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Does early timing of first birth lead to lower earnings in midlife in Britain?

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Abstract

Objective: To examine the effect of the timing of a woman's first birth on her midlife earnings, and the potential mediators of this effect.

Background: While many studies demonstrate that motherhood substantially affects women's wages and earnings, there is less research on the impact of the timing of entry into motherhood, particularly in the long term and in contexts outside the US.

Method: We analysed data on women who gave birth for the first time between the ages of 15 and 30, taken from the 1970 British Cohort Study. Within the framework of instrumental variable regression, our preferred specification utilised the occurrence of contraceptive failure as a source of exogenous variation in the age at first birth.

Results: We found tentative evidence that a higher age at first birth led to a higher probability of being employed in midlife. At the same time, a higher age at first birth reduced the earnings level of employed mothers in midlife. This was because a later first birth often resulted in mothers working part time rather than full time. Furthermore, a higher age at first birth decreased the time until the second birth, while increasing the probability of having a co-resident partner who could contribute to the household income.

Conclusion: These findings suggest that the impact of having an early first birth on earnings in midlife is not uniformly negative.

Key words: age at first birth; BCS70; Britain; earnings; employment; human capital; labour market attachment; midlife; United Kingdom

1. Introduction

While there is an extensive body of research on the negative effects of motherhood on women's careers (Cukrowska-Torzewska & Matysiak, 2020; Matysiak & Vignoli, 2008), the effects of the timing of entry into motherhood have received less attention, despite its growing relevance in light of current trends towards delayed childbearing (Mills et al., 2011). Many previous studies (e.g., Amuedo-Dorantes & Kimmel, 2005; Chandler et al., 1994; Taniguchi, 1999) have investigated the association between later age at first birth (AFB) and higher wages and higher labour force participation rates for mothers, as well as higher levels of family economic well-being (Hofferth 1984). However, a large fraction of the studies on this topic – including those cited above – use data from the United States (Blackburn et al., 1993; Buckles, 2008; Herr, 2016; Miller, 2011; Troske & Voicu, 2013; Wilde et al., 2010). In the US, AFB has increased less than in most other high-income countries and remains comparatively low (Human Fertility Database, 2024). In Europe, there has been a strong trend towards later AFB over the past few decades (ibid.). In England and Wales, for instance, the average AFB has increased by three years since 1995, reaching 29.1 in 2020 (ONS, 2022). There is a positive association between later family formation and women's midlife earnings in Europe as well (Muller et al., 2020), but our understanding of the mechanisms underlying this association is limited. Thus, it is important to provide further evidence of the impact of the timing of entry into motherhood in Europe.

Methodologically, it is challenging to identify an effect of the timing of a first birth on earnings due to processes of self-selection. Women with better career prospects might plan to have children later, while women with poorer prospects might choose earlier childbearing. Similar differences can exist depending on women's individual value judgments of childbearing. Instrumental variables (IV) regression utilising biological fertility shocks (i.e., miscarriages or stillbirths) (Bratti & Cavalli, 2014; Karimi, 2014; Miller, 2011; Rosenbaum, 2021) and family background characteristics (Blackburn et al., 1993; Chandler et al., 1994; Kind & Kleibrink, 2012) as instruments has previously been used to study the effects of the timing of a first birth. However, a limitation of this approach is the weak effects of these instruments on the timing (Bratti, 2015; Wilde et al., 2010). Alternatively, studies have used individual fixed effects (FE) models (Amuedo-Dorantes & Kimmel, 2005; Buckles, 2008; Cantalini et al., 2017; Dumauli, 2019; Putz & Engelhardt, 2014; Taniguchi, 1999), which compare the change in earnings following motherhood between groups of women who had a different AFB, and who may differ in other respects as well.

The current study aimed to overcome the methodological challenge of finding exogenous variation in first birth timing through an IV approach using contraceptive failure and biological fertility shocks as instruments. We built on previous studies that used biological fertility shocks as a source of exogenous variation in the AFB (e.g., Miller, 2011). Using data from the 1970 British Cohort Study (BCS70), we analysed the earnings at midlife of women who had their first child between the ages of 15 and 30. In addition to total earnings as a measure of labour market success, we separately modelled the probability of reporting non-zero earnings (i.e., being employed) and the amount of earnings, conditional on reporting non-zero earnings. AFB has the potential to influence these two outcomes via different mechanisms. Therefore, it is important to analyse them separately to better understand this heterogeneity. Results from a naïve OLS regression indicated that a higher AFB between the ages of 15 and 30 was associated with higher earnings across all definitions. We conducted a series of diagnostic checks for instrument validity and found that contraceptive failure was much more closely related to AFB and was more plausibly random than biological fertility shocks. Results from our preferred IV specification, using only contraceptive failure as an instrument for AFB, suggested that higher AFB was positively (by 2%, although not statistically significantly) related to the probability of reporting non-zero earnings at midlife, but also that postponing a first birth by one year significantly reduced the amount of earnings among employed women (by 6%). We also examined potential mediators of the effect of AFB on midlife earnings.

A limitation of this study is that the results may not be directly generalisable to women who delay their first birth until their thirties, as only mothers with an AFB of 30 or under, for whom detailed pregnancy histories were available, could be analysed. Nevertheless, we contribute new evidence to the debate on the labour market effects of the timing of entry into motherhood in Europe (Bratti & Cavalli, 2014; Cantalini et al., 2017; Fitzenberger et al., 2013; Karimi, 2014; Kind & Kleibrink, 2012; Lundborg et al., 2017; Nisén et al., 2022; Picchio et al., 2021; Putz & Engelhardt, 2014; Rosenbaum, 2021). We assessed the impact of AFB in the British context, where state support for work-family reconciliation is limited (Brooks, 2012; Sigle-Rushton, 2008). Our results show that later timing did not uniformly lead to better midlife outcomes

among women who had their first birth between the ages of 15 and 30 in Britain. Our focus on mothers' midlife earnings is important, given that mothers may need to financially support their children and save for retirement at this stage in their lives (Kahn et al., 2014). The existing evidence on the impact of later entry into motherhood on midlife earnings remains mixed (Buckles, 2008; Herr, 2016; Karimi, 2014; Picchio et al., 2021). The focus on midlife earnings deviates from many previous studies that measured mothers' earnings shortly after their first birth or when they are in their thirties (Amuedo-Dorantes & Kimmel, 2005; Bratti & Cavalli, 2014; Miller, 2011; Nisén et al., 2022; Taniguchi, 1999), or that estimated effects across a wide age range (Dumauli, 2019; Kind & Kleibrink, 2012; Putz & Engelhardt, 2014; Taniguchi, 1999).

