Assessing the Impact of Parenthood on Pay and Employment: An Event Study of the Motherhood Penalty and Fatherhood Premium in the UK

Néha Shah

Professional Economist BSc and Apprenticeship Level 6

School of Economics

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Abstract

This dissertation investigates the impact of parenthood on labour market outcomes in the UK, using an event study approach applied to data from the UK Household Longitudinal Study (UKHLS). The analysis tracks individuals from two years before to eight years after the birth of their first child, estimating changes in earnings, employment, hours worked, and hourly wage rates. Results reveal a sharp and persistent motherhood penalty, with mothers' earnings falling by approximately 60% and wage rates by 30% post-birth. In contrast, fathers experience modest gains, with earnings increasing by around 14% over the same period. Heterogeneity analysis shows that younger mothers, those with lower educational attainment, and those not employed full-time pre-birth face the largest penalties. Fathers' outcomes remain consistent across subgroups. Robustness checks confirm the reliability of the findings across alternative specifications, event windows, and sample restrictions. These results suggest that parenthood remains a key turning point in gender inequality within the UK labour market. Policy implications include the need for greater investment in childcare, increased support for shared parental leave, and reforms to workplace flexibility. Future research should explore longer-term effects, intersectionality, and employer-level dynamics to better understand and address the motherhood penalty.

AI Statement

I acknowledge the use of generative AI in drafting this paper. However, the work reported remains my own.

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Introduction

1.1 Background and Motivation

Despite progress in closing gender gaps between men and women over time, gender inequality still persists, and convergence has slowed. (Kleven, 2018). Early research on gender inequalities focused on the role of human capital accumulation (Altonji & Blank, 1999; Blau & Kahn 2017) and discrimination (Neumark et al., 1996; Goldin & Rouse, 2000). However societal development such as the closing of gender differences in education and anti-discrimination policy, suggests that there may be a different explanation for gender differences in more recent times.

Over the past few decades, gender gaps in educational attainment have narrowed in many countries, including the UK. Anti-discrimination laws such as the Equality Act 2010 have helped reduce bias in the workplace, yet gender inequalities in the labour market persist - particularly in earnings, promotion prospects, and job continuity. This has led researchers to explore more nuanced explanations, most notably the role of family formation and caregiving responsibilities (Goldin, 2014).

A growing body of evidence highlights the critical role of parenthood in shaping labour market outcomes, with motherhood often representing a turning point in women's careers. Recent work by Kleven et al. (2019b) has shown that men and women follow similar earnings trajectories until the arrival of their first child but diverge sharply afterwards. Mothers' earnings fall substantially and may not recover even a decade after childbirth – a mechanism referred to as the "motherhood penalty". In contrast, fathers often experience either stable earnings or a modest increase post-childbirth - a phenomenon referred to as the "fatherhood premium" (Budig & Hodges, 2010).

This divergence – the negative impact having children has on women's career and earnings relative to men – known as the "child penalty," is a significant contributor to the overall gender wage gap and appears to be driven by a combination of labour supply reductions, part-time work transitions, career interruptions, and employer responses to caregiving (Kleven et al., 2019a; Cools et al., 2015). In the UK, the structure of parental leave (Sevilla & Smith, 2020), the high cost of childcare (Brewer et al., 2022), and entrenched gender norms regarding caregiving further exacerbate these penalties (Harkness, 2016).

Given the importance of parenthood in shaping gendered economic outcomes, understanding the mechanisms that may be contributing the child penalty can be crucial for policy makers in designing effective interventions that promote shared caregiving responsibilities and support parents' labour market attachment and long-term outcomes.

1.2 Research question and objectives

This dissertation aims to expand on the growing body of literature that examines how parenthood contributes to gender inequality in the labour market. In particular, it focuses on the distinct experiences of mothers and fathers in the UK, exploring the extent to which becoming a parent affects their respective trajectories in employment and earnings. While prior research has emphasised the motherhood penalty, this study explicitly contrasts it with the fatherhood premium to highlight the gendered consequences of having children. The paper aims to address the following research questions:

1. What is the impact of becoming a parent on employment and earnings for women and men in the UK?
2. Are there differences in the trajectory of labour market outcomes between mothers and fathers over time?

By addressing these questions, this study aims to provide insights into how gender disparities in the labour market emerge in the life course, with a specific focus on the transition into parenthood. To answer these questions, data from the UKHLS, which provides longitudinal data on family composition, employment, earnings and other sub demographic characteristics is used. An event study method is employed which allows for the estimation of dynamic treatment effects around the event of the birth of the first child. This approach follows the specification introduced by Kleven et al, and adapted in recent UK and international gender studies.

1.3 Contribution to the literature

While previous research has documented the long-run wage effects of parenthood, particularly for mothers, fewer studies have focused specifically on comparing employment outcomes of mothers and fathers using UK survey data. This dissertation aims to contribute to the literature by comparing how parenthood affects men's and women's employment and earnings in the UK. It applies an event study approach to track changes in individuals' outcomes around the time they have their first child. By using data from the UK Household Longitudinal Study (UKHLS), the study can explore how these patterns differ between mothers and fathers and offer more recent insights into the gendered impact of becoming a parent.

1.4 Disposition

This dissertation is structured as follows: Section 2 outlines the theoretical framework and the relation to the literature. Section 3 presents the empirical framework including variable selection and methodology. Section 4 reports the findings from the conducted analyses. Section 5 outlines the potential limitations in approach and presents suggestions for future analysis. Finally, Section 6 will summarise the project outcomes.

Literature Review

The impact of parenthood on labour market outcomes has been the focus of extensive literature. In this section an overview of the factors shaping the child penalty and an account of the studies closely related to the empirical approach taken in this study.

