A New Model of Parental Time Investments: A Paradigm Shift for Addressing Gender Inequality in the Labor Market

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Abstract

This paper introduces a new framework for understanding the persistence of the motherhood penalty by emphasizing the role of on-call care. Using a pseudo-panel event study based on the 2003–2022 American Time Use Survey (ATUS), we quantify how different types of parental care time contribute to post-childbirth labor market outcomes. Our results show that gender gaps in on-call care, not primary childcare, drive the long-term reduction in mothers' paid work. In the first two years after birth, declines in paid work are largely explained by primary interactive childcare. Over time, however, on-call care becomes the dominant factor. This shift is not accounted for in existing labor market models, nor in standard policies such as parental leave and childcare subsidies. We argue that the persistent economic costs of gender inequality can be better understood and addressed by integrating the temporal and unpredictable nature of caregiving into economic theory and policy design.

1 Introduction

There is a growing consensus among economists about the deep interaction between family life and labor market decisions. We now know that if women's occupations followed the male distribution a third of the difference in earnings between men and women would be reduced (Goldin, 2014; Blau and Kahn, 2017). The other two-thirds of the gender-based difference in earnings comes from factors within each occupation (Goldin, 2021). Women's inability to combine work with family seems to account for the lion's share of the gender earnings gap (Kleven et al., 2019). Yet, after years of family policies such as parental leave and childcare subsidies, gender equality remains elusive (Kleven et al., 2019). This paper proposes a paradigm shift toward economic models that emphasize the often overlooked on-demand care as missing piece to understanding and addressing the persistency of the motherhood penalty.

Reductions in mothers' work hours following childbirth are widely recognized as a key driver of persistent gender gaps in labor supply and earnings. Primary caregiving is time consuming, and women are suddenly on call at home after the birth of the first child and cut back paid work hours.[1] Using the NLSY79, (Goldin et al., 2022) show that while mothers' earnings penalties gradually decline as children age and work hours increase, particularly for less-educated women, a full return to pre-childbirth employment levels remains elusive. Kleven et al. (2019) demonstrate that, after childbirth, women's earnings drop by 30%, while men's earnings remain unaffected. A decade later, this translates into a persistent 20% gender earnings gap, primarily due to the significant persistent decrease in women's work hours. [2]

Childcare demands are typically understood as direct, hands-on interactions with children such as feeding, bathing, helping with homework narrowly focused on interactive primary childcare. While these demands are substantial in early childhood, they decline as children grow more independent. Standard approaches to measuring parental time in labour supply models fail to reflect this shift, capturing only a narrow window of what caregiving entails across a child's development and failing to provide a sucessful explanation for the persistency of the motherhood penalty beyond the early years. In the first years of life, caregiving is

[1]Evidence from time diaries on "primary childcare", the time parents actively report engaging in childcare activities, shows that mothers devote substantially more time to primary childcare than fathers. In the United States, mothers allocate approximately 20 hours per week to primary caregiving tasks, whereas fathers contribute around 10 hours, effectively doubling the maternal time commitment to these essential responsibilities (Aguiar and Hurst, 2007; Guryan et al., 2008). Comparable figures are observed across other developed nations (Gimenez-Nadal and Sevilla, 2012; Doepke and Zilibotti, 2017).

[2]This pattern is not unique to Denmark. Similar findings are observed globally (Kleven et al., 2024). Additionally, evidence indicates that these gender gaps are not primarily rooted in biological differences (Kleven et al., 2021).

dominated by basic care, such as feeding and bathing, and child-directed play, which foster early cognitive and socioemotional development. As children enter the preschool years, parental time shifts toward teaching activities—like reading or helping with puzzles—before transitioning in middle childhood to management tasks such as organizing extracurriculars and monitoring school progress (Kalil et al., 2012). These later forms of involvement are less time-intensive and research shows that time spent in direct caregiving declines sharply once children start school, with primary childcare activities—such as playing, reading, and helping with tasks—dropping to near-negligible levels by middle childhood (Ramey and Ramey, 2010; Borra and Sevilla, 2019).

Using contextual diary information from the 2003–2022 American Time Use Survey (ATUS), we construct a measure of on-call parental time based on whether the parent is in the same room as the child or accompanying them. On-call parental time investments depart from conventional activity-based definitions of childcare that rely on primary childcare activities recorded in time diaries, such as feeding, bathing, or helping with homework. This approach shifts focus from what parents are doing to whether they are available to respond, reflecting a different dimension of caregiving. On-call time includes supervision, emotional availability, and readiness to intervene, even when no explicit childcare activity is reported. As children grow older and require less hands-on care, on-call demands become more salient, often arising during unscheduled and unpredictable moments. These demands cannot easily be outsourced and require sustained availability over long periods. [3] The relevance of this hidden constraint of being on-call at home became especially clear during the COVID-19 pandemic, when children were home full-time and parents' ability to work was severely restricted, yet primary childcare time in the data remained largely unchanged. On-call childcare can also explain why grandmothers, who often spend little time in direct interaction with their grandchildren, experience a reduction in work hours and earnings when they have their first grandchild, demonstrating that the mere need for availability can affect labor participation (Gørtz et al., 2025).

We estimate the impact of on-call parental time on the motherhood penalty using a pseudo-event study design centered around the birth of the first child. The key challenge in using repeated cross-sectional data is that negative event times—i.e., the period before childbirth—are unobserved for parents, as the data do not indicate whether or when currently childless individuals will go on to have children. To address this, we follow the pseudo-

[3] On-call time is broader than the mental load of managing household logistics such as planning meals, scheduling appointments, and anticipating children's needs (Cohen and Bianchi, 1999; Hochschild and Machung, 2012). These activities can often be performed remotely and flexibly. In contrast, on-call caregiving imposes a real constraint on when and where work can be done, particularly limiting parents' ability to participate in the labor market.

panel approach developed by Kleven et al. (2019), matching each parent observed at event time $\tau = 0$ to a childless individual of the same age, sex, education, and other relevant characteristics, observed n years earlier and n years younger. This yields a synthetic pre-birth observation and enables the construction of a full event-time profile around childbirth. We implement this method using data from the American Time Use Survey (ATUS) between 2003 and 2022, focusing on gender gaps in on-call time before and after the birth of the first child. The approach allows us to estimate dynamic treatment effects without relying on panel data, leveraging variation in calendar time and age to recover event study estimates of the motherhood penalty in time constraints.

Our findings show that accounting for on-call parental time reveals that total parental time investments remain high and gender-unequal long after childbirth, helping to explain the persistence of the motherhood penalty in paid work hours, even after primary childcare declines. While primary childcare drops sharply once children enter school, declining from 25 to 5 hours per week for mothers and from 12 to 2 for fathers by age 17, on-call parental time remains high and stable. Following childbirth, on-call time increases to approximately 35 hours per week for mothers and 25 for fathers, remaining relatively constant throughout childhood. As a result, total parental time investments decline far less over time than previously assumed.

Using a decomposition framework, we show that the enduring gender gap in paid work hours post-childbirth is fully accounted for by differential changes in parental time investments for mothers and fathers. Relative to fathers, mothers reduce their paid work hours by 14 hours per week after the birth of the first child. This decline is matched by a 17-hour increase in mothers' total parental time investments relative to fathers. We further document that the gender gap in on-call parental time investments becomes a crucial explanatory factor of the motherhood penalty in paid work hours as children age. Whereas in the first two years of the child's life reductions in maternal labor supply are mostly driven by primary childcare activities, on-call parental time investment become the predominant explanatory factor beyond the age of 5. These findings underscore the importance of broadening the scope of parental time investments to fully capture the persistent and less visible constraints that shape maternal labor market outcomes over the long run. Taken together, our findings challenge the idea that parental responsibilities taper off as children age, showing instead that ongoing, less visible forms of caregiving (like being on call) continue to constrain mothers' labor supply and are key to understanding long-term gender gaps.

This paper contributes new insights to the study of persistent gender disparities in labor market outcomes by broadening the concept of parental time investments beyond direct and interactive caregiving. A large body of research has documented the emergence of substan-

tial gender gaps in labor market outcomes following the birth of a child, commonly referred to as the motherhood penalty (e.g., (Kleven et al., 2019),(Kleven et al., 2019),(Kleven et al., 2024)). Existing studies emphasize the role of increased time spent on direct childcare in the early years, typically measured through primary activities in time-use data, and its consequences for human capital accumulation and labor supply. While these studies provide valuable estimates of the motherhood penalty, they offer limited insight into its underlying mechanisms, as they rely on a narrow view of caregiving that excludes many time-binding responsibilities beyond direct care. We advance the literature in two directions. The first is to leverage the rich contextual information from the American Time Use Survey (ATUS) to provide a new conceptualization of parental time investments that includes on-call care—periods in which a parent must remain physically present and available to respond to a child's needs, even in the absence of direct interaction. These demands include supervision, emotional availability, and the capacity to respond to unpredictable requests. They are difficult to outsource, extend well beyond early childhood, and impose persistent constraints on when and where parents—particularly mothers—can work. Despite their importance, these forms of caregiving are not captured by standard measures and have remained largely absent from economic models of labor supply. The second contribution is to empirically measure the labor market constraints resulting from on-call parental time investments. Taking advantage of the large number of observations from the almost two decades of yearly cross-sectional data in ATUS, we implement a pseudo-event study design to estimate how parental time investments evolve following childbirth. This approach allows for the identification of dynamic gender gaps in both primary and on-call time, and links these to observed differences in paid work hours across the life course of children. The results show that on-call care accounts for a substantial share of the persistent motherhood penalty in work hours, even as direct childcare time declines. These findings call for a reassessment of how labor supply models conceptualize parental constraints and suggest that policy efforts to reduce gender gaps must address the broader structure of caregiving across all stages of childhood.

