

Wage progression and the gender wage gap: the causal impact of hours of work

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Executive summary

Key findings

Differences in hourly wages between men and women remain substantial, despite some convergence.

The hourly wages of female employees are currently about 20% lower than men's on average, having been 23% lower in 2003 and 28% lower in 1993.

The gap has not been falling among graduates.

Only among low- and mid-educated individuals has the gap in average wages between male and female employees shrunk over the past two decades. The other driver of a falling overall gender wage gap has been an increase in the education levels of women relative to men.

The gender wage gap widens gradually but significantly from the late 20s and early 30s.

Men's wages tend to continue growing rapidly at this point in the life cycle (particularly for the high-educated), while women's wages plateau.

The arrival of children accounts for this gradual widening of the gender wage gap with age.

There is, on average, a wage gap of around 10% even shortly before the arrival of the first child. But this gap is fairly stable until the child arrives and is small relative to what follows: there is then a gradual but continual rise in the wage gap and, by the time the first child is aged 20, women's hourly wages are about a third below men's.

The gradual nature of the increase in the gender wage gap after the arrival of children is similar to the gradual accumulation of differences in labour market experience.

A big difference in employment rates between men and women opens up upon arrival of the first child and is highly persistent. By the time their first child is aged 20, women have on average been in paid work for three years less than men and have spent ten years less in full-time paid work (defined here as more than 25 hours per week).

Not working full-time tends to shut down wage progression. This has an especially large impact for more highly educated women, as they would otherwise have seen the most progression.

For example, a woman who has been in full-time paid work for seven years before childbirth would, on average, have her hourly wage boosted by a further 6% from an additional year of full-time experience if a graduate, compared with just 3% for those with no more than GCSEs. Switching to part-time work, meanwhile, would on average lead to negligible progression in hourly wages.

Gender differences in hours of paid work do contribute substantially to the widening of the gender wage gap after childbirth due to their cumulative impact on hourly wages via labour market experience.

Gender differences in rates of part-time and full-time paid work account for approximately half of the widening of the gender wage gap over the 20 years after the first child in a family is born. Most of this effect comes through women's greater propensity to work part-time after childbirth, rather than differences in employment rates per se.

But differences in the build-up of labour market experience after childbirth still leave a significant chunk of the gender wage gap unexplained.

By the time the first-born child is aged 20, the difference in average hourly wages between men and women is about 30%. Of that gap, around one-quarter already existed when the first child arrived. Of the remaining three-quarters, around half is due to factors other than differences in rates of part-time and full-time paid employment after childbirth. Previous research suggests those other factors could include women being less likely to work in more productive firms, less likely to successfully bargain for higher wages within a given firm, and more likely to enter family-friendly occupations over high-paying ones.

Graduates are different: more of the graduate gender wage gap is the result of differences in labour market experience.

This makes sense given that experience and wages are most strongly related for the highly educated. Looking at the gender wage gap when the first child is aged 20 just among those educated to degree level, less of the gap already existed when the child was born (around one-seventh), and most of the gap is due to differences in rates of full-time and part-time experience that emerged after childbirth.

We will take measures to close the gender pay gap.

*2017 Conservative Party Manifesto*¹

We will upgrade our economy, breaking down the barriers that hold too many of us back, and tackling the gender pay gap.

*2017 Labour Party Manifesto*²

Reducing differences in wages between men and women is high on the political agenda, as evidenced by the quotations above. Understanding these differences is important not only from the point of view of gender equality per se, but also for how best to address low pay and a lack of wage progression more generally. Poverty is increasingly a problem of low pay rather than lack of employment. The proportion of people in paid work has reached record levels, with female employment having risen especially quickly over the last 25 years, and two-thirds of children in poverty now live in a household with someone in paid work.³ Understanding the wage gap between men and women is important in its own right, but all the more so now that so many families are left in poverty as a result of low wages.

In principle, there are many reasons why the wages of male and female workers might be different: to name a few of the possibilities, they could have different levels of education or labour market experience; they could be in different kinds of jobs offering different balances between financial benefits (such as wages) on the one hand and other benefits (such as flexibility in hours) on the other; they could be working in different local labour markets, with different degrees of competition for workers between employers, putting different amounts of upward pressure on wages; they could bargain differently over their wages; or there could be outright discrimination. The potential underlying causes of those differences are also wide-ranging. Men and women can make choices about their jobs and careers, which will depend on their preferences; but they can also face different constraints. For example, the division of childcare responsibilities within the home can clearly shape the kinds of jobs and career choices that are open to different members of the household.

It would be very difficult for one study to disentangle robustly all of these mechanisms simultaneously – or at least, that is beyond the current frontier of social science. But making progress on these questions is crucial for knowing how public policy should best respond. This briefing note provides an accessible summary of a new IFS working paper on this topic.⁴ The main contributions of the paper are: to isolate the *causal* role of full-time and part-time experience in determining the wages of men and women; to draw out the implications for what these experience differences can and cannot explain about the gender wage gap over the life cycle; and to examine how this differs for different groups of men and women (in particular, the low- versus high-educated). This exercise does not reveal *why* the experience differences between men and women arise in the first place.

¹ <https://www.conservatives.com/manifesto>.

² <https://labour.org.uk/wp-content/uploads/2017/10/labour-manifesto-2017.pdf>.

³ C. Belfield, J. Cribb, A. Hood and R. Joyce, *Living Standards, Poverty and Inequality in the UK: 2016*, IFS Report R117, 2016, <http://www.ifs.org.uk/publications/8371>.

⁴ M. Costa Dias, R. Joyce and F. Parodi, 'The gender pay gap, children and experience in work', IFS Working Paper W18/02, 2018, <https://www.ifs.org.uk/publications/10356>.

These differences may themselves be caused by other inequalities, such as social norms towards unequal division of childcare or other home responsibilities. But by obtaining robust estimates of what can and cannot be explained by experience differences – however they arise – we can provide a sense of scale for how much of the gender wage gap policymakers could reasonably expect to tackle, were they to focus on factors that can affect the build-up of labour market experience.

The role of experience in paid work – given its association with wages – is an oft-discussed driver of the gender wage gap. But studies typically suffer from a methodological problem: people with different levels of labour market experience may be different from each other in all sorts of other ways that are difficult to control for, meaning that researchers risk bundling up the actual causal impact of experience with the impacts of other factors that also affect wages or wage progression. In the new working paper, we employ a technique to get around this problem and identify the impact of labour market experience in driving the observed gender wage gap.

The structure of this briefing note is as follows. In Section 1, we set out the context of wages for male and female workers, how they differ according to education level and how the gap has evolved over time. In Section 2, we show how differences in wages between men and women evolve over the life cycle, and relate this in a descriptive way to career patterns and the presence of children. Most of these first two sections are essentially updates of part of a previous IFS briefing note, published in 2016, which was the first output on the gender wage gap in this research programme and which set out some of the basic facts about the topic.⁵ In Section 3, we turn to our new estimates of the causal role of experience in determining the gender wage gap. We draw our conclusions in Section 4.