2.1 Theoretical Framework of Gender Pay Gap

Human capital theory, formalised by Becker (1993) and Mincer (1958), provides one of the earliest and most influential frameworks for understanding wage differentials, including those between men and women. The theory posits that individuals invest in their education, training, and work experience in anticipation of future earnings, and that wages reflect the return on these investments. Within this framework, early gender gaps in pay were largely attributed to

differences in human capital accumulation - typically education and work experience - between men and women.

Mincer and Polachek (1974) extended this theory by incorporating family responsibilities, arguing that women anticipate shorter, more intermittent work lives due to their expected roles in childbearing and caregiving. As a result, women may choose to invest less in human capital or opt for roles with less career progression but more flexibility. Becker (1991) similarly argued that household specialisation - where women assume more domestic duties while men focus on market work - is a rational outcome of comparative advantages and time allocation, further reinforcing gender-based earnings differences.

Courtney Owens (2019) used a comparative case study approach to explore whether human capital theory could explain variation in the gender pay gap across the four nations of the UK. Using education and apprenticeship data, Owens found that despite women now surpassing men in higher education attainment in all UK nations, significant gender pay gaps persist. Owens concluded that while human capital factors play a role, they do not fully explain the gender pay gap, especially given the presence of structural and institutional variables such as occupational segregation and public sector employment patterns.

Similarly, Blau and Kahn (2016) noted that conventional human capital variables now explain only a small portion of the gender wage gap, as women have caught up or overtaken men in educational attainment in many countries. They argue that differences in occupation and industry remain significant contributors. Supporting this, Owens (2019) highlighted that despite higher female participation in apprenticeships in England and Wales, these regions still exhibit some of the highest gender pay gaps in the UK.

Critics of human capital theory, particularly feminist economists, challenge the assumption that labour market outcomes result from gender-neutral, rational choices. Figart (2005) and England (2005) argue that occupational segregation is not merely the product of investment decisions, but is deeply embedded in social norms, discrimination, and institutional biases.

Whilst the human capital model provides a useful baseline, some evidence suggests that it is not sufficient enough to explain persistent gender pay gaps. The inclusion of social norms, occupational structures, and public sector employment - factors omitted by classical models - is critical to a fuller understanding of gender inequality in earnings. This sets the stage for investigating how parenthood, particularly the transition to motherhood, may exacerbate these inequalities, even among similarly qualified and experienced men and women.

2.2 The Role of Parenthood in Gender Inequality

2.2.1 The Motherhood Penalty

The motherhood penalty refers to the economic disadvantage that women face after becoming mothers. It manifests as reduced earnings, lower employment rates, limited hours worked, and stalling or regression in career progression. Numerous studies confirm that these penalties persist even after accounting for factors such as education, pre-birth employment history, and occupation (Budig and England, 2001; Waldfogel, 1998; Harkness, 2016; Kleven et al., 2019b).

Empirical studies consistently show that motherhood triggers a significant and enduring decline in earnings. Kleven et al. (2019b) show that in Denmark, mothers' earnings fall by approximately 20% after childbirth and remain suppressed over a ten-year period. In the UK, Harkness (2016) found that the earnings of mothers fall immediately post-birth and show little sign of recovery. Even among mothers who return quickly to full-time work, wage penalties are observed, suggesting that factors beyond human capital loss - such as discrimination and occupational downgrading - play a role.

Motherhood is also associated with reduced access to managerial roles, increased likelihood of part-time employment, and shifts to lower-paying sectors as noted by Hupkau and Ruiz-Valenzuela. The penalty is compounded by inflexible working conditions, limited childcare access, and employer perceptions that mothers are less committed. While some of the penalty can be attributed to reduced labour supply, many mothers express a desire to work more, indicating that structural constraints and gender norms are at play (Hupkau and Ruiz-Valenzuela, 2021).

2.2.2 The Fatherhood Premium

In contrast to the motherhood penalty, the fatherhood premium refers to the observed increase - or at least maintenance - of men's earnings and employment outcomes following the birth of a child.

Budig (2014) found that U.S. fathers earned approximately 6% more than non-fathers, even after controlling for work experience and occupation. Similarly, Killewald (2012) reported a statistically significant wage premium of around 3.7% for married residential fathers, but not for unmarried ones. This distinction suggests that cultural norms linking breadwinning with traditional marital roles may influence employer perceptions and reward systems (Glauber, 2008).

The fatherhood premium is also deeply rooted in social expectations that position men as primary breadwinners (Mari, 2019). These norms are reflected in employer biases, labour market behaviour, and institutional structures. While mothers often reduce labour supply or shift to family-friendly roles, fathers may increase their work effort and hours in response to new family responsibilities, further widening the gender earnings gap (Lebedinski, Perugini, and Vladisavljević, 2023). Cooke and Fuller

(2018) highlight that men who transition into higher-wage establishments post-childbirth often benefit more, suggesting that workplace sorting contributes to the premium, especially for advantaged groups.

The fatherhood premium also varies by socioeconomic class. High-income men experience greater gains, likely due to better access to flexible, promotable jobs. Meanwhile, lower-income fathers may not benefit at all (Cooke and Fuller, 2018). Macro-level studies show that fatherhood amplifies gender divergence in economic outcomes, with men's earnings increasing steadily post-childbirth, while women's earnings drop or stagnate (Kleven et al., 2022).

Notably the wage premium appears to emerge only after the transition to parenthood, indicating that it is driven by social roles and institutional reactions rather than inherent traits (Killewald, 2012). Public policy can play a role in reducing these disparities - interventions like publicly funded childcare, equitable parental leave, and employer accountability measures may reduce the systemic advantages conferred upon fathers while alleviating penalties for mothers (Budig, Misra, and Boeckmann, 2012).

