Child penalties on single mother's labour market outcomes: Evidence from the United Kingdom

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Abstract

What are the mechanisms underlying the child penalty? Is it a result of gendered roles, with women primarily focusing on domestic responsibilities and men engaging in the labour market? If so, how does this dynamic change when one single individual must assume both the provider and caregiver roles? This study aims to fill a gap in existing literature on gender equality by examining the impact of having a first child on the labour market outcomes of single mothers.

Taking an event study approach and using the British Household Panel Survey (1991-2009), this study sheds light on the intricate relationship between fertility and gender inequality by exploring the different dynamics of the child penalty for single and partnered mothers in the United Kingdom. In doing so, it contributes to a deeper understanding of the challenges faced by mothers in achieving gender equality in the labour market.

The findings indicate that the birth of their first child appears to generate a lasting gender gap in earnings for both groups of mothers, driven by the effect on hours of work, employment rates, and wage rates. However, contrary to initial predictions, there are no statistically significant differences in the way single and partnered mothers' labour market outcomes are affected by the arrival of their first child. While partnered mothers encounter a long-term child penalty on earnings amounting to 49% and single mothers face a penalty of 37%, the difference between these two groups is not statistically significant.

1 Introduction

Over the past few decades, there has been significant progress in narrowing the gender wage gap across all countries. However, even in the most egalitarian societies, women continue to face numerous challenges in the labour market and the gap has not been closed yet. Recent research has focused on the effect of children as a contributing factor to the persisting wage gap. The results consistently indicate that prior to having their first child, both women and men experience similar trends in their labour market trajectories. However, shortly after the birth of their first child, their paths diverge as a result of the negative impact of maternity on women's careers. Various mechanisms have been proposed to explain these findings, including the cost of childbirth, preferences for childcare, comparative advantages in the labour market or household work, discrimination, and traditional gender norms (Nix and Andresen, 2019; Pora and Wilner, 2019; Oesch et al., 2017; Kleven, 2022).

Taking into account the different challenges faced by single and partnered mothers, this study aims to uncover the underlying mechanisms that generate the child penalty in these distinct contexts. Understanding these differences is crucial for policymakers to create supportive environments to mitigate the negative effects of motherhood which would, ultimately, help close the remaining gender wage gap.

While the negative impact of motherhood on women's careers has been well-documented, there is a notable gap in understanding the specific challenges faced by single mothers in the labour market. The modernisation of societies has led to changes in household composition all over the world. The decline in marriage rates and the increase in divorce rates have resulted in a growing number of single-parent households. As of 2021, there were approximately 1.8 million lone-parent families with dependent children in the United Kingdom, accounting for 23% of all families. Moreover, in a country such as the United Kingdom, that has a lack of specific support for single parents, these families find themselves in precarious situations. Lone-parent households have exceptionally high rates of in-work poverty and are at a high risk of poverty. In 2021, 44% of children from these households were living in relative poverty in the United Kingdom.

Adopting an event study approach around the birth of the first child, this study examines the impact of children on the labour market trajectories of both single and partnered women, relative to men. Using data from the British Household Panel Survey from 1991 until 2009, I

find that women and men follow similar earning paths until the arrival of their first child, when they immediately start to diverge. Ten years after childbirth, there are no signs of convergence. This penalty is also found on labour force participation, hours of work, and the wage rate.

However, contrary to initial expectations, there are no statistically significant differences in the way motherhood affects the labour market trajectories of single and partnered women. The long-run child penalty on earnings for single mothers is 37%, whereas that of partnered mothers is 49%.

This paper is structured as follows. Section 2 reviews the literature on child penalties. Section 3 presents detailed information about lone-parent households in the United Kingdom, highlighting the unique challenges they face and discussing the policies implemented to support them. Section 4 describes the data used in the analysis, including an explanation about the sample identification and the outcome variables. Section 5 describes the empirical design employed to analyse the impact of having a first child on single and partnered mothers' labour market outcomes. Section 6 presents the results. Section 7 gives a possible explanation for the results obtained and discuss what road future research should take. Finally, Section 8 offers a concise summary of the key findings and highlights the contributions made by the study.

2 Literature review

The negative impact that the arrival of a first child has on women's career prospects in the labour market, compared to the lack of impact on men's, is a well-established fact in the literature on gender and the labour market. This phenomenon, commonly referred to as the 'child penalty', is a widespread concern globally, observed in both developed and developing countries (Kleven et al., 2019a). It has been identified as a contributing factor to the persistent earnings and wage gender gap. While earlier research focused on the role of human capital and discrimination, the increasing educational attainment of women and the implementation of numerous policies to address gender discrimination in recent decades suggest that the explanation for the remaining inequality lies elsewhere. Understanding the role of children is crucial in comprehending gender inequality in the labour market.

There are two main ways in which children can have an effect on women's labour market outcomes. Both of them have an undoubtedly negative impact on women's earnings and contribute to the gender wage gap.

The first effect is through intended fertility. Women with different levels of fertility tend to pursue different occupations. More family-oriented women will choose a family-friendly career in anticipation of motherhood in an effort to minimise the opportunity cost of raising their children. Adda et al. (2017) found that, in fact, women who expect to remain childless are less inclined to work in routine and manual occupations, and instead, they show a greater inclination to work in abstract occupations.[1] Given that those working in abstract occupations generally earn higher wages from the beginning, and experience more significant wage growth over time, the career paths of women who opt out of these occupations in anticipation of starting a family are affected even before their child is born.

Besides, even for women who make their labour market decisions without considering future motherhood, children will still affect their labour market trajectory through realised fertility. With the arrival of the first child, many women make changes to their working hours, occupation, and sector in order to adapt their lives to their new childcare-related responsibilities (Nielsen et al., 2004; Kleven et al., 2019b; Sieppi and Pehkonen, 2019).

Kleven et al. (2019b) define the 'child penalty' as "the percentage by which women fall behind men due to children". They find an immediate decline in women's earnings upon becoming mothers, while men's earnings remain unaffected by their new role as fathers. What is even more concerning is that, even ten years following the birth of their first child, women's earnings are still below their pre-child level. This phenomenon stems from the negative impact of motherhood on various factors, including working hours, labour force participation, and wage rates. Furthermore, following the arrival of the first child, women are less likely to progress into managerial positions and are more inclined to work in the public sector or family-friendly firms. These choices, in turn, are negatively associated with wage rates.

Numerous studies have adopted this methodology to estimate child penalties for other countries. Table 1 presents the long-term earning penalties that have been studied using the event study approach proposed by (Kleven et al., 2019b). These penalties are primarily attributed to motherhood, rather than marriage or pregnancy, as mothers adjust their labour market decisions following the birth of their first child (Berniell et al., 2022). The existence of significant and persistent child penalties is a widespread phenomenon across all countries, although the extent of the effect varies. The Scandinavian countries and Spain exhibit the

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[1] Routine occupations are characterised by stable skill requirements over time (e.g., salespeople, sewers), while the requirements for abstract tasks are likely to change at a faster pace (e.g., office clerks, bank specialists, accountants). Manual occupations fall in-between (e.g., nurses, hairdressers, consultation hour assistants).

lowest penalties, followed closely by United States and France. In contrast, the United Kingdom and the Netherlands experience substantial penalties, but the highest ones are observed in the German-speaking countries.

Table 1: Long-run earning penalties

Country	Long-run penalty
Denmark	21%
Finland	25%
Sweden	27%
Spain	28%
United States	31%
France	32%
United Kingdom	44%
Netherlands	46%
Austria	51%
Germany	61%

Note: The long-run penalty is defined as the average penalty from event time 5 to 10. For Netherlands, it corresponds to the penalty 7 years after the birth of the child. For Spain, the long-run effect is the impact 10 years after.
Source: Own elaboration using the results from Kleven et al. (2019a) for Denmark, Sweden, United States, United Kingdom, Austria and Germany; de Quinto et al. (2021) for Spain; Rabaté and Rellstab (2021) for the Netherlands; Sieppi and Pehkonen (2019) for Finland; and Meurs and Porra (2019) for France.