The analysis uses three large-scale UK data sets: the Labour Force Survey (LFS), the British Household Panel Survey (BHPS) and Understanding Society (USoc). Readers interested in the details of the data used, and the methods employed, should see the accompanying IFS working paper, which sets these out fully.

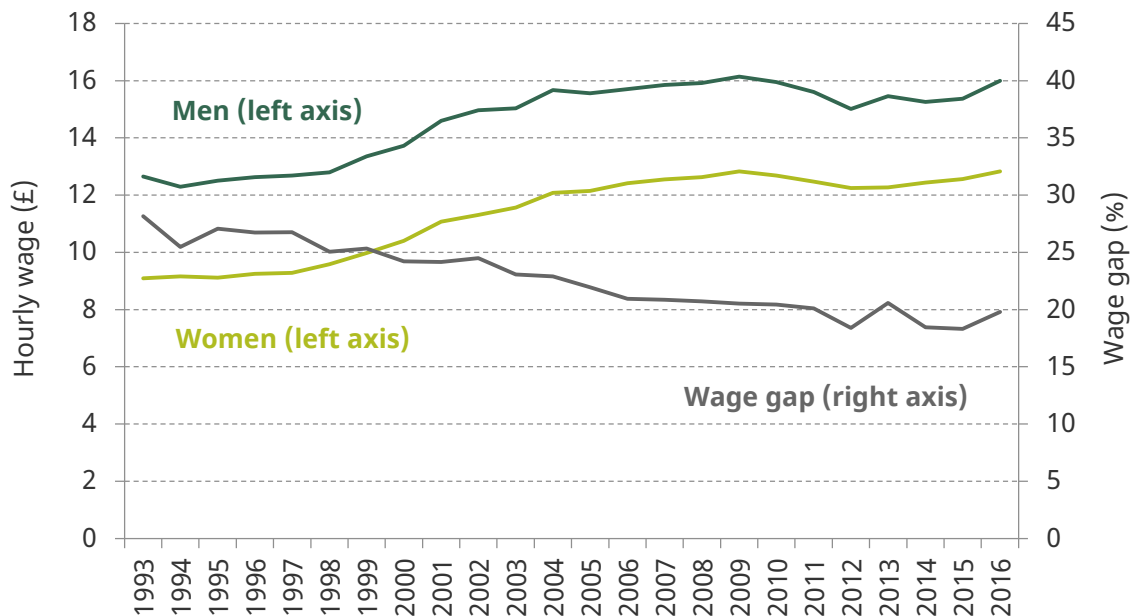
⁵ M. Costa Dias, W. Elming and R. Joyce, 'The gender wage gap', IFS Briefing Note BN186, 2016, <https://www.ifs.org.uk/publications/8428>.

1. Differences in wages between men and women

Figure 1 plots the average (mean) hourly wages of male and female employees over time according to the LFS. It also plots, in black and on the right-hand axis, the proportional difference between the two. Currently, the average female employee earns around a fifth less per hour than the average male employee. Note that this is similar to the gender pay gap of 18% that the Office for National Statistics (ONS) reports based on the Annual Survey of Hours and Earnings (ASHE).⁶ We do not use that data source here, as it does not contain information on education or family structure, which would prohibit much of our analysis. The gap shown in Figure 1 is also similar to the gap of 18% that we find when looking at median, rather than mean, wages for men and women. The wage gap has fallen over time, from almost 30% in 1993 (a trend that is also seen in the ASHE data).

As with the ONS statistics, this wage gap is what it says on the tin: the difference between average female wages and average male wages. It is not a 'like-for-like' comparison between otherwise-identical workers or jobs. To understand the wage gap properly, one needs to understand the relevant differences between male and female workers and their jobs, and what drives those differences.

Figure 1. Average real hourly wages of men and women over time

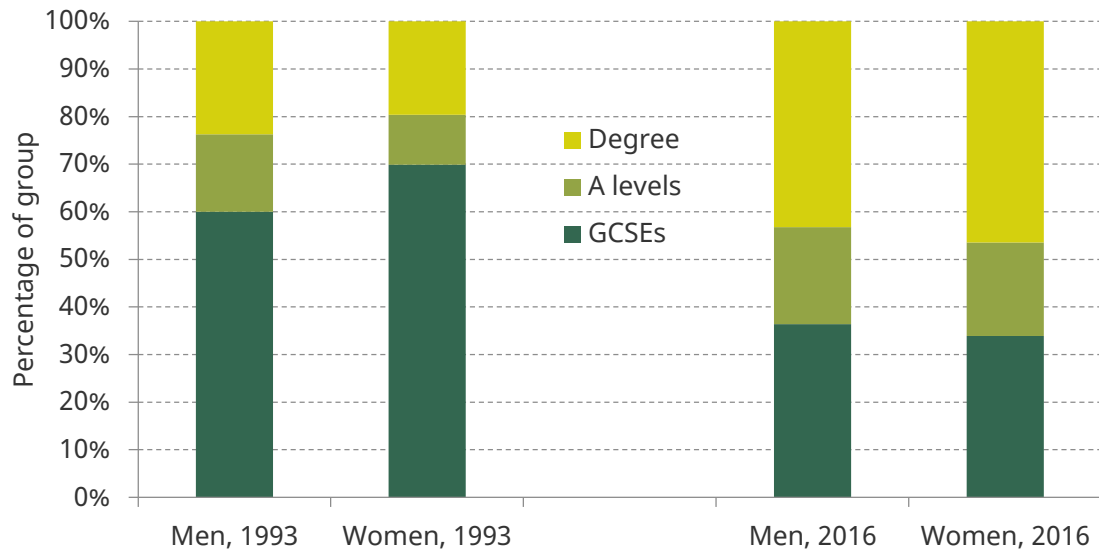


Note: The graph shows real (CPI-deflated) hourly wages in January 2016 prices. Individuals in the bottom two and top one percentiles of the gender- and year-specific hourly wage distributions are excluded.

Source: LFS 1993–2016.

⁶ Office for National Statistics, 'Annual Survey of Hours and Earnings: 2017 provisional and 2016 revised results', Statistical Bulletin, October 2017
<https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/annualsurveyofhoursandearnings/2017provisionaland2016revisedresults#gender-pay-differences>.

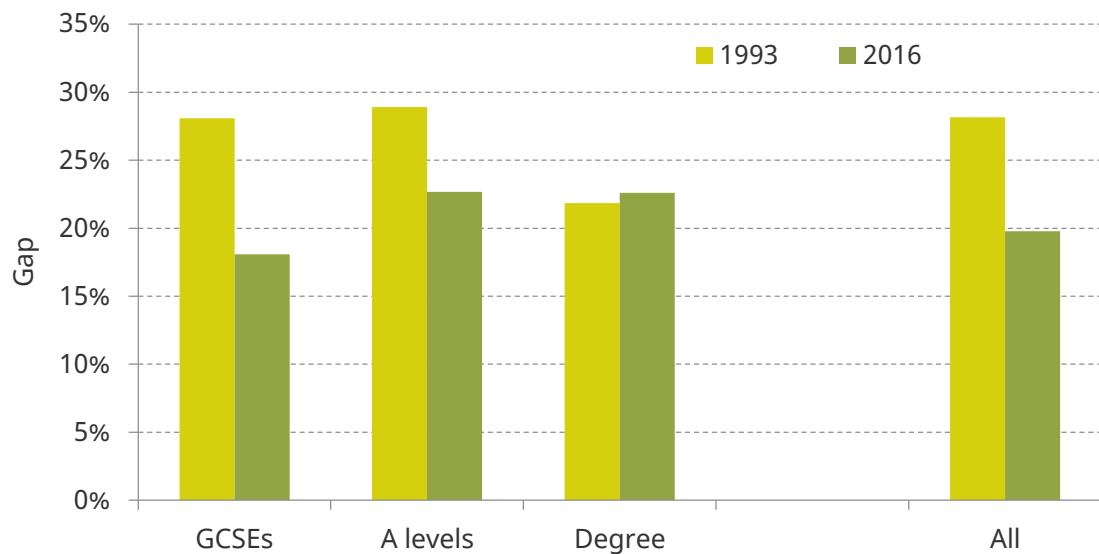
Figure 2. Educational attainment for men and women



Source: LFS 1993 and 2016.

