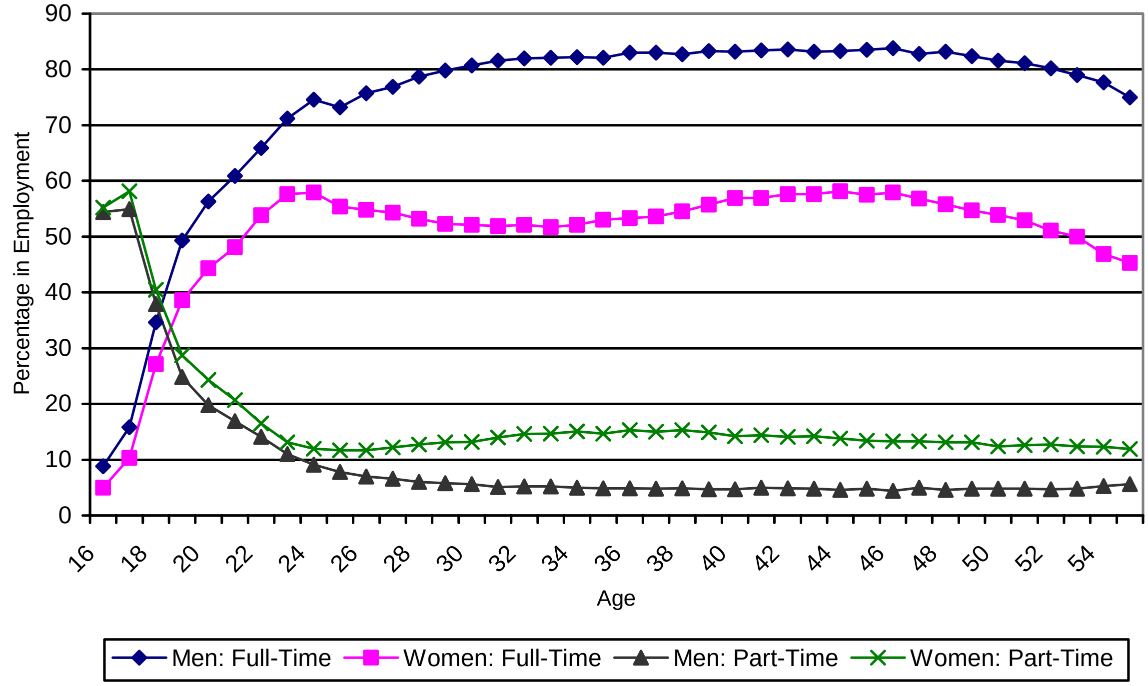
Notes: Figures are calculated from the Current Population Survey for the US and from the Family Expenditure Survey for the UK. Employment rates are calculated for all those aged 16 to 55 and not in full-time education.

Figure 3: Employment Rates by Gender and Age



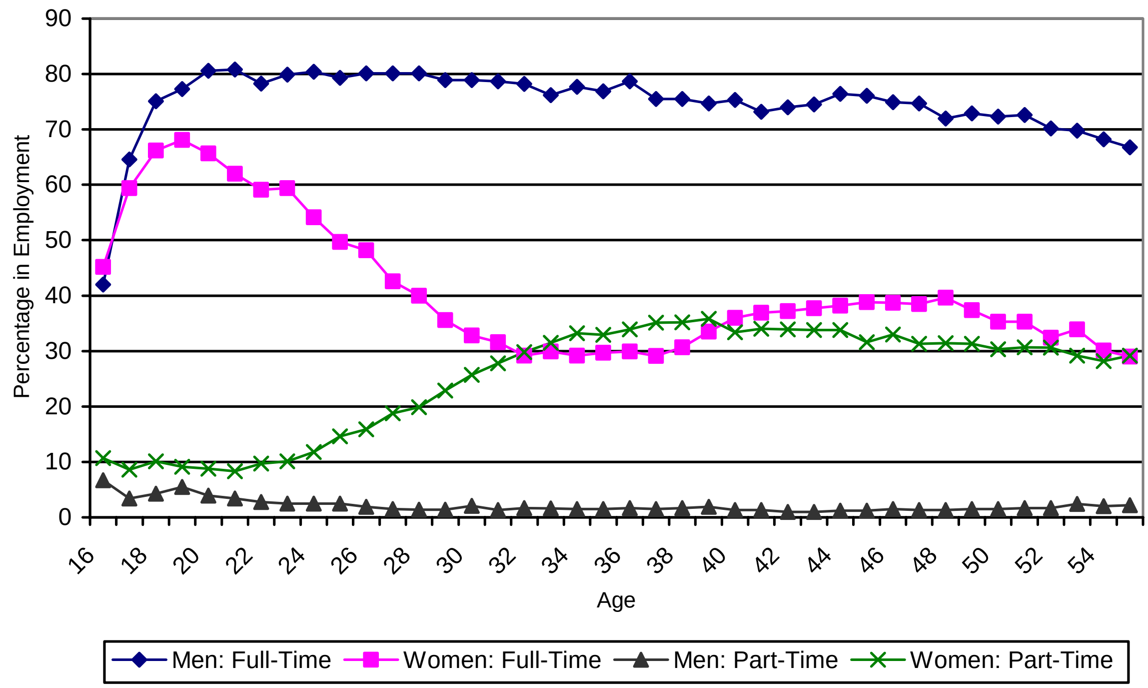
Notes: Figures are calculated from the Current Population Survey for the US and from the Family Expenditure Survey for the UK for the years 1979 to 2000. Employment rates are calculated for all those aged 16 to 55 and not in full-time education.