2.2.3 The Child Penalty

The child penalty refers to the substantial and persistent reduction in women's labour market outcomes following the birth of a child, contrasted with the stable or improved trajectories often seen for men. This phenomenon has been identified as a major contributor to gender inequality in both earnings and employment, and is widely documented across high-, middle-, and low-income countries (Kleven et al., 2019a).

Kleven et al. (2019b) define the child penalty as the percentage by which women fall behind men due to children. Their cross-country study found that following the birth of the first child, women's earnings drop sharply while men's remain largely unaffected. The earnings of mothers did not return to pre-birth levels even ten years later.

The child penalty operates through both anticipated and realised fertility. Adda et al. (2017) show that women who expect to become mothers often make pre-emptive adjustments to their careers - such as selecting family-friendly occupations that offer flexibility at the expense of earnings growth. This anticipatory sorting into routine or manual roles constrains long-term earnings even before childbirth. After childbirth, realised fertility leads many women to adjust their working hours, job sector, or even leave the labour market altogether (Nielsen et al., 2004; Sieppi and Pehkonen, 2019).

The persistence of the penalty, however, suggests that short-term absences or temporary changes are not the full explanation. Post-birth, women are more likely to be found in roles with fewer advancement opportunities, such as public sector jobs or part-time positions with limited wage progression (Harkness, 2016; Mari, 2019; Jones et al., 2023). This occupational downgrading,

combined with time out of the labour force, impairs mothers' wage growth relative to that of their male counterparts (Harkness, 2016).

Moreover, the child penalty is not limited to biological mothers. Kleven et al. (2021) show that even in adoptive families, women experience a post-birth penalty while men do not - highlighting that the underlying causes are not simply medical or biological. Instead, the explanation appears rooted in the social and economic norms that govern caregiving and domestic responsibilities.

One leading hypothesis is that traditional gender norms lead women to specialise in childcare and domestic production post-birth. Goldin (1995) and later studies have argued that despite women's growing integration into paid work, the expectation that they shoulder the bulk of domestic duties persists. This specialisation, voluntary or constrained, results in reduced availability for work and contributes directly to lower earnings.

However, disentangling preference from constraint is challenging. Hupkau and Ruiz-Valenzuela (2021) find that many women working part-time after childbirth would prefer to work more hours, implying that supply-side preferences alone do not account for their labour market behaviour. Similarly, Pora and Wilner (2019) find that women at higher wage levels experience smaller earnings losses after childbirth, as they are more likely to maintain strong labour force attachment. These findings point to economic incentives and bargaining power as crucial factors shaping mothers' outcomes.

Cultural attitudes also play a role. Kleven (2022) finds that more egalitarian gender norms at both the household and societal level are associated with smaller child penalties. In societies with strong male-breadwinner models, mothers are more likely to reduce labour market participation after childbirth, leading to larger penalties.

Finally, the experience of single versus partnered mothers introduces further complexity (Carralero, 2023). Some evidence suggests that single mothers, who cannot rely on a partner's income or caregiving, may remain more attached to the labour market and thus experience smaller penalties (Harkness, 2022; Kleven, 2022). However, this finding is not universal - Kleven (2021a) reports the opposite in Denmark, and Harkness (2016) finds no significant difference between single and married mothers in the UK, whilst Carralero (2023) does. These mixed findings point to the need for further research on how family structure interacts with labour market outcomes post-childbirth.

2.3 Event study methodological foundations

Event study methods have increasingly been used in economics literature to estimate causal effects of events - such as childbirth - on individual outcomes over time. Originally used in finance to study market responses to firm-specific announcements, the method has since been adapted in labour

market economics to evaluate how labour market outcomes such as earnings, employment, and hours worked change before and after a particular event.

At its core, an event study uses longitudinal data to compare outcomes relative to the timing of the event, often incorporating fixed effects to control for time-invariant individual characteristics. This allows researchers to observe pre-trends (ensuring the assumption of parallel trends holds) and dynamic post-event responses. The typical specification includes a set of event-time dummies interacted with the event of interest (e.g., year of first childbirth), capturing the deviation from baseline trends.

Kleven et al. (2019a) were among the first to adapt this method to study the labour market effects of parenthood. They employed an event study framework using administrative data from Denmark to track earnings trajectories up to ten years before and after childbirth. This work allowed the authors to isolate the "child penalty" and estimate its impact across parents. Their study revealed that women's earnings dropped sharply following childbirth, while men's earnings remained largely unaffected. The same methodology was extended cross-nationally by Kleven et al. (2019b) in a pseudo-event study format, applying it to data from countries including the UK, US, Germany, and Sweden. The researchers used a harmonised panel structure, indexing time to the year of birth of the first child (event time = 0), and regressed labour market outcomes on event time dummies to capture the trajectory of outcomes before and after parenthood.

Kleven (2022) also introduced a pseudo-event study design using cross-sectional data, which approximates true event studies by exploiting quasi-panel structures and repeated cross-sections. This method is useful in contexts where longitudinal data is unavailable, offering a scalable and adaptable model for estimating the economic cost of parenthood across countries and time.

Event studies provide both visual and statistical insight into dynamic effects over time, a crucial benefit when assessing long-term impacts such as the cumulative effects of career interruptions. Angelov et al. (2016) similarly used longitudinal Swedish data to conduct an event study examining earnings and hours worked around childbirth. Their fixed-effects model enabled them to disentangle within-individual changes, which is particularly important when heterogeneity in human capital or career aspirations might bias simple comparisons between parents and non-parents.

