

The gender gap in wages over the life course: evidence from a cohort born in 1958

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ABSTRACT

Using data tracking all those born in a single week in 1958 through to their mid-50s we find the gender wage gap (GWG) is inverse-U shaped over the life-course, widening substantially during childrearing years. However, family formation primarily affects the GWG through its impact on work experience. This effect of family formation is apparent among those in full-time as well as part-time. We also find women suffer wage penalties for motherhood while men benefit from wage premia for fatherhood. Not all of the GWG is linked to family formation. There is a sizeable pay gap on labour market entry and there are gaps between childless men and childless women.

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Key Words: gender wage gap; pay; family formation; work experience; life course

JEL codes: J16; J31

INTRODUCTION

Unequal rates of pay between men and women underpin gender inequality within and beyond the labour market. They offer disincentives to educating girls, and to women taking up training, they reinforce a gendered division of labour in the home and unpaid caring, they imply economic vulnerability of families who depend on women's earnings, particularly lone parents, and affect the adequacy of women's pensions in old age. Throughout the world countries have intervened in the labour market to tackle the gender wage gap (GWG) through legislation in an effort to squeeze out discriminatory practices which may underpin at least some of the gap. Since the implementation of the Equal Pay Act in 1975, the relative pay of men and women has been slowly converging in the UK, as elsewhere (Kunze, 2018). According to the Office for National Statistics, the raw median GWG (full and part-time combined) stood at 18% in 2017, having fallen from 28% in 1997 (Annual Survey of Hours and Earnings, ONS 2018 ref to be found). It had stood around that level for the previous 20 years (as recorded in the New Earnings Survey and quoted in Joshi 2005), though it had been markedly higher before the implementation of Equal Pay in 1975 - around 40% in 1968 (according to household survey data, Davies and Joshi, 1998).¹

The raw GWG continues to be a source of concern, as illustrated by the public outcry at the size of these gaps as reported by larger firms in response to the government's Gender Pay Audit.² Assuming the operation of a fully efficient labour market workers would be paid their marginal product, such that differences in hourly pay rates would reflect the human capital of workers, as indicated by their qualifications and work experience. Recent studies indicate the gap in human capital between men and women has closed in terms of formal qualifications, with young women now entering the labour market with better qualifications than their male counterparts (REF). There has also been a reduction in the work experience gap with women returning to work more quickly after childbirth, more often into full-time employment (Roantree and Vira, 2018). Yet, in spite of these trends, studies conditioning on human capital and other worker attributes continue to find a residual GWG, prompting speculation as to the source of this residual gap. It is traditional in the literature to maintain that the residual gap can be attributed, at least in part, to discriminatory employer practices, such as those relating to promotion prospects. There is clear evidence from audit studies that employers tend to discriminate against women in their hiring practices, and

¹ The time series data do not run consistently back in time, but the relative wages of men and women appeared to be constant between 1940 and 1975 – Joshi, Layard Owen, 1985.

² The private firms, employing more than 250, which submitted returns showed a median pay gap in favour of men, at 10% within organisations. This is less than the national estimate from survey data (18%) which does not allow for differences between firms (Colebrook, Snelling and Longlands, 2018). Neither allows for gender differences in education, grade or experience.

evidence from legal cases as well as some experimental evidence, that employers discriminate against women in pay setting for jobs of equal value (REFS).

However, the GWG is also likely to reflect wider societal expectations about gender roles which result in different labour market aspirations for men and women, leading to differential investments in human capital, different occupational choices and, perhaps, differences in labour market attachment. Still, even when these factors are accounted for, a residual gap persists (Adda et al). Men and women combine employment and family life in different ways. Their choices given gendered constraints (Folbre, 1994) are a major, but perhaps not the only factor behind the wage gap.

This paper focuses on the genesis of the GWG over the life-course. Most studies which tackle this question rely on cross-sectional data to compare the wages of workers of particular ages born at different times. These studies indicate that the GWG has fallen over time, and thus with cohort, but that within-cohort the GWG tends to rise until people reach their mid-40s, only to decline somewhat afterwards (Gardiner 2017, Manning and Swaffield, 2008, 2009).

According to Becker (1985) actual and anticipated domestic roles give men and women different incentives to invest in 'effort', which will result in differential pay and reinforce the domestic division of labour. This is illustrated empirically by Goldin (2014) Blau and Kahn, 2017 and Juhn and McCue,(2017) for the US; and by Costa Dias, Joyce and Parodi (2018) for the UK. Pay penalties are particularly pronounced for women returning to part-time employment after a gap. Some maintain that these patterns reflect women's preferences for work-life balance (Hakim, 2000) and conventional norms about the division of domestic labour leading women, but not men, to seek flexibility in their work schedule for which they are prepared to accept lower rates of pay as compensating differentials (Goldin 2014). Others point to employers' direct and indirect discriminatory practices, particularly in (often feminised) part-time jobs, such as fewer opportunities for training or promotion (Manning and Petrongolo 2008) or women's limited ability to search for a better job match (Manning and Swaffield, 2008, Addison et al 2017)

Recent studies indicate that the gap between men's and women's pay widens considerably on entry to parenthood (Costa Dias et al., 2018; Lucifora et al., 2018). Additional children lead to further wage penalties for women (Harkness, 2016) which may, however, be ameliorated by maintaining employment continuity through maternity leave (Waldfoegel, 1998; Joshi, et al. 1999). The life-time earnings losses, though lower wages, hours and participation associated women's childrearing are substantial (Adda et al., 2017; Rake, 2000).