2. The timing of first birth and earnings: a conceptual framework

2.1 Education and work experience

Human capital, acquired through formal education or work experience, can contribute to an increase in the future earnings of individuals (Becker, 2009). Early childbearing can have a negative impact on young women's opportunities to acquire human capital through formal education. Women who have children before finishing their education face various challenges, such as difficulties in combining parenting responsibilities with the time commitments required for their studies, as well as the high costs of childcare in contexts such as Britain (Lyonette et al., 2015). These challenges can lead student mothers to drop out of higher education, and could have a discouraging effect on mothers who are considering pursuing a higher degree. Consequently, early childbearing may negatively impact women's long-term work trajectories and earnings (Hynes & Clarkberg, 2005; Miller, 2011; Taniguchi, 1999). This mechanism is less relevant at higher ages, such as in the late twenties and thirties, when women are less likely to be in formal education.

Moreover, child-related career breaks may interrupt human capital accumulation at work (Mincer & Polachek, 1974), and lead to the depreciation of existing knowledge and skills (Mincer & Ofek, 1982). Such impacts are likely to increase with the length of the career break (Baum, 2002), with a greater potential for a decline in wages following the break (Miller, 2011). The timing of a woman's first birth can affect the length of her career break, and thus her subsequent earnings. A woman who is at an early stage of her career, and who therefore has lower current earnings, may choose to take a longer career break due to her lower current earnings relative to the costs of childcare and thus the lower opportunity costs associated with taking a break. In contexts where eligibility for job-protected leave depends on previous employment history, a mother with an earlier AFB may end up taking a longer career break because she is less likely to be able to return to her previous job (Burgess et al., 2008). Thus, having a higher AFB can have a positive impact on a woman's later earnings if it leads her to take a shorter career break. Moreover, a young woman may be at a critical career stage at which she is rapidly accumulating human capital (Leung et al., 2016; Picchio et al., 2021), and at which her investment in human capital is important for her later career (Herr, 2016; Taniguchi, 1999). This is another reason why entering motherhood later may be less harmful to a woman's career than entering motherhood earlier. However, this mechanism mainly applies to women with the potential for a steep career profile (e.g., highly educated women).

2.2 Work adjustment and work effort

The theory of compensating wage differentials states that in order to meet the care needs of their children, mothers may make adjustments in their work life by choosing to work in jobs that are more easily reconciled with family responsibilities, such as in jobs that offer a part-time work schedule (Cukrowska-Torzewska & Matysiak, 2020). These jobs typically pay lower wages because workers can be attracted by the working conditions rather than by high wages. Thus, mothers who work in such jobs often have lower earning opportunities. Moreover, work effort theory suggests that mothers might put less effort into their work than childless women because of the effort required for childcare (Chandler et al., 1994; Cukrowska-Torzewska & Matysiak, 2020; Kaufman & Uhlenberg, 2000). This is likely to further reduce the earnings and career opportunities of mothers. The study by Kleven, Landais, and Søgaard (2019) provided support for

these hypotheses, finding that the decline in Danish mothers' earnings after childbirth is driven by lower labour force participation and fewer hours worked, and that Danish mothers are more likely to choose family-friendly working conditions. An earlier entry into motherhood allows such effects to accumulate over a longer time period, and they may be particularly harmful for women with the potential for a steep career profile.

2.3 Other mechanisms

Moreover, the effects of AFB may operate through the occurrence and the timing of subsequent births, which often lead to further career breaks (Karimi, 2014; Troske & Voicu, 2013). Earlier entry into motherhood is associated with a larger number of subsequent children (Bratti & Tatsiramos, 2012), which may amplify the timing effects discussed earlier. A later first birth may also encourage a shorter interval between births, with potential implications for a mother's adjustment to work (Karimi, 2014). Another important aspect to consider here is the role of the partner, as whether a mother is able to adjust her working hours or to choose a family-friendly job with lower pay usually depends on whether she can rely on a partner's income (Matysiak et al., 2024; Muller et al., 2020). For example, a study of British mothers in the early 1990s who were entitled to maternity leave found that they returned to work more quickly after childbirth when their partner was unemployed (Burgess et al., 2008). However, constraints on labour market participation tend to be most severe for lone mothers, who may find it very difficult to reconcile work and family despite facing financial pressures to do so (Joshi, 2002; Misra et al., 2007). Finally, a motherhood earnings penalty that is not explained by any observable characteristics is often attributed to discrimination. Employers may discriminate against mothers because they expect mothers to put less effort into their work (Benard & Correll, 2010; Correll et al., 2007), especially if they take long career breaks (Albrecht et al., 1999). However, the impact of discrimination on women's earnings may only become visible in the long term (Bratti & Cavalli, 2014).

3. Previous empirical evidence

3.1 Evidence from the US

Much of the research on the impact of the timing of entry into motherhood on women's labour market outcomes comes from the US. Interest in the question of whether timing matters dates back to the 1970s (Cutright, 1973). Special attention, particularly in the US, has been paid to teenage mothers, who often end up with poor educational and labour market outcomes that appear to be at least partly the result of selection (e.g., Geronimus & Korenman, 1992; Hoffman et al., 1993; Hotz et al., 2005; Ribar, 1999). More generally, Blackburn et al. (1993), Chandler et al. (1994), and Taniguchi (1999) were among the first to identify a positive effect of a delayed first birth on working women's wages (see Appendix Table A1 for an overview of the literature). A number of subsequent studies have assessed the impact of the timing of entry into motherhood in the US by analysing data from the NLSY79[1]. Amuedo-Dorantes and Kimmel (2005) found that college-educated women experience a motherhood premium rather than a penalty in their wages, which increases in size with a later AFB. Buckles (2008) identified a wage penalty across skill levels and ages, but also found that higher-skilled mothers benefited more from a delay. Miller (2011) estimated that a one-year delay has a positive effect of 3.5% on mothers' wages at age 34, as well as positive effects on wage growth rates and hours worked. Wilde et al. (2010) provided further evidence of the beneficial effects of a delayed entry on US mothers' wages. Troske and Voicu (2013) found that a later entry into motherhood is associated with a smaller reduction in the post-birth propensity to work full time.

Recent studies from the US have provided further evidence of the heterogeneous effects of the timing of a woman's first birth. Herr (2016) reported that long-run positive effects of delaying the first childbirth on wages are only observed for non-Hispanic white college-educated women who enter the labour market before motherhood. Meanwhile, Doren (2019) found that women without a college degree experience a *smaller* motherhood wage penalty when they enter motherhood early in life. Similarly, Landivar (2020)

1 NLSY79 stands for National Longitudinal Survey of Youth 1979.

suggested that women in low-wage jobs do not benefit from delaying their first birth. Methodologically, the previous studies from the US mainly relied on IV regression (Blackburn et al., 1993; Chandler et al., 1994; Miller, 2011) or individual FE models (however, see Landivar, 2020; Troske & Voicu, 2013). Moreover, some of these studies highlighted that measures of human capital partially explain the observed positive effects of a later first birth (Blackburn et al., 1993; Buckles, 2008; Chandler et al., 1994). There is less evidence regarding other potential mediators, but the available studies suggest that the number of children plays only a small mediating role (Amuedo-Dorantes & Kimmel, 2005; Buckles, 2008; Miller, 2011).