2 Data: 2003-2022 American Time Use Survey

We use the American Time Use Survey (ATUS), an annual, nationally representative survey sponsored by the Bureau of Labor Statistics and conducted by the US Census Bureau that has been collected since 2003. An extensive literature confirms the reliability and validity of diary data and their superiority over other time-use surveys based on stylized questions, asking respondents to estimate time in activities on a 'typical day' (Bonke, 2005; Kan, 2008). Just as money expenditure diaries have become the gold standard in the consumption literature,

time-use diaries have emerged as the preferred method for capturing how individuals allocate time across market work, non-market work, and leisure. Most studies examining time use now rely on time diaries, including recent economic analyses of time use patterns (Aguiar and Hurst, 2007; Guryan et al., 2008; Krueger and Mueller, 2011; Gimenez-Nadal and Sevilla, 2012).

The diary captures detailed sequential information over a 24-hour period on a large number of activities as well as the location and who the activity is being done with. The ATUS collects detailed daily activity data from individuals over age 15 who previously participated in the Current Population Survey (CPS). Respondents detail every minute of a 24-hour period, from 4 a.m. to 4 a.m. the following day, through a 15-20 minute telephone interview conducted the next day. In the ATUS, trained coders use a standardized classification system developed by the Bureau of Labor Statistics to code respondents' open-ended, free-text descriptions. These responses are assigned to over 150 predefined categories, grouped into broader areas such as work, leisure, household activities, and personal care. The diary captures both the duration and context of each activity, ensuring consistency and accuracy in the coding process and enabling comprehensive analysis and comparison of time use patterns across different demographics and time periods.

Our cross-sectional sample includes individual data based on diary respondents aged 20–45 from 2003 to 2022 in the linked ATUS-CPS data. We restrict the sample to respondents present in both the CPS (for household structure and demographic characteristics) and ATUS (for the time-use diary), allowing us to assess time-use patterns alongside detailed demographic data. We retain responses of only self-respondents, spouses, unmarried partners, and household children. Outliers are excluded based on improbable parent-child age differences, keeping respondents with an age gap of 12–60 years from their first child or marking individuals as childless if child age data is unavailable. Table 2 reports summary statistics for the final cross-sectional sample, which includes 120,028 respondents (fathers: 30,583; childless men: 23,273; mothers: 47,051; childless women: 19,121).

2.1 Time Use Variables

As is standard in the literature, we construct primary childcare as the time that respondents spend on activities involving direct interaction and caregiving responsibilities, such as physical care for children, reading to/with children, helping children with homework, playing with children, and attending children's events (Guryan et al., 2008; Ramey and Ramey, 2010; Gimenez-Nadal and Sevilla, 2012). We convert the minute-per-day reports to hours per week by multiplying the response by seven and dividing by sixty (Aguiar and Hurst, 2007). ATUS

coders categorize childcare as primary caregiving time when the main activity is recorded as caring for and helping household children, any activity related to household children's education and health, travel related to children's needs, and telephone calls to/from education service providers and childcare services. Having a child present does not qualify as primary childcare unless an active caregiving task. If the respondent mentions multiple simultaneous activities but cannot identify one as main, the coder defaults to the first mentioned. Appendix A.1 provides a detailed description of how this variable is constructed from the ATUS original categorization of activities[4].

We construct on-call parental time investments as the time spent in activities that are not primary childcare and are reported as being done while a child present. This measure captures broader responsibilities of care that go beyond activity-based primary childcare. Appendix A.2 provides a detailed overview of the construction of on-call parental time from the ATUS activity categorization and definitions for child presence. To validate our measure of on-call parental time based on the presence of a child, we compare it to parental care time, constructed from the ATUS "child in care" flag. Parental care time captures whether a child under 13 was in the respondent's care during each activity. Parental care time is constructed as the time spent in diary activities that are not categorized as primary childcare and in which a respondent indicated that a child under 13 was in their care while engaged in other non-childcare-specific tasks. Prior literature has used parental care time constructed in this way as a proxy for supervisory responsibility (Folbre et al., 2005), highlighting its role in limiting parental autonomy and ability to work for pay. These constraints are legally reinforced. For instance, leaving a child under 9 unattended even while sleeping can be classified as neglect and have legal consequences for parents (Budig and Folbre, 2004; Folbre et al., 2005; Suh and Folbre, 2023).

Table 1 shows a strong alignment between on-call parental time investments and parental care time, supporting the interpretation of on-call parental time as parental availability. This implies a direct constraint on work hours, as availability must be maintained regardless of

[4]The ATUS codebook defines primary childcare as activities in which the respondent is directly engaged in caring for a child, such as feeding, bathing, or helping with homework, as their main activity. Secondary childcare, by contrast, involves supervising or caring for a child while primarily engaged in another task. However, the American Time Use Survey (ATUS) does not collect data on secondary activities, unlike earlier time-diary studies such as HETUS. Instead, ATUS uses a broader and more passive measure called "a child in your care", which captures periods when a child under age 13 is under the respondent's supervision, regardless of the primary activity being reported. This information is collected through post-diary questions rather than from the diary itself. In contrast, "a child present" is derived from "with-whom" data, indicating whether a child was physically with the respondent during an activity, without implying caregiving responsibility. Importantly, since ATUS does not ask "What else were you doing?" for each diary episode, it cannot capture secondary activities in the same way that HETUS and other earlier surveys, such as MTUS-X, do. Instead, ATUS relies on the "in your care" measure to estimate passive or supervisory childcare time.

the task. There is a high overlap between on-call parental time investments and parental care time at all children ages. The time that parents report a child is present is around 35 hours a week, of which 32 hours a week is parental care time. This means that over 90% of time reported with a child present is also time reported with a child under the parent's care. This substantial overlap is consistent across key activity types, including leisure (93.9% and 91.7%), personal care (92.9% and 86.7%), and paid work (84.9% and 88.7%). On call parental time is smaller in magnitude than parental care time by about 10 hours a week, suggesting that we are under rather than over-estimating care time. Overall, the high overlap between the two measures spanning leisure, personal care, and even paid work, indicates that on-call parental time reflects more than passive supervision. Instead, it captures active parental responsibility, validating its use as a meaningful measure of caregiving and a constraint on work availability.

[Insert Here Table 1]

We construct the number of hours of work as the sum of daily time a respondent spends on activities explicitly involving paid work. These activities include hours worked in main and secondary jobs, security procedures related to work, waiting associated with working, other work-related activities, and various forms of work-related travel. The complete list of activity codes from the ATUS data used to define paid work hours is presented in detail in Appendix A.3. We also construct an employment indicator as a dummy variable that takes value one if a respondent reports either positive weekly paid work hours or being employed, and zero otherwise.

3 Methods

3.1 Empirical Approach

To understand how parental time investments evolve as children grow up, we implement a pseudo-event study approach using ATUS cross-sectional survey data, following Kleven et al. (2019). The main challenge with cross-sectional data is that it does not capture negative event times, i.e. we cannot observe if or when childless individuals will eventually have children. This limits our ability to track changes in outcomes before and after childbirth within the same individual, as would be possible with panel data. To address this, we construct a pseudo-panel by matching each individual observed at *event time* (τ) with a childless individual who is n years younger and observed n years earlier, with similar demographic

characteristics. [5] This approach simulates pre- and post-childbirth comparisons, allowing us to analyze trends in on-call parental time investments across children's life stages. In particular, we construct synthetic pre-childbirth observations for childless individuals by matching them to parents based on gender, education, and marital status. This process translates our cross-sectional data into a pseudo-panel that includes up to 5 years of pre-child data. The final pseudo-panel consists of 81,385 respondents, of which 42,057 are mothers, 29,169 are fathers, 4,614 are childless men, and 5,545 are childless women. Individuals are observed at a given survey year between birth and 17 years post-birth.

The pseudo-event study specification leverages independent variation in all three dimensions of time arising from differences in the age at first birth: (1) *Calendar time* (t); (2) *Age* (a), and (3) *Event time* (τ). Event time (τ) is measured relative to the birth of the first child, where $\tau = t - T_i = a - A_i$. Here, T_i is the year of the first child's birth, and A_i is the age at first childbirth. This event time corresponds to the age of the first child. Thus, we can conduct event studies around the birth of the first child, indexed to occur at event time $\tau = 0$, conditional on calendar time t and age a. Specifically, we estimate (1) separately for men and women:

$$Y_{it}^{g} = \beta^{g}\mathbf{D}_{\text{Event},i\tau} + \gamma^{g}\mathbf{D}_{\text{Age},ia} + \delta^{g}\mathbf{D}_{\text{Year},it} + \varepsilon_{it}^{g} \tag{1}$$

where Y_{it}^{g} is the observed outcome for individual i of gender $g = w, m$ at calendar time t. The first term $\beta^{g}\mathbf{D}_{\text{Event},i\tau}$ includes dummies for each event time τ, omitting a base year ($\tau = -2$) which is the year before pregnancy. The second term $\gamma^{g}\mathbf{D}_{\text{Age},ia}$ controls for age at first birth, and the third term $\delta^{g}\mathbf{D}_{\text{Year},it}$ controls for calendar year effects. The error term ε_{it}^{g} captures unobserved factors affecting the outcomes.

The coefficient β^{g} measures how the time spent on parental time investment activities changes across event times τ after the birth of the first child for those who become parents. A positive β^{g} indicates an increase in parental time investment for parents at event time τ, relative to their pre-birth baseline (e.g., $\tau = -2$). Parental time investment is zero before birth, making it impossible to test the parallel trends assumption needed to identify the causal effect of first childbirth. Without pre-birth variation, we cannot assess whether future parents and childless individuals would have followed similar trends [6]. Thus, the coefficient β^{g} should be interpreted as measuring changes in parents' parental time investment after childbirth, net of any broader time trends that also affect childless individuals.

[5] For further details on the matching process, see Appendix Section B.

[6] See Roth et al. (2023) for a recent literature review on DiD research designs.