Figure 4a: Full-time and Part-time Employment Rates by Gender and Age: US



Notes: Figures are calculated from the Current Population Survey for the years 1979 to 2000. Employment rates are for those aged 16 to 55 and not in full-time education. Full-time is working 30 or more hours each week and part-time is working less than 30 hours.

Figure 4b: Full-time and Part-time Employment Rates by Gender and Age: UK



Notes: Figures are calculated from the Family Expenditure Survey for the years 1979 to 2000. Employment rates are for those aged 16 to 55 and not in full-time education. Full-time is working 30 or more hours each week and part-time is working less than 30 hours.

Table 1: Gender Wage Ratio and Employment Rates

	Gender Wage Ratio (in percentages)		Employment Rate (in percentages)			
			US		UK	
	US	UK	men	women	men	women
By education:						
group 1	70.9	67.4	72.9	47.9	75.3	62.2
group 2	71.3	68.6	83.9	65.7	82.8	72.0
group 3	74.7	76.4	89.1	76.8	82.8	74.3
By number of children:						
0	81.1	79.0	81.4	75.6	77.3	78.3
1	68.7	64.7	88.3	65.2	79.6	57.9
2	65.6	59.7	89.5	60.8	79.4	56.2
3	62.4	60.1	88.1	50.1	70.6	42.3
By cohort for those aged under 30:						
2	85.6	84.1	77.7	67.9	79.8	69.8
3	89.4	88.3	80.4	70.7	76.1	68.8
4	89.8	89.4	81.6	72.3	75.8	70.3
All	73.8	70.2	84.6	67.8	77.5	65.7

Notes: Figures are calculated from the Current Population Survey for the US and from the Family Expenditure Survey for the UK for the years 1979 to 2000. Employment rates are those aged 16 to 55 and not in full-time education. In the US, education group 1 corresponds to those who did not graduate from high school, group 2 to high school graduates and group 3 to those with some education beyond high school. In the UK, group 1 consists of those who left school at age 16 or before, group 2 contains those leaving full-time education aged 17 or 18 and group 3 includes those in education beyond the age of 18. Cohort 2 includes those born during 1961-65, cohort 3 includes those born during 1966-70 and cohort 4 contains those born during 1971-75.

T able 2: Summary of Experience Variable for Wage Regression Sample: Grouped Data

	US		UK	
	Men	Women	Men	Women
Total Experience in Years:				
mean	6.0	5.3	6.2	5.9
(standard deviation)	(4.4)	(4.0)	(4.3)	(4.1)
minimum to maximum	0.1 to 20.2	0.2 to 19.1	0.1 to 19.7	0.1 to 19.4
Full-time Experience in Years:				
mean	5.1	4.1	5.9	5.0
(standard deviation)	(4.1)	(3.4)	(4.2)	(3.6)
minimum to maximum	0.0 to 18.9	0.0 to 17.0	0.1 to 19.3	0.0 to 17.7
Part-time Experience in Years:				
mean	0.9	1.2	0.3	0.9
(standard deviation)	(0.5)	(0.8)	(0.2)	(1.0)
minimum to maximum	0.0 to 3.3	0.0 to 4.8	0.0 to 2.3	0.0 to 7.5

Notes: The statistics are weighted by group size. Full-time experience includes employment at 30 or more hours each week and part-time experience includes employment at less than 30 hours each week.