3.2 Evidence from Europe

In the European context, the evidence on the effects of the timing of entry into motherhood on women's labour market outcomes is more limited, mixed, and methodologically diverse. Using IV regression, Bratti and Cavalli (2014) found that for Italian mothers, a delay has a positive effect on labour force participation and hours worked two years after the birth. According to Picchio et al. (2021), who utilised dynamic modelling with unobserved heterogeneity, a delay of the first childbirth strengthens Italian mothers' labour market attachment and earnings, but a very long delay may result in a larger reduction in employment and decreasing returns to earnings. For Germany, using IV regression, Kind and Kleibrink (2012) estimated a 6.4% increase in mothers' wages with each additional year of delay of the first childbirth; while Putz and Engelhardt (2014), applying individual FE to the same data, found *larger* wage gaps for women who enter motherhood later. Applying a matching approach, Fitzenberger et al. (2013) also found that in Germany, the effect of motherhood on labour market participation is larger for women who enter motherhood later. In Sweden, Karimi (2014) found a negative effect of a delayed first birth on mothers' earnings, career earnings, and wages using IV regression and individual FE, while also showing that the effect is partially mediated through a shorter birth interval among mothers who have a later first birth. Based on IV regression on a sample of IVF-treated women in Denmark, Lundborg et al. (2017) showed that earnings losses are larger among women who have their first child later in life. In Denmark, Rosenbaum (2021), using IV regression combined with siblings FE, found that early timing of motherhood (<25 years) has a negative effect on earnings only until the early thirties, and that this effect is largely attributable to the lower participation rates of early mothers. Utilising longitudinal dynamic modelling, Nisén et al. (2022) found a positive effect of higher AFB on employment and income among Finnish women in their twenties and early thirties, which is partially mediated by increased formal education. Applying growth curve analysis, Cantalini et al. (2017) showed that Swedish women's earnings at age 40 do not vary by their AFB, although a delay is beneficial for their career earnings.

3.3 Summary of evidence

In summary, the previous empirical evidence on the impact of the timing of entry into motherhood on labour market outcomes is inconsistent and is focused on the US context. While the majority of studies find positive effects of a higher AFB, there are many exceptions. Evidence from the US context in particular highlights heterogeneous effects, showing, for example, that a later entry into motherhood is not necessarily beneficial for women without a college degree or for those in low-wage employment. Many of the existing studies have utilised either an individual FE approach or IV regression, but the results do not systematically vary based on the method chosen. An increasing number of studies cover women up to midlife, and some do not find any long-term effects of the timing of the first birth on the labour market outcomes of mothers (see also Appendix Table A1). Typically, measures of human capital explain some of the positive effects of a higher AFB, while evidence on the role of other mediators is more limited.

4. Expected findings in the British context

4.1 The British context

In Britain, many welfare services are provided by the private sector, and state interventions are often not universal (Brooks, 2012). The public support available for reconciling work and family life is limited (Harkness, 2016; Misra et al., 2007). Maternity rights were introduced in 1976 with the aim of enabling women to take a career break following childbirth with the assurance that they could return to their pre-birth job after the break (Gregg et al., 2007; Zabel, 2009). However, prior to 1994, only around half of female workers were covered by these rights, as eligibility was restricted to women with at least two years of full-time employment or five years of part-time employment (Waldfogel, 1998b). Since 1994, all women in Britain have been entitled to job-protected leave (Zabel, 2009). This unconditional leave was extended from 14 weeks in 1994 to 18 weeks by 2000. During this period, mothers who had been continuously employed for at least two years with the same employer were entitled to additional leave (up to a total of 28 weeks in 1994–1999). Improvements in maternity rights, including relaxed eligibility conditions for leave and more generous pay during the leave, improved mothers' labour market attachment by facilitating a faster return to work (Burgess et al., 2008). Accordingly, these changes led to higher employment rates for mothers with young children in the 1980s and 1990s, but these increases were mainly in part-time work (Gregg et al., 2007). Furthermore, the low availability of publicly provided, affordable childcare poses a challenge for British women seeking to reconcile work and family life (OECD, 2020). Until the late 1990s, the British government relied primarily on the private sector to provide childcare. In 1998, it began providing free part-time childcare for three- to four-year-olds, but this had limited impact on the full-time employment of mothers (Sigle-Rushton, 2008). Family policies have undergone further changes since the early 2000s, including an extension of leave entitlements and improvements in childcare provision (Lewis & Campbell, 2007; Sigle-Rushton, 2008). However, the policies implemented since the late 1990s would have had little impact on the women analysed in the current study, since they were born in 1970 and had their first child by 2000.

4.2 Expected findings

In the British context, childbirth has a comparatively strong negative effect on mothers' employment and wages (Cukrowska-Torzewska & Matysiak, 2020; Waldfogel, 1998a, 1998b; Waldfogel et al., 1999). Part-time work is very common among British mothers (Gregg et al., 2007; Waldfogel, 1995). Previous evidence also suggests that British mothers' wages do not recover as their children grow older (Harkness, 2016; Misra et al., 2007). Even after accounting for eligibility for maternity leave, a higher age at birth was found to increase the probability of returning to work within a year of birth for women who had their first child prior to the 1993 reforms (Waldfogel et al., 1999). In this context, we expect a later first birth to have a positive long-term effect on the likelihood of having any earnings (i.e., being employed) in midlife (H1).

For employed mothers, we expect a later first birth to have a positive effect on their earnings in midlife (H2a). This is because a career break taken at a higher age may be shorter and less harmful to women's later wages for reasons related to human capital. However, previous research has also suggested that mothers with a higher AFB are more likely to have a partner whose income they can rely on (Ermisch & Pevalin, 2005). British mothers with an employed partner tend to return to work later after childbirth (Burgess et al., 2008). Being able to rely on a partner's income can also make working part time a more viable option (Harkness, 2016; Matysiak et al., 2024). However, compared to full-time work, part-time work is likely to have a negative impact on wages (Waldfogel, 1995). Moreover, in Britain, lone motherhood has a weaker or no effect on employment or wages compared to motherhood in a partnership once selection effects have been accounted for (Gangl & Ziefle, 2009; Harkness, 2016), and it has an increasingly positive effect on full-time employment as the time since the first birth passes (Harkness, 2016). For these reasons, having a later first birth may result in women taking a longer career break after childbirth or deciding to work part time rather than full time. Consequently, the midlife earnings of these mothers are likely to be lower (H2b).

5. Data

The analysis presented in this study used data from the 1970 British Cohort Study (BCS70), which is an ongoing data collection that follows the lives of >17,000 British residents (Elliott & Shepherd, 2006; Sullivan et al., 2023). The study population includes all individuals who were born in the same week in Britain in 1970, and approximately 98% of births in that week were captured in the initial data collection (Brown et al., 2025). The data collection takes place at specific ages, with recent surveys being spaced between four and five years apart. This study incorporated information from throughout the cohort members' life course until 2016, when they were 46 years old. Since both the outcomes and the independent variable of interest (AFB) [2], of this study were measured at only one point in time, no panel data analysis was possible. The final sample included 2160 women for whom the necessary information was available (see Appendix Table A2 for more details). The analytic sample was restricted to mothers who reported the birth of their first child (first live birth) in the Age 30 Survey, as this survey included a detailed history of previous pregnancies. Thus, the sample consisted of women who had an AFB ≤ 30 and who had participated in the prospective follow-up. Women who had an abortion or experienced a miscarriage/stillbirth prior to their first live birth were included in the study, but we excluded 51 women who had an abortion after experiencing contraceptive failure before their first live birth[3].

