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Inside the black box of child penalties: Unpaid work and household structure☆

Sandra Aguilar-Gomez [a],*, Eva O. Arceo-Gomez [b], Elia De la Cruz Toledo [c]

[a] Universidad de los Andes, Department of Economics, Cra. 1 18a-12, 111211 Bogota, Colombia
[b] Centro de Investigación y Docencia Económicas, Department of Economics, Mexico
[c] Loyola Marymount University, Psychology Applied Research Center, United States of America

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ABSTRACT

The adverse effects of motherhood on market work are a persistent source of gender inequality. Using high-frequency data from Mexico, we unveil the dynamics of households' time budgets around childbirth. Mothers' disproportionate increases in unpaid work hours—which rise by more than 9 h per week more than men's—offset their decreased labor supply. A 5-hour gender gap in total productive time originates after childbirth. Other women in the household, including girls, adjust their time allocation to care for the newborn significantly more than male household members, perpetuating gender roles. Through the participation of female family members in childcare, family structure emerges as a relevant factor determining parental time allocation, disproportionately benefiting men. The potential cost of outsourcing the added time burden on mothers represents 24% of household income.

1. Introduction

The gender earnings gap, although narrower than in the past, remains pronounced. Over the last 50 years, this gap has shown a gradually diminishing trend in several countries (Kunze, 2018). While initial studies addressing gender inequality in the labor market focused on the role of human capital and discrimination, recent work has documented the closing or even reversal of gender gaps in education in every region of the world (Parro, 2012). Given this gender convergence in educational attainment, recent literature underscores the enduring role of motherhood as the primary factor behind the remaining earnings and participation gaps (Laun and Wallenius, 2021; Kleven et al., 2019a,b; Angelov et al., 2016).

The child penalties literature initially focused on the U.S. and Western Europe.[1] In developing countries, women face different challenges in working for pay. In these contexts, reliance on extended family members is still common (Gong and van Soest, 2002; Hank and Buber, 2009; Dimova and Wolff, 2011, 2008), and gender norms tend to be more traditional (Duflo, 2012; Jayachandran, 2015). Mexico is a prototypical setting where these factors could be at play: While slightly more women aged 18–22 attend higher education than men (UNESCO, 2021) and antidiscrimination laws are being enforced with mixed success, only 4 out of 10 Mexican women participate in the labor market. Those who do engage in the workforce face a gender wage gap currently estimated at between 24% and 29.6% (Cuellar and Moreno, 2022; Campos-Vazquez et al., 2022).

Traditional gender roles dictate that women should prioritize caregiving and domestic work over paid work (Shelton, 2006). Fortin (2005) shows that in countries with conservative attitudes to gender roles, women's labor market outcomes tend to be worse than men's.

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* Corresponding author.
E-mail address: s.aguilargomez@uniandes.edu.co (S. Aguilar-Gomez).

[1] Cortés and Pan (2023) present an overview of recent motherhood penalty research focusing on high-income countries.

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Restrictive gender norms create the expectation that women partners should shoulder domestic activities including household chores and caregiving (Bertrand et al., 2021). Adherence to these norms reinforces inequalities at home and slows labor market progress for women. Previous works have explored cross-country variation in the magnitude of the motherhood wage penalty to parse the influence of cultural norms that could impact inequality in the burden of nonmarket responsibilities (Kleven et al., 2019b; Musick et al., 2020). Another branch of the child penalties literature has compared labor market trajectories between women with male partners and those with female partners to separate biological factors driving the gendered division of labor from the effects of gender norms and preferences (Andresen and Nix, 2022; Evertsson and Boye, 2018; Moberg, 2016). The gendered division of caregiving responsibilities emerges as a theoretically relevant mechanism that could drive child penalties and other gender imbalances. In this paper, we provide empirical evidence for this mechanism in Mexico, illustrating how it not only impacts mothers' outcomes but extends to all women in the household, including girls. Unpacking the black box of gender differences in unpaid work is crucial for informing policies seeking to boost female labor force participation and, more broadly, achieve gender equality.