What underlies this phenomenon? What are the underlying mechanisms behind the significant and persistent child penalties? One might consider the biological aspect of childbirth. Postpartum complications and changes in women's family versus career preferences could potentially account for the observed results. However, the fact that this child penalty also applies to adoptive families suggests otherwise (Kleven et al., 2021).

The arrival of a child increases the need for domestic work due to the introduction of childcare responsibilities. A growing body of research attributes the child penalty to women's attempt to balance work and family life. During the industrial revolution, women were confined to work within the household (Goldin, 1995). The modernisation of societies gradually allowed women to enter the labour market, yet the prevailing gender norm in most countries still places the main responsibility for childcare and household duties on women.

Women specializing in domestic work after the birth of their first child, prioritizing family

life over their career in the labour market, could be the underlying mechanism that leads to a decrease in female labour supply and earnings following motherhood. But what factors contribute to women choosing to specialize in domestic work? Is it a matter of relative advantage, stronger preferences for childcare, or societal norms? Disentangling this relationship is crucial for designing public policies to address gender inequality.

Hupkau and Ruiz-Valenzuela (2021) show that women with children under 15 in Spain are more likely to work part-time compared to their male counterparts. However, a significant proportion of them express a desire to work more hours, indicating that preferences alone fail to explain the remaining gender gap.[2]

There is evidence supporting both gender norms and specialization as contributing factors. Kleven (2022) finds that increasing the acceptance of less traditional gender norms reduces child penalties in terms of employment and earnings. Pora and Wilner (2019)'s findings are consistent with the specialization channel: women at higher wage levels experience smaller earnings losses as they are less likely to interrupt their careers or reduce their working hours.

Although these two explanations are often seen as distinct channels, traditional gender norms may underpin the specialization of women in domestic work. This thesis explores that idea. Despite the rapid increase in evidence in this line of literature, there is a lack of studies examining the differences in child penalties based on the parent's marital status.

Differences between partnered and single-parent households can result in varying impacts of parenthood. Kiernan et al. (2020) show that, on average, single mothers are younger, less educated, and less likely to be employed, which ultimately implies that they have lower income than married mothers at the time of childbirth. This puts them in a disadvantaged position even before entering motherhood.

Furthermore, couples can take advantage of economies of scale resulting from living together, such as sharing public goods, reducing household production costs, or benefiting from bulk discounts in purchases (Nelson, 1988). Additionally, they benefit from the economic advantage of income pooling (Bonke, 2013; Kenney, 2004).[3]

Nevertheless, single parents do not have the option of specializing in either the labour market or home production, as they have to assume both the roles of breadwinner and caregiver.[4]

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[2]More than one third of mothers that work part-time with children under age 5 and more than half with children aged 5 to 15 express their desire to work more hours.

[3]Income pooling is known as the idea that all individual sources of income from each member of the household is combined and used for both common and individual expenditures.

[4]In this context, when referring to single parents, I am specifically addressing those that have never been married before. The dynamics may differ for single parents who are divorced or separated, as they may still have

Therefore, single mothers may be more inclined to remain connected to the labour market in order to fulfill such responsibilities, and thus, they may be less affected by motherhood compared to partnered couples.

In this regard, the scarce evidence is inconclusive. For the United States, Harkness (2022) and Kleven (2022) find lower child penalties for single mothers compared to married mothers. Interestingly, the penalties appear to be more pronounced for those who were previously married than for those who were not married in the first place. This suggests that the traditional gender roles regarding who must assume each role in the family are closely linked to marriage, and are disconnected from the gender of the parent in single-parent households. However, in the case of Danish single mothers,the child penalty is significantly larger than for their married counterparts (Kleven, 2021a). Moreover, using a fixed-effect model, Harkness (2016) finds that single and married mothers in the United Kingdom experience similar effects on their labour market outcomes as a result of motherhood.

This paper will contribute to the existing literature on child penalties by examining the impact of having a child in a context where parents lacks the option to specialize in either home production or labour market. Studying the effect of motherhood on single-mother's labour market outcomes is crucial in order to establish appropriate policies to support these households.

3 Context in the United Kingdom

3.1 Divorce and lone-parent households

One global tendency is evident across all countries. Households are becoming more diverse as they transition from traditional to modern family structures. The traditional family, characterised by a married man and woman raising their children together following a religious ceremony, has declined in popularity in recent decades. Instead, other types of families have become more prevalent, such as couples married through a civil wedding, couples living under cohabitation, lone-parent households, and same-sex marriages.

Many researchers have attributed this fact to the secularization phenomenon (González and Requena, 2008; Fisher, 2017).[5] The proportion of people identifying as Christians in the United Kingdom has experienced a decreasing trend in the last decades, while the proportion of those

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a partner who can provide financial support and assist with childcare responsibilities.

[5]Secularization refers to the process by which religion loses its social significance as society progresses (Wilson and Bruce, 2016).

with no religious affiliation has significantly increased. In the 1980s, over 60% of the population identified themselves as Christians, compared to a 30% who identified as non-religious. By 2018, these rates had shifted to 38% and 52%, respectively (Curtice et al., 2019).

Moreover, another common trend observed worldwide over the past few decades is the decline in marriage rates and the increase in divorce rates (Ortiz-Ospina and Roser, 2020). Figure 1 illustrates the crude marriage and divorce rates in the United Kingdom from 1960 to 2020.[6] The marriage rate has consistently decreased throughout the period and is currently at its lowest point. While the divorce rate has generally increased, there has been a slight decline since the 1990s. This is primarily due to a significant decline of the marriage population rather than a reduction in the risk of divorce (Chen and Yip, 2018).

Figure 1: Crude marriage and divorce rates in the United Kingdom (1960-2020)
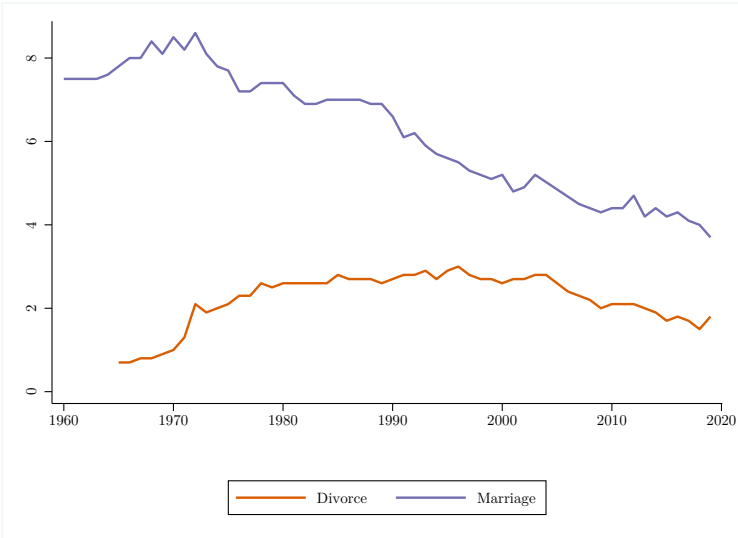
Note: Crude marriage rate is defined as the number of marriages during a given year per 1000 people. The crude divorce rate is defined as the number of divorces during a given year per 1000 people. Both statistics are based on civil registration.
Source: Authors' elaboration, using data from the OECD.

According to the OECD Family Database, 61,1% of divorces involved children.[7] Consequently, the number of lone-parent households has increased. While most single parents have never been married (57%), a significant proportion of them became single parents as a result of divorce or

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[6]The crude marriage rate is defined as the number of marriages per 1000 people, and the crude divorce rate is defined as the number of divorces per 1000 people. The statistics on marriage and divorce are based on civil registration.