One reason why wage differentials between men and women might change is that their relative levels of education change. This is actually important in interpreting the declining wage gap over time. Figure 2 shows that the population has become more highly educated at a rapid rate over the past 20 years, with a rapid rise in the proportion of graduates and a rapid fall in the proportion of people with no more than GCSE-level qualifications. It also shows that women have experienced the more rapid increase in education levels. In fact, in the late 2000s, they ‘overtook’ men in this respect: women are now, on average, more highly educated than men. Because graduates tend to earn more than non-graduates, these differential trends in educational attainment have contributed to reducing the gender wage gap.

Figure 3. Gender wage gap by education level over time



Note: Individuals in the bottom two and top one percentiles of the gender- and year-specific hourly wage distributions are excluded.

Source: LFS 1993 and 2016.

Figure 3 presents the wage gap for the three different education groups in 1993 and in the latest full year of data available (2016). This shows that the wage gap among the lowest-educated individuals has clearly fallen over the past two decades. But the wage gap between male and female graduates is approximately the same as it was 20 years ago. As a result, there has been a notable change in the nature of the gender wage gap. The gap used to be bigger (in proportional terms) for less well-educated people than for graduates, whereas the reverse is now the case.

In summary, the fall in the overall gender wage gap over the past 20 years has been driven mostly by the lowest-educated individuals, and by an increase in the number of women who are highly educated.

2. Children, career patterns and the gender wage gap

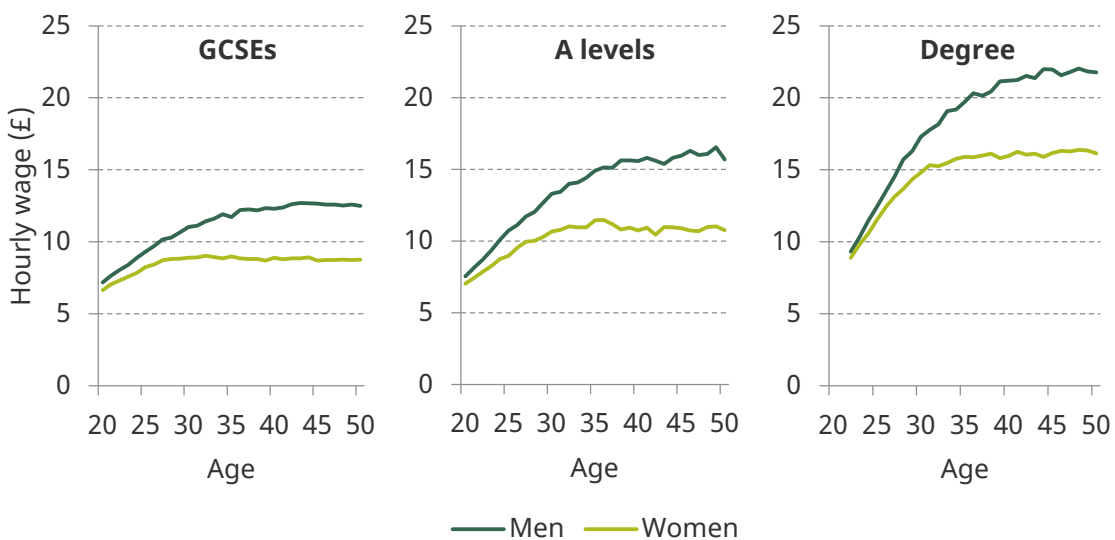
A crucial starting point for disentangling the drivers of wage differences between men and women, which simple aggregate figures miss, is that those differences evolve over the life cycle. This in turn is highly related to the arrival of children and changes in labour market behaviour associated with that. The next few figures illustrate this.

Figure 4 shows how average wages for male and female employees relate to their education level and age (pooling those observed at the relevant ages between the start of 1993 and the middle of 2017). Bear in mind here that the sets of individuals who are employed at each age are different, so it is possible, for example, that women with low levels of experience return to employment in their 40s, thereby dragging down average female wages at that age. Wages are shown in 2016 constant-wage terms – that is, the effects of general wage growth over time are stripped out. For example, if the figure shows wages increasing with age, this means that wages increase by more than would be expected simply due to economy-wide growth.

The figure shows that wages typically increase with age throughout the 20s, for both men and women, which is consistent with the returns to additional experience being especially high for those with little experience. These returns look higher for graduates: their wage profile is especially steep throughout their 20s and, for men, well beyond that.

The gender wage gap is relatively small or non-existent at around the time of labour market entry and it widens only slowly up to the mid 20s (and especially slowly for graduates). The gap then opens up more from around the late 20s and gets gradually wider over the next 20 years of the life cycle. This is because male wages continue to

Figure 4. Mean hourly wages across the life cycle by gender and education



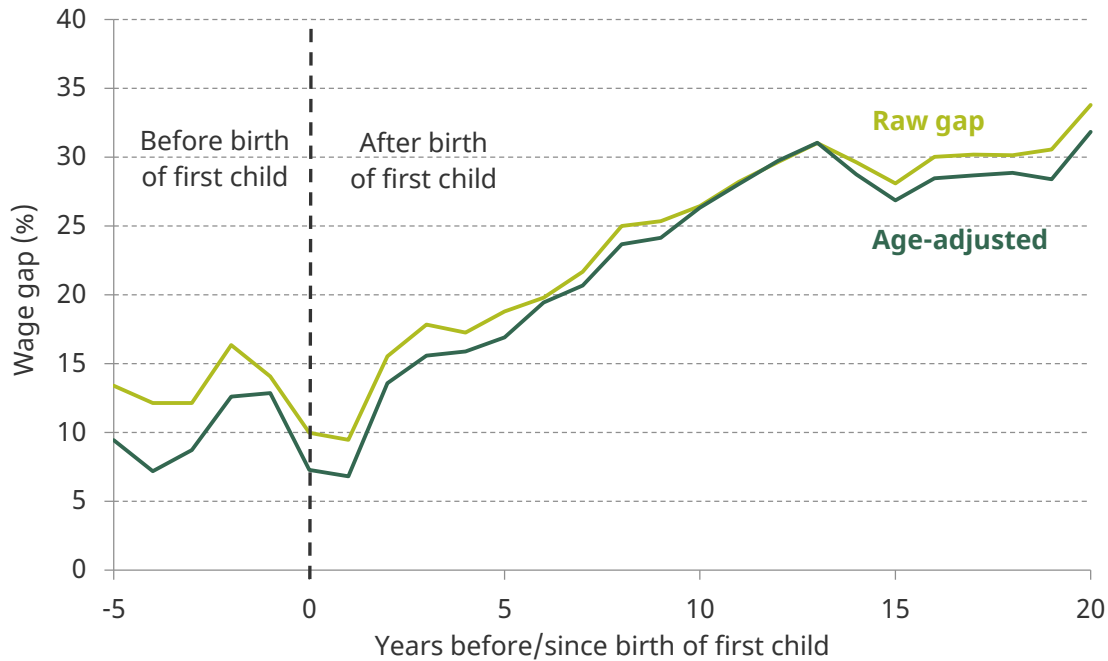
Note: Wages are shown in 2016 constant-wage terms. Individuals in the bottom two and top one percentiles of the gender- and year-specific hourly wage distributions are excluded.