The question still arises as to whether the widening gap in men's and women's wages from their twenties onwards is fully accounted for by unequal accumulation of human capital. Any 'residual

gap', not accounted for by human capital and family responsibilities can, be thought of as 'unequal treatment' of equally qualified persons, even those without children. Under prevailing cultural norms, women may be less likely to apply for promotion, less likely to get it, and face, perhaps unconscious, discrimination in appointment to higher paid jobs. (Babcock and Lashever, 2003, Manning and Swaffield 2008). Sexism in workplace may present obstacles to pay and promotion and also reinforce women's acceptance of low paid jobs. An unexplained, possibly discriminatory, gender premium in favour of men would contribute to a different opportunities for mothers and fathers in the labour market, and reinforce traditional choices of who takes parental leave. It would also mean that those who for whatever reason avoid parenthood, may not completely escape the pay penalties of gender.

The contribution of this paper is to chart the pay gaps and employment histories that have been uniquely recorded for a cohort who entered the labour market in the mid-1970s and has been followed over four decades, exploring evidence for the obstacles that have faced women born in 1958 over their careers to age 55 in 2013, as the gender pay gap reached a peak in their 40's. This cohort, the National Child Development Study (NCDS) is among the most recently born of the generation labelled 'Baby Boomers' by the Intergenerational Commission (Gardiner 2017). They entered the labour market at the time of the Equal Pay Act and other Equal Opportunity policies. Both men and women were better educated than their predecessors, with a diminishing gap, but males were still had more qualifications in mid-life. This cohort also lived through a time when choice and control over fertility had advanced, they had fewer children, at a later age, than their parents' generation but more and sooner than the cohorts which followed them. Women would have been expected to make contributions to the State Pension in their own right,³ and started their careers under the 1975 pension legislation which made some allowance for home responsibilities affecting earnings. The cohort were in their forties by the time a fresh set of policies were introduced around 2000 to facilitate flexible employment, leaves for both parents and public support for children's early years. Many of the women in this cohort would have had their children already in a less 'family friendly policy environment. Changes in pension legislation mean that neither women nor men will be able to claim their state pension till they are 66 in 2024. In a wider context, In a wider context, including cohorts who are still in mid career, maternal employment has been increasing, and the pay gap has been declining. Our focus on the connection of these phenomena within a single cohort will provide a starting point for the understanding of more recent developments as well as the pension assets of women born in the Baby Boom

³ The married women's option to rely on their husband's contributions was abolished from 1977

Ours is a descriptive account of the GWG and how it is accounted for by human capital and family formation, all the way through to age 55, providing a unique life-course insight into the relative fortunes of women in the labour market.

We confirm that family formation intensified the development of this cohort's gender pay gap. This worked mainly via its association with work experience, particularly in part-time work, where the pay-off to accumulating experience was much less than masculine norm of building up a record in full-time work, although unequal treatment was amplified in the asymmetric remuneration, all else equal, of mothers and fathers. We also show that not all of the gap was about family formation. There was a sizeable unexplained pay gap on labour market entry, pre-parenthood and there was still a gap at 55 between men and women who never have children.

METHOD

The objective of this paper is to marshal the descriptive evidence, recognising that there are limitations with this approach. We make no efforts to recover causal estimates of the influences on the GWG, recognising that many choices regarding human capital and family investments are endogenous with respect to earnings potential. Nor do we adjust for sample selection across the cohort, both in terms of survey response and employment participation.⁴ That said, we do estimate the GWG for those in full-time employment and compare those results to the full sample, thus shedding light on the role of labour market attachment. We also incorporate a variable capturing the number of times respondents appear in the study sweeps to net out some of the effects of survey non-response. We also ignore issues of occupational choice which have been shown to be important in the recent literature (Goldin).⁵

We estimate log hourly wage regressions for those observed in employment at the time of each survey sweep for those with non-missing data on the dependent variables. The construction of our dependent variable is described below. We drop observations in the tails of the earnings distribution (top and bottom 1 percent), as is common in the literature, to limit the impact of outliers. Our conditioning variables, presented in full in Appendix Table X, include education, family building, and work experience. To allow for the low, possibly negative, pay returns to part-time work experience (as found by Neuberger, 2010 and Costa Dias et al., 2018), we distinguish between time spent in full- and part-time employment, and time worked with the current employer. We also allow throughout

⁴ Neuberger, Kuh and Joshi (2011) found some positive selection into employment for women at 23 and 33.

⁵ We anticipate tackling issues of sample selection, survey non-response and occupational choice in future papers taking account of recommendations made by those who have considered this issue previously (Hawkes and Plewis, 2006).

for unmeasured characteristics associated with repeated observation in the unbalanced panel and very broadly for regional differences in rates of pay.

We present a range of model specifications which introduce controls in a step-wise fashion to establish how family formation and work experience relate to one another. All models include controls for region and the number of times respondents are observed with wages. Model 1 also includes educational qualifications (ED) at the time of interview; Model 2 adds work experience to Model 1 (ED+EXP); Model 3 drops experience and introduces a set of variables recording current and past family responsibilities (ED+FAM). Our full model 4 includes them all, ED+ EXP+ FAM.

Wage regressions are run for men and women pooled, with the female dummy interacted with all other explanatory variables in the model. These fully-interacted linear models (FILM, programmed by Leuven and Sianesi), estimated in STATA, allow values for all parameters in the model to vary by gender, whose difference can be tested.

We then decompose the GWG between men and women using Oaxaca-Blinder decompositions based on separate regressions for men and women. This divides the GWG into the part associated with the attributes and the part associated with unequal coefficients (including constant terms), and any interaction between them. We weight the differences in model coefficients, $\beta_m - \beta_f$, by the mean attributes of the female sample at each age, thereby estimating the gain women would have if paid like men, which can be thought of as the 'price of being female'. Our estimates cannot be interpreted as causal. They are offered as an accounting exercise to map out the correlates of unequal pay over the a life cycle. They also enable us to see whether it is the existence of family responsibilities that accounts for the average woman's low pay, or the differential remuneration of males and females with a given level of family responsibilities, including none.