Table 3a: Wage Regressions with Total Experience: US

Dependent Variable: Log Hourly Wage	Levels		First Differences	
	coefficient	standard error	coefficient	standard error
Female dummy	- 0.187 ***	0.006	not included	
Year 1 of experience	0.287 ***	0.031	0.133 ***	0.020
Year 2 of experience	0.094 ***	0.024	0.130 ***	0.020
Year 3 of experience	0.135 ***	0.022	0.119 ***	0.018
Year 4 of experience	0.037 *	0.020	0.078 ***	0.017
Year 5 of experience	0.085 ***	0.020	0.060 ***	0.060
Year 6 of experience	0.039 **	0.018	0.061 ***	0.061
Years 7-8 of experience	0.055 ***	0.007	0.024 **	0.012
Years 9-11 of experience	0.041 ***	0.005	0.004	0.010
Years 12-14 of experience	0.034 ***	0.005	- 0.034 ***	0.011
Years 15-17 of experience	0.012	0.008	- 0.071 ***	0.014
Years 18-20 of experience	0.091 ***	0.023	- 0.089 ***	0.027
Constant	1.844 ***	0.025	not included	
Year dummies	included		included	
R^2	0.260		0.016	
Number of groups	24,088		24,088	

Notes: Regressions are weighted by the square root of the group size. Coefficients are significantly different from zero at the 1 percent level (***), 5 percent level (**) and 10 percent level (*).

Table 3b: Wage Regressions with Total Experience: UK

Dependent Variable: Log Hourly Wage	Levels		First Differences	
	coefficient	standard error	coefficient	standard error
Female dummy	- 0.254 ***	0.009	not included	
Year 1 of experience	0.403 ***	0.064	0.264 ***	0.031
Year 2 of experience	0.149 ***	0.037	0.158 ***	0.027
Year 3 of experience	0.067 *	0.037	0.123 ***	0.027
Year 4 of experience	0.076 **	0.036	0.121 ***	0.027
Year 5 of experience	0.038	0.035	0.046 *	0.026
Year 6 of experience	0.059 *	0.030	0.067 ***	0.026
Years 7-8 of experience	0.033 ***	0.012	0.041 **	0.018
Years 9-11 of experience	0.036 ***	0.007	0.018	0.016
Years 12-14 of experience	0.021 ***	0.008	- 0.023	0.017
Years 15-17 of experience	0.062 ***	0.013	- 0.018	0.021
Years 18-20 of experience	0.093	0.057	- 0.129 **	0.065
Constant	1.257 ***	0.052	not included	
Year dummies	included		included	
R^2	0.275		0.023	
Number of groups	10,325		10,325	

Notes: Regressions are weighted by the square root of the group size. Coefficients are significantly different from zero at the 1 percent level (***), 5 percent level (**) and 10 percent level (*).

Table 4a: Wage Regressions with Full-time and Part-time Experience: US

Dependent Variable: Log Hourly Wage	Levels		First Differences	
	coefficient	stand. error	coefficient	stand. error
Female dummy	- 0.090 ***	0.006	not included	
Year 1 of full-time exp.	0.293 ***	0.023	0.086 ***	0.031
Year 2 of full-time exp.	0.108 ***	0.019	0.080 ***	0.020
Year 3 of full-time exp.	0.110 ***	0.018	0.063 ***	0.019
Year 4 of full-time exp.	0.081 ***	0.018	0.049 ***	0.017
Year 5 of full-time exp.	0.084 ***	0.018	0.054 ***	0.017
Year 6 of full-time exp.	0.071 ***	0.016	0.026	0.017
Years 7-8 of full-time exp.	0.056 ***	0.007	0.023 *	0.012
Years 9-11 of full-time exp.	0.039 ***	0.005	0.001	0.011
Years 12-14 of full-time exp.	0.025 ***	0.006	- 0.029 **	0.013
Years 15-20 of full-time exp.	0.029 ***	0.011	- 0.066 ***	0.018
Year 1 of part-time exp.	0.060 ***	0.018	0.226 ***	0.039
Year 2 of part-time exp.	- 0.148 ***	0.010	- 0.016	0.041
Year 3 of part-time exp.	- 0.114 ***	0.016	- 0.393 ***	0.048
Years 4-7 of part-time exp.	0.019	0.028	- 0.999 ***	0.073
Constant	1.872 ***	0.019	not included	
Year dummies	included		included	
R^2	0.292		0.025	
Number of groups	24,088		24,088	

Notes: Regressions are weighted by the square root of the group size. Coefficients are significantly different from zero at the 1 percent level (***), 5 percent level (**) and 10 percent level (*).