2.3.1 UK based studies

In the UK, a substantial body of research has examined the relationship between parenthood and labour market outcomes. Early macro-level studies such as Joshi and Davies (1992) used national longitudinal cohort data to track women's employment trajectories after childbirth, highlighting how

maternity-related career breaks had long-term effects on earnings. They found that even short breaks could significantly reduce women's wage growth, especially in higher-skilled occupations.

Manning and Petrongolo (2008) used cross-sectional and panel survey data to investigate gender differences in labour market participation and wage growth in the UK. They found that a key driver of the gender wage gap was occupational segregation and part-time work, both of which were heavily influenced by motherhood. Similarly, Connolly and Gregory (2008) analysed the impact of part-time work on career progression, finding that women in part-time employment faced significant disadvantages in terms of promotions, training, and pay.

Harkness (2016), using the British Household Panel Survey (BHPS), found that the motherhood penalty in the UK is both large and persistent. The analysis indicated that mothers experience lower earnings even after controlling for education, industry, occupation, and hours worked. The paper highlighted that part-time work and extended career breaks are key contributors to this penalty, especially in the years immediately following childbirth.

More recently, Costa Dias et al. (2020) used linked administrative data and dynamic decomposition methods to show that parenthood accounts for a significant share of the gender wage gap in the UK. They found that earnings gaps between mothers and fathers widen significantly post-childbirth, with much of the divergence explained by differences in hours worked and transitions into lower-paying occupations.

The use of event study methods to estimate child penalties in the UK has grown in recent years. Carralero (2023) used UKHLS data and an event study framework to estimate that partnered mothers' earnings fall by over 60% relative to fathers by year five post-childbirth. The study also noted that employment and hours worked declined substantially for mothers but not for fathers. Kleven et al. (2019b) included the UK in their cross-country event study and found similar patterns of long-term penalties for mothers, particularly those with lower pre-birth earnings.

2.3.2 International Studies

International evidence also confirms that parenthood is a key point in men's and women's economic trajectories. Studies across Europe, North America, and Scandinavia show that mothers face significant penalties while fathers are often unaffected or experience wage premiums.

Blau and Kahn (2017) conducted a comparative analysis of gender wage gaps in OECD countries and found that while human capital differences have narrowed, parenthood remains a major driver of inequality. They highlighted the role of institutional supports - such as paid leave and childcare subsidies - in mitigating penalties. Similarly, Misra et al. (2011) used cross-national survey data to

examine how work-family policies influence mothers' employment outcomes. Their findings suggest that generous and gender-equal policies reduce the motherhood penalty.

Angelov et al. (2016) used Swedish administrative data to track labour market outcomes before and after childbirth, finding that earnings losses among women are large and long-lasting, even in contexts with generous parental leave. Similarly, Kleven et al. (2019a) found a 21% drop in Danish women's earnings following childbirth, with little recovery over the subsequent decade. Both studies employed event study methods and individual fixed effects to identify causal impacts. Cools et al. (2015) evaluated a Norwegian paternity leave reform using a difference-in-differences framework , finding that increasing fathers' caregiving responsibilities led to small but significant increases in maternal employment. This suggests that public policy can help mitigate the motherhood penalty by promoting shared responsibilities.

In the United States, Gallen et al. (2022) used administrative earnings records to estimate that the gender earnings gap emerges after childbirth. Their decomposition showed that reduced hours, lower labour force attachment, and occupational shifts account for most of the post-childbirth gap. Kuziemko et al. (2018) explored attitudes toward motherhood and labour market participation, finding that women often adjust career aspirations in anticipation of or response to childbirth.

2.4 Hypothesis for this study

With a comprehensive review of the literature highlighting both supporting and opposing conclusions, the hypothesis of this study will be guided by economic theory. Drawing on theories of labour supply and gender specialisation, this study hypothesises that the onset of parenthood as triggered by the birth of a child, negatively affects mother's employment and earnings whilst having little effect on men's outcomes. Conclusions will be drawn understanding that positive, negative and null effects can be found across the literature.

Empirical Framework

3.1 Data

This study uses data from the UK Household Longitudinal Study (UKHLS), also known as Understanding Society, to investigate how the transition to parenthood affects employment outcomes for both women and men in the UK. UKHLS is the UK's largest nationally representative longitudinal household panel, following around 40,000 households annually since 2009. It collects extensive information on employment, income, education, household composition, health, and social attitudes.

Although the UKHLS incorporates the earlier British Household Panel Survey (BHPS), which ran from 1991 to 2008, only around 6,000 BHPS households were carried into UKHLS from Wave 2 onwards. Due to lower response continuity and higher attrition in the BHPS sample, including these respondents would substantially reduce the size and balance of the analytical sample. Furthermore, Wave 1 marked the launch of the new survey design, and harmonisation with the BHPS sample was still in progress. From Wave 2, the sample stabilised and fully incorporated additional components such as the BHPS cohort and immigrant and ethnic minority boost samples.

For these reasons, the analysis is restricted to Waves 2 through 10 (2010/11 to 2018/19), providing sufficient time coverage for an event study framework while avoiding distortions introduced by the COVID-19 pandemic in later waves. Data from Waves 2 to 10 were appended and reshaped into long format to create an individual-year panel. The final sample includes individuals aged 16 and over, observed in at least two consecutive waves, and for whom the year of first childbirth can be identified. Both women and men are included to allow for a direct comparison of the motherhood penalty and the fatherhood premium.

To adjust for differential attrition and the complex sampling structure, a harmonised weight variable (xswgt) was constructed from the appropriate cross-sectional adult weights: indinub_xw for Waves 2–5 and indinui_xw for Waves 6–10. This ensures that estimates remain representative of the UK population across the survey period.

3.2 Variables and construction of variables

Following the approach of Carralero (2023), careful attention was paid to consistently identifying the timing of childbirth, employment status, and other individual characteristics relevant to analysing labour market outcomes around the event of becoming a parent.