Using 15 years of high-frequency panel data from Mexican household surveys, we estimate the gendered impact of childbirth on all household members' employment and unpaid work at home. Building on previous work on child penalties (e.g., Angelov et al., 2016; Chung et al., 2017; Kleven et al., 2019a; Nix et al., 2019), this paper uses an event study framework, including the prepregnancy, pregnancy, and postnatal (up to fifteen months postbirth) periods. The identification assumption is that the event of childbirth generates sharp changes in time allocation that are orthogonal to unobserved determinants of employment and time use outcomes.

A major strength of our research is that we use information on the exact interview date from the quarterly Mexican Labor Survey to examine these effects at monthly frequency—a finer temporal resolution than in prior studies. The monthly variation in our data allows us to analyze multiple prebirth periods and observe dynamics occurring during pregnancy. We document reductions in overall labor force participation and the intensity of labor market engagement beginning in the first trimester of pregnancy. These dynamics differ between formally and informally employed mothers, with the former able to reduce their intensive-margin participation more sharply during pregnancy and maternity leave but experiencing a much faster recovery. These findings expand the existing literature, which predominantly relies on annual data to estimate the impact of having children on women's employment prospects.

Quantifying the "pregnancy penalty" is important for three reasons. First, a drop in income during pregnancy, when the family is expected to increase spending, can worsen the household's financial standing. For the case of women in the formal labor market, workforce exit also implies loss of access to prenatal and perinatal healthcare, which has been found to lead to adverse birth outcomes (Todd Jewell and Triunfo, 2006). Second, a pregnancy penalty could indicate potential employee discrimination or layoffs linked to pregnancy, which are illegal but documented to occur widely in Mexico (Frías, 2011, 2024; Vela Barba, 2017). According to the National Council to Prevent Discrimination (CONAPRED), most complaints of discrimination against women are cases of pregnancy-related discrimination (CONAPRED, 2012).[2] The stress associated with losing a job during pregnancy can lead to adverse health outcomes (Wüst, 2015). Third, our results indicating that a substantial share of women's attrition from the labor force happens during pregnancy suggest that policies aimed at retaining women in the workforce during this period may have wide-ranging benefits for them and their families.

Consistent with previous findings, we document the substantial impacts of the arrival of a child on mothers' labor market outcomes. Fifteen months after the birth, mothers are, on average, 17 pp (38%) less likely to participate in the workforce, while fathers' labor force participation remains unaffected. Mothers also see a decrease of 24% in their labor income. These changes are accompanied by divergent patterns in paid and unpaid time use for mothers and fathers. We show that the arrival of a child opens a wide gap in unpaid work. Fifteen months after the birth, mothers experience an increase of more than 12 h in weekly unpaid hours. In contrast, the increase in fathers' unpaid work is of approximately 3 h per week.

By aggregating our results on paid and unpaid labor, we measure the change in the total postbirth time burden on mothers. We find that mothers' unpaid work increases by *more* than their hours of paid work decrease. A 5-h gender gap in total productive time originates after birth. Hence, our findings indicate that time deficits affect mothers disproportionately. These results are relevant for explaining other gender gaps in the labor market because time not used in the production of goods and services can be used to build social and human capital (Becker, 1965) or to improve mental health and labor productivity if used for sleep (Gibson and Shrader, 2018).[3] In economics, research has found that for women, parenthood is associated with deteriorated self-reported health status and increased mental health issues relative to the outcomes of fathers (Wolfe and Haveman, 1983; Ahammer et al., 2023).