Our main outcome – earnings – was measured at age 46 at the individual level as the weekly net labour income from a respondent's primary (paid) job. For those women who did not participate in the Age 46 Survey, data on earnings from the last available survey (i.e., Age 42 Survey) were used instead (~17% of observations in the final sample). Earnings were modelled as a continuous variable and transformed to their natural logarithm to normalise the distribution[4]. About 29% of the final sample reported zero earnings (Table 1). Based on our hypotheses, it is plausible that AFB would have different effects on the probability of having positive earnings and on the amount of earnings conditional on having positive earnings. We therefore decomposed the total earnings variable into two further outcomes: (*i*) a binary indicator measuring whether a woman reported earnings that were greater than zero; and (*ii*) the log-transformed amount of positive earnings for women who reported non-zero earnings (i.e., employed women). We explored other operationalisations in a series of sensitivity analyses.

We analysed several potential mediators of the effect of AFB on earnings: tertiary education, years in paid work (work experience), working hours, family size, and birth spacing. Tertiary education was assessed using information on the highest academic qualification recorded at age 34. Women who obtained at least an undergraduate degree, a higher education diploma (awarded after two years of full-time study at a university), or a teaching qualification were classified as having tertiary education. The years spent in paid work were derived from the Activities dataset. This measure covered all activities carried out by women from the age of 16 onwards. Work was measured in years and included all types of paid work, regardless of whether it was part-time or full-time work or dependent employment or self-employment. Periods of maternity leave, education, unemployment, illness, or unpaid care work were counted as time not spent in paid work. We assessed working hours using binary indicators for women reporting their employment status as working full time or part time. We used a binary indicator for women having two or more children as a measure of family size, and birth spacing was measured as the difference in months between the birth date of the first and the second child born to a woman (including births up to age 46). For the analysis of birth spacing only, we removed ~2.5% of respondents in the entire BCS70 sample who reported birth spacing of less than 10 months.

6. Method

We first examined the association between AFB and earnings in an OLS regression model. Then, we conducted a series of diagnostic checks to assess the validity of two candidate instrumental variables before estimating our preferred IV specification. Heteroskedasticity-robust standard errors were used in all

2 In our analysis, AFB consistently refers to the age at the first live birth.

3 Including these observations might lead to a violation of the monotonicity assumption required for IV models.

4 To avoid the occurrence of missing values for women without earnings, 1 GBP was added to all of the earnings before the logarithm was calculated.

analyses. Since the BCS70 study includes almost all people who were born in a specific week, neither weighting of observations nor controlling for cohort or period effects was necessary. The analysis was carried out using Stata 18.0 (StataCorp, 2023).

6.1 OLS regression

The OLS regression model can be written as:

$$Y_i = \beta_0 + A_i\beta_1 + \mathrm{X_i}\beta_2 + \varepsilon_i \quad (1)$$

Y_i denotes the outcome variable for observation *i*. A_i represents the AFB and X_i is a vector containing several control variables predetermined before a woman's first birth[5]. We controlled for the age at completion of education of the mother as a proxy for the mother's educational level, the mother's AFB, the occupational class of the parents at the time of the woman's birth, whether the woman was conceived out of wedlock, and the marital status of the parents at the time of the woman's birth. Moreover, the model included the region of birth to account for regional differences in socio-economic status and fertility behaviour. Finally, to control for systematic differences between earnings at age 46 and at age 42, a dummy variable for the survey from which the earnings data were taken was included. Estimates from this model can only be interpreted as causal effects if all relevant factors that may have influenced both AFB and earnings are controlled for. This assumption is likely to be violated by unobserved factors (e.g., career aspirations) that are related to AFB and earnings.

6.2 Instrumental variables regression

To address such potential biases, we carried out a two-stage least squares (2SLS) regression analysis. Two instruments were used for this analysis. The first instrument was a dummy variable describing whether a woman experienced a miscarriage or stillbirth in her first pregnancy. In the BCS70 data, a loss of pregnancy before the 26th week of pregnancy was defined as a miscarriage, whereas a loss of pregnancy after the 26th week was defined as a stillbirth. The second instrument used in the analysis was contraceptive failure, measured as a dummy variable describing whether a woman's first child was conceived despite the use of contraception at the time of conception[6]. If the first pregnancy was an abortion, information on the outcome of the first non-aborted pregnancy was used. Here, we considered both instruments individually, because, as we show in Appendix Material A3, they differed in their validity and in the strength of their association with the AFB.

The IV regression analysis followed a two-stage approach, delineated below:

$$A_i = \alpha_0 + Z_i\alpha_1 + X_i\alpha_2 + \nu_i \quad (2)$$

$$Y_i = \beta_0 + \widehat{A}_i\beta_1 + X_i\beta_2 + \varepsilon_i \quad (3)$$

where A_i denotes the AFB for women i and Z_i is one of the two possible instruments. In the second stage, $\hat{\mathrm{A}}_i$ denotes the predicted values for the AFB from the first stage. Essentially, the IV model identified the causal effect of AFB on the outcome by focusing on the variation in AFB induced by biological fertility shocks or contraceptive failure. A miscarriage or stillbirth may have forced a woman who was about to have a child to delay childbearing until she became pregnant again at a later point in time. Contraceptive failure was expected to affect AFB in the opposite direction, as women who used contraception would usually have their first child at a later point in time after stopping contraception. The causal effect identified under the required IV assumptions was a local effect[7], i.e., it only applied to women whose fertility timing was determined by the instrument ("compliers"). It is worth noting that for both instruments, the variation in AFB stemmed from deviations from desired fertility timing. In particular, the contraceptive failure instrument identified variation in AFB due to unplanned pregnancies. In contrast, women whose AFB was

5 We modelled AFB using a linear trend, because modelling nonlinear trends in endogenous variables is very challenging in instrumental variable models. We explored one possible non-linear modelling approach in a sensitivity analysis.

6 Miller (2011) used these instruments together with a third instrument (years from first attempt to conceive to birth).

7 Because our treatment variable is continuous, technically the IV model identifies a local average causal response function rather than a local average treatment effect.

not determined by the instrument gave birth following a planned pregnancy, either because they did not use contraception and experienced an early birth ("always-takers" in the IV literature) or because they would not have continued an unplanned pregnancy in the event of contraceptive failure ("never-takers"). The distinction between planned and unplanned births is therefore crucial when considering how our results can be generalised. We return to this issue in the discussion section.