Table 4b: Wage Regressions with Full-time and Part-time Experience: UK

Dependent Variable: Log Hourly Wage	Levels		First Differences	
	coefficient	stand. error	coefficient	stand. error
Female dummy	0.008	0.014	not included	
Year 1 of full-time exp.	0.433 ***	0.052	0.273 ***	0.033
Year 2 of full-time exp.	0.183 ***	0.034	0.150 ***	0.028
Year 3 of full-time exp.	0.091 ***	0.033	0.095 ***	0.029
Year 4 of full-time exp.	0.124 ***	0.032	0.098 ***	0.028
Year 5 of full-time exp.	0.054 *	0.031	0.055 **	0.027
Year 6 of full-time exp.	0.080 ***	0.027	0.066 **	0.027
Years 7-8 of full-time exp.	0.041 ***	0.011	0.023	0.019
Years 9-11 of full-time exp.	0.043 ***	0.007	- 0.000	0.017
Years 12-14 of full-time exp.	0.016 *	0.009	- 0.027	0.019
Years 15-20 of full-time exp.	0.063 ***	0.015	- 0.037	0.026
Year 1 of part-time exp.	- 0.427 ***	0.029	0.079	0.061
Year 2 of part-time exp.	0.014	0.025	- 0.090 **	0.045
Year 3 of part-time exp.	- 0.133 ***	0.030	- 0.004	0.044
Years 4-7 of part-time exp.	0.037 **	0.018	- 0.068 *	0.038
Constant	1.308 ***	0.041	not included	
Year dummies	included		included	
R^2	0.320		0.024	
Number of groups	10,325		10,325	

Notes: Regressions are weighted by the square root of the group size. Coefficients are significantly different from zero at the 1 percent level (***), 5 percent level (**) and 10 percent level (*).

Table 5: Gender Wage Ratios Controlling for Experience

Gender Wage Ratio in Percentages	US	UK
No experience controls	77.2	75.1
Controlling for total experience:		
o levels regressions	82.9	77.6
o first differences	86.0	84.4
(percentage of gap explained by experience)	(38.6)	(37.3)
Controlling for full-time and part-time experience:		
o levels regressions	91.4	100.8
o first differences	89.3	85.1
(percentage of gap explained by experience)	(53.1)	(40.2)

Notes: The proportion of the wage gap explained by experience is calculated as (the ratio controlling for experience minus the ratio with no experience controls), divided by (100 minus the ratio with no experience controls).

Table 6: Gender Wage Ratios Controlling for Experience Using First Differences: by Education Group

Gender Wage Ratio in Percentages	US			UK		
	Education Group			Education Group		
	1	2	3	1	2	3
No experience controls	77.9	74.0	76.6	71.6	78.2	79.7
Controlling for total experience	84.7	82.9	84.1	81.7	84.2	84.4
(% of gap explained by experience)	(30.8)	(34.2)	(32.1)	(35.6)	(27.5)	(23.2)
Controlling for full-time and part-time experience	83.4	85.2	90.7	85.0	79.8	87.4
(% of gap explained by experience)	(24.9)	(43.1)	(60.3)	(47.2)	(7.3)	(37.9)

Notes: Separate regressions were estimated for each education group and country.

Table 7: Gender Wage Ratios Controlling for Experience Using First Differences: by Cohort for those Aged Under 30

Gender Wage Ratio in Percentages	US			UK		
	Cohort			Cohort		
	2	3	4	2	3	4
No experience controls	79.3	84.0	84.9	77.2	80.6	82.7
Controlling for total experience	88.2	93.2	94.0	85.7	88.4	90.7
(% of gap explained by experience)	(43.0)	(57.5)	(60.3)	(37.3)	(40.2)	(46.2)
Controlling for full-time and part-time experience	86.6	91.9	93.3	87.6	95.7	99.5
(% of gap explained by experience)	(35.3)	(49.4)	(55.6)	(45.6)	(77.8)	(97.1)

Notes: Separate regressions were estimated for each cohort and country.