Additional analyses are undertaken for sub-groups in our data. These include those in full-time employment at the time of the survey, who are assumed to be among those with the greatest labour market attachment. We also consider those who had no children by a given survey

DATA

Our data are drawn from the British National Child Development Study (NCDS) of men and women born in 1958 (Joshi, 2012). We track the wages of those in employment at ages 23, 33, 43, 46, 50 and 55, but the NCDS also allows us, unlike cross-sectional data, to place observed wages in the context of what the informants had done in the past.

The cohort study started with around 17000 members born in a single week of 1958, at roughly 8,500 each male and female.⁶ There was a net loss of informants by the first sweep in adulthood, at age 23, where our study starts, with 6,267 young men providing data and 6,270 young women. This is the first of six surveys of adults to date, the others being at age 33, 42, 46, 50 and 55, as the resources became available. All but the telephone survey at age 46 involved an interviewer visit to the home. The size of the samples in survey contact suffered further losses, death, emigration and gradual attrition, not necessarily permanent, as some cohort members who were absent at one wave participated later.

Table I shows the sample size at 55 had fallen to 4,434 men and 4,704 women. The table also shows that the sample initially had more male employees than female, but from age 42 onwards more of the employees in the cohort were female than male. These differences between men and women in their 20s and 30s reflect (not explicitly shown) lower female economic activity rates than men's, and higher self-employment rates among the men in this cohort. When it comes to our analysis of hourly wages the cohort is further reduced by those employees for whom an hourly wage could not be defined, particularly in the Age 46 telephone survey.⁷ We also excluded outliers at the top and bottom percentile of the sweep's wage distribution, a common practice to deal with potential measurement error among outliers. The wage sample for males at the interview sweeps runs from 4,263 at 23 to 2,346 at 55, and for women from 3,585 to 2,546, sample size overtaking men's at 50, but never falling very far behind.

Note that in the cohort, as in the population at large, membership of the wage-earning group is not always continuous. We have just over 6000 men and women whose wages enter our sample at least once, but only 181 men and 103 women who appear in all 6 waves. If we discount the low response to the age 46 telephone survey, these numbers rise to 808 and 551 respectively, or 13 percent and 9 percent of the employees of their own sex ever observed. Thus, intermittent membership of the panel is the norm for males as well as females, though to a greater extent, as one would expect among the women.

⁶ Some children born abroad on in the survey week were recruited at three follow-up surveys when they were of school (age 7, 11 and 16)

⁷ The main problem with the telephone survey data was poor reporting of hours worked, making it difficult to compute hourly earnings (Neuburger 2010)

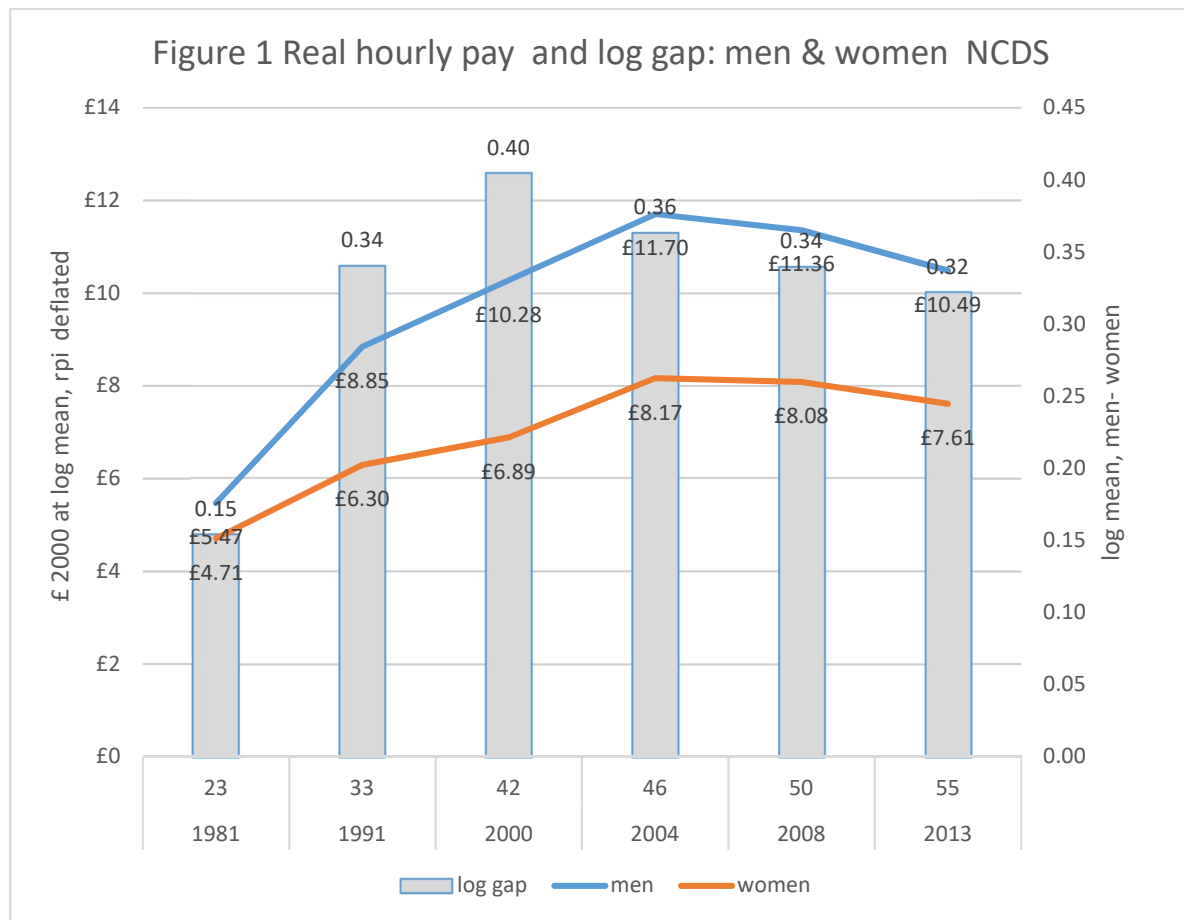
Table 1 Descriptive statistics for whole cohort and wage sample, by gender NCDS