3.2 Validating the Pseudo-Panel Approach

This section presents descriptive statistics from the cross-sectional and pseudo-panel datasets constructed from pooled ATUS-CPS data. The similarity in means between the two samples supports the pseudo-panel as a credible and unbiased tool for analyzing parental time investments. Table 2 shows that parenthood is not a random event. Men with children are, on average, 4 years older, have slightly higher educational attainment, engage in 3.22 more weekly hours of paid work and are 57% more likely to be married compared to those without children. For women, the selection effect is also present though less pronounced. Women with children are 2 years older, marginally more educated, engage in 6.52 less weekly hours of paid work, and 30% more likely to be married than their childless counterparts.

Table 3 presents the matched sample at two key event times, where individuals at $\tau = -1$ represent childless individuals matched to future parents, and individuals at $\tau = 0$ are parents observed at the time of first birth. Our matched sample of parents and non-parents are more closely aligned than in the cross-section. The descriptive statistics for matched men and women at event times $\tau = 0$ (year of first birth) and $\tau = -1$ (one year before first birth) in the pseudo-panel show minimal differences across matched characteristics. Educational attainment and marital status differences between men at $\tau = 0$ and $\tau = -1$ are negligible, and similar consistency is seen among women.

In terms of parental time investments the figures between the cross-section presented in Table 2 and the pseudo panel are very for men, with some differences arising for women in the pseudo-panel sample. Fathers in the pseudo panel ($\tau = 0$) report a total of 41.86 hours per week, of which 12.86 hours is primary childcare and 28.99 hours is on-call parental time investments. Mothers ($\tau = 0$) report 61.89 hours in total parental time investment, of which 25.13 hours are primary childcare and 36.76 hours are on-call parental time investments. These figures are higher than those reported in the cross-section sample presented in Table 2, the difference being driven by more hours in primary childcare. This makes sense as the period right after the birth of the first child presented in Table 3 is when most of primary childcare takes place. In terms of hours of paid work and employment rates, the figures are very similar between the cross-section presented in Table 2 and the pseudo panel for men, with some differences arising for women in the pseudo-panel sample reporting fewer hours of work and lower employment rate at the birth of the first child in period ($\tau = 0$).

[Insert Here Table 2]

[Insert Here Table 3]

4 Parental Time Investments after the Birth of a Child

Figure 1 plots the coefficients β_τ^g from Equation (1) for each outcome (primary parental time investment, on-call parental time investments, and total parental time investments) for event time τ from $\tau = -5$ to $\tau = 18$, representing years around the birth of the first child (indexed at $\tau = 0$). These coefficients measure the change in parental time investment outcomes for women (left panel) and men (right panel) over event time, relative to their pre-birth baseline $\tau = -2$) , using childless individuals as a counterfactual to account for broader time trends.

[Insert Here Figure 1]

Figure 1 shows that once on-call parental time is included alongside primary childcare, total parental time investments appear significantly higher than estimates based solely on primary care. While primary childcare declines as children age, on-call parental time remains relatively stable throughout childhood and adolescence, with mothers contributing the majority of this time. Mothers account for the majority of this combined time. For instance, at $\tau = 2$ (two years after the birth of the first child), mothers dedicate approximately 20 additional hours per week to primary childcare relative to childless women. However, when on-call parental time investments is included, their total parental time investment increases to around 60 hours per week. For fathers, the change is smaller but still substantial, with primary childcare reaching about 8 additional hours per week at $\tau = 2$ and total parental time, including on-call parental time investments, rising to about 30 hours. Over time, primary childcare decreases for both mothers and fathers, nearing zero as children reach their late teens ($\tau = 15$ to $\tau = 18$). In contrast, on-call parental time investments remain relatively stable throughout the child's life, with mothers consistently providing around 30 hours per week and fathers around 15 hours throughout. As a result, as children grow older the relative importance of on-call parental time investments increase relative to primary childcare. By the teenage years ($\tau = 15$ to $\tau = 18$), on-call parental time investments constitute nearly the entirety of total parental time investments and mothers continue to provide around twice as much on-call care as fathers.

Figure 2 rules out that on-call parental care becomes increasingly passive as children age, addressing concerns about the validity of this measure as a proxy for meaningful caregiving and whether it reflects time in which parents are meaningfully constrained for work. One possibility is that a growing share of on-call time overlaps with leisure activities, suggesting that parents are merely in the presence of the child without being actively engaged. For example, a parent might watch television while their teenage child is in the same room, requiring minimal attention and posing little interference with remote or flexible work. Another

possibility is that more on-call time occurs at home in low-intensity supervisory contexts. For instance, a parent may be present while working from home at the same time that their teenager works independently in the same room. We decompose on-call parental time investments across key contextual dimensions, including whether the parent is alone or with a partner, at home or elsewhere, and engaged in leisure or non-leisure activities. The patterns show clear stability in the context of on-call care throughout the child's life. For fathers and mothers the majority of on-call care is done at home and during leisure activities, and this pattern holds consistently over time. Fathers tend to do more on-call parental time in the company of his partner, while mothers tend to do more on-call care time alone. These patterns remain strikingly stable as children age, showing no meaningful decline in caregiving intensity or shift toward passive supervision, reinforcing the idea that on-call parental time is active parental involvement that continues to constrain paid work well beyond the early years.

[Insert Here Figure 2]

Our findings align with prior work documenting increases in unpaid work following the birth of a first child in the US, and offer new insights into the nature of this increase. In particular, the rise in housework after the birth of the first child documented in previous studies may largely stem from on-call parental time investments in children. Galván and García-Peñalosa (2025) use the PSID to measure housework based on self-reported weekly hours spent on tasks such as cooking, cleaning, and laundry. Their measure, derived from stylized survey responses rather than diary data, does not distinguish between child-related and non-child-related tasks, nor does it condition on the presence of children. They find that mothers increase their housework hours by approximately 8 hours per week (from 13 hours to 21 hours) one year after childbirth, while men increase their housework hours by around 1 hour per week (from 7 hours to 8 hours).[7] Our findings in Panels E and F of Figure 2 show that mothers' on-call parental time during unpaid work increases by 15 hours per week and then levels off. This suggests that the 13-hour rise in housework reported in other studies may largely reflect on-call parenting rather than domestic production, underscoring the importance of distinguishing between the two when analyzing the impact of motherhood and the effective design of policy.

[7]Using a comparable measure of housework in a nationally representative sample of Mexico, Aguilar-Gomez et al. (2019) finds that women increase their housework time by approximately 15 hours per week following childbirth.

5 Implications for Theoretical Models of Female Labor Supply

Having shown that parental time, especially on-call care, remains a substantial and persistent commitment throughout a child's life, particularly for mothers, we now turn to its implications for paid work. Specifically, we ask whether these sustained childcare demands help explain the motherhood penalty in work hours. To answer this, we apply the same pseudo-event study design as in our main analysis, using Equation (1) to track how gender gaps in paid hours evolve as children age, extending the analysis into the teenage years.

Following standard practice in the literature (Kleven et al., 2024), we use Equation 2 to compute the motherhood penalty as the average impact of parenthood on women's paid work hours relative to men's, and the gender gap in parental time investments as the difference in mothers' time spent caring for children relative to men from the birth of the first child until the child is 17:

$$\text{Motherhood Penalty} = E\left[P_\tau^m - P_\tau^w \mid \tau \geq 0\right] - E\left[P_\tau^m - P_\tau^w \mid \tau < 0\right] \tag{2}$$

A positive motherhood penalty in paid work hours indicates that parenthood widens the gender gap in work, with mothers working fewer hours than fathers after the birth of their child relative to the pre-birth period. Similarly, a positive gender gap in parental time investments indicates that mothers allocate more time to parental responsibilities than fathers do post-birth.

Figure 3 plots the coefficients for each event time τ from Equation (1) to illustrate changes in the motherhood penalty and gender gap in parental time investments[8]. The left panel shows how paid work hours evolve for mothers and fathers around the birth of their first child (indexed at $\tau = 0$), and reports the average motherhood penalty in paid work hours from $\tau = 0$ to $\tau = 17$ as per Equation (2). In the right panel, the coefficients capture changes in total parental time investment by gender, as well as the gender gap in total parental time investments.

Figure 3 illustrates how the gender gap in parental time investments fully accounts for the motherhood penalty in paid work. The left panel shows a sharp drop in mothers' paid hours, about 20 hours per week relative to fathers, immediately following the birth of the first child, stabilizing to an average penalty of 13.98 hours per week over the following 17

[8]Our estimates are validated in the appendix by restricting the sample to individuals with only one child as a robustness check. See Figure 9. These estimates are consistent with those of Kleven et al. (2019), Kleven et al. (2019), and Angelov et al. (2016), who also find that the long-run child penalty is driven almost entirely by the first child, with little or no additional impact from subsequent children.

years. This persistent gap, with no significant recovery even by the child's late teens, aligns with previous findings on long-run effects of parenthood on maternal labor supply and the motherhood penalty.[9] The right panel highlights the underlying driver for the motherhood penalty. Mothers consistently take on far more caregiving than fathers, even as children grow older. The gender gap in parental time investments is 17 hours per week. Overall, our findings reinforce the view that sustained gender differences in caregiving responsibilities are central to understanding the motherhood penalty and highlight the importance of accounting for the full scope of care when understanding its impact on gender gaps in paid work. These results follow regardless of level of education or number of children as shown in Fig. 8 and 9 in Appendix D.