Table 8: Wage Regressions with Total Experience and Female Interactions: First Differences

Dependent Variable: Log Hourly Wage	US		UK	
	coefficient	standard error	coefficient	standard error
Year 1 of experience	0.149 ***	0.027	0.271 ***	0.040
Year 2 of experience	0.157 ***	0.027	0.180 ***	0.036
Year 3 of experience	0.092 ***	0.023	0.135 ***	0.037
Year 4 of experience	0.120 ***	0.022	0.133 ***	0.037
Year 5 of experience	0.066 ***	0.022	0.084 **	0.035
Year 6 of experience	0.067 ***	0.020	0.071 **	0.034
Years 7-8 of experience	0.025 *	0.014	0.046 **	0.023
Years 9-11 of experience	0.010	0.012	0.021	0.019
Years 12-14 of experience	- 0.013	0.013	- 0.026	0.020
Years 15-17 of experience	- 0.062 ***	0.016	- 0.013	0.026
Years 18-20 of experience	- 0.079 ***	0.028	- 0.081	0.091
Year 1 of exp. * female	- 0.041	0.036	- 0.013	0.050
Year 2 of exp. * female	- 0.059 *	0.035	- 0.046	0.046
Year 3 of exp. * female	0.042	0.031	- 0.024	0.047
Year 4 of exp. * female	- 0.093 ***	0.029	- 0.023	0.048
Year 5 of exp. * female	- 0.026	0.028	- 0.078 *	0.046
Year 6 of exp. * female	- 0.025	0.027	- 0.010	0.045
Years 7-8 of exp. * female	- 0.015	0.017	- 0.013	0.028
Years 9-11 of exp. * female	- 0.029 **	0.015	- 0.010	0.023
Years 12-14 of exp. * female	- 0.079 ***	0.018	0.002	0.026
Years 15-17 of exp. * female	- 0.061 **	0.029	- 0.017	0.040
Years 18-20 of exp. * female	- 0.126	0.089	- 0.099	0.130
Year dummies	included		included	
R^2	0.017		0.023	
Number of groups	24,088		10,325	

Notes: Regressions are weighted by the square root of the group size. Coefficients are significantly different from zero at the 1 percent level (***), 5 percent level (**) and 10 percent level (*). The female interaction terms are jointly significantly different from zero at the 1 percent level for the US. The female interaction terms are not jointly significantly different from zero for the UK.