	Males						Females					
	23	33	42	46*	50	55	23	33	42	46*	50	55
Whole cohort												
N participating	6267	5634	5626	4644	4822	4433	6270	5835	5793	4890	4968	4704
N employees	4737	4161	4077	3392	3291	2739	3881	3542	4128	3684	3632	3129
% with NVQ Level 4 or 5 ¹	17.7	27.6	32.2	35.2	34.9	38.3	18.7	24.4	30.2	33.5	35.4	38.5
Average work experience in years	5.2	13.8	21.5	26.2	29.5	33.9	4.5	10.6	16.9	21.2	24.2	28.2
% with dependent children	16.7	61.1	69.5	68.0	58.7	46.0	32.6	74.9	79.7	73.4	59.7	43.3
N with observed wages	4363	3755	3629	891	2880	2392	3648	3126	3546	827	3151	2600
Wage sample – excluding outliers ²												
N with observed wages ²	4263	3691	3567	871	2801	2346	3585	3050	3464	811	3108	2546
N observed at all previous sweeps ²		2,450	1,703	338	257	181		1,734	1,153	211	164	108
N all previous sweeps ² except 46					1,124	808					799	551
N observed ² intermittently			1,362	490	2,415	2,115			1,552	539	2,696	2,368
N observed ² at no previous sweep		1,241	502	43	129	50		1,316	759	61	248	70
Real log hourly pay ³	1.70	2.18	2.33	2.46	2.43	2.35	1.55	1.84	1.93	2.10	2.09	2.03
% with NVQ Level 4 or 5 ¹	18.1	31.5	36.6	39.4	38.2	42.1	23.3	28.9	32.9	35.4	38.7	40.8
% working full-time	99.2	99.1	98.0	98.0	97.3	94.8	90.5	55.1	60.3	67.4	67.4	65.6
Mean years full-time experience	5.4	13.8	21.7	26.7	30.0	34.6	4.8	9.4	13.0	16.4	18.0	21.0
Mean years part-time experience	0.1	0.2	0.3	0.4	0.5	0.6	0.3	2.3	5.2	6.4	8.1	9.8
Years with current employer	3.5	6.9	10.6	13.4	12.7	14.4	3.2	4.7	6.8	9.1	8.9	11.3
% with dependent children	16.3	61.8	72.9	64.3	60.3	47.7	9.0	65.4	78.5	68.1	60.4	44.6

* Telephone survey. 1 Percentage based on cases with non-missing education data. 2 Excluded outliers are top and bottom 1% of sweep specific wage sample. 3 Hourly wage deflated to January 2000 prices by the RPI

Wages

Our dependent variable is the natural log of hourly earnings, deflated to January 2000 prices by the Retail Price Index (RPI).⁸ As shown in figure 1, evaluation at the log mean, real wages for both men and women grew until the mid forties, with men's rates of pay rising faster than women's until both fell back slightly after 50. Among these employees, at age 23, men's mean log hourly earnings exceeded women's by 15 log points, the gap had grown to 40 log points by age 42 in 2000, but by age 55 in 2013 it had closed somewhat to 32 points. The data for age 46, though shown in Figure 1, are discarded in the regressions, due to the high level of missing wage data (see Table 1).



Educational qualifications

The NCDS cohort taken as a whole entered adulthood with similar levels of tertiary attainment for each sex in their twenties (Makepeace, Woods, Galinda-Rued & Joshi, 2003). The average level increased over time, partly due to selective attrition and partly due to the acquisition of further qualifications as time passed (Jenkins, 2017). Our classification of qualifications is based on the attainment of academic and vocational qualifications equivalent to NVQ levels 1 to 5. The proportion

⁸ The values of relative pay are very similar if we deflate current values of the wage by the Average Wage and Earnings Index instead. The insensitivity of relative pay to the deflator used indicates that on average at least the real earnings of men and women grew, or stagnated at the same rate.

with high qualifications in the wage sample is greater than in the cohort as a whole, but there are more surveys where males' qualifications are better than females'. At 23, the female lead is greater among the wage sample than in the cohort as a whole – reflecting the higher employment participation rates of more educated women. Table 1 focuses on those with higher qualifications (Level 4 or 5), although a full battery of dummies for 6 levels are entered into the regressions with level 4 (a university degree or its vocational equivalent) as the reference category.

Employment experience

Many of the mothers who had returned to employment mid-life worked part-time. The men in the sample worked almost exclusively full-time, with negligible rates of part-time employment at the survey snapshots, while the proportion of women in part-time jobs was always non-negligible, particularly at 33 (46%) and 42 (40%). The mean full-time work experience of men in the wage sample grew steadily to 35 years at 55, while women's only reached 21 years. They did accumulate 10 years of part-time experience, compared with just 7 months for men. The block of variables about work experience also includes an estimate for time spent with the current employer (recorded in months but reported in years). Women's average job tenure falls below men's, but also rises with time.