We conducted a series of diagnostic checks to examine the required assumptions for IV estimation. Following these diagnostic checks (see Appendix Material A3 for a detailed discussion), we chose as our preferred IV specification a 2SLS regression using contraceptive failure as an instrument for the AFB, controlling for parental characteristics, as shown in Table 1. IV estimation assumed that the instrument was exogenous and was only related to the outcome through its effect on AFB. Previous studies have documented that contraceptive failure is more common among women who have lower education (Musick et al., 2009) and are in less stable partnerships (Wellings et al., 2013). We controlled for parental characteristics because they were likely to capture such socio-economic differences, but were not potential mediators as they were determined before sexual activity began[8]. We present additional estimates using the biological fertility shock instrument in the appendix (Appendix Table A4).

We additionally examined potential mechanisms by estimating our preferred IV specification using the potential mediators as outcomes. We also conducted a mediation analysis (see Appendix Material A8). Since this analysis required additional, strong assumptions, the results should be considered only as suggestive evidence.

7. Results

7.1 Sample characteristics

The characteristics of the sample are presented in Table 1. On average, the women in the sample earned 222.72 GBP per week at midlife[9]. However, the outcome variable had a high standard deviation. The low mean and the high standard deviation of earnings can be explained by the fact that only 70.9% of the women had any labour earnings at midlife. All women who reported positive earnings were either full-time or part-time employed, whereas women reporting a different employment status (self-employed, unemployed, in education, temporary or permanent sickness/disability, looking after home/family, and retired) did not report any earnings; only 22 women reported being in full-time or part-time employment but did not report any employment income (not shown). Put differently, the indicator of having any earnings was essentially analogous with being employed. The characteristics of the women without earnings are presented in Appendix Table A5. The table shows that compared to women who had some earnings, women with no earnings at midlife came from lower socio-economic backgrounds, had less education, had worked fewer years, and were much more likely to belong to the lowest household income quintile.

The average AFB of the analysed women was just under 24 years, which was more than two years higher than that of their mothers (Table 1). The AFB of the mothers was comparable to that reported for England and Wales in 1970 (i.e., 23.7), and the AFB of the women was close to the respective mean in 1994 (i.e., 26) – or when our cohort would have reached 24 years of age (ONS, 2022). Less than 10% of these women experienced a miscarriage or stillbirth in their first pregnancy, and 15.5% conceived their first child while using contraception[10]. The vast majority of these women (86%) had at least two children (Table 3),

8 In a sensitivity analysis, we also consider IV specifications without covariates to address concerns around negative weighting (Blandhol et al., 2022; Słoczyński, 2020). The exclusion of these covariates does not qualitatively alter our conclusions. These results are shown in Appendix Table A4.

9 This amount corresponds to 269 EUR and 302 USD using the exchange rates of 1 July 2016 and 31 May 2012 for the earnings measured in the BSC70 surveys in the respective years.

10 The share of births following contraceptive failure in our sample is lower than the share of 32% in the US reported by Miller (2011), but aligns with the evidence on the proportion of unintended pregnancies in Britain. For example, Wellings et al. (2013) reported that in the NATSAL-3 data (2010–2012) 16.2% of pregnancies with an observed outcome were unintended. Lakha and Glasier (2006) reported that 8.6% of women attending an Edinburgh hospital for antenatal care had an unintended pregnancy, while 65.6% of continuing pregnancies were intended.

and the average number of children born to these women was 2.35 (not shown). Approximately a quarter of the women attained a tertiary-level degree (Table 3). The majority of the women left the education system after completing their O-levels/GCSEs, which were typically taken at age 16, the statutory minimum school-leaving age at the time, and only about a third continued their education after this stage and completed their A-levels or a tertiary degree (not shown). Thus, these women spent more time in education than their mothers, who, on average, left the education system below the age of 16 (Table 1). The parents of the majority of the women in our sample were married and belonged to the working class at the time of the women's conception and birth.

Table 1: Sample characteristics: British women with a first birth at age ≤30

	N	**Mean**	**SD**[1]	**Min**	**Max**
Net earnings	2,160	222.72	243.13	0	4,158.46
Net earnings>0[2]	1,531	314.22	233.76	0.77	4,158.46
Age at first birth (AFB)[3]	2,160	24.00	3.63	15	30
Mother's age at completion of education[4]	2,160	15.58	1.59	0	25
Mother's age at first birth	2,160	21.64	3.65	12	43
	N	**%**			
P(Net earnings>0)					
0	629	29.1			
1	1,531	70.9			
First non-abortion pregnancy was a stillbirth/miscarriage					
No	1,955	90.5			
Yes	205	9.5			
First birth was conceived while using contraception[3]					
No	1,825	84.5			
Yes	335	15.5			
Parents' occupational class at woman's birth					
V unskilled	126	5.8			
IV partly skilled	397	18.4			
III manual	1,010	46.8			
III non-manual	286	13.2			
II managerial and technical or I professional	341	15.8			
Woman was conceived out of wedlock					
No	1,830	84.7			
Yes	330	15.3			
Parents' marital status at woman's birth					
Single, widowed, divorced or separated	158	7.3			
Married	2,002	92.7			

Note: Region of residence at woman's birth consisting of 10 categories is not shown in the table. 1SD = Standard deviation. 2Total amount of earnings among women who had non-zero earnings (i.e., employed women). 3First birth refers to the first live birth. 4A value of zero for the mother's age at completion of education implies that the mother has never attended school. Source: BCS70, own calculations

7.2 Effects on earnings

Appendix Table A3.1 shows the first-stage regression for both potential instruments. Experiencing a biological fertility shock led to a shift in AFB of about 9.2 months, while contraceptive failure reduced AFB by about 1.5 years. Importantly, the F-statistic on the strength of the instruments suggests that biological fertility shocks were not sufficiently strongly related to AFB, while contraceptive failure was a much stronger predictor. We therefore estimated our preferred IV regressions using only the contraceptive failure instrument (see Appendix Material A3 for a detailed discussion), controlling for several observable parental characteristics.

Table 2 shows the estimates of the effect of AFB on earnings from the OLS and IV regression models. Full regression tables are available in the appendix (Appendix Tables A6 and A7). Consistent with the findings of previous research, the OLS estimates showed a significant positive association, with a one-year delay in AFB being associated with a 7.5% increase in midlife earnings. Columns 2 and 3 suggest that this positive association was primarily driven by the probability of working: for example, delaying childbearing by one year was associated with a 1.3-percentage-point higher probability of reporting any earnings at midlife. In contrast, conditional on reporting any earnings, AFB was not significantly associated with the amount of earnings at midlife.