Figure 5: Estimated Gender Wage Ratio Profiles by Experience

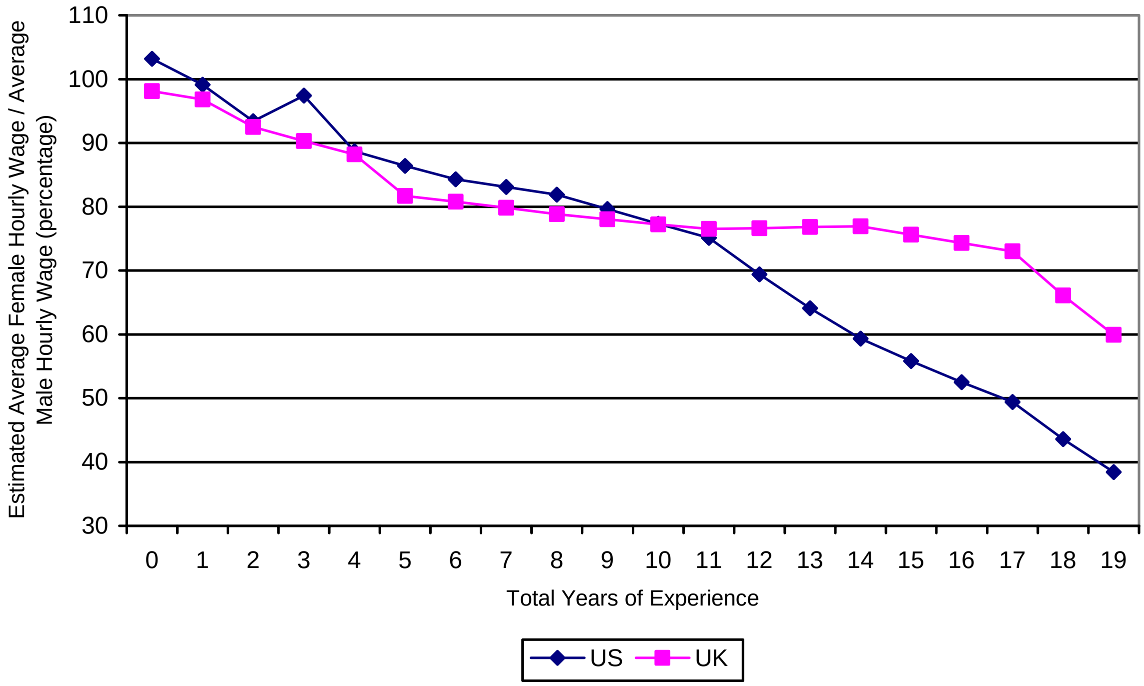


Figure 6a: Estimated Gender Wage Ratio Profiles by Experience and Education Group: US

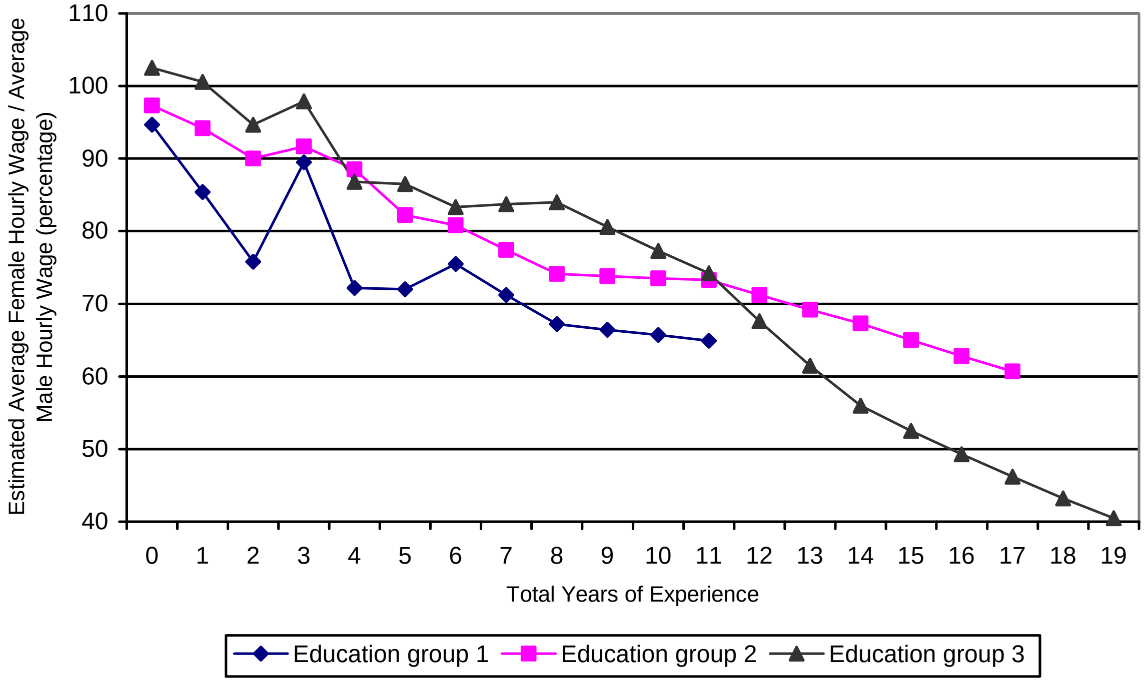


Figure 6b: Estimated Gender Wage Ratio Profiles by Experience and Education Group: UK