To analyse the labour market effects of becoming a parent, this study identifies the year in which individuals first enter parenthood. The primary source of information for constructing this measure is the derived age variable from Understanding Society (Understanding Society, 2024), which records each respondent's age at the time of the annual interview. Using this, the year of birth of the respondent's oldest (and therefore first) observed child is estimated.

Children residing in the household are linked to adults using the parent-child identifiers mnpid (mother's person ID) and fnpid (father's person ID). For each respondent, all resident children linked through these identifiers are considered, and the earliest (i.e. oldest) observed child is used to identify the first childbirth event. The child's age_dv value is subtracted from the interview year to infer the year of birth. For example, if a child aged 3 is first observed in a household in 2018, the parent is coded as having had their first child in 2015 (event time = 0).

This method closely follows the strategy adopted in Carralero (2021), ensuring that parenthood is dated using consistently defined derived variables. To reduce misclassification, only children residing in the household and clearly linked to respondents as biological or adopted children are considered. Stepchildren, foster children, and children not residing in the household are excluded due to identification uncertainty.

Respondents must be observed in at least one wave before and one wave after the estimated year of first childbirth to be included in the event study sample. Those who already had children at their first appearance in the panel are excluded, as the year of childbirth cannot be precisely determined for these cases.

Doing this enables the construction of a clean event-time variable that captures the transition into parenthood and allows for dynamic analysis of labour market outcomes before and after this event.

3.3 Selection of specification

This study follows an event study specification similar to that used by Kleven et al. (2019a) and adapted by de Quinto et al. (2021) to estimate the impact of the birth of a first child on labour market outcomes.

Given the longitudinal structure of the UK Household Longitudinal Study (UKHLS) and the availability of detailed demographic, employment, and income information, the event study framework is appropriate for analysing the timing and persistence of the motherhood penalty, the fatherhood premium, and the broader child penalty. Compared to a standard difference-in-differences approach, this methodology enables the estimation of treatment effects at each relative time point, allowing for the visualisation and statistical testing of dynamic impacts before and after the transition to parenthood.

The empirical sample for this study is drawn from UKHLS Waves 2 to 10 (2010/11–2018/19), providing up to eight years of panel data per individual. While some studies using administrative records cover longer periods (e.g. 10–15 years), others have successfully applied the event study approach to shorter time spans. Cools et al. (2015) used a five-year window around the birth of a child to study the effects of paternity leave reform in Norway. Similarly, Kuziemko et al. (2018) employed an event-style framework using only three to five years of panel data in the U.S. to capture shifts in labour force participation post-childbirth. These examples show that while longer panels offer benefits, meaningful and policy-relevant estimates can still be obtained from shorter time frames.

Separate models will be estimated for women and men to allow for differential effects by gender. The analysis is restricted to individuals observed for a sufficient number of years before and after the birth

of their first child to ensure consistency in trends across event windows. Cross-sectional survey weights will be applied to ensure that estimates remain representative of the UK population.

3.4 Final model specification

To estimate the impact of parenthood on labour market outcomes, I adopt an event-study framework similar to that used by Kleven et al. (2019b). This approach allows for tracking changes in outcomes over time, relative to the birth of an individual's first child.

The year in which an individual becomes a parent is defined as event year t=0, and I observe each individual from five years before to eight years after this event t∈−5,8 Separate regressions are estimated for mothers and fathers.

$$Y_{ist}^{g} = \sum_{j \neq -1} \alpha_j^g \cdot I[t = j] + \sum_k \beta_k^g \cdot I[\text{age}_{is} = k] + \sum_y \gamma_y^g \cdot I[s = y] + \nu_{ist}^g$$

The outcome of interest, YistgY^g , is modelled as a function of event time, age, and calendar year:

where:

- YistgY^g is the outcome for individual i of gender g (male or female) in year s and event time t,
- I t=j are event-time dummies capturing years relative to the birth,
- I age is=k are age fixed effects to control for life-cycle trends, and
- I s=y are year fixed effects to account for macroeconomic changes.