[7]A children is considered involved when they are under 18 and depend on either of the parties to a divorce at the time the petition for divorce is filed. Children from any previous partnership are also included.

separation from their partner (38%) (Dixon et al., 2023).

In 2021, there were around 1.8 million of lone parent families with dependent children in the United Kingdom.[8] They account for 23% of all families with dependent children, making lone parent households the second most common type of family with children. As shown in Figure 2, this rate has remained stable for two decades. Women head nine out of ten single-parent households, a proportion that has been constant over time (Figure 3).

**Figure 2:** Number of families with dependent children by family type (1996-2021)
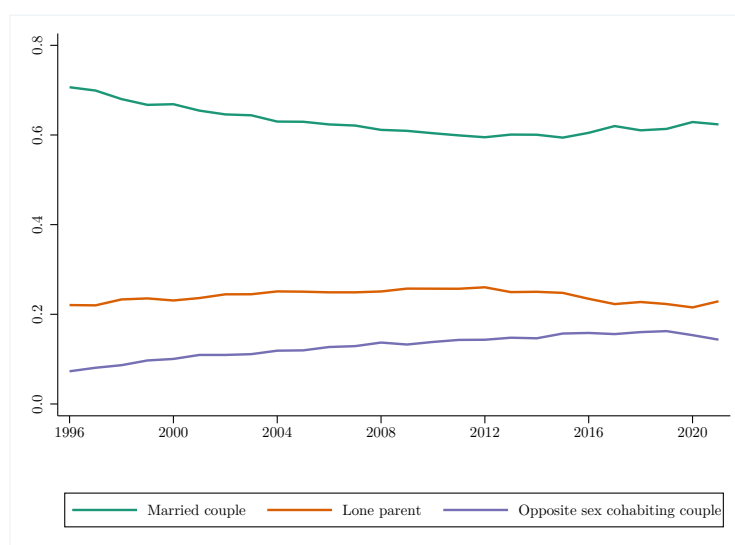
Note: Number of families (thousands) living with dependent children. Dependent children are living with their parent(s) that are aged under 16, or aged between 16 and 18 but are in full-time education. Children aged 16-18 that have a spouse, partner, or a child living in the household are exluded.
Source: Authors' elaboration, using data from the Office of National Statistics's *Families and households* dataset.

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[8]This definition of lone parents includes situations in which the child has contact and/or partly resides with their other parent, and situations where the child resides with only one parent. Dependent children are defined as those aged under 16, or between 16 and 18 but are in full-time education and living with their parent.

Figure 3: Proportion of lone families by sex of the parent (1996-2020)
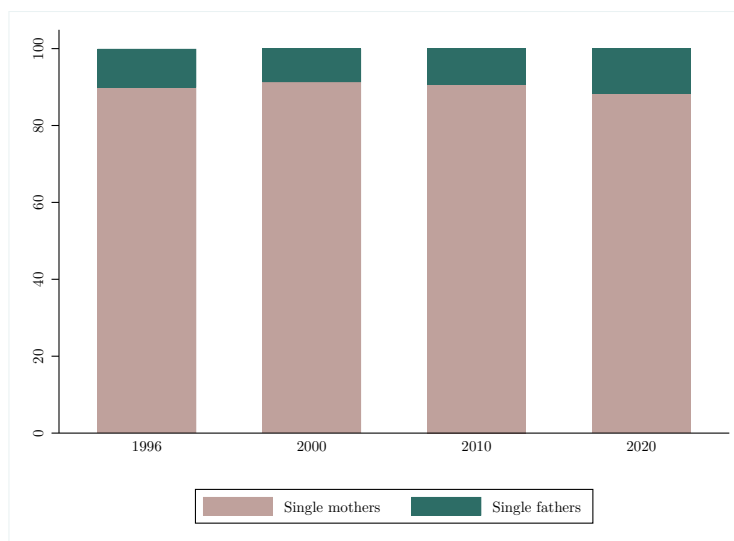
Source: Authors' elaboration, using data from the Office of National Statistics's *Families and households* dataset.

3.2 The challenge of single-parenting

The sexual division of labour between household and market activities has been extensively studied in the family economics literature. Historically, the main explanation for this phenomenon has been that of the comparative advantage, whereby women's innate ability for childbearing leads them to specialize in household work, while men focus on the labour market (Becker, 1981). However, recent research suggests that comparative advantage plays a smaller role in the gendered division of labour than previously believed, and social norms appear to be the driving force behind this division (Bertrand et al., 2013; Siminski and Yetsenga, 2022). If traditional gender stereotypes are fully internalised, people's preferences and behaviour can be influenced and shaped by such norms (Bertrand, 2020).

The overall maternal employment rate in the United Kingdom has shown a positive trend in recent years. However, there have been significant differences in employment rates based on partnership status, and which now appear to be decreasing. The gap between the maternal employment rates of single and partnered women has significantly narrowed over the past two decades (Figure 4). Two factors contribute to this finding: a slowdown in the employment rates of partnered mothers and a substantial increase in the employment rates of single mothers. The employment rates of partnered mothers have grown by 11.9% over the last two decades, rising from 68.22% in 1999 to 76.34% in 2019. In contrast, the employment rates of single mother's

have experienced a much stronger growth, increasing from 44.17% in 1999 to 67.40% twenty years later, representing a growth rate of 52.59%.

Figure 4: Maternal employment rates in the United Kingdom (1999-2019)
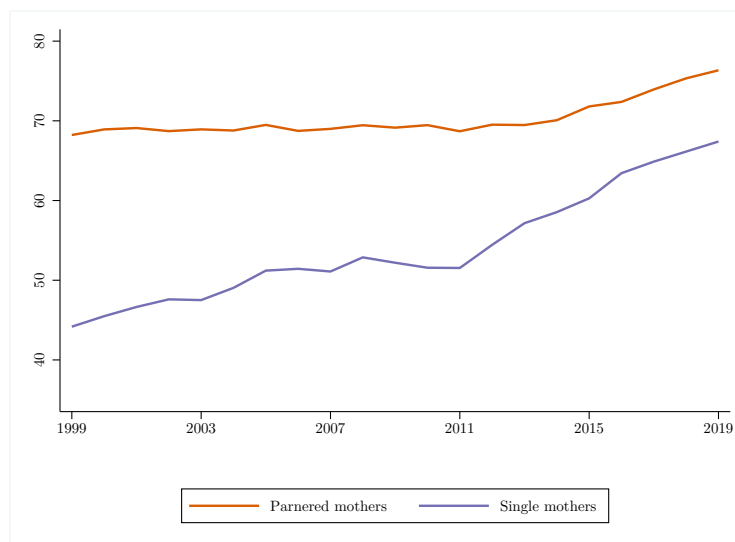
Note: Employment rates for 15-64 years old partnered and single women with at least one child aged 0-14. Partnered women are defined as those who live in the same household as a spouse or cohabiting partner. Single women are defined as those without a spouse or cohabiting partner in the same household. Only woman with children that live in the same household and are reported their own (including biological, step, or adoptive children) are included.
Source: Authors' elaboration, using the OECD Family Database.

The presence (or lack thereof) of a partner appears to be one of the most crucial factors influencing mothers' decision regarding the labour market. Lone parenting removes the option of sharing responsibilities, making it hard to find balance between work and family life. Being both the main caregiver and provider for the family constitutes one of the main challenges faced by single mothers (Rabindrakumar, 2018). As a result, single mothers feel a greater imperative to work, as they must fulfill both roles individually. As can be seen in Figure 5, the proportion of single parents that do not work has substantially decreased in the last two decades. Consequentially, the proportion of single parents working part-time and full-time has increased. While in most OECD countries single parents are more likely to work full-time than part-time, in the United Kingdom, working part-time is equally common as working full-time.[9]

Despite this improvement, single mothers' incomes are affected by external childcare costs and a reduction in work hours. Single mothers may choose part-time employment as a way to

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[9]According to data from the OECD Family Database

balance childcare and work responsibilities, but this inevitably has negative consequences for their earnings. Even those working full-time will experience the impact of expensive childcare services.