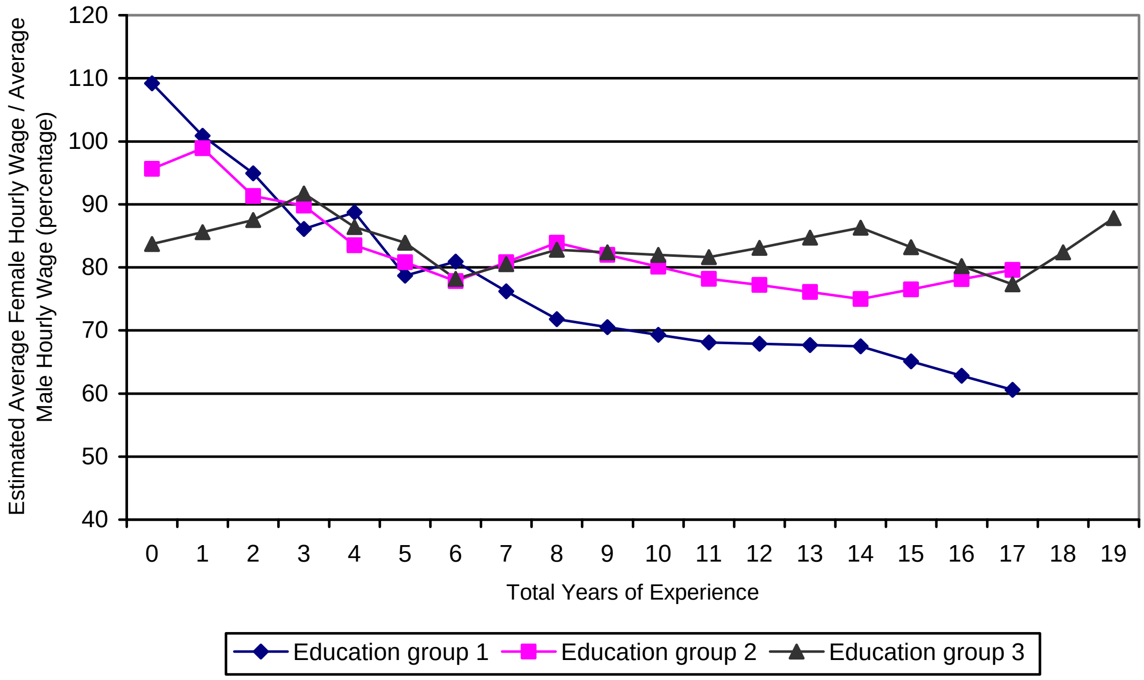


Figure 7a: Estimated Gender Wage Ratio Profiles by Experience and Cohort: US

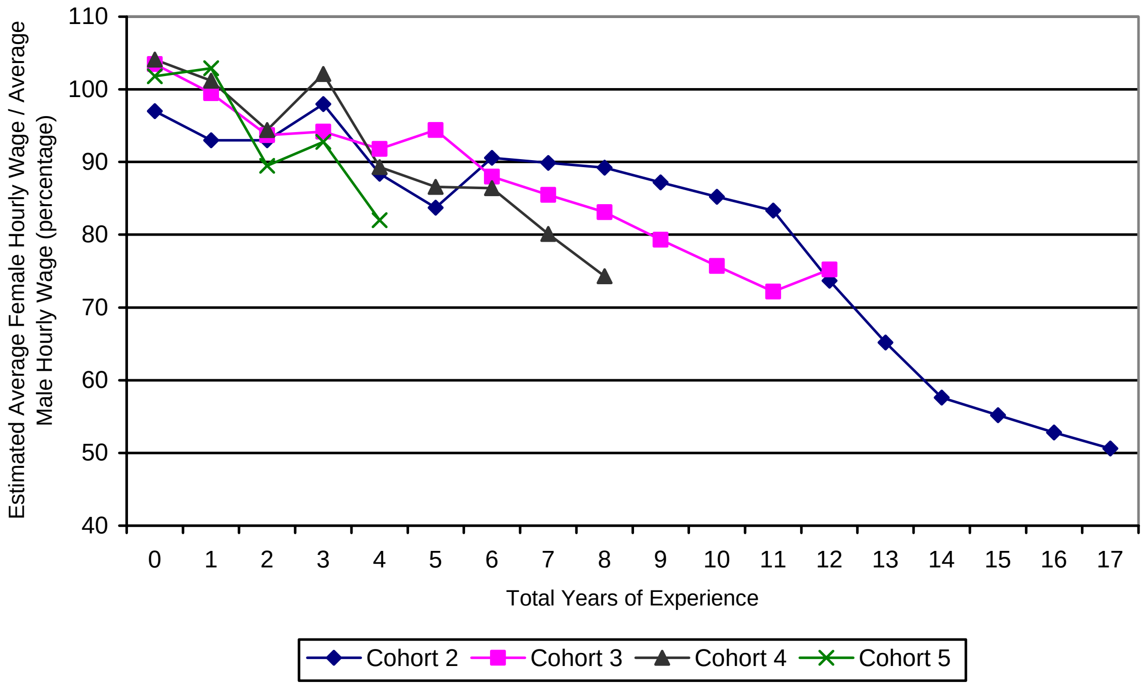


Figure 7b: Estimated Gender Wage Ratio Profiles by Experience and Cohort: UK