Source: LFS 1993Q1–2017Q2.

increase, especially for the highly educated, while female wages completely flatline on average. (Again, recall that this does not mean literally no change in female wages as women age; it means that there is no association with age once the effect of general, economy-wide wage growth over time has been stripped out.)

The fact that the gender wage gap begins to open up more when people reach their late 20s is related to the arrival of children.⁷ Figure 5 shows this explicitly by plotting the wage gap not by age, but by time to or since the birth of the first child in a family (where zero is the year in which that child is born). There is, on average, a wage gap of over 10% even before the arrival of the first child. A small part of this gap is simply due to age differences – men tend to be slightly older than women when the first child arrives – though the age-adjusted line on Figure 5 still yields a wage gap of 7–13% in the five years preceding the birth of the first child.⁸ A key feature of the patterns shown in the figure is that the gap appears to be fairly stable until the first child arrives, and is small relative to what follows: after the child arrives, there is a gradual but continual rise in the wage gap over the following 13 years, until it reaches around a third.

Figure 5. Gender wage gap by time to/since birth of first child



Note: Individuals in the bottom two and top one percentiles of the hourly wage distributions are excluded. The age-adjusted series comes from an ordinary least squares (OLS) regression of (detrended) log wages on a full set of age dummy variables interacted with three education-level dummy variables. Having estimated this equation, we predict each person’s wage under the scenario where they are all the same age (we use age 20, but the final result is independent of which age one chooses, because we then take the difference between the predicted values for men and women) and add on the regression residual. We then take the difference between the averages of these simulated age-adjusted wages for the men and women in the sample and divide this by the average (raw, i.e. unadjusted) wage among the men.

Source: BHPS 1991–2008 and Understanding Society 2009–15.

⁷ As also documented in G. Paull, ‘Children and women’s hours of work’, *Economic Journal*, 2008, 118, F8–27.

⁸ This can be interpreted as an estimate of what the gender wage gap would be if women’s ages at childbirth were the same as men’s ages, and if all other determinants of wages for men and women were as they are. See the note to Figure 5 for how this estimate is constructed.

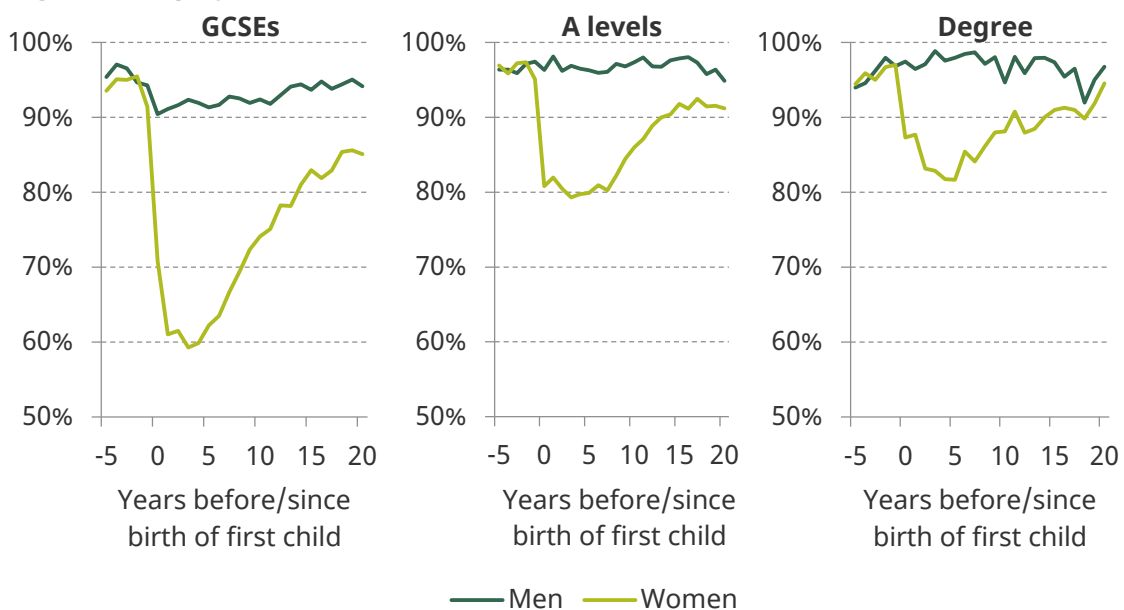
It is important to remember that we are analysing hourly wages here, not weekly earnings. Therefore this is not a simple mechanical effect of women working fewer hours in order to care for children and hence missing out on extra hours of pay.

However, for more subtle reasons, Figure 5 suggests that changes in women’s working patterns after the arrival of children may well be important in explaining this wage gap. The crucial observation is that the wage gap opens up *gradually* – not in any sudden jump – after the first child arrives and continues to widen for many years after that point. This means that gender gaps in the level of labour market experience follow the same basic shape as the gender gap in wages: relatively stable in the years before childbirth, growing incrementally for many years after that point, before eventually largely stabilising once more. The next three figures illustrate this.

Figure 6 shows the employment rates of men and women by the time to or since the birth of the first child. Before the arrival of the first child, it is difficult to discern any differences between the employment rates of men and women. However, when the first child arrives, a large employment gap opens up immediately: many women leave paid employment at this point, while any employment responses by men look tiny in comparison, and non-existent for the mid- and high-educated. (Note that being on maternity or paternity leave is treated as being in paid employment.) The employment response among the lowest-educated women is more than double the response among other women. Between one year before and one year after the birth of the child, women’s employment rates drop by 30 percentage points (ppts) for those with GCSEs, 13ppts for those with A levels and 9ppts for graduates.