Figure 5: Distribution of children in single-parent households by households employment status in the United Kingdom (1999-2018)
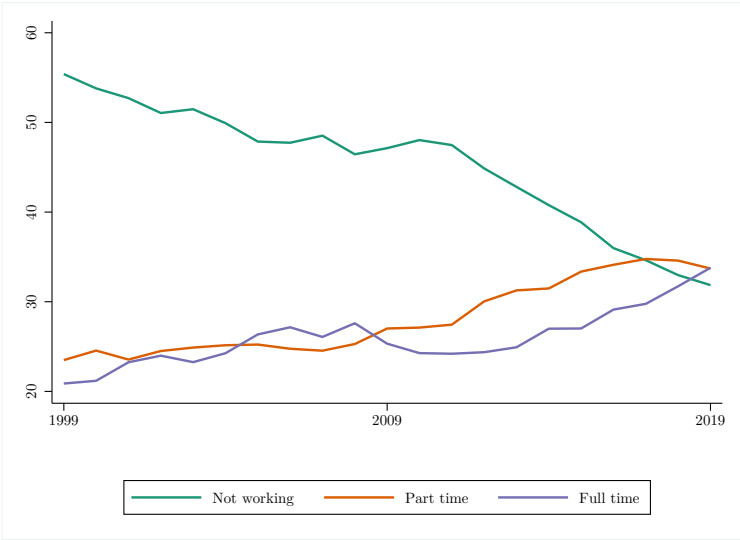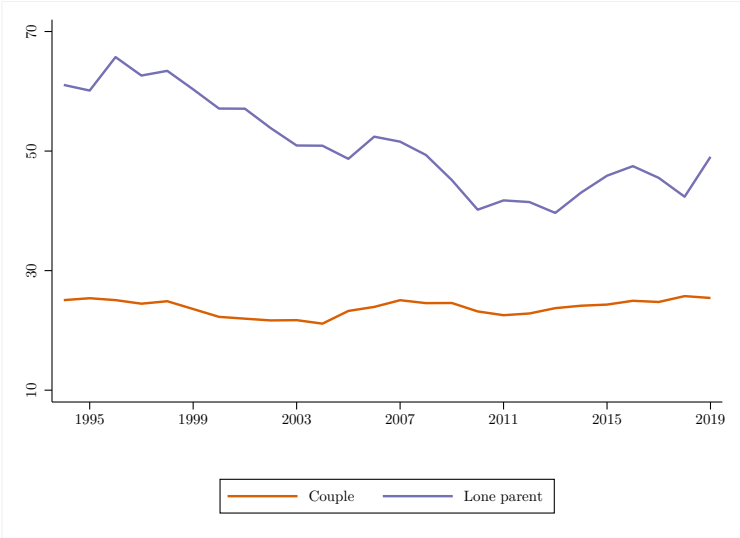

Note: Children aged 0-14 that live in households with only one adult. In most cases the one adult is one of the child's parents, but it is possible that they are another relative or a non-relative guardian. The adult in the household may be working full-time, part-time, or may not be in employment.
Source: Authors' elaboration, using data from the OECD.

In 2021, 29% of children were living in relative poverty. Figure 6 illustrates a significant decrease in the percentage of children from lone-parent households living in relative poverty over the last few decades, although the percentage remains considerably higher than that of children living in households with two adults. Approximately 44% of children in lone-parent households were living in relative poverty, almost double the number of those living with a married couple (25%).[10]

Families with children are the most affected by in-work income poverty, particularly lone-parent households, which face the highest risk of falling into this group (Bradshaw and Bennett, 2019). Among children living in lone-parent households where the parent is working full-time and part-time, 26% and 37% respectively were living with less than 60% of the contemporary median household income.

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[10]According to data from the Households Below Average Income statistics.

Figure 6: Percentage of children living in households with less than 60% of contemporary median household income after housing costs, by family type, United Kingdom (1998-2019)

The arrival of a child is linked to the need for childcare (Connelly and Kimmel, 2003). While couples can share these new responsibilities, external childcare is crucial for helping single parents make work possible. Moreover, they need to rely on a single wage, which adds another layer of complexity to this issue.

Since the 2000s, there has been an increasing trend in the cost of childcare. In Great Britain, as of 2023, the average cost of placing a child under two in a nursery for 25 hours a week is £7,134 per year, and £6,912 for two-year-old children (Jarvie et al., 2023).

Childcare is the primary barrier to improving the situation of lone-parents. 40% of lone parents are likely to experience complications when trying to meet childcare costs, compared to 24% of coupled parents (Department for Education, 2019). This is reflected in the fact that many of them have reported borrowing from friends or family to cover these expenses (Rabindrakumar, 2017).

Single parents are also more likely to work fewer hours and seek employment closer to home to manage childcare, which often leads to lower-paying jobs (Foundation, 2021). They are also disproportionately represented in low-skilled occupations. On average, single parents have lower levels of education compared to the rest of the working-age population. Only 29% of single parents have a high educational level, in contrast to 44% of fathers and 50% of mothers in

couples. Moreover, even those with higher education often find themselves in jobs with low-skill requirements (Clery et al., 2020). These characteristics hinder single parents from escaping the cycle of poverty they find themselves into.

3.3 Policies

Policies play a significant role in shaping the lives and well-being of single parents, serving as a crucial factor in understanding why single parents experience more success in some countries and context than in others (Maldonado and Nieuwenhuis, 2019). Policies targeting lone-parent households are essential to support these families through the situation of vulnerability that they find themselves in.

As mentioned, one particular concern attached to lone parenthood is the fact that single parents must be both the main earner and the main carer of the household. To mitigate the negative effects induced by this double burden, policies try to improve the labour market attachment of lone parents by helping them in either commitment. The main policies aim to promote work-family balance by offering social assistance or help in the labour market (OECD, 2022).

Social assistance is usually provided through specific benefits and higher rates of family allowances for single-parent households. Up until November 2008, lone parents were eligible to Income Support based on the grounds of being a lone parent up until the youngest child reaches age 5. Lone parents aged 16 to 17 were granted with £67,20 weekly, while those aged 18 or over with £84,80.

Nowadays, however, there is no specific benefit directly linked to being a single parent, although they are eligible for benefits based on income (Commission et al., 2019). Income Support has been replaced by Universal Credit, which is now the primary benefit system in the country, and it consists on a means-tested monthly single benefit payment.[11] Single individuals get a basic allowance of £292'11 or £368'74 a month if they are under or over 25, respectively. For each child, up to the second child, they get an extra £269'58. If the child is disabled, they are also entitled to an extra payment of £146'31.

Parents can also get Child Benefit for children under 16 living in the United Kingdom.[12]

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[11]18 years old or over that are under State Pension age, living in the United Kingdom with less than £16,000 in savings are eligible for the benefit. 16 and 17 years old who are pregnant, have a child, or have no parental support can also have access to the benefit.

[12]Children can be under 20 if they remain in education or training.

They are entitled to £24 per week for the first child, and £15'90 for each additional child. Single parents can be eligible for Council Tax Reduction, which can reduce their bills up to 100%, or for Healthy Start, which helps buying healthy food and free vitamins to pregnant mothers or those with a child under four. Single parents through widowhood are also entitled to the Bereavement Support Payment.

Another effective approach to support these families is by actively promoting their engagement in the labour market. Promoting parental employment is crucial in mitigating poverty (Coleman and Lanceley, 2001). In this regard, implementing policies that grant access to early childhood education, after-school care, extracurricular activities, and financial coverage for childcare costs becomes crucial. These measures serve as essential support mechanisms for single parents who face the challenge of balancing work and caregiving responsibilities.