[Insert Here Figure 3]

5.1 How much of the Motherhood Penalty in Paid Work Hours Can Gender Gaps in Parental Time Investment Explain?

To assess how gender gaps in primary and on-call parental time investments contribute to the motherhood penalty and how their roles evolve as children grow older, we perform a decomposition analysis. This approach allows us to isolate the impact of each type of caregiving on the motherhood penalty, calculating a decomposition ratio at each child age to track how the explanatory power of primary and on-call care changes over time. Specifically, we calculate the decomposition ratio for each age of the child as follows:

$$\Delta_\tau = \frac{E\left[C_\tau^w - C_\tau^m \mid \tau \geq 0\right] - E\left[C_\tau^w - C_\tau^m \mid \tau < 0\right]}{E\left[P_\tau^m - P_\tau^w \mid \tau \geq 0\right] - E\left[P_\tau^m - P_\tau^w \mid \tau < 0\right]} \tag{3}$$

where Δ_τ represents the decomposition ratio at each event time τ, which measures the proportion of the gender gap in paid work hours that can be explained by gender disparities

[9]Results in Appendix C show that caregiving responsibilities shape labor market outcomes primarily through employment exits rather than reductions in hours among employed mothers. Continuously employed mothers experience only a modest reduction in paid work hours (approximately 6.6 hours per week) but face a substantial hourly wage penalty of $4.25 (Figure 6). This pattern aligns with evidence from Kleven et al. (2019), who find that in the U.S. and U.K., employment penalties closely track overall earnings penalties, highlighting the central role of the extensive margin. In contrast, in Denmark, Kleven et al. (2019) document convergence in hours worked over time, though wage gaps persist, suggesting cross-country differences in how caregiving responsibilities translate into long-run labor market penalties. Figure 7 in Appendix D presents an event study of the impact of having a first child on employment. Parenthood leads to substantial and persistent reductions in labor market participation, especially among women. We find that, following the birth of the first child, maternal employment drops by approximately 25 percentage points relative to pre-birth levels, with no meaningful recovery even as children reach adolescence. In contrast, men's employment remains essentially unchanged. These patterns are consistent with prior work showing that the motherhood penalty in employment participation, measured as the drop for mothers relative to fathers, is around 20%, with men's employment largely unaffected (Kleven et al., 2024).

in parental time investments. The numerator captures the differential increase in parental time investment following childbirth, measured as the expected difference in parental time investment hours between women (C_τ^w) and men (C_τ^m) in the post-birth period ($\tau \geq 0$), relative to the pre-birth period ($\tau < 0$). This term quantifies the additional parental time investments demands assumed by mothers as compared to fathers as a consequence of parenthood. The denominator represents the motherhood penalty in paid work hours, calculated as in Equation (2).

Figure 4 shows that the motherhood penalty in paid work is fully explained by gender gaps in both primary and on-call parental time investments, with primary care driving the motherhood penalty early on and on-call care driving it as children grow. At the child's birth (τ=0), the motherhood penalty in paid work hours is at its highest, exceeding 20 hours per week. As the child grows older, this penalty gradually lessens, reaching approximately 15 hours of paid work per week by age 10. Throughout a child's life, the combined demands of primary and on-call parental time investments fully explain the penalty in paid work hours. Primary childcare constitutes the largest component of the gap in the early years, reflecting the intensive hands-on caregiving required during infancy and early childhood. As the child reaches school age, primary childcare demands taper off, while on-call parental time investments stay relatively constant. As a result, on-call parental availability becomes increasingly prominent in relative terms and eventually accounts for the majority of the parental time investments gap by the time the child reaches adolescence.

Table 4 presents the results of our decomposition exercise, showing the contribution of the gender gap in parental time investments to the observed motherhood penalty in paid work hours at a given child age (τ). The gender gap in parental time investments demands fully account for the motherhood penalty in paid work, with primary care driving the gap early on and on-call care becoming increasingly important as children grow. At age 0 ($\tau = 0$), the gender gap in total parental time investments exceeds the motherhood penalty in paid work hours, with parental time investments demands accounting for 146% of the drop in hours. As children age, the total explained share of the work hours penalty decreases to 112% by age 5, 102% by age 10, and 93% by age 16. At young ages, the gender gap in primary childcare explains a substantial portion of the penalty in paid work hours, accounting for 79% at age 0. As children age, this contribution decreases to 49% by age 5, 43% by age 10, and 37% by age 16. In contrast, at age 0 on-call responsibilities account for 67% of the drop in paid work hours. This contribution remains high as the child ages, explaining 63% at age 5, 60% at age 10, and 56% at age 16. The persistent gender gap in on-call parental time reveals why many mothers remain out of full-time work long after these early demands decline. Ongoing responsibilities like supervision, availability, and emotional support continue well

into adolescence, making on-call care essential to understanding the long-term impact of parenthood on mothers' employment.

[Insert Here Figure 4]
[Insert Here Table 4]

6 Conclusion and Discussion

We show that incorporating on-call parental time into labor supply models provides a more comprehensive understanding of the persistency of the motherhood penalty beyond the early years. Primary, interactive childcare demands explain the initial reduction in mothers' paid work hours following childbirth, however these demands diminish as children grow older. Instead, on-call responsibilities, such as supervision, availability, and emotional support, persist well into adolescence and constrain mothers' ability to work in the labor market well beyond early childhood.[10]

The persistence of parental time investments demands as children grow older highlights the need to break with the early-years-focused policy paradigm and rethink the foundations of policy intervention. The key challenge is no longer the immediate drop in labor supply following childbirth, but the sustained caregiving responsibilities that constrain mothers' work over the long run. Traditional models focus narrowly on primary childcare needs in the early years to explain mothers' reduced work hours, attributing long-term penalties to early human capital losses driven by primary childcare needs in the first years (Mincer, 1958; Mincer and Polachek, 1974). This framework has informed policies that focus on subsidized childcare and maternity leave during a child's early years and on retraining programs to restore women's lost human capital as children grow older. However, after decades of implementing these policies gender inequality in the labor market persist.[11] We argue that exisiting policies may not be enough on the face of continuous constraints due to care demands at home. By accounting for on-call parental time investments, our findings highlight

[10]We focus on increased parental time investments demands resulting from children's real or perceived developmental needs as the key driver of the motherhood penalty. Other papers explore the limited advancement opportunities in the workplace as women are directed toward non-promotable tasks or projects with limited potential for career advancement after childbirth (Babcock et al., 2017).

[11]Formal work-related training programs are designed to enhance individuals' skills and employability, particularly following periods of labor market inactivity. These policies have been shown to have a significant impact on women's economic outcomes, especially after childbirth, when labor market interruptions are common. Blundell et al. (2021) uses data from the British Household Panel Survey to find that such training plays a key role in shaping women's earnings trajectories and labor supply over the life course. Specifically, receiving more than 40 hours of job-related training within the previous year helps mitigate the wage penalties associated with part-time work and periods of non-employment following a return to work, particularly when undertaken early in a career or after substantial employment gaps.

the need for policy solutions that go beyond the early years to support mothers in managing the ongoing demands of caregiving throughout a child's development.

In rethinking policy from the early years of childcare to the full trajectory of parenthood, policies must move beyond the implicit assumption that mothers are the primary caregivers to be truly effective, promoting a balanced division of caregiving within households and actively challenging the gender norms and expectations that underpin unequal household labor allocation and contribute to persistent gender inequality and inefficiencies in the allocation of talent in the labor market and at home (Sevilla-Sanz et al., 2010 De Laat and Sevilla-Sanz, 2011). Emerging evidence suggests that non-transferable, well-compensated paternity leave policies can foster co-parenting in dual-career households by encouraging a more equal division of childcare and challenging entrenched gender norms (Olivetti and Petrongolo, 2017; Farré and González, 2019; Patnaik, 2019). While remote work is often proposed as a policy solution to alleviate the on-call burden mothers face, our findings suggest that such measures may be insufficient because they are likely to reinforce the unequal distribution within households. We show that mothers' on-call parental time is predominantly spent alone, while fathers' is more likely to be shared with mothers. This persistent imbalance undermines the potential of remote work to ease the constraints on mothers' time. If even when working from home mothers remain the main caregivers, their productivity and wages will suffer as they are more likely to be interrupted (Coviello et al., 2015). Recent evidence from an online labor market, where flexibility is theoretically maximized, shows that women with children earn roughly 20% less per hour than men, not because of differences in task selection or experience, but due to slower task completion driven by work interruptions (Adams-Prassl et al., 2024).

Policies promoting gender equality in caregiving, such as flexible work and shared parental leave, must be supported by strong public provision of care to be fully effective. Without accessible support beyond early childhood, the burden of after-school supervision continues to fall disproportionately on mothers. In England, where school typically ends at 3.30 p.m., there is a significant gap between school hours and the standard workday. Youth clubs once filled this gap by providing supervised, enriching environments that helped ease the on-call burden on parents. These services were largely funded by local councils and formed part of the broader social safety net, but since 2011 funding for youth services has dropped from £1 billion to £409 million in real terms (The Economist, 2024). Recent policy proposals, such as the Labour Party's Young Futures Hubs, are valuable but remain focused on disadvantaged or at-risk youth. In contrast, countries like Sweden, Denmark and Finland adopt a universal approach to after-school care (Drange and Jorde Sandsør, 2024; Finnish Government, 2024). Municipalities in these countries offer structured, subsidized or free extended-day programs

to all children, regardless of socioeconomic background. These services are considered a standard part of the education system and support both child development and maternal employment. The UK's targeted approach, while important for addressing disadvantage, does little to support dual-earner families more broadly or to ease the structural pressures behind the motherhood penalty. A universal public care infrastructure from birth and all the way to adulthood, as seen in other European countries, is essential for policy efforts to reduce gender gaps in labor supply and reshape caregiving norms.