Family

We allow for family responsibilities at each snapshot survey mainly with an indicator of the presence of dependent children (ie under 16), regardless of whether they are the biological offspring of the cohort member.⁹ In the cohort as a whole only one-in-six men had children in the home at 23 while twice that proportion of the women did. At the peak, age 42, 70% of men and 80% of women employees had children at home. This reflects childbearing having started earlier for the women and more of them being single parents. By age 55, more men than women had children in the home (46% vs 43%) due mainly to later fatherhood. The proportion of men in the wage sample with dependent children is much the same as for the cohort at large, whereas for women it is lower at young ages reflecting reduced participation of mothers of young children in employment. By 42 the participation of mothers was almost as high as that of women with no children. We include an indicator to identify people who have ever had a dependent child in the household, which reached 82 % of the male wage sample and 85% of the female wage sample at 55. We also allow for the presence of a partner.¹⁰ At 23, the females in the wage sample were more likely than the males to

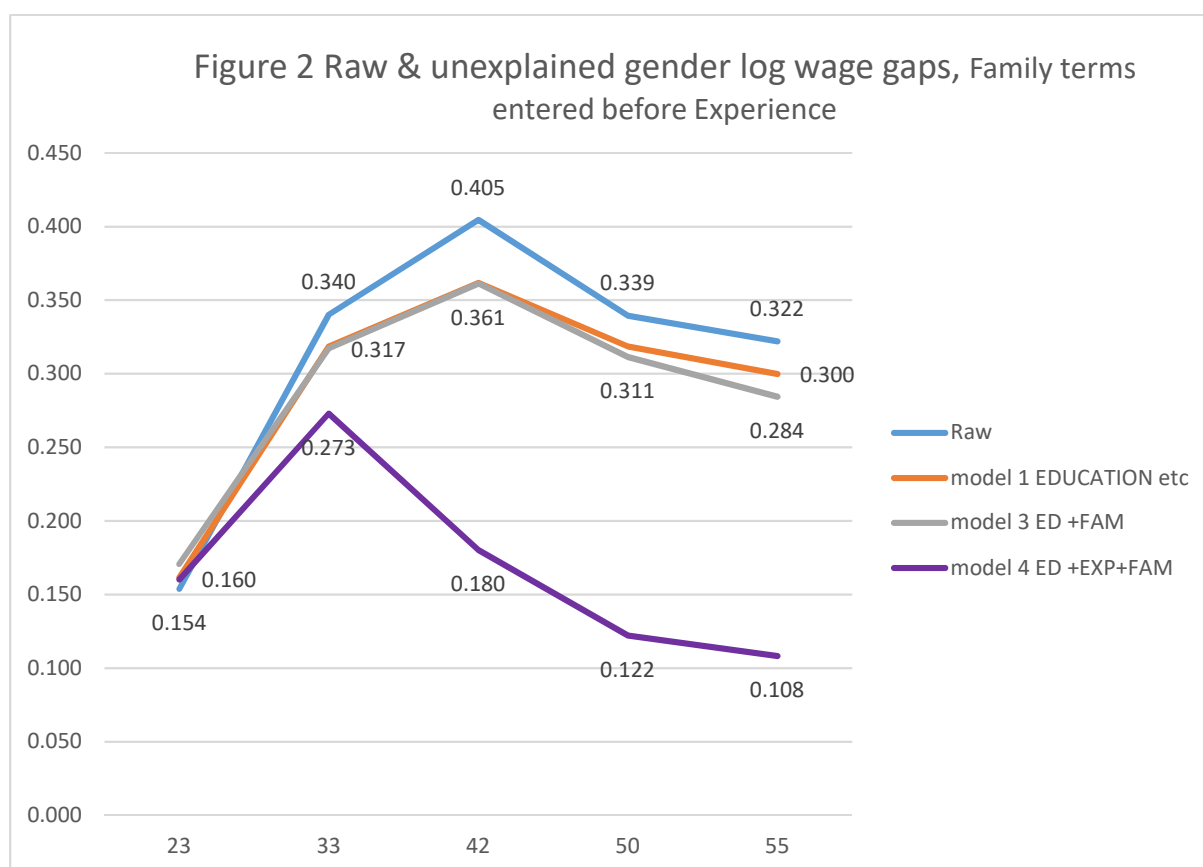
⁹ We assume that co-resident dependent children who might be adopted, fostered or step children would present similar constraints to parental employment as their natural children, and that biological offspring not in the household do not.

¹⁰ Note that in contrast to data from household panels, the cohort members did not generally (if at all) share households with each other. Their partners are not, as far as we know, cohort members. The women will tend to have partners a few years older than themselves, and the men vice-versa.

have a partner (53% vs 43%), but from age 33 onwards around eight in ten of the wage sample were partnered. At 55, 84% of the men had partners against 77% of women. One reason for this may be higher rates of remarriage among men.

RESULTS

Raw wage gaps for five of the surveys, shown in bars in Figure 1, reappear as the top line in Figure 2. Figure 2 also shows the estimates of the gender gap after adjustments for the blocks of variables in the step wise regression. Details are presented in Table 2. Education (and the baseline controls) make only a little difference to the explanation of the raw gap, as shown in the small margin of the plot for Model 1 below that for the raw gap. The addition of information about family responsibilities (ED+ EXP or model 3) makes virtually no contribution to explaining the pay gap until ages 50-55. The same is true if the family terms are introduced after the experience terms. Model 2 (ED + EXP) is not plotted as it lies almost exactly along the path of Model 4 (ED+ EXP+FAM).



Clearly the main factor affecting the GWG is employment experience, represented by the gap between lines for Models 3 and 4. This gap widens as age advances (and time passes) between age

33 and age 50, accounting for half the raw gap at 55. The proximity of the lines for models 1 and 2 to the raw profile reflects the difference in their regressors at the mean for men and women being quite small.

There is little difference between the raw GWG and any of the adjusted GWGs at 23, when the gap was around 0.16 (around 15% of men's wage). The family terms have their impact on wages via their association with labour market attachment. They make an additional contribution to the explanation of variance within the male and female samples but they do not account for the differences between them. The parameters making up the unexplained wage gap unbundle the gender differences apparent in the models (such as 1 or 2) which do not include family responsibilities, showing where the gaps fall rather than reducing them. We examine below which family terms are carrying unequal, sometimes opposite, estimates.