From 1998 until 2011, the New Deal for Lone Parents (NDLP) was implemented with the objective of assisting unemployed lone parents in finding paid employment and encouraging those who were out of the labour market to enter it. The NDLP also aimed to enhance their long-term employability and broaden their employment prospects. Evidence supports the effectiveness of the NDLP in terms of employment outcomes (de Paz et al., 2009).

Currently, parents are entitled to three distinct childcare benefits that provide financial support for childcare expenses, but no policy directly targets single parents. Firstly, all three to four-year-olds are eligible for 570 free hours of childcare per year. Furthermore, parents under Universal Credit can avail free childcare for their two-year-olds. Those under Universal Credit can further apply for the Goverment's Tax Free Childcare scheme (Kennedy et al., 2023).

Despite the existing measures and policies, they have proven insufficient in addressing the root causes of the persistently high poverty rates faced by single parents. Consequently, as of 2020, a staggering 80% of single parents continue to encounter discrimination in areas such as housing, employment, fees, and charges, as highlighted by the Single Parent Rights campaign (Talbot, 2021).[13]

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[13]In terms of benefits, single parents do not have access to certain benefits that are available to partnered parents, such as the entitlement to 30 hours of funded childcare for three to four-year-olds and the ability to reclaim 85% of childcare costs under Universal Credit.

4 Data

4.1 Dataset and outcome variables

To analyse child penalties for single mothers, I use data from the British Household Panel Survey (BHPS) (University Of Essex, 2021). The BHPS is an annual panel survey that took place between 1991 and 2009. The original sample consisted on 5,050 households and 9,092 individuals over 16, and was designed to be representative of the Great Britain population.[14]

In order to identify parental marital status as well as the date of birth of their first child, I use the British Household Panel Survey Consolidated Marital, Cohabitation and Fertility Histories dataset (Pronzato, 2011). This dataset is a longitudinal panel containing the retrospective lifetime histories of 32,342 adults' partnerships and childbearing from 1991 until 2009. After identifying the relevant individuals for my sample, I merge this dataset with the BHPS to get the relevant information on their labour market outcomes.

The main dependent variable is earnings, which is defined as the annual labour income. To investigate the factors contributing to these earnings disparities, I will also analyse their impact on the likelihood of employment, hours of work, and wage rates.

An individual is classified as employed if they indicate being self-employed, engaged in paid employment or on maternity leave.[15] Hours of work refer to the number of hours typically worked per week in the main job, second job and on self-employment. Since the BHPS lacks information regarding the wage rate, it is calculated by dividing gross monthly income from all labour market earnings over monthly hours worked on the main job, second job, and self-employment.[16] Both hours of work and wage rate are conditional on participation.

4.2 Identification of single mothers

The absence of a universally accepted definition of lone parenthood poses significant challenges in identifying and studying these families. Research usually defines a lone parent as an individual who lives with their dependent children, without a partner or spouse, residing in either their own household or a multi-unit dwelling. However, there is no consensus on the exact definition of dependent children, the criteria for 'living alone', or the interpretation of 'without a partner'.

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[14]It excluded Northen Ireland and North of the Caledonian Canal.

[15]Alternatively, I also explore a different definition where individuals are considered employed if they report having positive earnings (Kleven et al., 2019a). However, the results remain consistent regardless of the definition used.

[16]Gross monthly income from all labour market earnings is the sum of the gross monthly wage from the main job, self-employment income, and gross pay from the second job.

Lone parenthood can arise from the death of one parent or as a result of separation or divorce within couples. Furthermore, single mothers may be defined as those who have never been married or cohabited before having children, and this could include cases where the child is born from an unplanned pregnancy or as a result of a conscious decision to adopt or become pregnant and raise a child independently (Letablier and Wall, 2017).

To address the difficulty of identifying single parents, I employ three distinct definitions to strengthen the analysis. Firstly, using the BHPS Consolidated Marital, Cohabitation, and Fertility Histories (Pronzato, 2011), I classify individuals as partnered parents if they were in a marital or cohabiting relationship at the time of their child's birth. If they were not in any type of union at the time of their first child's birth, they are classified as single parents. Additionally, I define single and partnered parents based on marital status. Individuals who report being widowed, divorced, separated, or never married are classified as single, while those who indicate being married or living as a couple are categorised as partnered. By employing these definitions, I identify the groups of single and partnered parents at the time of their first child's birth. Lastly, I define lone parents as those who are not living with a spouse or cohabiting partner at the time of their child's birth. Going forward, I will present the results based on the first definition.[17]

Ideally, I would distinguish between three different groups of single mothers based on their pathways to lone motherhood: those who made a deliberate choice to become single mothers, those who intentionally chose to become single mothers, those who became single mothers due to unplanned pregnancies, and those who found themselves single after experiencing a separation, divorce, or the loss of a partner. By recognizing these different categories, we could gain a deeper understanding of the unique challenges and dynamics within each group.

If a woman is already single at the time of becoming a mother, she will likely make labour market decisions taking into account the absence of shared income and responsibilities with a partner. This awareness may lead her to prioritize her involvement in the labour market, potentially mitigating the impact on her earnings. On the other hand, for those who experienced a change in their marital status after giving birth, their life expectations and circumstances undergo a significant transformation. If they had initially made labour market decisions based on the assumption of having the support of a partner, the transition into motherhood can have a more profound impact on their financial situation and overall well-being (Harkness, 2016).

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[17]Results using the other two are more imprecise, given the sample size of those samples, but the main conclusion holds.

However, due to the small sample size, I am unable to make precise predictions and draw definitive conclusions when attempting to differentiate between these groups. As a result, the sample of single mothers in this study encompasses individuals from all of these subgroups. Moreover, I will have to make the assumption that their status as single mothers remains unchanged following the birth of their first child.

This assumption is somewhat more difficult to accept when it comes to single fathers. Besides, the sample size is even smaller than that of single mothers. For that reason, I will compare the outcomes of single and partnered mothers with the full sample of fathers, as in Kleven (2021b, 2022).

Single mothers in the sample are, on average, younger than their partnered counterparts. Meanwhile, fathers tend to be older than both types of mothers. 45% of single mothers had their first child before the age of 25, compared to only 24% of partnered mothers. A mere 18% of fathers were younger than 25 at the time of their first child's birth.

The proportion of partnered mothers with a low educational level at the time of giving birth is significantly higher than that of single mothers. Only 7% of partnered mothers had a low educational level, in contrast to 21% of single mothers. Consequently, only 24% of single mothers had a high educational level, whereas almost half of the partnered mothers had a high educational level. Fathers, on average, were more educated than single mothers but less educated than partnered mothers.

All these differences can potentially be explained by the age disparities. Partnered mothers, on average, are older when they have their first child, which increases the probability of having attained a higher educational level compared to their single counterparts.

Partnered mothers are also more likely to be in high-occupational positions compared to single mothers, who are more prevalent in low-occupational roles. There is a larger proportion of fathers working in low-occupational positions compared to either group of mothers, but the percentage of fathers in high-occupational positions is nearly as high as that of partnered mothers.

The employment rate prior to childbirth is similar for partnered mothers and fathers, but significantly lower for single mothers. This discrepancy could be explained, in part, by the age difference between partnered and single mothers. In the sample, nearly 50% of single mothers were younger than 25 at the time of their first child's birth, suggesting that they may still be pursuing education and have not yet entered the labour market.