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Figures

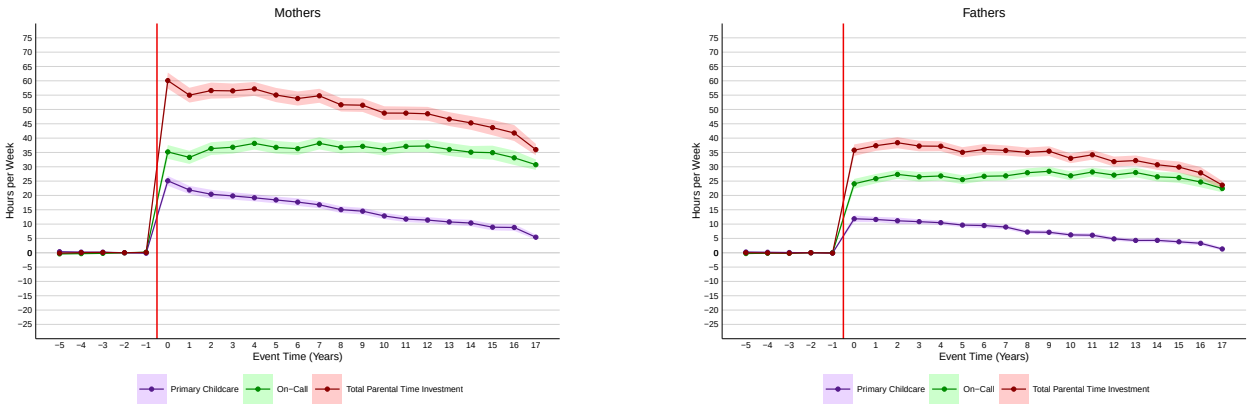
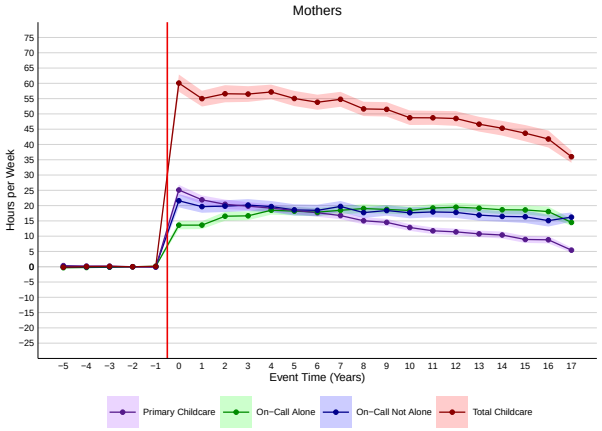
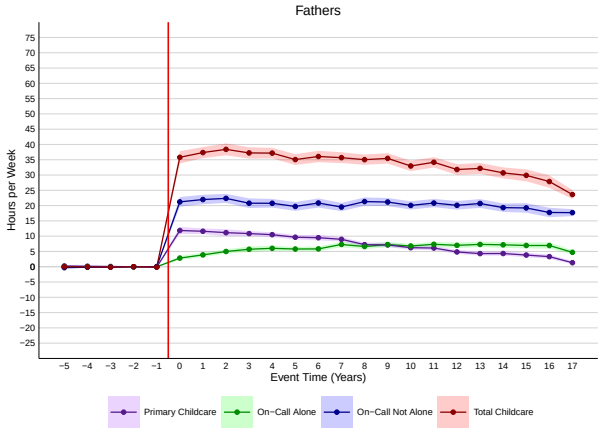


Figure 1: Comparison of Mothers and Fathers (Event Studies)

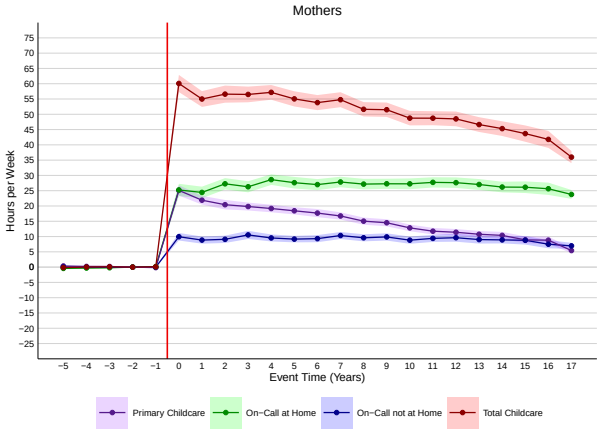
Note: This figure presents pseudo-event studies of first child birth for mothers and fathers. Each panel shows an event study of the impact of the first child, indicated by the vertical line, on hours per week spent on Primary Childcare (violet series), On-call Parental Time Investment (green series), and Total Parental Time Investment (red series). The series illustrate the hourly impact of childbirth at each event time t. Age at first birth is restricted to 20–45. Shaded areas represent 95% confidence intervals, calculated with robust standard errors.



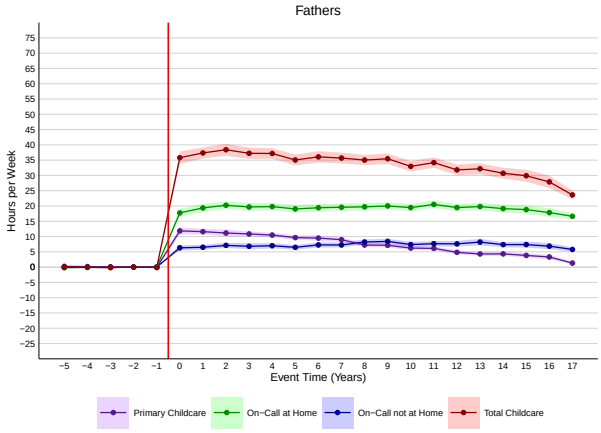
(a) Alone vs. With Partner (Mothers)



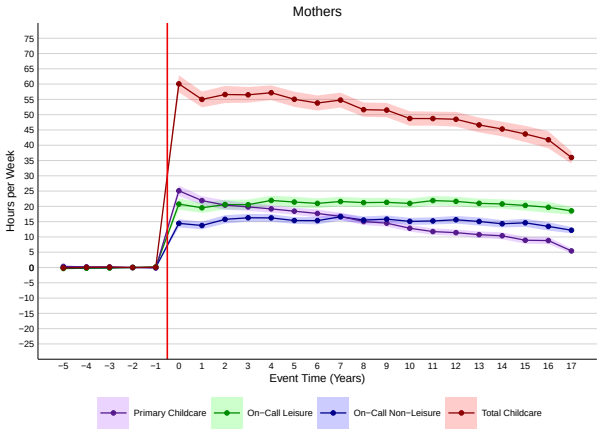
(b) Alone vs. With Partner (Fathers)



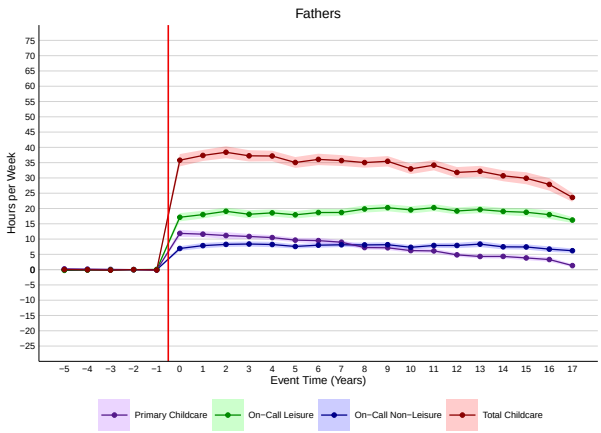
(c) At Home vs. Not at Home (Mothers)



(d) At Home vs. Not at Home (Fathers)



(e) Leisure vs. Non-Leisure Activities (Mothers)



(f) Leisure vs. Non-Leisure Activities (Fathers)

Figure 2: Contextualization of Parental Time Investments (Event Studies)

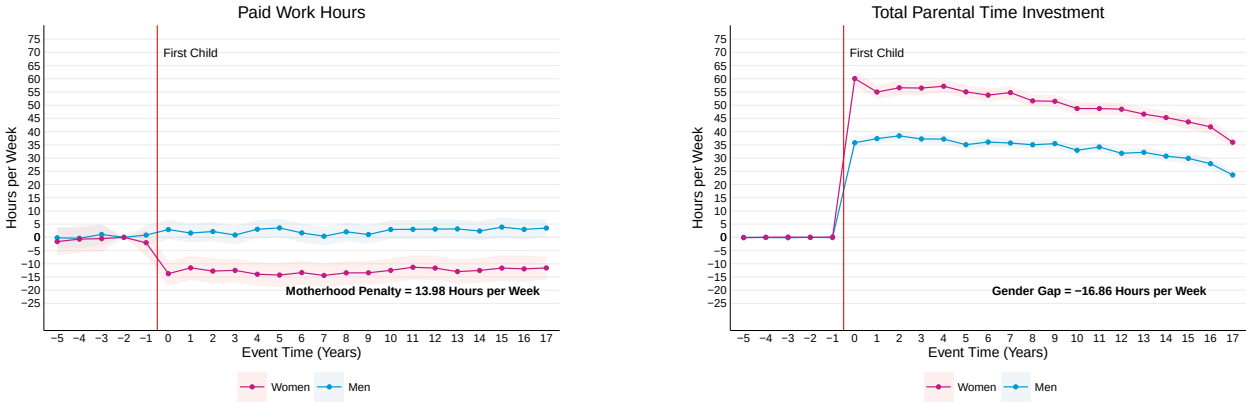


Figure 3: Paid work hours and Parental Time Investments

Note: This figure presents panels of pseudo-event studies of first child birth for mothers and fathers. It shows an event study of the impact of the first child, indicated by the vertical line, on hours per week spent on paid work hours (on the left) and on total parental time investment (on the right) for mothers (in pink) and fathers (in light blue). The series illustrate the hourly impact of childbirth at each event time t. Age at first birth is restricted to 20–45. Shaded areas represent 95% confidence intervals, calculated with robust standard errors.