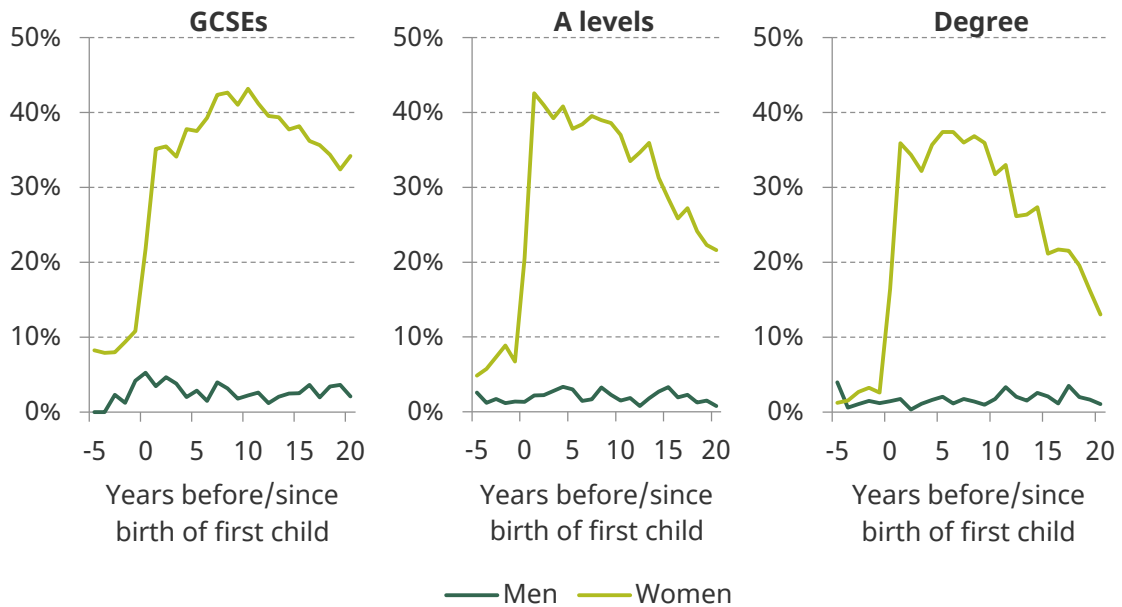
The other important feature of Figure 6 is that, once the employment gap opens up after the arrival of the first child, it persists. Women’s employment rates do start to rise again once the first child is around school age, but they remain below male employment rates for the full 20 years shown. Hence, the gap in time spent in paid work keeps growing year on year for a long time after the first child arrives.

Figure 6. Employment rates of men and women



Source: BHPS 1991–2008 and Understanding Society 2009–15.

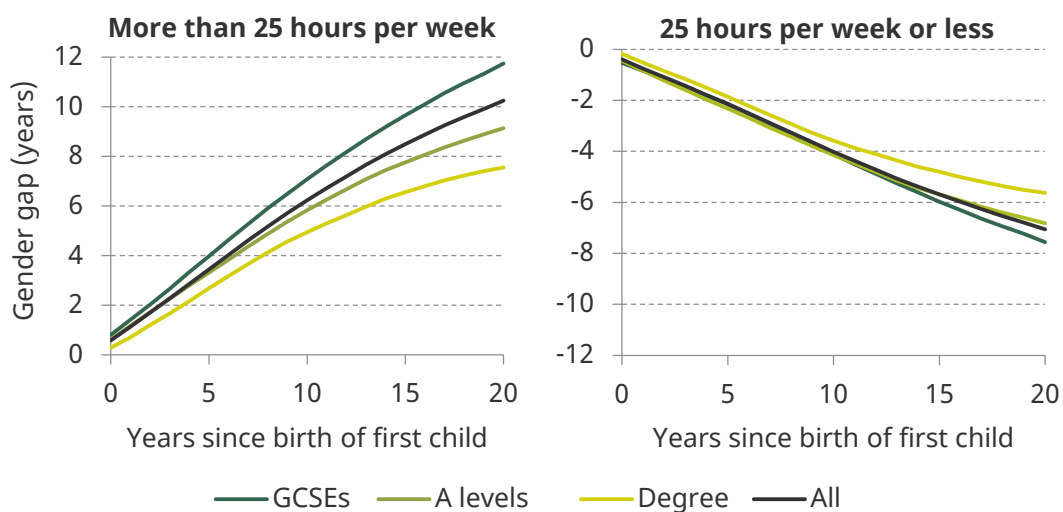
Figure 7. Percentage of all men and women in jobs of no more than 25 hours per week



Source: BHPS 1991–2008 and Understanding Society 2009–15.

Figure 7 shows that not only do many women move out of paid employment altogether after having their first child, but many others move to work that is part-time (which we define here as no more than 25 hours per week, though the basic story is robust to using other reasonable hours thresholds). Again, the male rate of part-time employment looks essentially unaffected by the arrival of the first child, and the gap that opens up is persistent: women are still significantly more likely to be in this kind of work than men when their first child reaches adulthood.

Figure 8. Gender gap (men minus women) in years spent working full-time and part-time



Note: The figure cumulates the gender gaps shown in Figures 6 and 7, and therefore does not include any differences in experience that already exist more than five years before the birth of the first child, but these differences are negligible.

Source: BHPS 1991–2008 and Understanding Society 2009–15.

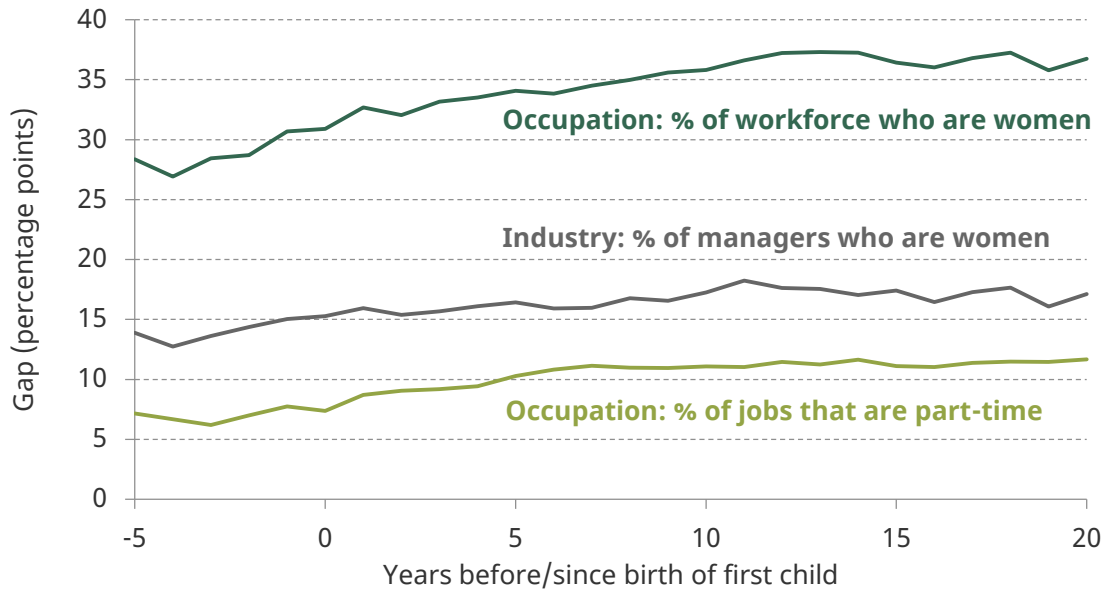
Figure 8 shows the direct implications of this: a steadily increasing gap in accumulated labour market experience after the arrival of the first child. By the time their first child is aged 20, women have on average been in paid work for three years less than men, comprising ten years less full-time paid work and seven years more part-time paid work. The gap is larger still for the low-educated. Previous research⁹ tells us that the three years less spent in any form of paid work understates the gender differences in accumulated 'human capital' (i.e. skills and experience that employers value) – it is the ten-year gap in full-time experience that is more relevant. This is because it is only full-time paid work which seems to have substantial benefits in terms of the accumulation of experience that allows workers to command higher wages in future. We confirm this in the new analysis summarised in Section 3, where we also examine the implications of the lack of wage progression in part-time work for the gender wage gap.