Table 2: Summary statistics

	Mothers		Fathers
	Single	Partnered	
Age at birth	26.10	28.33	29.75
First child before 25	0.45	0.24	0.18
Educational level at time of birth			
Low education	0.21	0.07	0.14
Medium education	0.55	0.46	0.45
High education	0.24	0.47	0.40
Occupation at time of birth			
Low occupation	0.17	0.11	0.23
Medium occupation	0.45	0.44	0.34
High occupation	0.38	0.45	0.43
Employed prior to childbirth	0.62	0.88	0.89
Annual earnings prior to childbirth	8,757.7	13,775.8	17,355.3
Hourly wages prior to childbirth	6.03	7.88	9.07
Weekly hours prior to childbirth	37.6	37.9	42.12
Number of observations	1,119	1,987	2,967

Note: Statistics are computed after applying age and event time restrictions. Earnings, hours of work, and hourly wages are conditional on being employed. Low education refers to ISCED levels 1 (primary education) and 2 (low secondary). Medium education contains ISCED levels 3a (upper secondary, general) and 3c (upper secondary, vocational). High education includes ISCED levels 5b (short cycle tertiary), 5a (bachelor, master, or equivalent) and 6 (doctoral or equivalent). Occupational level is constructed according to the Standard Occupational Classification from 1990 (SOC90). Low occupation includes sales occupations, plant and machines operatives, and other occupations. Medium occupation includes clerical and secretarial occupations, craft and related occupations, and personal and protective service occupations. High occupation includes managers and administrators, professional occupations, and associate professional and technical occupations.

There are significant variations in average earnings prior to childbirth. The average annual labour income of fathers in the five years preceding the birth of a child is higher than that of mothers. Moreover, substantial differences are observed between single and partnered mothers, with partnered mothers earning almost double the amount earned by single mothers.

These differences could be attributed to variations in hourly wages. On average, mothers tend to receive lower wages than fathers, and single mothers earn lower wages compared to partnered mothers. While fathers work more hours per week than both groups of mothers, there are no differences in the weekly hours of work prior to childbirth between single and partnered mothers.

5 Empirical design

Finding a causal relationship between fertility and gender inequality has been one of the main challenges in the literature given the endogenous nature of fertility. There is an issue of reverse causality between these two variables: fertility choices are expected to negatively impact gender inequality, while gender inequality is also likely to influence fertility choices. The ideal framework for studying this relationship is through the random allocation of children among women. By randomizing fertility, we can ensure that we have two comparable groups of women, differing only in whether they have a child or not. This allows us to compare the labour market outcomes of both groups before and after the arrival of their child, enabling us to determine the impact of motherhood.

However, the lack of such a setting has led economists to explore alternative methods for disentangling this relationship. One widely used approach involves the use of instruments such as sibling sex mix or twins (Angrist and Evans, 1998; Rosenzweig and Wolpin, 1980). Nevertheless, these studies can only measure the effect of a second or a third child, and do not fully answer the main question: what is the impact of children on gender inequality?

Kleven et al. (2019b) suggests exploiting the sharp change that having a first child generates in labour market outcomes by adopting an event study approach. The idea is that at a certain point, the event –childbirth– takes place and sets the treatment –motherhood– in motion. Therefore, any changes observed before and after the event can be attributed to the treatment. An important assumption we need to make is that the pattern observed before the event would have continued if the event had not occurred. The disruption in such a pattern at the time of the event is solely caused by the event itself, thus allowing us to correctly identify the causal effect (Huntington-Klein, 2021; Cunningham, 2021).

I follow the event-study specification proposed by Kleven et al. (2019b). For each individual, I denote the year in which they have their first child as $y = 0$, and index the rest of the years relative to that date. Each individual will be followed from 5 years prior up to 10 years after the birth of the child, so event time t goes from -5 to $+10$. Denoting Y_{ist}^g the outcome of interest for individual i of gender g in year s and at event time t, I run the following regression separately for men, and married and single women:

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

The first term of the right hand side is a set of event time dummies. The event time dummy at time $t = -1$ is excluded, so the event time coefficients, $\hat{\alpha}_j^g$, will measure the impact of having a first child relative to the year prior to the birth. The second and third terms of the right hand side are a set of age and year dummies that will control for life-cycle trends and time trends, respectively. To keep the zeros in the data because of non-participation, equation (1) is specified in levels rather than in logs. To convert the estimated level effects into percentages, we calculate:

$$P_t^g = \frac{\hat{\alpha}_t^g}{E[\tilde{Y}_{ist}^{gm}|t]} \tag{2}$$

where $\tilde{Y}_{ist}^g$ is the predicted outcome when omitting the contribution of the event dummies.[18] P_t^g captures the year-t effect of children as a percentage of the counterfactual outcome absent children. Once the impact of children on women and men are estimated, child penalty at event time t for single and partnered mothers is estimated as:

$$P_t^{single} = \frac{\hat{\alpha}_t^{men} - \hat{\alpha}_t^{single}}{E[\tilde{Y}_{ist}^{single}|t]} \qquad\qquad P_t^{partnered} = \frac{\hat{\alpha}_t^{men} - \hat{\alpha}_t^{partnered}}{E[\tilde{Y}_{ist}^{partnered}|t]} \tag{3}$$

The child penalty measures the percentage by which single and partnered women are falling behind men due to children at event time t.

Over the specified event time horizon, the child penalty is defined as the average effect across treated event times net of the average effect across untrated event times (Kleven, 2022):

$$ChildPenaltySingle = E[P_t^{men} - P_t^{single}|t >= 0] - E[P_t^{men} - P_t^{single}|t < 0] \tag{4}$$

$$ChildPenaltyPartnered = E[P_t^{men} - P_t^{partnered}|t >= 0] - E[P_t^{men} - P_t^{partnered}|t < 0] \tag{5}$$

The long-run penalty is defined as P_t^{single} and $P_t^{partnered}$ at event time $t = 10$. In the long-term, these penalties encompass the cumulative impact of children, since they include the impact of children born after the first one. Thus, they have the potential to capture the overall effect of children on gender inequality.

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[18]That is, it is defined as $\tilde{Y}_{ist}^g = \sum_k \hat{\beta}_k^g \cdot \mathbf{I}[k = age_{is}] + \sum_y \hat{\gamma}_y^g \cdot \mathbf{I}[y = s]$

6 Results

6.1 Impact on earnings.

Figure 7a illustrates the impact of parenthood on fathers and both single and partnered mothers' earnings across event time. The figure includes 95% confidence bands around each coefficient. The confidence bands for the group of single mothers are relatively wide in comparison to those of fathers and partnered mothers. A possible explanation could be attached to the definition of single mothers. As mentioned, I could not differentiate between those who chose to be single, those who got separated or divorced after childbirth, and those who became single mothers due to an unexpected pregnancy. Therefore, it is likely that the great variability that is observed in this sample is given to the great variability in the characteristics of these groups.

Once we account for life-cycle and time trends, we can observe a relatively parallel earnings trajectory for all three groups before they become parents.[19] However, when the first child is born, both partnered and single mothers experience an immediate drop in earnings, while fathers remain largely unaffected. Women's earnings undergo an immediate decrease of 18% and 38% below their pre-child levels for partnered and single mothers, respectively. Furthermore, these earnings continue to decline in subsequent years. Although the initial drop is more significant for single mothers, their earnings stabilize at 50% below their initial levels the year following the birth of their first child. In contrast, partnered mothers' earnings continue to decrease until they stabilize at approximately 63%.[20] Over the whole period, the child penalty for single mothers is of 40%, whereas for partnered mothers is of 47%.

Ten years after the birth of their first child, neither single nor partnered mothers show any signs of recovery in their earnings. Single mothers' earnings remain 51% below their pre-birth level, while partnered mothers' earnings are 63% below, indicating a long-term earnings penalty of 37% for single mothers and 49% for partnered mothers.

Although there are differences in the long-run penalties for both groups, it is noteworthy that the earnings trajectories of single and partnered mothers exhibit a parallel trend. Additionally, the standard errors of both groups overlap, indicating that there are no significant differences in the impact of motherhood on single and partnered mothers, consistent with the findings in Harkness (2016). In other words, having children did not appear to have a differential impact

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[19]While the pre-birth earnings trajectory of partnered mothers and fathers is almost identical, the trajectory of single mothers is somewhat more unsteady and differs a bit more. However, it is not statistically significant.