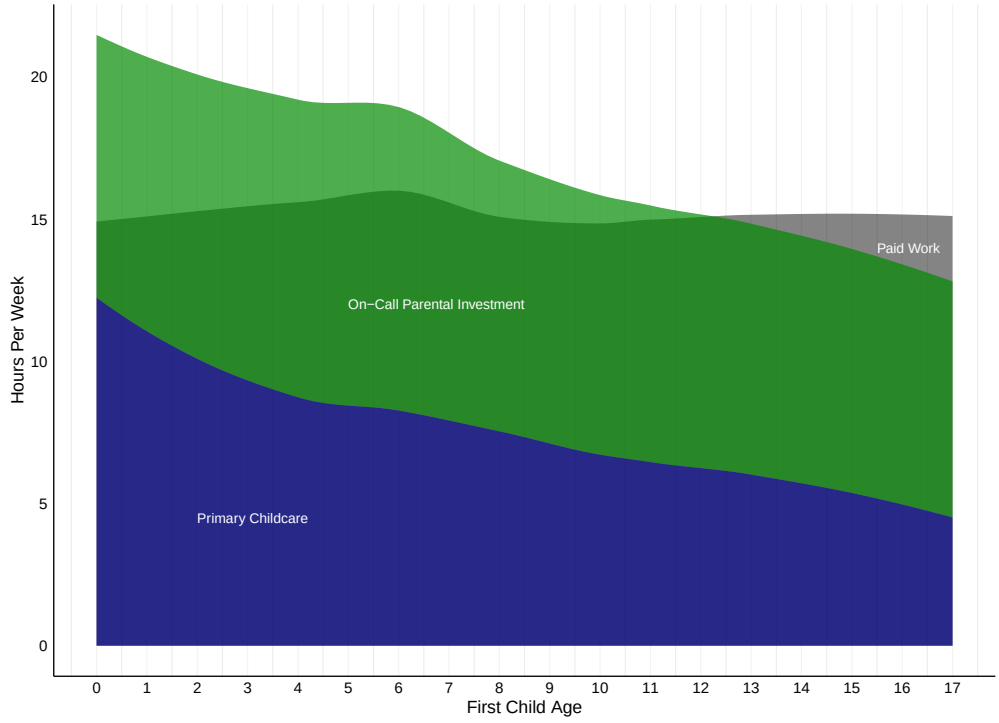


Figure 4: The Motherhood Penalty and the Gender Gap in Parental Time

Note: This figure shows the motherhood penalty (measured as the gender gap in hours spent on paid work), and the gender gap in primary childcare time and on-call parental investment time by age of the first child, from birth through age 17.

Tables

Table 1: On-Call Time of which In-Your-Care

Panel: Child Age 0–6

	On Call	**Of which In-Your-Care**	**Overlap (%)**
Total	34.70	32.72	94.29%
Of which leisure	21.35	20.03	93.83%
Of which personal care	0.14	0.13	92.86%
Of which paid work	0.53	0.45	84.91%
Of which housework	8.46	8.13	96.10%
Of which other	4.22	3.97	97.16%
Number of individuals	21,941	21,093	–

Panel: Child Age 6–13

	On Call	**Of which In-Your-Care**	**Overlap (%)**
Total	34.93	32.15	92.04%
Of which leisure	21.47	19.68	91.67%
Of which personal care	0.15	0.13	86.67%
Of which paid work	0.53	0.47	88.68%
Of which housework	8.66	8.06	93.07%
Of which other	4.12	3.80	95.63%
Number of individuals	27,657	25,764	–

Notes: This table shows weekly average hours of On-Call Parental Time Investment and the share of time when a child under age 13 was actively under care, based on the Cross-Section Sample. The categorization of activities follows Table A1 in the Appendix. "In-Your-Care" is based on the ATUS Childcare Module responses. The average time spent under care while on call is 46.41 hours for children aged 0–6 and 48.47 hours for those aged 6–13, indicating similar trends to the overall On-Call time reported in the table.

Table 2: Descriptive Statistics in the Cross-Section

	Men			Women		
	With Children	**Without Children**	**Difference**	**With Children**	**Without Children**	**Difference**
On-Call Parental Time Investment	29.62	—	—	35.17	—	—
Primary Childcare	8.15	—	—	13.09	—	—
Total Parental Time Investment	**37.77**	—	—	**48.26**	—	—
Paid Work Hours	33.37	30.15	**3.22**	19.14	25.66	**-6.52**
Employment Rate	0.92	0.83	**0.09**	0.70	0.81	**-0.11**
Demographics						
Age	38.81	34.74	**4.07**	37.18	35.08	**2.10**
Fraction College	0.51	0.56	**-0.05**	0.50	0.46	**0.04**
Fraction High-School or below	0.49	0.56	**-0.07**	0.49	0.45	**0.04**
Fraction Ever Married	0.94	0.37	**0.57**	0.85	0.45	**0.40**
Number of Individuals	30,583	23,273	—	47,051	19,121	—

Note: This table compares time use outcomes in hours per week and demographic outcomes for men and women with and without children in cross-sectional data from the ATUS-CPS dataset, including all individuals aged 20–50 from 2003–2022. Table A1 in the Appendix shows a breakdown of on-call Parental Time Investment by activities.

Table 3: Descriptive Statistics in the Pseudo-Panel at Different Event Times

	Matched Men			Matched Women		
	$\tau = 0$	$\tau = -1$	**Difference**	$\tau = 0$	$\tau = -1$	**Difference**
On-Call Parental Time Investment	29.00	—	—	36.76	—	—
Primary Childcare	12.40	—	—	25.13	—	—
Total Parental Time Investment	41.40	—	—	61.89	—	—
Paid Work Hours	32.69	31.29	**1.40**	15.27	24.80	**-9.53**
Employment Rate	0.92	0.88	**0.04**	0.65	0.83	**-0.18**
Demographics						
Age	31.28	30.86	**0.42**	28.95	28.47	**0.48**
Fraction College	0.58	0.62	**-0.04**	0.62	0.66	**-0.04**
Fraction High-School or below	0.41	0.38	**0.03**	0.38	0.34	**0.04**
Fraction Ever Married	0.88	0.87	**0.01**	0.77	0.78	**-0.01**
Number of Individuals	1,112	1,007	—	1,407	1,259	—

Notes: This table compares time-use outcomes in hours per week and demographic outcomes for matched men and women at event times $\tau = 0$ and $\tau = -1$ in the pseudo-panel. The sample includes all matched parents at $\tau = 0$ (together with their matched non-parents at $\tau = -1$) with an age at first birth between 25-45 in all years of the pooled ATUS-CPS data.

Table 4: Drop in Work Hours Decomposition

	Age 0	**Age 5**	**Age 10**	**Age 16**
% Primary Childcare	79%	49%	43%	37%
% On-Call Parental Time Investment	67%	63%	60%	56%
% Total Explained	**146%**	**112%**	**102%**	**93%**

Notes: This table shows the decomposition of the drop in work hours after the first child's arrival, explained by an increase in primary childcare and on-call parental time investment.

Appendices

A Construction of Time Use Variables

This appendix details the construction of time use variables used throughout the analysis. Our objective is to classify all daily activities into a set of mutually exclusive main categories and sub-categories, consistent with the structure presented in Table A1. These include time spent in Primary Childcare, On-Call Childcare with its five mutually exclusive subcomponents Paid Work, Housework, Personal Care, Leisure, and Other, as well as Paid Work. The time use measures are based on detailed American Time Use Survey ATUS activity codes and are constructed to ensure that all reported time across categories adds up to 1440 minutes per day per respondent. Sleep is excluded from this accounting. What follows is a description of how each component is defined and aggregated from the underlying activity data.

A.1 Primary Childcare

In this analysis, primary childcare is defined by selecting a set of activities involving direct caregiving responsibilities. Following Guryan et al., 2008, Ramey and Ramey, 2010, and Gimenez-Nadal and Sevilla, 2012, these activities are chosen to capture those that respondents explicitly report as childcare-related.

Primary childcare for respondent i is calculated by summing the hours spent in direct caregiving responsibilities across activities p and converting this total to weekly hours, as defined below:

$$\text{Primary Childcare}_i = 7 \times \sum_{p=1}^{P} \text{Duration Primary Childcare}_i^p$$

where Duration Primary Childcare represents the time respondent i dedicates to each activity p (for $p = 1, \ldots, P$), with each p denoting an activity classified as primary childcare. Primary childcare activities are defined as those in which respondents explicitly report childcare-related tasks as their main activity. The activity codes include:

- **Caring for and Helping Household Children**
  - 030101: "Physical care for household children"
  - 030102: "Feeding household children"
  - 030103: "Putting household children to sleep"

  - 030104: "Household children's health care"
  - 030105: "Obtaining medical care for household children"
  - 030106: "Dropping off/ picking up household children"
  - 030107: "Helping or teaching household children (not related to education)"
  - 030108: "Attending household children's events"
  - 030109: "Organizing and planning for household children"

- **Activities Related to Household Children's Education**
  - 030201: "Homework - household children"
  - 030202: "Meeting/ teacher conferences for household children"
  - 030203: "Waiting associated with household children's education"
  - 030204: "Home schooling of household children"
  - 030299: "Other educational activities with household children"

- **Activities Related to Household Children's Health**
  - 030301: "Reading to household children"
  - 030302: "Playing with household children, not sports"
  - 030303: "Arts and crafts with household children"
  - 030399: "Other activities with household children"

- **Traveling**
  - 180301: "Travel related to caring for and helping household children, inclusive (2003, 2004)"
  - 180302: "Travel related to caring for and helping household children (2005+)"
  - 180303: "Travel related to household children's education (2005+)"
  - 180304: "Travel related to household children's health (2005+)"
  - 180801: "Travel related to using childcare service"

- **Telephone Calls**
  - 160103: "Telephone calls to or from education services providers"

- **Childcare Services**

- 080101: "Using paid childcare services"
- 080102: "Waiting associated with purchasing childcare services"
- 080199: "Using paid childcare services, n.e.c."

A.2 On-Call Parental Time Investments

On-call parental time investments for respondent i is calculated by summing the hours per day spent in on-call childcare activitiesnp with at least one child present, and then converting to weekly hours, as follows:

$$\text{On-Call Parental Time Investment}_i = 7 \times \sum_{np=1}^{NP} \text{Duration On-Call Childcare}_i^{np}$$
$$\text{s.t.} \quad \text{Child Present during Activity}_i^{np} = 1$$

where Duration On-Call Childcare represents the time respondent i spends on each activity np (for $np = 1, \ldots, NP$), with np indicating an activity classified as on-call parental time. The indicator function $1(\text{Child Present}_i^{np})$ equals 1 if a child is present during the activity and 0 otherwise (see definition below).