Table 2: Effects of the age at first birth (AFB) on earnings at midlife

	ln(Net earnings)	P(Net earnings>0)	ln(Net earnings>0)
OLS estimates			
Age at first birth (AFB)	0.075****	0.013****	0.007
	(0.016)	(0.003)	(0.005)
IV estimates			
Age at first birth (AFB)	0.055	0.018	-0.058**
	(0.097)	(0.017)	(0.027)
KP F-statistic[1]	60.878	60.878	46.977
Number of observations	2,160	2,160	1,531
Mean of dependent variable	222.72	0.709	314.22

Note: **** p<.001, *** p<.01, ** p<.05, * p<.1 The table shows estimates of an OLS and a 2SLS regression of earnings on the age at first (live) birth (AFB) using contraceptive failure as an instrumental variable. The three outcome variables are defined as: log of total net earnings + 1 (Column 1), a binary indicator for whether a woman reported non-zero net earnings (Column 2), and the log of total net earnings conditional on reporting non-zero earnings (Column 3). Robust standard errors are shown in parentheses. Models control for the mother's age at completion of education, the mother's age at first birth, the occupational class of the parents at the time of the woman's birth, whether the woman was conceived out of wedlock, the marital status and region of residence of the parents at the time of the woman's birth, and the survey at which the most recent earnings data were collected. 1The KP F-statistic is the Kleibergen-Paap F-statistic on the strength of the excluded instrument. Source: BCS70, own calculations.

The point estimate of the effect of AFB on total earnings in the IV regressions was positive (5.5%), but not statistically significant. However, columns 2 and 3 show that this estimate concealed considerable heterogeneity. Column 2 indicates that higher AFB increased the probability of reporting any earnings at midlife by 1.8 percentage points. This was in line with the OLS estimate, although our IV estimate was not statistically significant. However, in the IV regressions, a higher AFB reduced the amount of earnings for women who were working by 5.8%[11], which was in stark contrast to the insignificant (and close to zero) OLS estimate. A possible explanation for these results is that the OLS estimates were biased upwards by factors that were related to a higher AFB and higher earnings, but that were unrelated to labour force participation (e.g., career aspirations).

7.3 Potential mechanisms

Table 3 shows the estimated effect of AFB on eight potential mediators, broadly capturing women's education, previous and current employment, subsequent fertility, and current partnership status. For most outcomes, the OLS and IV estimates were qualitatively similar, but the effect sizes were larger in IV regressions with three exceptions (years in paid work, tertiary education, and having two or more children). This might indicate that the OLS estimates were biased towards zero. The IV estimates indicated that a delayed first birth led women to be 5.4 percentage points less likely to be working full time, and 6.8 percentage points more likely to be working part time. For years in paid worked, we estimated a positive yet insignificant coefficient of AFB. We did not observe any effects on education or the occurrence of a second

[11] At the sample average of 314.2 GBP per week, a decrease of 6% corresponded to about 19 GBP per week. To put our point estimates in perspective, we note that the impact of an additional year of education on the earnings of women in the UK has been estimated to be 7.7% (Bonjour et al., 2003)

birth. However, the delay of a first birth by one year led to a 5.5-month shorter interval between the first and the second birth, and a higher probability of living with the father of the first child (+8.4 percentage points), as well as of living in any cohabiting partnership (+2.8 percentage points, significant at the 10% level).

Table 3: Effects of the age at first birth (AFB) on potential mediators

	Tertiary-level degree	N. of years in paid work	Full-time employed	Part-time employed	Two (or more) children	Birth spacing (1st to 2nd)	Living with father	Living with partner
OLS estimates								
Age at first birth (AFB)	0.019****	0.572****	-0.008**	0.020****	-0.007****	-1.381****	0.040****	0.012****
	(0.003)	(0.052)	(0.003)	(0.003)	(0.002)	(0.249)	(0.003)	(0.003)
IV estimates								
Age at first birth (AFB)	0.003	0.475	-0.054***	0.068****	0.022	-5.453****	0.084****	0.028*
	(0.017)	(0.291)	(0.019)	(0.017)	(0.014)	(1.646)	(0.020)	(0.017)
N of observations	1,882	2,051	2,155	2,155	2,160	1,833	1,843	2,160
Mean of dep. variable	0.255	21.26	0.466	0.361	0.861	47.31	0.543	0.762

Note: **** p<.001, *** p<.01, ** p<.05, * p<.1. The table shows estimates of the effects of the age at first (live) birth (AFB) on the potential mediators specified in the columns. Estimates come from an OLS and a 2SLS regression using contraceptive failure as an instrumental variable. Robust standard errors are shown in parentheses. Models control for the mother's age at completion of education, the mother's age at first birth, the occupational class of the parents at the time of the woman's birth, whether the woman was conceived out of wedlock, the marital status and region of residence of the parents at the time of the woman's birth, and the survey at which the most recent earnings data were collected. Source: BCS70, own calculations.

A decomposition of the total effects of AFB on earnings into direct effects (not explained by the mediators) and indirect effects (explained through changes in the mediators) suggests that the total effects in the OLS regressions effects on earnings were almost completely explained through changes in the mediators (see Appendix Tables A8.1 and A8.2). When the mediators were included in the IV regressions, they explained most of the effect of the AFB on the amount of earnings (i.e., the only outcome that was significantly affected by fertility timing in our main specification). However, due to missing values on the mediators the sample size in this mediation analysis was substantially smaller than the sample in Table 2, and, consequently, the estimated total effects did not match those reported in Table 2. We did not test the mediation by individual variables separately, as this would require making assumptions about sequential ignorability (Imai et al., 2010) that were unlikely to hold.

7.4 Sensitivity analyses

We conducted a series of sensitivity tests to assess the robustness of our findings from the IV regression models (see Appendix Table A9). First, we considered alternative operationalisations of earnings. We examined whether our results were sensitive to analysing (self-reported) gross rather than net earnings, or to the inclusion of self-employment income in addition to income from the main job. The effects remained qualitatively similar with these alternative specifications. Results were also robust to controlling for tertiary-level education or the age of the youngest child in the household. Second, we re-estimated our IV regression models using different sample selection criteria. Our working sample did not condition on a woman having entered the labour market before the first childbirth, but it has been suggested that a delay in the first birth would only increase the earnings of women who engaged in paid work prior to having their first child (Herr, 2016; Karimi, 2014). Research focusing on teenage mothers suggests a negative impact on labour market outcomes up to the early thirties in Britain (Chevalier et al., 2003; Ermisch, 2003). Our results remained similar with the exclusion of (i) women without work experience before their first birth, or (ii) women who had their first birth before age 20. With the first specification, the negative coefficient on the amount of positive earnings was significant at the 10% level.

We also used inverse probability weights (IPW) to correct for the selection of women whose AFB was ≤30 in our working sample. We first estimated a probit regression in which we regressed an indicator for our sample selection on the same covariates included in our regression models. Based on this probit regression, we constructed inverse probability weights and re-estimated our IV regressions using these

weights to correct for sample selection. Standard errors for these IPW-adjusted IV estimates were derived by repeating this two-step procedure for 1000 bootstrap replications. The results from these regressions were very similar to our baseline specification, even if the negative effect on the amount of positive earnings was only significant at the 10% level.

Finally, we considered nonlinear changes in the effects of AFB by splitting our sample based on the predicted AFB derived from a lasso regression (Braghieri et al., 2022) (see Appendix Material A10 for a detailed description and the results). While the estimates for women with an early predicted AFB were slightly larger, the estimated effects of AFB on earnings were qualitatively similar for women with an earlier or a later predicted AFB. We interpret this as evidence suggesting that our estimated linear effect of AFB on earnings approximates the (potentially nonlinear) causal response function sufficiently well.