Table 2 presents details of the decomposition of the pay gaps into those explained by endowments, coefficients, and their interaction, at selected ages at strategic points of the lifecycle, namely 23 (before many cohort members became parents), 42 (when most had dependent children in the home) and 55 (a point when some nests had been emptied). The decompositions are based on the fullest model, namely model 4. Negative terms represent cells where women do better than men (eg. on the education endowment for employees at 23), thus closing the GWG. The component of the endowment gap associated with experience is the largest except at age 23 (when experience had hardly begun accumulating). The coefficients gap is also partitioned by the broad group of regressors which attract different, sometimes opposite remuneration. The differentials associated with the family coefficients are greatest at 42. At this 'heyday' of dependent children, the differences arise as men's pay is enhanced by the presence of partners/children, whereas women's tends to show penalties. In later life, gender differences in the experience terms become absolutely and relatively more important at 55.

Table 2: Decomposition of gender pay gap in NCDS at selected ages: full model 4

	AGE 23		Age 42		Age 55	
	Coef.	<i>P> z </i>	Coef.	<i>P> z </i>	Coef.	<i>P> z </i>
Difference in Log Pay	0.154	0.000	0.405	0.000	0.322	0.000
Explained by differences in Endowments						
Education ¹	-0.016	0.000	0.038	0.000	0.018	0.024
Family	-0.006	0.023	0.020	0.000	0.008	0.029
Experience	-0.001	0.682	0.148	0.000	0.136	0.000
Total	-0.022	0.000	0.206	0.000	0.162	0.000
Explained by differences in Coefficients						
Education ¹	0.051	0.001	0.038	0.239	0.016	0.729
Family	0.038	0.000	0.177	0.000	0.131	0.000
Experience	0.068	0.003	0.053	0.596	0.254	0.166
constant	0.003	0.907	-0.087	0.421	-0.292	0.131
Total	0.160	0.000	0.180	0.000	0.108	0.030
Interaction						
Education ¹	0.007	0.001	-0.003	0.616	-0.004	0.458
Family	-0.002	0.582	-0.019	0.000	0.001	0.858
Experience	0.011	0.001	0.039	0.246	0.055	0.280
Total	0.016	0.002	0.018	0.591	0.052	0.306
R squared in Fully Interacted Linear Regression						
		0.220		0.331		0.350
N (males +females)	7848		7031		4892	

¹ Education block includes controls for region and times observed in wage sample

Table 3: Individual coefficients and their gender gaps, selected ages, model 4

	age 23						age 42						age 55					
	males		females		m-f		males		females		m-f		males		females		m-f	
	β_m		β_f		$\beta_m-\beta_f$		β_m		β_f		$\beta_m-\beta_f$		β_m		β_f		$\beta_m-\beta_f$	
FAMILY																		
Partner	0.068	***	0.016	*	0.052	***	0.073	**	0.052	**	0.021		0.119	***	0.039	*	0.080	**
Ever parent	0.007		0.003		0.004	**	0.082	**	-0.094	***	0.176	***	0.082	***	-0.001		0.082	**
Household has																		
kids<3	-0.010		-0.076	**	0.066		0.028		0.215	***	-0.187	***	-0.188		-0.351		0.158	
kids 3-4	-0.011		-0.097	***	0.086	*	0.026		0.090	**	-0.064		0.132				0.132	
kids 5-15	0.013		-0.130	***	0.143		0.028		-0.010		0.039		0.039		0.077	*	-0.037	
EXPERIENCE																		
Years in job	0.017	***	0.022	***	0.005	**	0.006	***	0.009	***	-0.002		0.005		0.003	***	0.002	
tenure miss	-0.195	**	-0.242		-0.046		-0.143				-0.143		-0.199	*	-0.214	**	0.015	
Yrs full-time	0.009		0.011		-0.002		0.050	***	0.021	***	0.029		0.042	***	0.013	***	0.029	**
Yrs ft sqd	0.000		-0.003	***	0.003	**	-0.001	***	0.000	*	-0.001	***	-0.001	***	0.000		-0.001	***
Yrs part-time	-0.043	*	-0.059	***	0.016		-0.067	***	-0.015	***	-0.052	***	-0.039	***	-0.011	***	-0.028	***
Yrs pt sqd	0.009	**	0.007	***	0.002		0.004	***	0.001	***	0.003	***	0.002	**	0.000	***	0.001	**
EDUCATION																		
Highest nvq																		
0	-0.169	***	-0.271	***	0.102	***	-0.571	***	-0.508	***	-0.063		-0.539	***	-0.508	***	-0.030	
1	-0.154	***	-0.295	***	0.141	***	-0.459	***	-0.531	***	0.072	*	-0.530	***	-0.487	***	-0.043	
2	-0.100	***	-0.190	***	0.090	***	-0.332	***	-0.410	***	0.078	**	-0.380	***	-0.405	***	0.025	
3	-0.045	***	-0.123	***	0.077	***	-0.211	***	-0.324	***	0.113	***	-0.296	***	-0.300	***	0.003	
5	-0.065		0.065		-0.130		0.212	***	0.232	***	-0.019		0.214	***	0.271	***	-0.057	
miss	-0.110	***	-0.192	***	0.083	***							0.476	***	0.401	***	0.075	
OTHERS																		
Wage obs							0.031	**	0.050	***	-0.019		0.017	*	0.018	**	-0.001	
Region	0.089	***	0.160	***	-0.071	***	0.212	***	0.145	***	0.067	**	0.169	***	0.083	***	0.086	***
CONSTANT	1.643	***	1.640	***	-0.003		1.834	***	1.921	***	-0.087		1.618	***	1.910	***	-0.292	