We consider the following activity codes as on-call childcare activities (where XXXX are generic placeholders), classified into the following mutually exclusive macro-categories:

- **Personal Care**
  - 01XXXX: "Personal Care"
  - 11XXXX: "Eating and drinking"
- **Housework**
  - 02XXXX: "Household Activities"
  - 0304XX: "Caring for Household Adults"
  - 0305XX: "Helping Household Adults"
  - 04XXXX: "Caring for and Helping Non-Household Members"
  - 07XXXX: "Consumer Purchases"
  - 08XXXX: "Professional and Personal Care Services" (excluding 080101, 080102, 080199)

- 09XXXX: "Household Services"
- 10XXXX: "Government Services and Civic Obligations"

- **Paid Work**
  - 05XXXX: "Working and Work-Related Activities"

- **Leisure**
  - 12XXXX: "Socializing, Relaxing, and Leisure"
  - 13XXXX: "Sports, Exercise, and Recreation"
  - 14XXXX: "Religious and Spiritual Activities"
  - 15XXXX: "Volunteer Activities"
  - 16XXXX: "Telephone calls" (excluding 160103)

- **Other**
  - 06XXXX: "Education"
  - 18XXXX: "Traveling" (excluding 180301, 180302, 180303, 180304, 180801)

Breakdown by Activities. The composition of On-Call Parental Time Investment is detailed below.

Table A1: Descriptive Statistics in the Cross-Section

	Men		Women		% Difference
	Total	**% of Total**	**Total**	**% of Total**	**(Men - Women)**
On-Call Parental Time Investment	**29.62**		**35.17**		
Of which leisure	20.25	69%	20.44	57%	12%***
Of which personal care	0.07	0%	0.19	1%	−1%***
Of which paid work	0.47	2%	0.51	1%	1%
Of which housework	5.39	18%	9.89	28%	−10%***
Of which other	3.43	12%	4.14	13%	−1%***

*p<0.1; **p<0.05; ***p<0.01

Note: This table presents descriptive statistics for On-Call Parental Time Investment by type of activity in the cross-section sample. The activity categories correspond to those consistently analyzed throughout the paper: housework, personal care, main paid work, leisure, and a residual "other" category. The percentage differences are calculated as (Men - Women). The sample includes parents with children of all ages, including those older than 13 years.

Child Present. "Child Present" is defined using two activity-level variables from the ATUS: RELATEW and AGEW. The RELATEW variable records the relationship of individuals who were with the respondent during the activity, while AGEW collects the age of each person identified in RELATEW. Specifically, respondents are asked: "Who was in the room with you? / Who accompanied you?'. To construct the variable "Child Present," we identify cases where RELATEW equals 202, indicating that a household child was present during the activity, and assign a value of 1 to "Child Present" if such a code is found. We assign a value of 0 to "Child Present" when child presence information is either unavailable or not applicable. This includes activities for which the "With whom" information is not collected by ATUS, such as "Personal Care" (010000), "Sleeping" (010100), "Sleeplessness" (010102), "Sleeping, n.e.c." (010199), "Grooming" (010200), "Washing, dressing, and grooming oneself" (010201), "Grooming, n.e.c." (010299), "Personal Activities" (010400), "Personal or private activities" (010401), "Personal activities, n.e.c." (010499), "Respondent refused to answer" (500105), and "Respondent didn't remember" (500106). In these cases, we assume the absence of a child or the inability to verify child presence, leading to an assignment of 0.

Partner Presence. "Partner present" indicates whether the respondent is performing on-call parental time investments in the physical presence of their partner. This helps distinguish between time spent solely caring for the child and activities carried out in the partner's presence, where child care responsibilities can be shared. "Not Alone" is defined using the activity-level variable from the American Time Use Survey (ATUS) RELATEW as described above. In order to construct the variable "Not Alone", we identify cases where RELATEW equals 200 or 201, indicating that the spouse of the unmarried partner was present during the activity, and assign a value of 1 to "Not Alone" if such a code is found. We assign a value of 0 to "Not Alone" when partner presence information is either unavailable or not applicable.

In Your Care. "In your care" is constructed from the variable SCC_ALL_LN in the American Time Use Survey (ATUS), which reports the amount of time respondents spent providing care to children under the age of 13 during their activities. This information is obtained from the question, "Were you also taking care of any household or non-household children under age 13 during this time?", asked about each activity recorded during the respondent's day. The responses to this question are used to determine whether the respondent was responsible for the care of a child during a specific activity. For instance, this variable tracks activities where the respondent is responsible for the child's safety and well-being.

A.3 Paid Work Hours

In this analysis, "paid work hours" is defined by selecting a set of activities that involve paid work hours. These activities are chosen to capture those that respondents explicitly report as working-related in the paid occupation.

Paid work hours for respondent i is calculated by summing the time spent in activities that involve paid work p and converting the total to weekly hours, as follows:

$$\text{Paid Work}_i = 7 \times \sum_{p=1}^{P} \text{Duration Paid Work}_i^p$$

where Duration Paid Work denotes the time respondent i spends engaged in activity p (where $p = 1, \ldots, P$), with p representing an activity classified as paid work. Paid Work-related activities are those in which respondents explicitly report activities concerning paid work as their main activity. We consider the following activity codes:

- 050101: "Work, main job"
- 050102: "Work, other job(s)"
- 050103: "Security procedures related to work"
- 050104: "Waiting associated with working (2004+)"
- 050199: "Working, n.e.c."
- 180501: "Travel related to working"
- 180502: "Travel related to work-related activities"
- 180599: "Travel related to work, n.e.c."

B Matching

For individuals with children, we know the age of their oldest child, which places them in positive event time ($\tau \geq 0$). For individuals without children, however, we do not know if or when they will have children, so we cannot directly observe their position in negative event time ($\tau < 0$). To address this, we impute negative event times for childless individuals, translating our cross-sectional data into a pseudo-event study dataset with individuals at different event times. The matching procedure works as follows:

1. For each parent i observed at event time $\tau = 0$ (the birth of their first child) in calendar year t with age a and demographic characteristics X_i, we find a childless individual j who is observed in year $t-n$ with age $a-n$ and has the same demographic characteristics ($X_j = X_i$).

2. This childless individual j is assigned a synthetic observation for $\tau = -n$. By repeating this matching process for multiple years ($n = 1, \ldots, 5$), we create a pseudo-panel that includes up to 5 years of pre-child data for each parent.

The set of matching variables used here are chosen to avoid such selection bias. These are gender, education and marital status.

C Mechanisms Behind the Gender Gap

This appendix explores potential mechanisms behind the gender gap in employment documented in Figure 7. The analysis draws upon prior literature, which highlights three primary margins where earnings penalties associated with motherhood typically manifest: the extensive margin (employment exits), the intensive margin (reduction in hours worked), and the wage rate.

The observed motherhood penalty in employment likelihood is approximately 0.24, as demonstrated in Figure 7. Additionally, mothers experience a substantial reduction of about 13.98 hours per week in paid work (Figure 3), accompanied by an hourly wage penalty of approximately $2.96 (Figure 5).

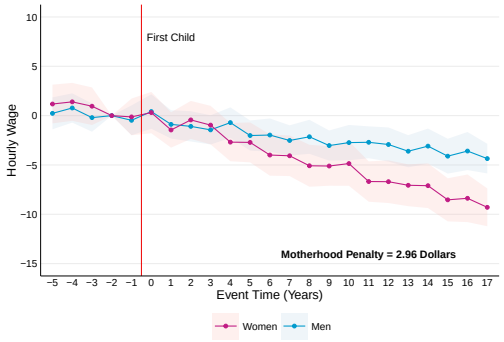
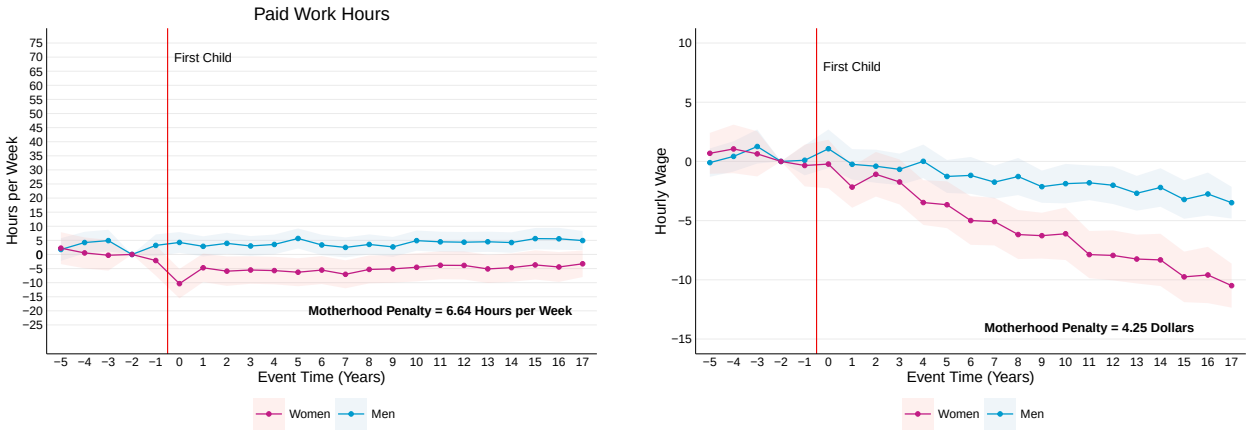


Figure 5: Hourly Wage Penalty

Note: This figure illustrates the impact of the arrival of the first child on women's hourly wages, using the full matched sample without restrictions. Estimates reflect the average effects until the first child reaches age 17.