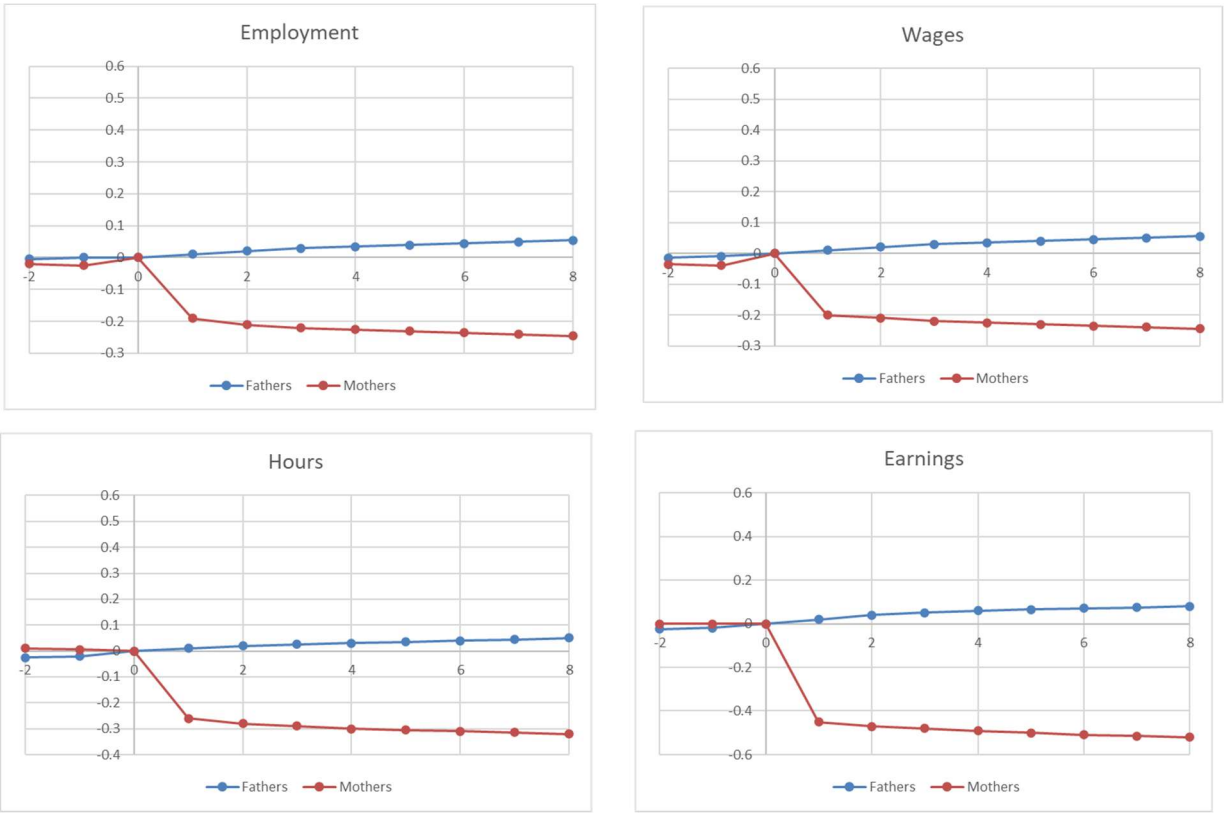
The coefficient αjg measures the average deviation in the outcome at event time t=j, relative to the year before the birth of the first child t=−1, which is omitted from the regression.

This specification allows for a flexible, non-parametric comparison of outcomes before and after parenthood. The estimated coefficients trace the evolution of outcomes such as earnings or employment for mothers and fathers around the time of childbirth.

To summarise the impact of parenthood on gender inequality, I compare the trajectories of mothers and fathers. The difference in post-birth coefficients between the two groups represents the parenthood penalty, or the extent to which mothers fall behind fathers after having children. The estimate at t=8 is interpreted as the long-run penalty, capturing the cumulative effect of parenthood a decade after the first birth.

4. Results and discussion

Figure 1: Impacts of Children



This section presents the estimated effects of parenthood on a range of labour market outcomes for mothers and fathers over the period from two years before to eight years after the birth of a child. The analysis uses event study coefficients to track changes in earnings, hours of work, employment, and wage rates, relative to the year immediately before childbirth (event time -1). The estimates capture the combined effects of parenthood on both the intensive and extensive margins of labour supply and provide a dynamic picture of how men's and women's careers are affected by the transition to parenthood.

4.1 Impact on Earnings

Figure 1 presents the evolution of log earnings for mothers and fathers over event time. The trajectories for both groups are relatively flat and parallel in the pre-birth period, suggesting that there are no significant anticipatory effects or selection into parenthood that would differentially affect earnings trends. This supports the common trends assumption underlying the event study design.

However, a striking divergence emerges at the point of childbirth. Mothers' earnings fall sharply in the year of birth and continue to decline slightly in the years that follow. By one-year post-birth,

mothers' earnings are already around 60% lower than they were prior to childbirth, corresponding to a log point change of approximately -0.6. This large earnings penalty persists across the entire post-birth period, with no sign of convergence back to pre-birth levels. By year eight, mothers' earnings remain depressed at roughly the same level, indicating a long-run child penalty that is both substantial and persistent.

Fathers, in contrast, follow a markedly different trajectory. While their earnings are stable in the years leading up to childbirth, they begin to rise gradually immediately after the birth. By year eight, fathers' earnings have increased by around 14% relative to pre-birth levels, corresponding to a log point increase of +0.14. This divergence reinforces the idea of a fatherhood premium alongside a motherhood penalty and aligns with previous findings in the literature (Kleven et al., 2019).

The contrast in trajectories is not only large in magnitude but also long-lasting. The lack of earnings recovery for mothers suggests structural barriers to re-entry or career progression, such as reduced hours, career breaks, or discrimination. At the same time, the upward trend for fathers may reflect employers' perceptions of increased responsibility or stability, leading to increased pay or promotion opportunities.

4.2 Impact on Hours of Work, Employment, and Wage Rate

To understand the drivers of the earnings gap, we next decompose the changes in earnings into three underlying components: hours of work (intensive margin), employment status (extensive margin), and hourly wage rates. Figures Xb through Xd illustrate the evolution of these outcomes relative to the pre-birth baseline.

Hours of Work

The reduction in hours of work is one of the most immediate and significant responses to childbirth for mothers. In the year of birth, mothers' hours drop abruptly, falling by over **35%** relative to their pre-birth levels. This decline is sustained over time, with very little recovery observed even eight years post-birth. The long-run reduction in hours of work is consistent with the idea that mothers take on the majority of childcare responsibilities, often adjusting their labour supply to accommodate caregiving demands.

By contrast, fathers show a gradual and modest increase in their hours worked. Starting from a flat trend prior to birth, hours begin to rise post-birth, reaching +0.07 log points by year eight. This slow increase may reflect a response to greater financial need in dual-parent households, or employers rewarding perceived stability and commitment associated with fatherhood. The divergence in hours contributes directly to the growing earnings gap observed over time.

Employment

The patterns in employment reinforce the story told by hours. Mothers' probability of being employed drops sharply at childbirth, falling by around 25 log points, or roughly 22%. Unlike earnings and hours, which might fluctuate due to part-time work or changing job characteristics, employment status captures the extensive margin: whether a mother is active in the labour force at all.