wage obs = no of previous wage observations to date

Region = In London or South East

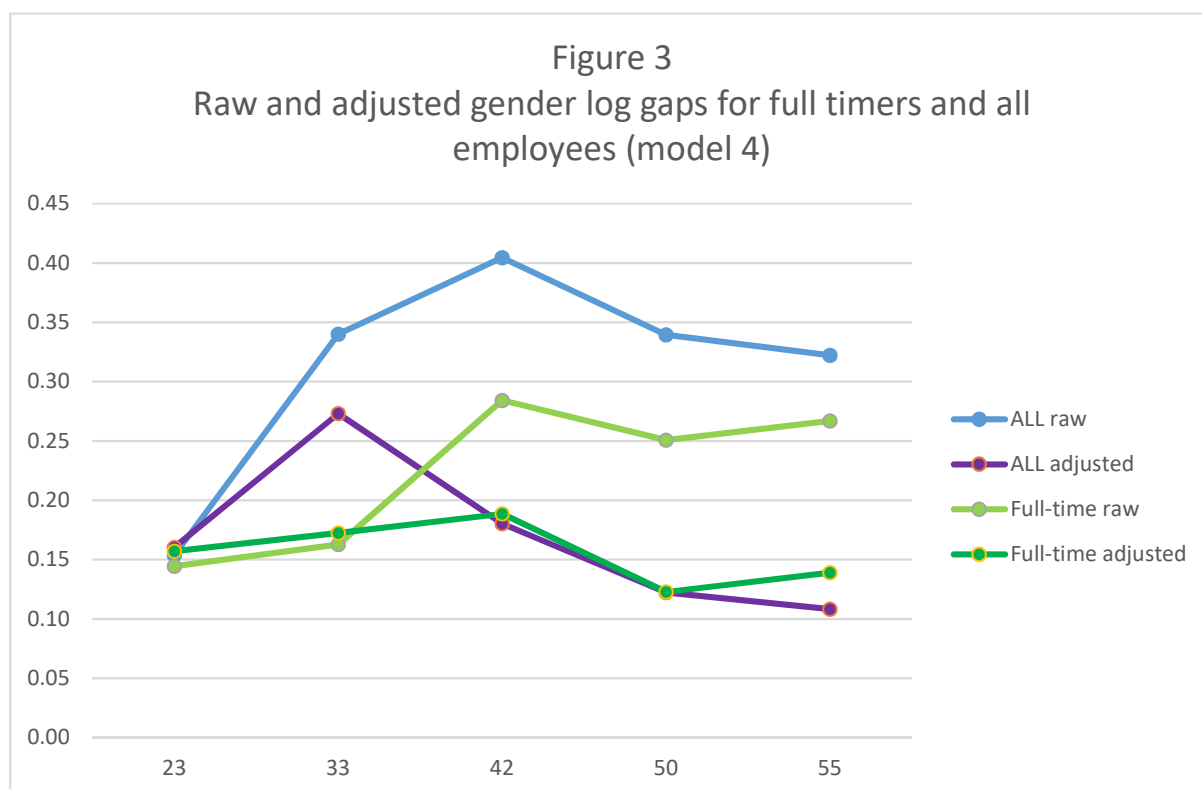
Model 4

* p<.1; ** p<.05; *** p<.01

The particular sources of the β differences are shown in Table 3 (using model 4) at the same three strategic ages. The first line shows that a consistent element of the pay gap at all points is the higher premium recorded for males having a partner than for females, accounting, all else equal, for 0.05 of the coefficients gap at 23, 0.02 at 42 and 0.08 at 55. This could be due to the labour market perceiving married/partnered men as more productive than women with partners or also, it might reflect low paid men having relatively less success in the partnership market at finding or keeping a mate. The second element in the family group, the indicator of parenthood, attracts opposite signs for male and female parents, ie fathers and mothers, (at ages 33 not shown) onwards. For example, at age 42, fathers, all else equal, receive a pay premium of 0.082 while mothers face a penalty of -0.094, resulting in a coefficient gap of 0.176. However this term has to be evaluated in conjunction with the variables indicating the ages of children currently in the household. For a 42 year old living in a household with children all in the school age range (5-15), the estimate for fathers compared to men with no children is +0.110 (ie 0.082+0.028), and for mothers -0.104 (ie -0.094 -0.010), compared to women with no children. This yields a [point] estimate of the coefficients gap for these parents of 0.214 (ie 0.176+0.039). However women employees with younger children are estimated to be less poorly paid, which is enough to moderate, and, if there are only children under 3, reverse, the gender gap in coefficients. This may be picking up the protective effect of remaining in employment over childbearing. Employment continuity at this time might have been facilitated for those who were able to take maternity leave (Joshi and Paci, 1998, Waldfogel 1998), but we have not explicitly specified here whether they might have qualified for it. Another consideration about the reduced wage penalty for mothers who participate in the labour market in children's earliest years is that they are likely to have especially high earning ability, which may not be fully captured elsewhere in the model. At age 55, dependent children had largely departed, but the legacy of having ever had a parental role remains, largely in its consequences for accumulated experience for women (Table 2 shows an endowment gap of 0.136 on experience for women at 55). In the model where experience is not controlled (Model 3, not shown) the gap in the parenthood parameter gap is -0.183, over half the raw gap. The "ever parent" coefficient for men, unaffected by the omission of experience terms, remains at +0.08, while that for 55 year old mothers is -0.104 – the more frequently studied 'family gap' between mothers and childless women.