8. Discussion

8.1 Main findings and implications

This study investigated the impacts of the timing of entry into motherhood on women's midlife earnings in Britain, using BCS70 data on women with a detailed history of pregnancies recorded up to the age of 30. We drew on an IV regression approach, which assumed that the occurrence of contraceptive failure predicted the AFB but was not correlated with earnings through any other mechanism. Our rigorous testing provided support for this assumption. We found only tentative evidence of a positive (~ 2%, non-significant) effect of a one-year increase in the AFB on women's probability of having any labour earnings at midlife – i.e., of being employed. This finding partially aligns with our H1, which assumed a significant positive effect. At the same time, we also found that, among mothers who were employed in midlife, a one-year increase in their AFB significantly reduced their current earnings (~ 6%, equivalent to 19 GBP per week at the sample average), which is aligned with our H2b. We further demonstrated that AFB influenced potential mediators of the latter effect, including by increasing the likelihood of working part time as opposed to full time in midlife. In other words, our findings show that while a higher age at first birth increased maternal employment in midlife, it did not necessarily result in higher midlife earnings for employed mothers in Britain. This is because women in Britain who had their first child at a higher age (between 15 and 30) were more likely to work part time in midlife than those who had their first child at an earlier age. Altogether, these findings provide new evidence on the impact of the timing of entry into motherhood on women's earnings, especially in a context where support for work-family reconciliation is limited. However, as the current study sample only included women whose AFB was no higher than 30, the results are not directly generalisable to differences in timing among women who delay their first birth beyond age 30, who are often highly educated (Berrington et al., 2015; Joshi, 2002)[12].

Our findings are similar to some previous findings from Europe. For instance, using an IV regression with biological fertility shocks, Karimi (2014) estimated a negative effect of delayed motherhood on wages in Sweden. Rosenbaum (2021) combined IV regression with biological fertility shocks and siblings FE and found that early motherhood has no impact on earnings beyond the early thirties in Denmark. US studies have typically found positive wage effects of later entry into motherhood, while also observing that some effects may be limited to women with higher levels of education (e.g., Doren, 2019; Herr, 2016). Such heterogeneity may partly explain why the present study did not find a positive impact of timing on earnings. Given the educational differences in the AFB, highly educated women were under-represented in the present study, which was based on British women whose AFB was ≤30. Moreover, the results could be related to differences in the motherhood penalty along the earnings distribution. Cooke (2014) found that the motherhood earnings penalty in the United Kingdom is largest for women in the middle of the earnings distribution, while women at the bottom actually receive a premium. Since, on average, earnings increase with age (Robinson, 2003), early mothers are likely to be situated lower in the earnings distribution at the time of their first birth than later mothers. Thus, early mothers may experience less of a motherhood

[12] In the present study, 25.5% of women attained a tertiary-level degree. For the BCS70 female cohort as a whole, this proportion was 32%. Of all women, 54% had become mothers by age 30, with variation by education (see Joshi, 2002).

penalty or even a premium, supporting our finding of a positive effect of early entry into motherhood on midlife earnings for employed British mothers.

The negative effect of higher AFB on employed mothers' midlife earnings was not due to differences in human capital (i.e., education or work experience) or the occurrence of a subsequent birth. Rather, other mechanisms seem to be more relevant for explaining this effect. Our results indicate that the positive effect of later timing on the likelihood of working part time was a reasonably direct mechanism. We estimated that a one-year increase in the AFB led to a relatively large increase – by 5.4% in the IV model – in the probability of working part time as opposed to full time in midlife. However, our findings also suggest that the choice of earlier mothers to work full time in midlife may be influenced by less direct reasons, such as the presence of a partner.

We found that mothers who had their first child later in life were more likely to have a co-residential partner in midlife. In such cases, they could more often rely on their partner's income and reduce their working hours. Mothers who had their first birth earlier were, in turn, more likely to be single and to be working full time. It is more challenging for mothers without a partner to reconcile work and family life in Britain (Joshi, 2002; Misra et al., 2007). For some British lone mothers, however, full-time work becomes a more viable option as their children grow older (Zagel, 2014). Once selection effects have been accounted for, becoming a lone mother does not reduce the likelihood of being in full-time employment in Britain relative to that of partnered mother, and it has a positive effect on full-time employment as the time since the first birth passes (Harkness, 2016). There is also no additional wage penalty for lone mothers relative to that of partnered mothers after controlling for work experience (Gangl & Ziefle, 2009; Waldfogel, 1995).

In addition, it has been previously shown that early motherhood among British women increases the likelihood of partnering with a man who is at risk of unemployment (Ermisch & Pevalin, 2005). A partner's weaker position in the labour market may be another incentive for early mothers to work full time rather than part time in midlife (Gregg et al., 2007). Indeed, recent research suggests that a partner's unemployment can lead to an increased labour supply of mothers (Matysiak et al., 2024). Overall, we consider mechanisms related to the partner as plausible explanations for the negative impact of AFB on earnings found among employed women in the current study. Our results show, empirically, that the timing of the first birth affected the likelihood of having a co-resident partner in midlife.

Moreover, our results suggest that the negative earnings effect of higher AFB, as mediated by part-time work, may be related to a more closely spaced second birth (see also Karimi, 2014). According to our IV estimates, an increase in the AFB of one year resulted in a decrease in the interval between the first and the second birth of 5.5 months. A short interval between births may require a mother to take one long career break instead of two shorter ones and to make greater adjustments to her work in order to accommodate the care of young children, possibly leading to long-term adjustments in her working hours. The child-related career breaks of British mothers have shortened over time (Joshi, 2002). This trend has coincided with an increase in part-time employment among mothers with young children in the 1980s and 1990s, alongside improvements in maternity rights, which have led to only marginal increases in mothers' wages (Gregg et al., 2007).

In light of our results, future research should consider mechanisms other than human capital when examining the impact of AFB on women in the labour market. We highlight that among women who had their first child between the ages of 15 and 30, a tendency to shift from full-time to part-time work is likely to explain why women with a later first birth earned less in midlife. Partnerships and birth spacing are less direct mechanisms that may influence earnings through choices concerning working time. Partnerships and birth spacing may also be related, given that the dissolution of a partnership is a possible underlying reason for longer birth spacing. Some of the longer birth intervals observed among mothers who had their first child earlier may stem from having children with multiple partners, given that the impact of AFB on not living with the father of the first child was found to be stronger than the impact of AFB on living with a partner overall.

8.2 Study limitations

The available sample size decreased the statistical power of our IV regression analysis, despite the significant association of the instrument with motherhood timing and no violations of the IV assumptions being found. Future studies would benefit from larger datasets that include information on contraceptive histories. Our tests of instrument validity suggested that biological fertility shocks might not be valid

instruments for assessing the effect of motherhood timing, likely because of unobserved differences between women who did and did not experience such fertility shocks (see also Herr, 2016; Wilde et al., 2010). However, using large administrative data, Karimi (2014) found that women who miscarried differed little from other women with respect to their prior health-related characteristics, while Rosenbaum (2021) suggested that complementing the IV estimation with sibling FE to control for family heterogeneities could produce estimates with higher internal validity. Future research should carefully assess instrument validity and also consider alternative approaches to establishing causality (see also Bratti, 2015).