A second significant advantage of our study is that we have detailed household structure information and time use data for all household members. The granularity of the data allows us to study the effects of the birth of a child on household members not impacted by associated biological factors (e.g., breastfeeding) that could drive the parental gender differences in time allocation. By analyzing the time use of nonparents[4] within the household and exploiting heterogeneity in household structure, we show that time support from live-in female family members eases parents' unpaid work burden. However, this support is unequally distributed: Grandmothers' help primarily benefits fathers, while sisters of the new baby seem to assist both parents. Male family members, by contrast, take on little of this burden. Since many of the female household members who contribute are children, our findings also help explain persistent gender gaps in economic outcomes. They suggest that a sort of "housework trap" starting in childhood reinforces gendered expectations into adulthood.

Women in the household, including young girls and older women, experience a 5-h increase in unpaid labor. The sisters, aunts, and grandmothers of the newborn respond by increasing their supply of care work. Meanwhile, brothers, uncles, and grandfathers experience little change. We show that these patterns translate into heterogeneity in child penalties by household structure. We present suggestive evidence that the time constraints faced by parents are alleviated when there is another female member of the household to contribute to unpaid work. Specifically, when other women are present in the household, mothers experience lower increases in unpaid work, with a reduction of up to 6 h, and their average decrease in paid work is roughly 2 h smaller than that of mothers who reside solely with the father. Moreover, the impact of children on the care work undertaken by fathers living with more than one female household member when first interviewed is 37%

[2] CONAPRED's counterpart in Mexico City (COPRED) reports that pregnancy dismissal is the leading cause of complaints (18.8%) and the primary cause of discrimination in Mexico City (COPRED, 2015, 2017).

[3] Interdisciplinary work on gendered time use dynamics has shown that time deficits are directly related to health deterioration (Wolfe and Haveman, 1983; Bittman and Folbre, 2004; Floro, 1995; Zilanawala, 2014).

[4] Throughout this paper, for simplicity, we sometimes refer to female and male coresident household members as nonparents because they are not the parents of the newborn. They could be parents of other people, including, for instance, grandmothers of the newborn who are parents to the head of the household or their spouse.

smaller than the impact on fathers cohabiting solely with the mother. For mothers, these patterns are driven by the presence of sisters of the new baby, who start helping from a very young age. The presence of grandmothers accounts for most of the reductions in fathers' unpaid work and does not benefit women's unpaid work burden, suggesting the household prioritizes support for the father.

Finally, we conduct a back-of-the-envelope exercise to calculate the cost of outsourcing to the market the extra work that mothers assume, which would be needed to close the parenthood-driven gender gap in time use. Using a market replacement cost approach (Folbre, 2008), we estimate the economic value of women's asymmetric contributions at between 24% and 30% of the median household income, depending on the substitutability of unpaid work in the market.[5]

Overall, our work contributes to three strands of literature. First, we expand the body of work that quantifies the effects of children on mothers' market and nonmarket outcomes. While there has been a boom in research on the gendered impacts of the arrival of a child on paid work, studies on the effect of ad hoc childcare in the household on unpaid work are scarcer and certainly not focused on the developing world (Jessen, 2022). In these contexts, there is usually a large informal sector acting as a source of flexible (Alcaraz et al., 2008; Berniell et al., 2022)—but unstable and precarious—jobs (Maloney, 2004). Thus, the growing research on child penalties in developing countries has focused on the role of the informal market (Berniell et al., 2021; Schmieder, 2021; Tumen and Turan, 2023), perhaps at the expense of other important features of these contexts. For instance, under weaker social protection systems and deeply entrenched gender roles, households rely heavily on female family members for caregiving (Gong and van Soest, 2002; Hank and Buber, 2009). Our analyses of gender differences in parents' time use patterns before and after childbirth improve existing knowledge of how fertility interacts with the social norms and constraints prevalent in developing countries (Cruces and Galiani, 2007; Agüero and Marks, 2011; Agüero et al., 2020; Kleven, 2024).