Of course, there are other factors, besides levels of experience in paid work, that might be affected by childbirth and that could potentially contribute to differences in wages between men and women. One possibility is that women undertake different kinds of work, potentially in different sectors of the economy. This could be related to their wages for a number of reasons. For example, priorities or constraints could change around the time that children arrive, such that women move towards occupations in which the benefits are less skewed towards wages and more towards other factors such as flexibility. It could also be that a concentration of women in certain occupations or industries allows employers to exercise market power in order to hold wages down if, for example, they know that many of those women have limited ability or desire to search for alternative employment because they are time-constrained or want to work close to home. These different kinds of mechanisms linking occupation or industry to the gender wage gap would have very different implications for policy, and it is beyond the scope of this work to disentangle them (and there are many other possibilities besides the examples given). But what we can do is provide a sense of their likely importance in accounting for the evolution of the gender wage gap.

Figure 9 summarises three example differences between the occupations and industries that women and men work in, and how these differences evolve at around the time of childbirth. We take the occupation or industry that each worker is in, and map this to the composition of the workforce in that occupation or industry (computed from the LFS). As time goes on, women who have children tend (relative to men who have children) to concentrate increasingly in female-dominated occupations, occupations in which part-time work is relatively common, and sectors in which female managers are relatively common. To that extent there are similarities with the evolution of the gender wage gap – which also grows over the life cycle, as we have seen. However, a closer look reveals a caveat to that: whereas the gender wage gap is fairly stable in the years before childbirth and then begins gradually increasing from the time of the first child, occupation and industry differences between men and women seem to be on a more uniformly increasing trajectory (even a few years before the birth of the first child). This may in part be due to job changes in anticipation of having children. But it casts some doubt on the ability of these occupation or industry differences to explain powerfully the shape of the gender wage gap over the life cycle documented above.

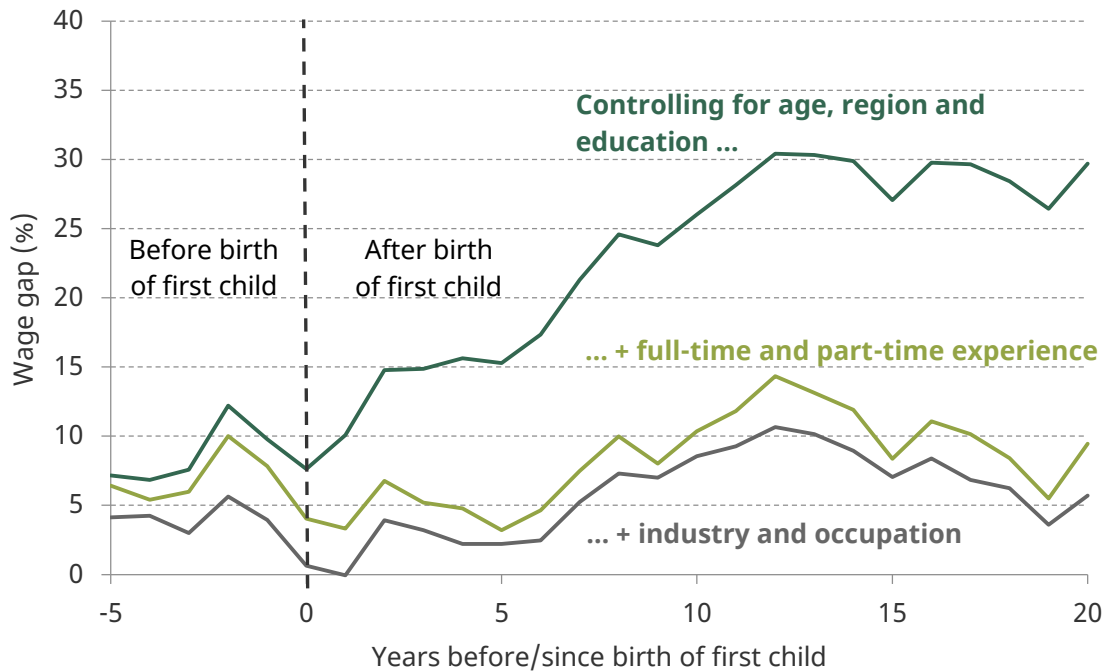
⁹ R. Blundell, M. Costa Dias, C. Meghir and J. Shaw, 'Female labor supply, human capital, and welfare reform', *Econometrica*, 2016, 84, 1705–53, http://www.ucl.ac.uk/~uctp39a/BDMS_Ecta_Sept_2016.pdf.

Figure 9. Gender gaps (women minus men) in characteristics of occupation and industry



Source: BHPS 1991–2008 and Understanding Society 2009–15.

Figure 10. Gender wage gap by time to/since birth of first child, controlling for association between wages and other characteristics



Note: Individuals in the bottom two and top one percentiles of the hourly wage distribution are excluded. Data show the gaps between OLS regression residuals for men and women. The dependent variable in the regressions is (detrended) log wages. In the top series, the regressors are government office region and the interaction between age dummies and education-level dummies. In the middle series, additional regressors are cubics in full-time and part-time experience, interacted with education level. In the bottom series, additional regressors are dummies for occupation (measured at the three-digit level using the SOC 2010 classification) and sector (measured at the two-digit level using the SIC 2007 classification).

Source: BHPS 1991–2008 and Understanding Society 2009–15.

Figure 10 investigates this more precisely and comprehensively. It plots the gender wage gap before and after the birth of the first child, along the same lines as Figure 5, but after controlling for various sets of differences between male and female workers, using simple regression analysis: age, region, education, full-time and part-time experience, industry and occupation. This highlights that experience has the potential to account for a large amount of the gender wage gap, including the way that it evolves over the life cycle – albeit while also seeming to leave a substantial part of the gender wage gap unexplained (and our causal analysis in the next section confirms this). Industry and occupation differences, by contrast, seem to explain far less. Section 3 of this briefing note focuses on examining the causal role of the experience differences.

3. The causal impact of labour market experience on the gender wage gap

For the remainder of this briefing note, and in the bulk of the working paper, we focus our attention on robustly identifying the *causal* role of accumulated experience in paid work in affecting women's wage progression, and hence the gender wage gap. Doing this definitively requires more careful analysis than just 'controlling' for experience in a simple way as in Figure 10. Take the example of people who do paid work this year versus people who take time out of the labour market this year. People do not belong to one of these groups randomly, but end up there based on some combination of their preferences, their constraints and their expectations of the consequences for them of doing, or not doing, paid work this year. This means that the two groups could plausibly be different from each other in all sorts of respects (e.g. their ability, health and expectations of promotion), and some of those other differences may well be related to their potential wages in subsequent years. Therefore if we compare the wages of these two groups in some future year, we cannot be sure that any differences are solely due to the fact that one group has built up more experience in paid work than the other. For the same reason, it may also lead to incorrect inferences being made about the role of experience in driving gender wage gaps, given that (for example) mothers who spend lots of time in paid work are a smaller – and hence probably less representative – group than fathers who do so.