[20]As shown in Figure A.1a in the Appendix, the penalty during the whole period, without distinguishing between mothers based on their marital status, is 44%, which coincides with the estimate reported by Kleven et al. (2019a). The long-run penalty is of 47%.

on earnings or employment participation for single mothers compared to partnered mothers.

Figure 7: Impacts of children.
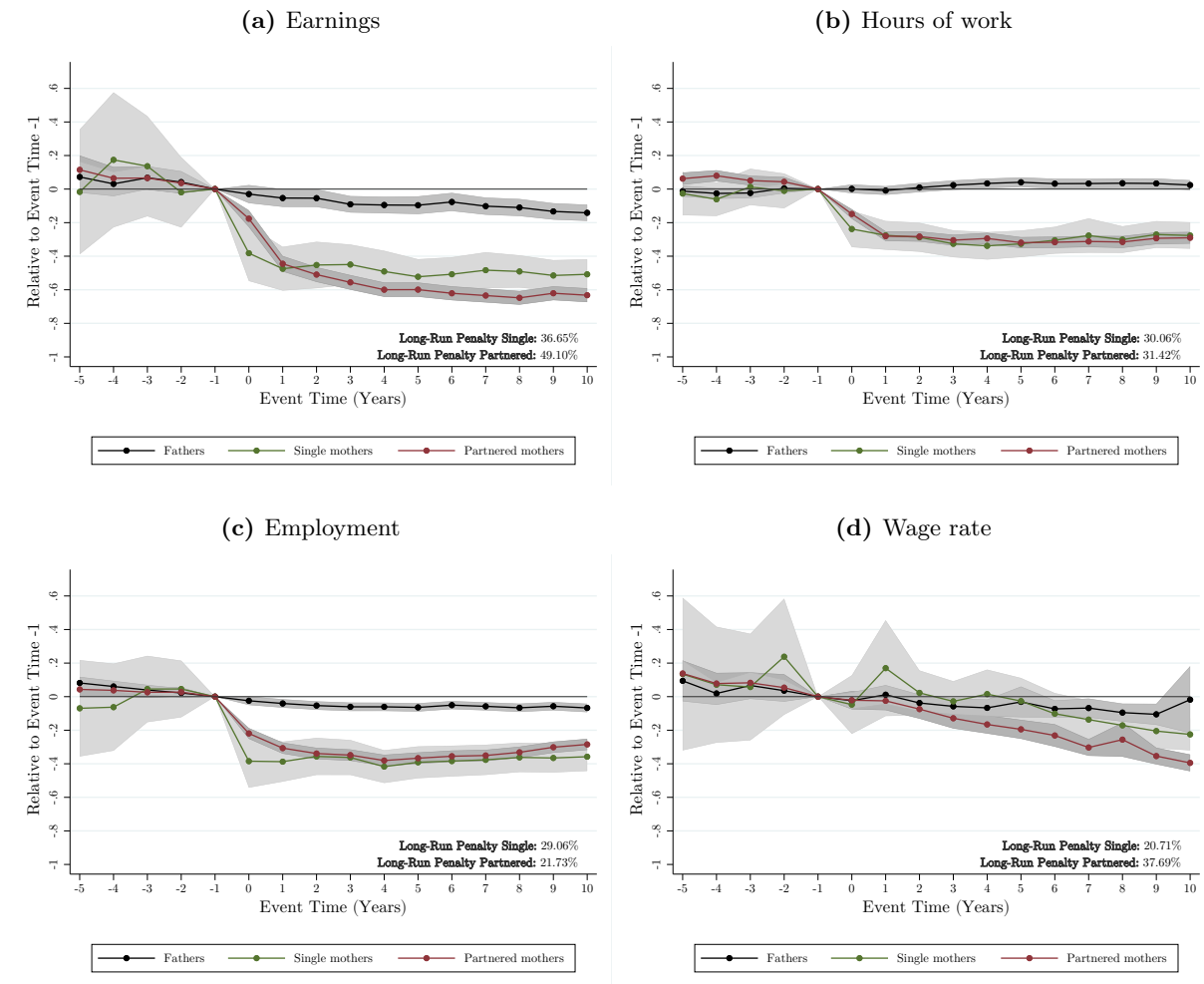
(a) Earnings

(b) Hours of work

(c) Employment

(d) Wage rate

Note: The graph show the estimated event time coefficients from equation (1) as percentage of the counterfactual outcome absent of children, defined as (2) for fathers, single mothers and partnered mothers and for different outcomes. Each panel also reports the long-run child penalty, measured at event time 10, calculated as (3). It measures the percentage by which single and partnered women are falling behind men due to children. The impact on earnings is estimated unconditional on employment status, and thus, is capturing the effect on both the extensive and intensive margins. The effects on hours worked and wage rates are estimated conditional on being employed. 95% confidence intervals are based on robust standard errors.

6.2 Impact on hours of work, employment, and wage rate.

These earnings penalties can be attributed to three key factors: hours of work (intensive margin), employment (extensive margin), and the wage rate. Figures 7b-7d show that all three margins are in play.

Partnered mothers face a higher long-term penalty in terms of both hours of work and wage rate, although not in the employment rate. However, as what happened with earnings, there

are no statistically significant differences between single and partnered mothers regarding the impact of having a first child on either of the three variables.

The year that the first child is born, single mothers suffer a drop in their hours of work of 24% with respect to their pre-birth levels, while the effect for partnered mothers is only of 15%. Both single and partnered mothers' hours of work immediately stabilize at around 30% of their pre-birth levels and follow an almost identical trajectory. In the longer run, both of them start showing a slight recovery. The long-run penaly in hours of work is of 30% for single mothers, and of 31% for partnered mothers.

The employment rate significantly drops the year of childbirth. Partnered mothers are 22% less likely to be employed the year they have their first child, while single mothers face a 38% decrease. In the following years, the child penalty in the employment rate of single and partnered mothers become almost identical. Five years after the birth, the employment rate for both groups begins to gradually increase. Ten years after childbirth, partnered mothers have a 28% lower likelihood of being employed, while single mothers face a 36% decrease. The long-term penalty for single and partnered mothers amounts to 22% and 29%, respectively.

Regarding wage rates, although the analysis is somewhat less precise and the pattern seems to be different, there are no statistically significant differences between single and partnered mothers. Single mothers' wage rates are not statistically different than their wages the year prior childbirth, until seven years after the first child is born, when they begin to decrease. For partnered mothers, their wage rate becomes statistically different than their pre-birth level two years after becoming a mother. In the long run, both groups experience wage rates that are 23% and 39% below their pre-birth levels, resulting in a long-run penalty of 21% and 37%, respectively.

7   Discussion and future research

Two possible hypothesis emerge when considering the differential impact of the birth of their first child on single mothers compared to partnered mothers. Firstly, lone mothers may experience more substantial child penalties due to the inherent difficulties of balancing work and childcare responsibilities. Conversely, single mothers might display a greater inclination to work after becoming mothers, as they lack a partner who can economically contribute to the household. Consequently, their overall impact may be less pronounced compared to partnered women.

Previous research has identified contradictory findings in different countries. For instance, in Denmark, child penalties were significantly larger for single women compared to married women (Kleven, 2021b). In contrast, the United States witnessed smaller child penalties on single women compared to their married counterparts (Kleven, 2022). One possible explanation can be attributed on the effect of the welfare system. In the United States, a country lacking a structured welfare system, single mothers, who lack the option to share responsibilities with a partner, are compelled to work to support their families. In contrast, Denmark, known for providing one of the most generous welfare benefits in the world, allows single mothers to take extended periods of time off work after giving birth to care for their children while receiving government benefits to support their families. The longer absence from the labour market leads to larger child penalties for them.

This study shows that British single mothers' employment trajectories after becoming a mother are very similar to those of partnered mothers: after becoming a mother, they experience large child penalties associated with earnings, hours of work, participation rate and wage rate. These findings are consistent with those of Harkness (2016), who found little evidence of additional penalties to lone motherhood.