As our IV regressions identified the effects of AFB for women who gave birth earlier than planned, these effects may be different for women who were able to achieve their desired timing or who gave birth later than planned. Previous evidence shows that unplanned births often occur due to contraceptive failure rather than non-use (ESHRE, 2018), and that they are more common among women with lower levels of education (Musick et al., 2009; Wellings et al., 2013). Such differences may be due to lower levels of economic and relationship stability, or lower efficacy and self-regulation, among the less educated. An unplanned pregnancy is also associated with a higher risk of depression and poorer health behaviours in the following year (Wellings et al., 2013), and potentially worse long-term mental health outcomes (Gipson et al., 2008). Furthermore, it can be argued that the ability to plan the timing of a first birth may allow a woman to reduce the career costs of motherhood (Bailey et al., 2012). As a result, an unplanned birth may be more damaging to a mother's career than a planned birth. Alternatively, an unplanned birth may be associated with fewer work adjustments, and might therefore be less damaging to a career (Bearak et al., 2021). Moreover, anticipating the costs of having a child, such as career costs, may be associated with the degree of birth planning (Simoni et al., 2017) and the likelihood of having an unplanned birth (Brzozowska et al., 2021). Contraceptive use among British women is almost universal, but there is some evidence of socio-economic, and particularly educational, differences in patterns of use (Wellings et al., 2001)[13].

Our sensitivity analysis showed that the main findings held even when educational attainment, in addition to parental characteristics, was controlled for in the IV models. Despite our statistical testing, we cannot completely rule out the possibility that unobserved differences between mothers who had a contraceptive failure and mothers who did not could affect our results. However, methodological considerations suggest that direct effects of contraceptive failure related to such factors, i.e., effects not attributable to lower AFB, should bias our estimates of the negative effect of AFB on employed mothers' earnings mainly towards zero. Based on the link between low education and unplanned births, we might expect contraceptive failure to be linked to a lower probability of employment and lower earnings. In such a case, our estimate of a true negative effect of timing on the amount of earnings would be conservative.

Finally, the restriction of the study sample to women who had their first child between the ages of 15 and 30 limits the generalisability of our findings. A sensitivity analysis using inverse probability weights suggested that our results remain robust. However, that analysis required further assumptions, and observing births at older ages would provide stronger evidence than our sensitivity analysis could. Due to methodological limitations, we assumed that the marginal (monetary) returns to delaying childbearing by one year are constant. The results from a sensitivity analysis suggest that estimates for women with a predisposition towards earlier or later AFB are qualitatively similar. Nevertheless, we cannot fully rule out the possibility that the effects change nonlinearly, and therefore might also differ for women giving birth before or after age 30. There is limited evidence on the shape of the "dose-response" relationship between the timing of entry into motherhood and earnings. A Danish study suggested that an AFB under 30 is associated with larger gains (Leung et al., 2016), while an Italian study found decreasing returns to earnings of very long delays (Picchio et al., 2021). A higher AFB may even lead to more diverse labour market trajectories (Frühwirth-Schnatter et al., 2016). We call for more evidence on the heterogeneity in the effects of motherhood timing by life stage. In theory, the timing may be most critical for women with potentially steep career profiles (e.g., highly educated women) who have entered the labour market but have not yet progressed in their careers.

[13] In our study sample, at age 30, around 35% of women reported currently taking the contraceptive pill and 9% reported never having taken any oral contraceptives.

8.3 Conclusion

This study suggests that early motherhood can have long-term effects on earnings, which are not necessarily uniformly negative. Our results show that for British mothers born in 1970, who were employed in midlife and did not delay their first birth until their thirties, earlier entry into motherhood led to higher current earnings in midlife. This can be explained by the observation that having an early birth also resulted in mothers being more likely to work full time rather than part time in midlife. Our findings suggest that this direct mechanism may have been impacted by partnerships and birth spacing. Some early British mothers may have been driven by necessity to work full time in midlife, as they were less likely to be able to rely on the income of a co-resident partner.

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Data availability statement

The analyses of the present study use data from the 1970 British Cohort Study (BCS70), through Age 46 Survey (DOI: 10.5255/UKDA-SN-8547-2). The data were deposited at the UK Data Archive by the Centre for Longitudinal Studies at the UCL Institute of Education, University of London. BCS70 is funded by the Economic and Social Research Council (ESRC). More information on these data, including the collection and ethical aspects of and access to these data are available at https://cls.ucl.ac.uk/cls-studies/1970-british-cohort-study/.

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Information in German

Deutscher Titel

Führt eine frühe Erstgeburt zu niedrigeren Einkünften im mittleren Alter in Großbritannien?

Zusammenfassung

Fragestellung: Den Effekt des Zeitpunktes der Erstgeburt einer Frau auf ihre Einkünfte im mittleren Alter und die potentiellen Mediatoren dieses Effekts zu untersuchen.

Hintergrund: Während viele Studien zeigen, dass Mutterschaft die Löhne und Einkünfte von Frauen deutlich beeinflusst, gibt es wenig Forschung zum Einfluss des Zeitpunktes des Beginns der Mutterschaft, insbesondere auf lange Sicht und in Kontexten außerhalb der Vereinigten Staaten.

Methode: Wir analysierten Daten von Frauen, die in einem Alter zwischen 15 und 30 Jahren ihr erstes Kind gebaren, erhoben in der 1970 British Cohort Study. Unsere bevorzugte Spezifikation nutzt das Versagen von Verhütungsmitteln als eine exogene Einflussgröße auf das Alter bei der ersten Geburt im Rahmen einer Instrumentvariablenregression.

Ergebnisse: Wir fanden Anzeichen dafür, dass ein höheres Alter bei der Erstgeburt zu einer erhöhten Wahrscheinlichkeit führt, im mittleren Alter beschäftigt zu sein. Gleichzeitig reduzierte ein höheres Alter bei der Erstgeburt das Niveau der Einkünfte beschäftigter Mütter im mittleren Alter, da eine spätere Erstgeburt häufiger zu einer Teilzeiterwerbstätigkeit führte anstelle von einer Vollzeiterwerbstätigkeit. Zudem verringerte ein höheres Alter bei der ersten Geburt den Abstand zur zweiten Geburt und erhöhte die Wahrscheinlichkeit, mit einem Partner im Haushalt zu leben, der zum Haushaltseinkommen beitragen konnte.

Schlussfolgerung: Diese Ergebnisse deuten an, dass der Einfluss einer frühen Erstgeburt auf die Einkünfte im mittleren Alter nicht durchweg negativ ist.

Schlagwörter: Alter während der Erstgeburt; Arbeitsmarktbindung; Beschäftigung; BCS70; Einkünfte; Großbritannien; Humankapital; mittleres Alter; Vereinigtes Königreich

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