To solve this problem and isolate the causal impact on wages of experience, one needs effectively to find groups of people who have different levels of experience but who are the same in all other relevant respects – even in terms of factors that we, as researchers, are unable to observe. To do this, we exploit the fact that changes to tax and benefit policy over time have shifted the financial incentives that different people have to do paid work, and to work different numbers of hours, in a way that depends on the details of one's circumstances.¹⁰ This means there are some women who have ended up doing different amounts of paid work from other women purely because they were exposed to a different policy regime, or because the regime affected them in a different way. By definition, subsequent differences in wages between these subgroups of women are not due to confounding factors that we cannot observe (e.g. health), and so they can be attributed to differences in experience. Interested readers should see the working paper for full details.¹¹

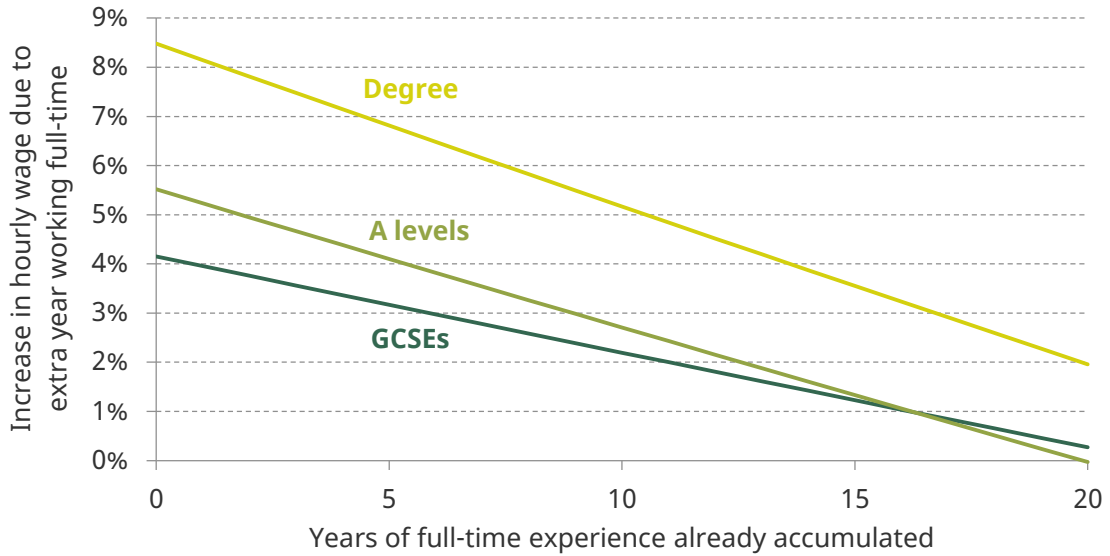
The analysis yields estimates of the *causal* effect of experience in paid work on wage levels. There are a number of key findings. First, the effect of extra part-time experience on women's wages is negligible. This mirrors the conclusions of previous research.¹² Second, the wages of the high-educated are raised considerably more by additional (full-time) experience than the wages of the low-educated. This can be seen in Figure 11, which plots the estimated effects of a year of additional experience in full-time paid work on

¹⁰ Our modelling approach seeks to exploit any reforms made to cash transfer or direct tax policy between 1991 and 2008. Major examples are the large expansions to tax credits in the late 1990s and early 2000s.

¹¹ M. Costa Dias, R. Joyce and F. Parodi, 'The gender pay gap, children and experience in work', IFS Working Paper W18/02, 2018, <https://www.ifs.org.uk/publications/10356>.

¹² R. Blundell, M. Costa Dias, C. Meghir and J. Shaw, 'Female labor supply, human capital, and welfare reform', *Econometrica*, 2016, 84, 1705–53, http://www.ucl.ac.uk/~uctp39a/BDMS_Ecta_Sept_2016.pdf.

Figure 11. Estimated effect on women’s hourly wages of a year’s additional experience in full-time paid work, by education level and existing full-time experience



Note: The figure plots estimates from a model of growth in log wages, where the impact of working full-time is allowed to vary linearly with the amount of full-time experience already accumulated. For full details of methodology, see M. Costa Dias, R. Joyce and F. Parodi, 'The gender pay gap, children and experience in work', IFS Working Paper W18/02, 2018, <https://www.ifs.org.uk/publications/10356>.

Source: BHPS 1991–2008.

hourly wages, for women with different levels of experience and different education levels.

To see the implications of those two findings for women’s wage progression, take the example of a woman who has been in full-time paid work for seven years before childbirth. The numbers in Figure 11 tell us that, on average, if she is a graduate then her hourly wage next year would be boosted by a further 6% as a result of continuing to work full-time this year; if she had no more than GCSE-level qualifications then this figure would be 3%. If, on the other hand, she worked part-time, she would see none of that wage boost in the following year (her hourly wages would simply follow the path of economy-wide wages, with no benefit from additional experience).

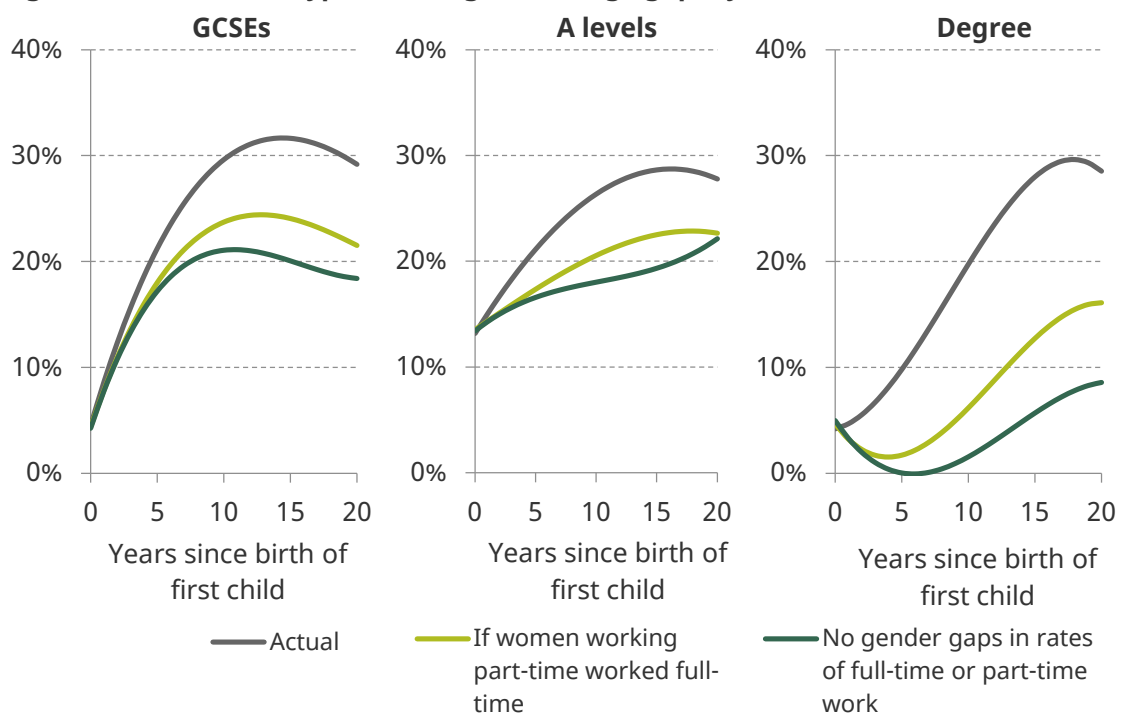
The third important finding, also made clear by Figure 11, is that the benefits of additional experience are highest for the inexperienced, and decline as more experience is built up (an example of the common ‘diminishing returns’ phenomenon). At the start of a career, the wage premiums from an extra year of full-time experience are around 8% for female graduates and 4% for women with no more than GCSEs; for both groups, the returns to additional experience gradually decline towards zero as more experience is accumulated. Overall, the results presented in Figure 11 help to explain the patterns of wages over the life cycle described earlier in Figure 4.