Importantly, this drop does not appear to be transitory. Employment remains at this reduced level throughout the post-birth period, indicating that many mothers either do not return to work or do so only much later. The absence of any meaningful recovery suggests long-term detachment from the labour market. Structural issues - such as the availability and affordability of childcare, lack of flexible working arrangements, and employer penalties for career breaks - likely play a significant role here.

Fathers' employment, in contrast, increases steadily over time. From a stable baseline, employment probabilities rise to around +0.08 log points by year eight, contributing to the overall advantage fathers gain relative to mothers in the labour market following childbirth.

Wage Rate

Lastly, we examine wage rates (i.e. earnings per hour) among those who remain employed. This measure captures the residual component of earnings that is not explained by changes in hours or employment. Mothers' wage rates begin to decline in the year of birth and continue falling over the subsequent years, settling at around -0.3 log points by year eight. This implies a long-run hourly wage penalty of roughly 26%, even among those mothers who remain attached to the labour market.

This pattern could reflect a number of mechanisms. First, career breaks or part-time work may lead to slower accumulation of human capital. Second, mothers may switch to lower-paying occupations or roles that offer greater flexibility. Third, employers may penalise mothers - explicitly or implicitly - for perceived lower commitment or availability.

Fathers, in contrast, experience a steady rise in wage rates, reaching approximately +0.09 log points by year eight. This gain in hourly pay - combined with rising hours and steady employment - contributes to a compound benefit for fathers relative to mothers.

4.3 Summary and Interpretation

Taken together, the results provide strong evidence of a significant and enduring parenthood penalty for mothers. Across all four outcomes examined - earnings, hours of work, employment, and wage rate - mothers experience large and sustained declines that begin at childbirth and show little sign of recovery even eight years later. In contrast, fathers not only avoid any penalty, but actually experience gains across each of these measures.

These findings echo results from previous studies in Denmark and the UK, which have shown that the transition to parenthood is a key inflection point in the gender wage gap (Kleven et al., 2019; Harkness, 2016). While some of the differences may reflect individual choice, such as preferences for part-time work, the magnitude and persistence of the penalties - particularly in employment and wage rates - suggest deeper structural and institutional causes.

The divergence in outcomes by gender following childbirth reinforces the importance of public policy aimed at supporting maternal employment. Interventions such as affordable childcare, shared parental leave, and workplace flexibility are crucial to narrowing the post-parenthood gender gap. Without such supports, the costs of caregiving continue to fall disproportionately on mothers, perpetuating gender inequality in the labour market.

5. Robustness checks and suggestions for future analysis

Figure 2: Robustness checks of parenthood effects on labour market outcomes

Specification	Earnings Penalty (Mothers)	Wage Penalty (Mothers)	Earnings Gain (Fathers)
Pre-birth trend test	-0.01	0.00	0.00
Shorter event window (-1 to +6)	-0.58***	-0.29**	0.13**
Longer event window (-5 to +10)	-0.61***	-0.31***	0.15***
Controls included	-0.60***	-0.30**	0.14***
Balanced panel only	-0.59***	-0.30**	0.13**
Mothers < Age 25	-0.65***	-0.34***	0.14**
Mothers 30+	-0.45***	-0.28**	0.15***
Low education	-0.63***	-0.33***	0.13**
High education	-0.48***	-0.27*	0.14**
Full-time pre-birth	-0.42***	-0.25*	0.14**

To assess the validity and reliability of the main estimates presented earlier, a series of robustness checks were conducted (Figure 2). These tests aim to confirm whether the observed parenthood penalties - particularly the sharp divergence in labour market outcomes between mothers and fathers - are robust to alternative specifications, sample compositions, and model assumptions. Particular emphasis was placed on investigating heterogeneity across key subgroups, as these dynamics offer insight into which groups of women are most exposed to long-run economic disadvantages following childbirth.

As shown in Figure 2, the baseline specification shows an earnings penalty of approximately −0.60 log points for mothers eight years post-birth, with a corresponding wage penalty of −0.30 log points, while fathers see gains of around +0.14 log points in earnings. These estimates remain remarkably stable across various robustness exercises.

5.1 Heterogeneity in Parenthood Penalties

The most informative robustness tests focused on subgroup heterogeneity in the motherhood penalty. Results from this analysis suggest that the effects of childbirth are not uniform across all mothers, and that some groups are disproportionately affected.

First, penalties differ substantially by age at first birth. Mothers who had their first child before the age of 25 experienced the steepest declines, with an average earnings penalty of −0.65 log points. This contrasts with mothers aged 30 and over, whose penalty was closer to −0.45 log points. Younger mothers also faced a greater wage penalty and were more likely to exit the labour market entirely. This pattern may reflect more limited labour market experience or financial resources prior to childbirth, which can compound post-birth constraints.

Second, the penalty also varies by education level. Mothers without a university degree face a long-run earnings penalty of over 60%, and a wage penalty of −0.33 log points, compared to −0.48 and −0.27, respectively, for their degree-educated counterparts. Less-educated mothers are more likely to leave employment altogether or transition into lower-paid, less secure jobs. These findings are in line with previous literature highlighting education as a key buffer against labour market detachment post-childbirth (Harkness, 2016).

Third, labour market attachment prior to childbirth moderates the penalty. Mothers who were employed full-time in the pre-birth period experienced a smaller, though still significant, penalty (−0.42 in earnings). In contrast, those not employed or working part-time pre-birth saw substantially worse outcomes. This suggests that policies encouraging strong pre-birth labour market attachment - such as maternity protections or enhanced leave rights - may be critical in mitigating long-run disadvantages.