Figure 6 provides additional insights by focusing solely on individuals who remain always

employed in our sample, thus isolating intensive margin effects (reduced paid work hours) and direct wage penalties. Among this subgroup, the reduction in paid work hours shrinks to 6.64 hours per week (Figure 6a), suggesting only a modest adjustment in paid work hours for women who remain employed. However, the hourly wage penalty among these employed women is more pronounced, reaching $4.25 (Figure 6b).



(a) Paid Work Hours (Conditional on Employment)

(b) Hourly Wage Penalty (Conditional on Employment)

Figure 6: Conditional Analysis: Intensive Margin and Wage Penalties

Note: These figures depict motherhood effects on hours worked and hourly wages within a sample restricted to women remaining employed. Estimates represent average impacts until the first child reaches age 17.

A comparison between Figures 3 and 9 underscores the substantial role of the extensive margin (employment exits) in driving the overall motherhood penalty. The data indicate that while women who remain employed do reduce their working hours somewhat, employment exits are the predominant mechanism behind the total observed reduction in hours and earnings penalties. This result aligns closely with prior literature, particularly Kleven et al. (2019), affirming that in the U.S. context, the motherhood penalty largely manifests through reduced employment levels and significant wage penalties rather than a pronounced reduction in working hours.

D Figures

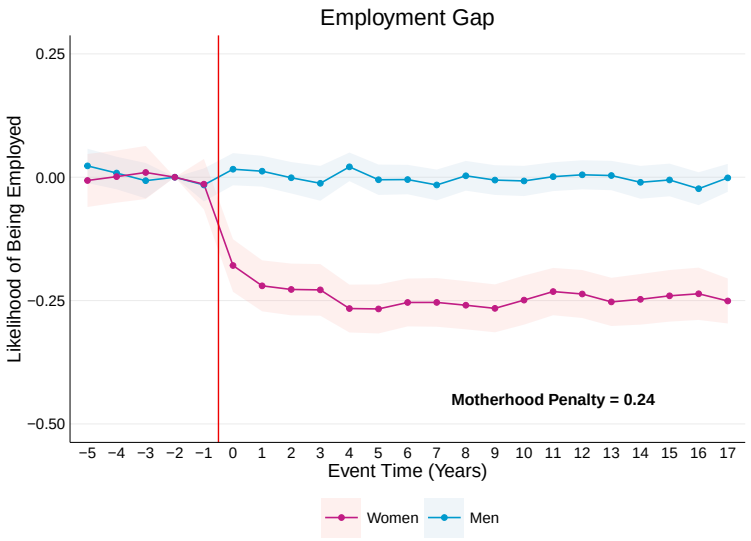
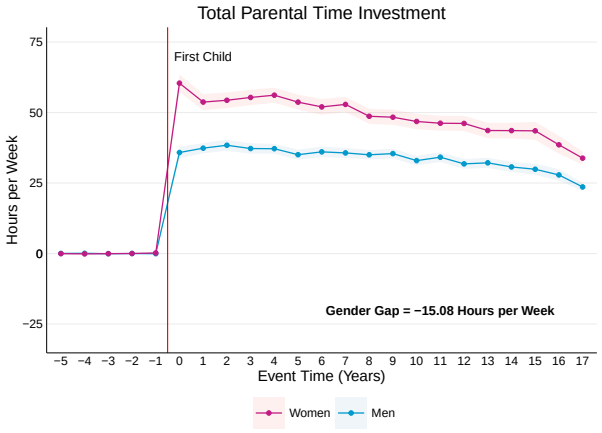


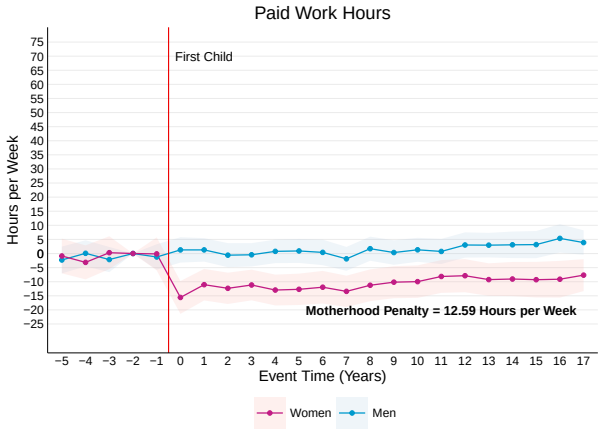
Figure 7: The Employment Gap

Note: This figure shows the impact of the arrival of the first child on the likelihood of being employed for men and women. This is known as the Child Penalty (Kleven et al. (2024)).

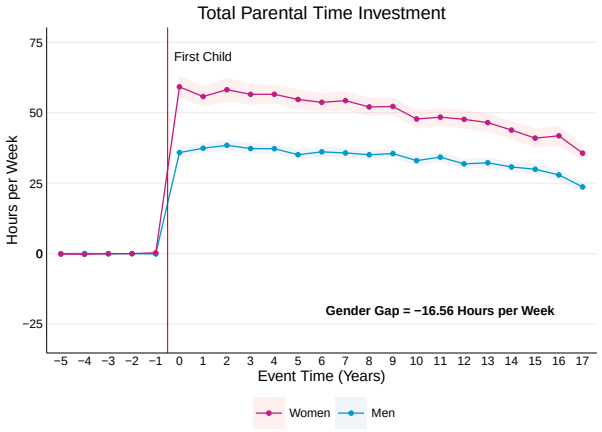
Interpretation: Following the birth of the first child, women are 24% less likely to be employed than men.



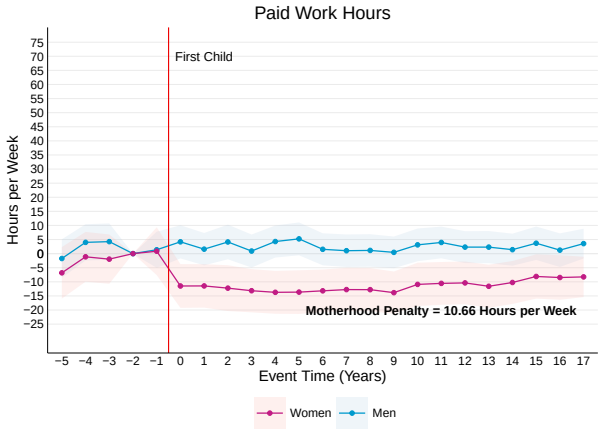
(a) Total Parental Time – College Educated Women



(b) Paid Work Hours – College Educated Women



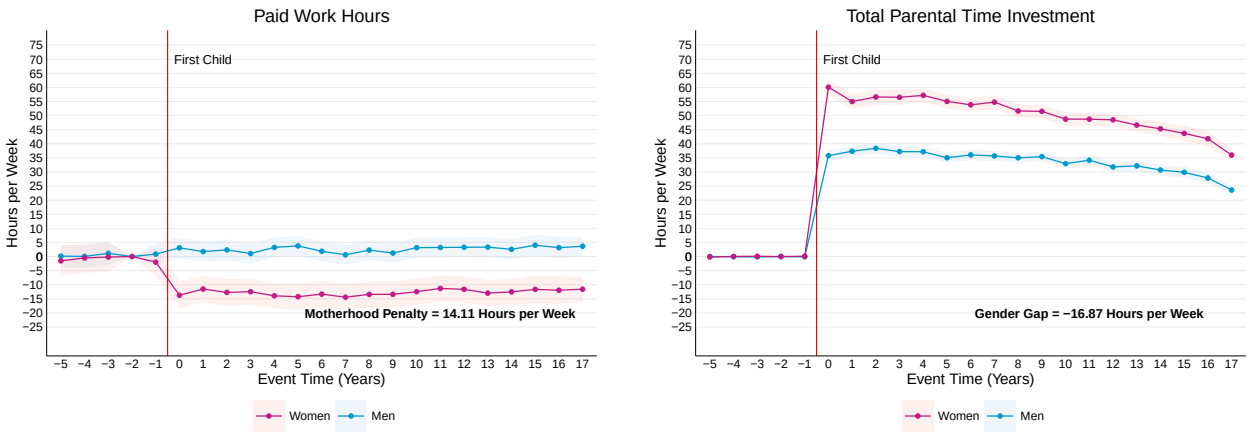
(c) Total Parental Time – Less than College



(d) Paid Work Hours – Less than College

Figure 8: Event Study: Gender Gaps in Childcare and Work Before and After First Child, by Education Level

Note: We include all men in the sample. For women, we restrict the sample to those within specific education categories, using the woman's education level as the inclusion criterion, regardless of whether she is the respondent or the partner. This allows us to examine whether on-call parental time investments affect higher-educated women differently. While one might expect education to moderate the motherhood penalty through mechanisms such as comparative advantage in childcare or gains from specialization, the data do not support this view. Our findings show no significant differences in total parental time investment or paid work hours between more and less educated mothers. This aligns with previous research. Kleven et al. (2019) find no heterogeneity in child penalties based on parents' relative education levels and report that the long-term career effects of children on women are persistent across the education distribution.



(a) Paid Work Hours

(b) Total Parental Time Investment

Figure 9: Robustness Check - Event Study for Individuals with Only One Child

Note: These figures show the effects of the arrival of the first child on weekly paid work hours and total parental time investment. The sample is restricted to individuals with only one child after matching. Estimates reflect average effects from event time −5 to +17 years relative to the birth of the first child. These results validate our main analysis, confirming that since we do not condition our samples on having only one child, the long-run child penalties also capture the effects of subsequent children and therefore depend on total fertility. However, differential fertility is unlikely to drive variation in child penalties across countries, in line with Kleven et al. (2019) and Kleven et al. (2019). A potential explanation for the flat marginal effect of additional children is early specialization within the household: evidence from Kleven et al. (2019) and Angelov et al. (2016) suggests that couples tend to adopt traditional gender roles shortly after the first birth with mothers reducing labor supply and fathers increasing work hours. This division remains stable over time, even as more children are born. As a result, subsequent children do not lead to significant additional changes in labor market behavior.