With these estimates of the causal effect of experience in paid work on hourly wage levels, we can simulate thought experiments for the gender wage gap. Figure 12 plots the actual percentage difference between the average hourly wages of male and female employees, by years since the birth of the first child. This is essentially the same as Figure 5, except we

split the results by education group. Figure 12 also includes two hypothetical series, based on exactly the same sample of men and women. The first simulates what the wage gap would be if women in paid employment always worked full-time – removing the part of the wage gap caused by the fact that part-time experience, which is rewarded less than full-time experience, is more common among women. It is equivalent to asking what the wage gap would be if the wage returns from part-time experience were the same as the returns from full-time experience. The second additional series in the figure goes further still, asking how the wage gap would evolve if women’s hours of work after childbirth were the same as men’s: aligning the employment rates of the sexes, as well as the part-time/full-time split. We perform these simulations from the birth of the first child, taking the wage gap that already exists at that point as given, since gender differences in work experience up to this point are minimal. The series are smoothed in order to highlight clearly the key points, of which there are several:

- Differences in hours of paid work between men and women do contribute substantially to the widening of the gender wage gap after childbirth, due to their impact on wages via experience.
- This is mostly due to the fact that women in employment are more likely to work part-time at this stage in life, and part-time experience leads to much less wage growth than full-time experience. Gender differences in employment rates per se account for less of the widening of the gap after childbirth.

Figure 12. Actual and hypothetical gender wage gap, by time since birth of first child



Note: For full details of methodology, see M. Costa Dias, R. Joyce and F. Parodi, 'The gender pay gap, children and experience in work', IFS Working Paper W18/02, 2018, <https://www.ifs.org.uk/publications/10356>. For clarity, the 'raw' results underlying each series have been smoothed by regressing the wage gaps on a cubic in 'years since birth of first child' and plotting the predicted values.

Source: BHPS 1991–2008.

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- Experience differences by no means account for all of the gender wage gap: not only is there already a gap when the first child arrives – especially for the lower-educated – but our estimates suggest that the gap would rise after that point even if rates of full-time and part-time employment were the same for men and women. Other factors besides experience are at play too.
 - Gender differences in experience explain less of the gender wage gap for the lower-educated than for the higher-educated. This makes sense given that, as Figure 11 showed, experience makes less difference to wages for the lower-educated.

We can split the gender wage gap that exists by the time the first-born child is aged 20 into three components. Taking all education groups together, that gap is about 30%. About one-quarter of it (8ppts) already exists when the first child is born. Of the three-quarters (21ppts) of the gap that opens up afterwards, about half (11ppts) can be explained by the fact that women and men have different employment patterns after childbirth, since these result in differences in labour market experience which are causally associated with wages; the other half, meanwhile, is due to other factors causing gender wage divergence after childbirth.

Looking more closely at the component of the gap explained by differences in employment patterns after childbirth highlights that a lack of wage progression in part-time work is the biggest factor. By the time the first child is aged 20, about a quarter of the wage gap between mothers and fathers is explained by the higher propensity of the mothers to have been in part-time rather than full-time paid work while that child was growing up. In contrast, only a tenth of that gap is explained by mothers' higher propensity to have taken time out of the labour market altogether.

The story for graduates is different. Although the gender wage gap among graduates by the time the first child is aged 20 is quite similar to that for those with less education, less of the gap exists before the first child is born (around one-seventh), and the majority of the graduate gender wage gap is explained by the differences in labour market experience between men and women that emerge after childbirth. Again this fits with the fact that experience and wages are most strongly related for the highly educated. However, for graduates and non-graduates alike, the role of experience differences in driving the gender wage gap is mostly due to the lack of wage progression arising from part-time paid work.

4. Conclusion

Gender differences in rates of full-time and part-time paid work after childbirth are an important driver of differences in hourly wages between men and women. This is because they affect the amount and type of labour market experience that men and women build up, and this experience affects the hourly wage levels they can command.

With respect to the role of experience in driving the gender wage gap, perhaps the most important point is that the main impact of experience arises from women's greater likelihood of working part-time after childbirth – rather than their greater likelihood of taking time out of the labour market altogether. This is because extra experience in full-time work leads to higher hourly wages, whereas extra experience in part-time work does not.

A key challenge for future research, then, is to understand why part-time work shuts down wage progression so much. There are a number of possibilities, including less training provision, missing out on informal interactions and networking opportunities, and genuine constraints placed upon the build-up of skill by working fewer hours. Understanding this properly looks of great potential importance for policymakers who want to address the gender wage gap. Of course, our results also suggest that an alternative (or complementary) focus would be on understanding the causes of gender differences in rates of full-time work in the first place, such as the division of childcare responsibilities.

That said, our results also show that closing gender gaps in rates of full-time and part-time paid work, or narrowing the difference between the impacts of full-time and part-time paid work on wage progression, cannot be expected to close the gender wage gap fully. This is especially relevant when thinking about the relationship between the gender wage gap and poverty: among lower-educated people, there is already a relatively substantial gender wage gap before the first child is born, and gender differences in full-time and part-time paid work in the subsequent 20 years explain only a minority of the gender wage gap that has built up by that point. Previous research suggests that other contributing factors could include women being less likely to work in more productive firms, less likely to successfully bargain for higher wages within a given firm, and more likely to enter family-friendly occupations over high-paying ones.¹³ Better understanding of mechanisms such as these, and their underlying causes, is another key priority for further research.

¹³ See: J. Adda, C. Dustmann and K. Stevens, 'The career costs of children', *Journal of Political Economy*, 2017, 125, 293–337; and D. Card, A. Cardoso and P. Kline, 'Bargaining, sorting, and the gender wage gap: quantifying the impact of firms on the relative pay of women', *Quarterly Journal of Economics*, 2016, 131, 633–86.