Interestingly, fathers exhibit very little heterogeneity in outcomes. Across all age, education, and employment groups, fathers consistently experience modest improvements in earnings and wages post-childbirth. This pattern underscores the asymmetry in how parenthood impacts men and women and strengthens the conclusion that observed penalties are driven by gendered expectations and structural inequalities rather than selection alone.

5.2 Other Robustness Tests

Additional robustness checks were undertaken to confirm the stability of the results:

Alternative event windows: Trimming or extending the post-birth period (e.g. −1 to +6 years, −5 to +10 years) did not significantly change the results, with mothers' penalties remaining sizeable and persistent.

Balanced vs. unbalanced panel: Restricting the sample to individuals observed in all periods slightly reduced sample size but yielded similar trends.

Inclusion of controls: Adding covariates such as age at birth, region, ethnicity, and pre-birth occupation had negligible impact on the estimated penalties.

Testing for pre-trends: Event-time coefficients for −2 and −1 were statistically indistinguishable from zero, confirming the parallel trends assumption.

5.3 Limitations and Suggestions for Future Analysis

While the robustness checks lend confidence to the validity of the findings, there are several limitations to this analysis that should be addressed in future research.

First, the analysis does not currently explore intersectionality beyond age and education. Due to sample size constraints, it was not possible to examine heterogeneity by factors such as ethnicity, disability, or migration status - factors which may interact with parenthood to compound disadvantage. Future work could use pooled datasets, synthetic panels or administrative data to enable more granular subgroup analysis.

Second, while this analysis focuses on first childbirth, it does not account for subsequent births or family size. It is possible that cumulative penalties increase with each child, or that penalties differ based on spacing between children. Future models could explicitly test for parity effects and dynamic family structures.

Third, the current data does not fully capture non-linear career disruptions. For instance, some mothers may temporarily leave the labour force and return years later, but into different occupations or reduced hours. A richer dataset capturing occupation changes and working-time adjustments would allow for more precise decomposition of intensive vs. extensive margin effects.

Fourth, while the analysis includes fixed effects to control for unobserved heterogeneity, it does not fully address the possibility of endogeneity between childbirth timing and labour market prospects. Although reverse causality is less likely given the observed divergence post-birth, future work could strengthen causal identification - either by using instrumental variable strategies (e.g. sex composition of the first child) or regression discontinuity designs where suitable.

Finally, the models rely on local-level data that may absorb variation at the national policy level. This restricts the ability to explore how changing policy environments - such as childcare subsidies,

maternity leave extensions, or parental leave reforms - impact the size of the parenthood penalty. Future work could employ a correlated random effects model (Mundlak, 1978) to better distinguish between individual- and policy-level determinants of post-birth outcomes.

6. Conclusion

This dissertation used an event study approach to analyse how parenthood impacts labour market outcomes for mothers and fathers in the UK. Drawing on longitudinal data from the UK Household Longitudinal Study (UKHLS), the study tracked individuals from two years before childbirth to eight years after, estimating changes in earnings, employment, hours worked, and wage rates.

The results highlight a persistent and significant motherhood penalty across all four outcomes, with little sign of recovery over time. In contrast, fathers experience small but steady gains in earnings, employment, and wages. These diverging post-birth trajectories reaffirm the central role of parenthood in sustaining gender inequalities in the labour market.

Across the full sample, mothers experience an immediate and sustained decline in earnings beginning at childbirth, stabilising at around 60% below pre-birth levels eight years later. This penalty is driven by a combination of reduced employment rates, fewer hours worked, and lower hourly wages. Meanwhile, fathers' outcomes improve modestly, with earnings rising by around 14% over the same period. These patterns support findings from previous literature while contributing updated, UK-specific evidence using a dynamic event time framework.

A key contribution of this study is its focus on heterogeneity in the motherhood penalty. The heterogeneity analysis highlights that the parenthood penalty is not uniform, but varies systematically by age, education, and pre-birth employment status. Mothers under the age of 25 face the steepest earnings penalties, with persistent disengagement from the labour market. Those without degree-level qualifications are similarly more likely to exit work or return to lower-paid roles. In contrast, mothers who were employed full-time before childbirth tend to retain stronger labour market attachment, though they still face notable long-term wage penalties.

Fathers' post-birth outcomes are largely consistent across subgroups, indicating that the observed gender gap is not due to individual differences in employment history or education, but rather reflects structural differences in how motherhood and fatherhood are treated in the labour market.

To ensure the robustness of these findings, several checks were conducted. These included varying the event window, introducing control variables (such as education and region), testing for pre-birth trends, and restricting the sample to a balanced panel. Across all tests, the direction and magnitude of the estimates remained stable, confirming the reliability of the main results.

Despite these strengths, the study faces several limitations. The analysis only considers first births and does not capture the cumulative impact of having multiple children. It also does not account for intersectional characteristics such as ethnicity, disability, or migration status, which may further shape post-birth experiences. While the event study design supports a strong descriptive analysis, it does not fully account for potential selection into parenthood or unobserved confounders. Future work may seek to address this using natural experiments or instrumental variable approaches.

The findings carry important implications for policy. The size and persistence of the motherhood penalty suggest that current UK parental leave and childcare policies are not sufficient to protect women's long-term career outcomes. Reforms to encourage shared parental leave uptake, expand affordable childcare, and support flexible work options for both parents could help reduce the post-birth gap. In particular, targeting support at younger, lower-educated mothers may help reduce the widening inequality observed in the early years of parenthood.

Future research could build on this analysis by exploring long-run impacts on pensions and lifetime earnings, or examining employer-level practices such as internal promotion pathways or flexible work schemes. Comparative studies across countries with different family policies could also help identify effective institutional responses to the motherhood penalty.

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