Our most novel contribution consists of detailing how children impact the time use of household members other than parents. We show that other female members of the extended family undertake a substantial portion of the childcare burden in Mexico. While evidence on the "grandmotherhood" penalty in European countries (Gørtz et al., 2025; Backhaus and Barslund, 2021; Rupert and Zanella, 2018; Frimmel et al., 2022) and China (Meng et al., 2023), measured as decreases in grandmothers' labor supply and income, has been accumulating, analyses on women family members' unpaid work are scarcer and certainly not focused on the developing world. Through our analysis of other live-in family members, we estimate the grandmotherhood penalty on unpaid work and unveil a "sisterhood" penalty.

Relatedly, we contribute to the understanding of how household structure modulates the impact of children on parents. In general, extended household structures are associated with lower education (Bertocchi and Bozzano, 2014) and market participation and more home production (Alesina and Giuliano, 2010) for women. At the same time, the literature has established that public services that substitute for mothers' care increase female labor force participation.[6] Furthermore, previous work has shown that childcare provided by family members enables female labor supply in both developed (Dimova and Wolff, 2011, 2008; Posadas and Vidal-Fernandez, 2013; Arpino et al., 2014; Aparicio-Fenoll and Vidal-Fernandez, 2015; Garcia-Moran and Kuehn, 2017; Yu et al., 2023) and developing countries (Gong and van Soest, 2002; Hank and Buber, 2009; Talamas Marcos, 2023). To pull back the curtain on the determinants of women's labor force participation, we study how household structure shapes broader time use dynamics. Specifically, we show that, relative to coresidence with only male relatives, having at least one live-in female relative in the household reduces the added unpaid time burden on both mothers and fathers. Our findings shed light on intrahousehold dynamics that prioritize fathers' time budgets over those of other household members—including young girls.

By showing that the birth of a child has gendered impacts on the time allocation of women other than the mother in the household, especially girls, our analysis provides insights into the causes and persistence of child penalties. According to Nix et al. (2019), the five potential mechanisms driving child penalties in the labor market are (1) biological factors (the health shock from childbirth and the attachment generated by breastfeeding), (2) preferences for childcare, (3) traditional gender norms, (4) comparative advantage in childcare/housework, and (5) motherhood-related discrimination on the part of employers.

Our finding of a child penalty on unpaid work for other female household members (women not bearing children) is inconsistent with the operation of the biological channel and aligns with the conclusion of Kleven et al. (2021), who find that adopting and biological mothers experience a child penalty of similar magnitude. Our findings on child penalties for extended family members also run counter to the motherhood-related job discrimination channel, as effects of this kind cannot arise from such discrimination from employers. The third channel we can discard is comparative advantage of women in childcare/housework, as underage girls in the household do not yet have a comparative advantage in childcare. It would be difficult to argue that hours spent on housework have a lower opportunity cost for girls than for boys when the alternatives to housework are human capital formation activities, including education and other forms of child development. This is especially true when there are reversed gender gaps in educational performance (Parro, 2012). For older children, our results on time use patterns are perhaps also an insight into the black box of gendered comparative advantage formation starting at a young age. Moreover, previous research has found that parents who strongly adhere to traditional gender norms are likelier to allocate housework to children in a way that reflects stereotypes about which domestic tasks are appropriate for men and women (Álvarez and Miles-Touya, 2012).

That the child penalty is borne only by female household members, including girls, implies that traditional gender norms and/or preferences are the likeliest causes of child penalties among nonparents. While we cannot rule out the role of preferences, we argue that the disproportionate burden of unpaid work that girls face might contribute to the gendered preference formation processes often discussed in the literature and to the persistence and perpetuation of gender gaps in market and nonmarket outcomes.

The remainder of this paper is organized as follows: Section 2 presents the data description, descriptive statistics, and a brief institutional background. In Section 3, the baseline empirical strategy and identification assumptions are presented. Section 4 presents a wide battery of results. First, Section 4.1 examines how the arrival of a child affects parental time use and how these impacts differ between formal and informal workers. Section 4.2 shifts the focus to nonparents, especially siblings and grandparents, and how their time use adapts after the new baby arrives. Section 4.3 quantifies the evolution of the child penalties over time for mothers and coresident women in the household. Section 4.4 analyses how household structure influences motherhood penalties. Section 5 presents a back-of-the-envelope valuation of the private cost of closing gender gaps in time contributions to the household. Section 6 concludes.