But, why is it that, despite the differences in opportunities that single mothers face with respect to their partnered counterparts, we observe no statistically significant differences in the way these two groups are affected by motherhood in the United Kingdom?

First, it is important to consider the large standard errors observed in the sample of single mothers. Due to the limited size of the sample, it has been challenging to identify the various subgroups within the category of single mothers. Therefore, if we anticipate that the impact of motherhood differs in magnitude between women who choose to become single mothers and those who become single mothers after divorcing or separating from their partners, the estimated standard errors increase. Consequently, this lack of statistical significance hinders our ability to observe a statistically significant difference compared to partnered mothers.

Another possible explanation relates to the time period under study. The implementation of the New Deal for Lone Parents (NDLP) in 1998, which aimed to incentivise single parents to engage in paid work and enhance their employment prospects, remained in effect until 2011. Consequently, it is possible that our study captures some of the impacts stemming from this policy given the period of study.

Further research should focus on increasing the sample size of single mothers to accurately

identify the child penalty within the various subgroups. Moreover, it would be valuable to conduct this study across different time frames to assess whether the child penalties for single and partnered mothers have evolved over time. Such investigations would provide insights into potential changes in the dynamics of child penalties and their implications for different types of single mothers.

Moreover, to delve deeper into the underlying mechanisms behind the large child penalties, it is also important to explore the effect of motherhood on qualitative aspects. Examining factors such as the likelihood of transitioning to different occupations, securing managerial positions, or working in the public sector or in family-friendly firms could provide important insights. Analysing these qualitative aspects would contribute to a more comprehensive understanding of the complex dynamics at play in relation to child penalties.

8   Conclusion

Despite significant progress in narrowing the wage gap between men and women, gender inequality persists across all countries. Motherhood has emerged as a crucial factor in explaining the remaining gender gap in earnings. Prior to the arrival of their first child, women and men exhibit similar trajectories in the labour market, but women face substantial penalties immediately after childbirth.

Numerous mechanisms have been explored to comprehend the phenomenon known as the 'child penalty', including the gendered specialization of women in childcare and men in the labour market. However, limited attention has been given to understanding the dynamics within lone parent households, where the option of specialization is unavailable.

Using the British Household Panel Survey from 1991 to 2009, this study delves into the child penalties experienced by single and partnered mothers. The findings reveal that partnered mothers encounter a long-term penalty of 49% on their earnings, while single mothers face a penalty of 37%. Nevertheless, the earnings trajectories of the two groups of mothers is not statistically different from each other, preventing us from conclusively state that the arrival of their first child differently impacts the earnings of single and partnered mothers.

Furthermore, the child penalty also manifests across three crucial dimensions: hours of work, employment rates, and wage rates. Once again, no statistically significant differences are discernible between single and partnered mothers in these aspects.

The main limitation of this study lies in the sample size and the inability to identify different subgroups of single mothers. Future research should address this limitation by analysing a larger sample size to explore the diverse subgroups of single mothers based on their pathways into lone motherhood in order to obtain a more comprehensive understanding of the child penalties experienced by single and partnered mothers.

The results indicate that, in terms of labour market outcomes, the arrival of the first child impacts both single and partnered mothers to a similar extent. This suggests that factors other than partnership status may play a crucial role in shaping labour market outcomes after the arrival of a first child. Further investigation into these factors is essential to inform policy and support initiatives aimed at reducing gender disparities and promoting equality in the labour market.

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A Appendix

Figure A.1: Impacts of children.
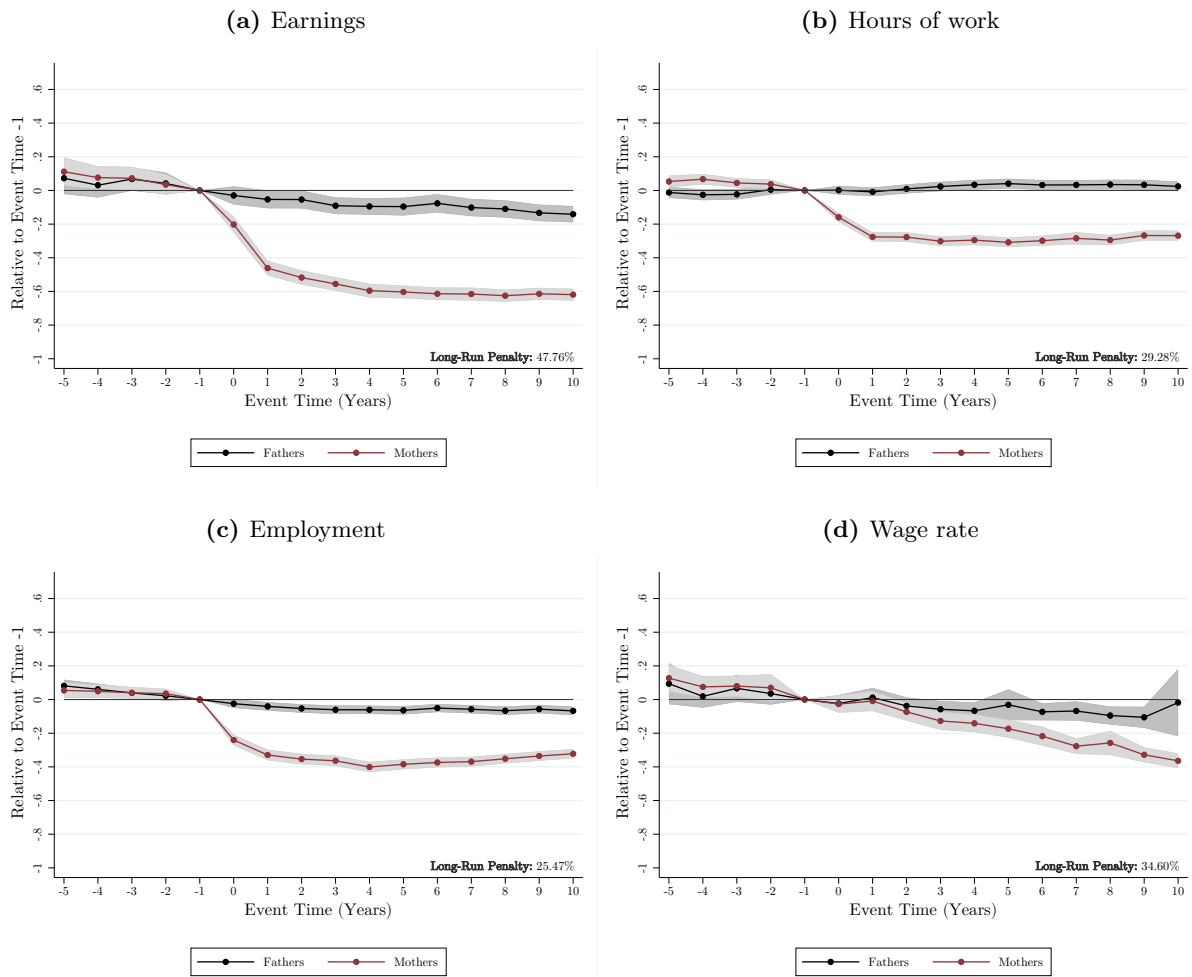
(a) Earnings

(b) Hours of work

(c) Employment

(d) Wage rate

Note: The graph show the estimated event time coefficients from equation (1) as percentage of the counterfactual outcome absent of children, defined as (2) for fathers and mothers and for different outcomes. Each panel also reports the long-run child penalty, measured at event time 10, calculated as (3). It measures the percentage by which single and partnered women are falling behind men due to children. The impact on earnings is estimated unconditional on employment status, and thus, is capturing the effect on both the extensive and intensive margins. The effects on hours worked and wage rates are estimated conditional on being employed. 95% confidence intervals are based on robust standard errors.