Among the individual elements of the experience terms, job tenure generally makes no more than a modest addition to the returns to a year of full-time employment. These modest estimates are higher for women than men, but only significantly so at age 23. This is consistent with the idea that women gain from staying with the same employer while men are more likely to gain from 'job shopping', at least in early stages of labour market life. This may reflect the protective effect of maternity leave for women, but needs further investigation

Table 4 looks at two sub-samples to see if the estimated gender gaps differ between different groups within the overall samples. The first sub-group is those who were working full-time at each survey. This excludes very few men at any survey but a sizable minority of women from age 33 onwards. If some of the female pay disadvantage arises from low pay in part-time jobs unequal treatment among full-time workers would be expected to be less than for all workers. This is indeed the case at age 33, but not all. The main point is that the extent of unequal treatment is generally not much reduced when attention is confined to full-timers – compare the second column in table 4 with the first, particularly the pay penalty unexplained by model 3. The finding of a gender premium is not driven solely by the supposed low motivation of women who work part-time, since we find similar patterns among people working full-time.



Another sub-group, labelled 'No kids to date', form the reference category for the family terms at each age. They do not have dependent children in the home and have not had them in the past. Isolating them from the general sample yields an estimated gender gap among them which is less than that among contemporary parents – as one would expect from the coefficients on family composition – but unequal treatment is not eliminated. It stands at 0.131 at 33 and falls to 0.07 at 55, though passing through a low estimate at 42 which is above zero but not significantly so. Some of this sub-group had children at a later point. Towards the end of the career women who had remained childless were still receiving lower pay than their male contemporaries at around 0.08 log

points. If we consider the different premia for partnership and parenthood, the gender premium for childless, partnered women is close to zero.

Table 4. Estimates of female pay penalty ($\beta_m - \beta_f$) for two sub-groups and whole sample, by age

model		ALL	FULLTIME	No kids (to date)
23				
N		7848	7474	6829
Raw		0.154	0.144	0.132
model 1	ED	0.162	0.153	0.139
model 3	ED+FAM	0.171	0.161	0.153
Model4	ED+FAM+EXP	0.160	0.157	0.149
33				
N		6741	5351	2393
Raw		0.340	0.163	0.091
model 1	ED	0.319	0.187	0.125
model 3	ED+FAM	0.317	0.177	0.129
Model4	ED+FAM+EXP	0.273	0.173	0.131
42				
N		7031	5513	1343
Raw		0.405	0.284	0.037
model 1	ED	0.362	0.270	0.050
model 3	ED+FAM	0.361	0.252	0.062
Model4	ED+FAM+EXP	0.180	0.189	0.039
50				
N		5909	4675	996
Raw		0.339	0.251	0.063
model 1	ED	0.319	0.250	0.113
model 3	ED+FAM	0.311	0.231	0.126
Model4	ED+FAM+EXP	0.122	0.123	0.074
55				
N		4892	3782	801
Raw		0.322	0.267	0.083
model 1	ED	0.300	0.267	0.120
model 3	ED+FAM	0.284	0.250	0.123
Model4	ED+FAM+EXP	0.108	0.139	0.070

Estimates not significantly different from zero $p < 0.05$ are shaded

LIMITATIONS

As stated at the outset, this is a descriptive exercise, which does not attempt, at this stage any causal modelling. While this may seem to be a limitation, it is offered as setting out the territory for further exploration. Our data is confined to one cohort and to the dates they were interviewed. Cross sectional data sources, such as official statistics from ASHE are also snapshots conditional on participation. We make little use of the panel nature of the data. Observations are intermittent, and spaced further apart than the annual evidence available from BHS/USoc,

Estimates are at the mean (of logs) and pay no attention to high or low ends of the wage distribution.

We do not include information on industry or occupation. We suggest that further work at a more detailed level might help understand the gender gap, but have not yet undertaken it.

We have made no imputation of missing wages or of the wage offer facing non-participants. Both these operations were undertaken by Neuburger (2010). This complicates a detailed comparison of our results with hers.

We have not included any information on informal caring for people other than children.

Thus we do not offer a definitive interpretation of the unexplained pay gap, but suggests there is enough evidence to warrant further investigation and to suggest that the unequal treatment of men and women was a persistent phenomenon for most people in this cohort.

CONCLUSIONS

Almost half a century after the Equal Pay Act (EPA) women continue to earn less than their male counterparts. The rate of convergence is slow, despite women closing most of the gap in work experience and overtaking men in their academic attainment.

Our analyses track the wage gap, and descriptively account for that gap based on human capital and family formation, all the way through to age 55, providing us with a unique life-course insight into the relative fortunes of women in the labour market. The gender pay gap observed among cohort members in work follows an inverse U shape, reaching a peak at the age 42 and then falling back somewhat at surveys in their fifties , but still above level seen at 23.

To investigate this pattern we have run repeated estimates of a linear model, fully interacting with a consistent set of predictors of the log hourly pay of men and women in the 1958 birth cohort. These are conditional on their being in employment at successive surveys. We have partitioned pay gaps into those explained by blocks of regressors and the unexplained residual attributable to a pay penalty for being female.

Looking across all the estimates for at age 23 in 1981, which for most was before parenthood, the estimates suggest a significant price for being female, (between 10% and 15% of male pay) according to subsequent childbearing patterns. For this cohort the gender penalty did not start (or end) with family formation. The pay gap did indeed increase as family building proceeded to mid life, but this was mainly accounted for by a divergence in work experience -women's slower accumulation of experience in full-time employment, an indirect consequence of family. Workers with equal employment experience were not equally remunerated, and the extent of these pay gaps did depend on family circumstances. At both mid life and the empty nest stage, two major parts of the raw pay gap were those in levels of experience and parameters associated with family composition. By 2013, at 55 the gender penalty was still present and significant, even for those who had not become parents. The penalty applied within full-time jobs, not just because more women worked part-time.

This evidence on wages and work experience at our various snapshots indicate that women's lifetime earnings for this cohort will be considerably below men's, for reasons which include, but extend beyond, the direct and indirect effects of motherhood. This will have implications for the pension income they can expect. The protection of state pension rights for the direct consequences of spending (up to 22) years out of paid work will not level the differences in hourly earnings received by men and women when in work. The experience of this cohort will form a yardstick by which to judge the fortunes of those who follow.

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