[5] Other recent works employing Folbre's 2008 methodology to value unpaid work include Suh and Folbre (2016) and Córdoba and Ripoll (2016).

[6] See Calderon (2012) on the effect of daycare centers, De la Cruz Toledo (2018) on universal preschool, and Padilla-Romo and Cabrera-Hernández (2019) on full-time schools.

2. Data and institutional background

Our main data source is the Mexican Labor Survey (ENOE, for its acronym in Spanish) from 2005 to 2019. The ENOE is a quarterly rotating panel labor market survey collected by the National Statistical and Geography Institute (INEGI) in Mexico since 2005. Each household is included in the sample for five consecutive quarters. Approximately 21,000 households enter the sample in each round of the survey.[7] In the Mexican statistical framework designed by INEGI, a household is a group of individuals who live in the same dwelling space and share food expenditures. ENOE data incorporate detailed information on family structure, which allow us to identify extended family members.

For our analytical sample, we include individuals within the age range of 16–45 years. Since households with births might be qualitatively different from those without, we further restrict the sample to households for which the arrival of a child coincides with their ENOE interview cycle. For the analysis of mothers and fathers, we focus on heterosexual couples. Finally, we restrict our analyses to individuals interviewed at least four times in the panel.[8]

In ENOE, as with other panel household surveys, attrition is somewhat pronounced. In our analytical sample, ≈80% respondents have four or more interviews (Appendix Table A.1), whether we count respondents at the household or individual level. Attrition would be a concern if the households in which a birth occurs (or some of these households' members) were likelier to drop out of ENOE because of the birth. Appendix Table A.1 shows that households with births complete an average of 4.30 surveys,[9] while households without births respond to 4.37. While this difference is statistically significant, it amounts to a gap of 1.6% and, hence, is of limited economic significance. For the sample of respondents counted at the individual level, the difference is even smaller (0.9%). Similarly, 79% (80%) of households (individuals) with a birth participated in at least four interviews, in contrast to 81% of the households (household members) without births. In sum, while attrition is indeed a limitation of this study, as is often the case with research employing longitudinal household surveys, the small differences between households with and without births indicate that attrition is unlikely to introduce substantial bias in our estimates.

Despite this limitation, a key advantage of our using household surveys for this analysis is that administrative records do not provide the whole picture in a country with a large informal sector. For instance, administrative records from the Mexican Institute of Social Security (IMSS) offer information only on formal-sector workers. Furthermore, employers tend to underreport wages to avoid payroll taxes and social security contributions. Using ENOE (2018, Q4), we find that 52% of the labor force works in the informal sector, in which there is a slight overrepresentation of women.

The ENOE collects time use data for all household members aged 12 years and older. Productive time allocation is divided into paid and unpaid work. To measure total unpaid work, we include hours dedicated to the following time use categories: (a) providing exclusive care for children or elderly, sick, or disabled individuals without payment; (b) building or expanding the home; (c) repairing or maintaining the home, furniture, appliances, or vehicles; (d) carrying out chores in the house (e.g., washing and ironing clothes, preparing and serving food, sweeping). To avoid double counting, the ENOE asks respondents to report their hours of care work only if those hours are used exclusively on that activity.[10]

2.1. Descriptive statistics

Appendix Table A.2 shows labor and nonlabor outcomes for our analytical sample. Panel A compares the outcomes of women between the prepregnancy and pregnancy periods. Panel B shows the outcomes of mothers and fathers after the birth of the child. Women have higher salaries and monthly labor income during preconception than in the pregnancy period. Regarding paid hours, women work 26% more during preconception than in the pregnancy period and are on average less likely to be formally employed. Unpaid hours of work at home do not change once women become pregnant, as they continue to shoulder unpaid work at home.

Panel B compares mothers and fathers after the birth of the child. Overall, mothers spend fewer hours on labor market activities but spend more hours on unpaid activities than fathers. However, mothers' total burden of unpaid work is large enough to more than offset their reduced hours of paid work. Post-birth, when we add up paid and unpaid work, mothers work on average 9 more hours than fathers, most of which are spent on nonmarket work.

Fig. 1 examines the trajectory of the full sample of ENOE respondents aged 16–45, comparing parents and childless individuals. Mothers spend, on average, 10 more weekly hours working on unpaid activities than women who have no children (Fig. 1 Panel (a)), while fathers' and childless men's trajectories over time are nearly identical. This pattern has remained constant over time, as has women's relatively low labor force participation (Panel (b)). Panel (b) shows a marked gap in the trajectory of labor supply between men and women, with childless men and fathers prevailing at the top of the distribution, followed by childless women, and, at the bottom, mothers. The gap in the average paid hours worked between women and men is wide and does not show convergence in the 15-year period analyzed in this study.

2.2. Institutional background

Some institutions are in place to ease the obstacles that mothers face in the labor market. Women working in the formal sector have 12 weeks of paid maternity leave with 100% wage replacement and no upper limits.[11] In a country where over 60% of working mothers are in the informal sector, a large share of working women lack this benefit. Since 2012, fathers of newly born or adopted children have had the right to 5 days of paid paternity leave, with 100% wage replacement.

Once the child is born, working mothers in formal jobs have access to a subsidized network of government-run daycare centers called *guarderías del IMSS*, where children can be enrolled at 6 weeks of age. Nonetheless, public daycare centers are very scarce; for instance, the potential demand for IMSS daycare centers is approximately 2,000,000 infants, whereas IMSS has an installed capacity to care for approximately 240,000 infants (12% coverage).[12] In the period of analysis, mothers in the informal sector had access to home-based daycare centers called *estancias infantiles* (EIs). These centers were part of a government-run program designed to support low-income mothers who were working, looking for a job, or enrolled in school. The program was means tested, with fees heavily subsidized (up to 90%) based on an income gradient (Calderon, 2012). The EI program ran from 2007 to 2018. In 2019, an alternative program called Apoyo para el Bienestar de Niñas y Niños started providing direct cash transfers to low-income parents, but the EI home-based centers were defunded.

[7] The identifiers assigned to households are not globally unique across all survey waves. Instead, these identifiers are sometimes recycled for new households entering the rotating panel after several quarters. We resolve this issue by combining each household identifier with the year of the first interview.

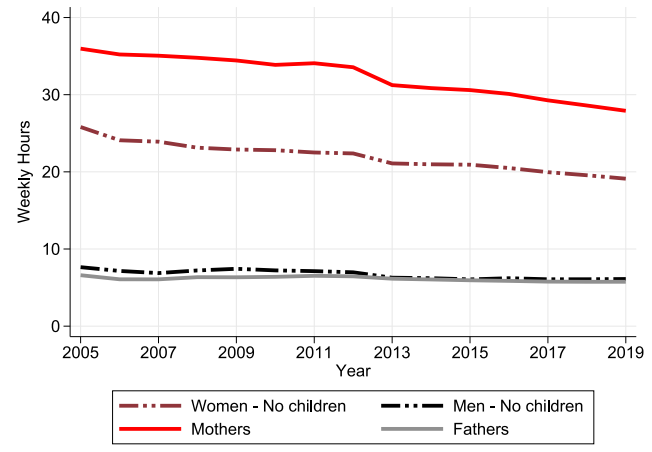
[8] Our main results are not sensitive to this restriction.

[9] Households "with a birth" are those in which the arrival of a child coincides with their ENOE interview cycle and which thus are included in the estimating sample.

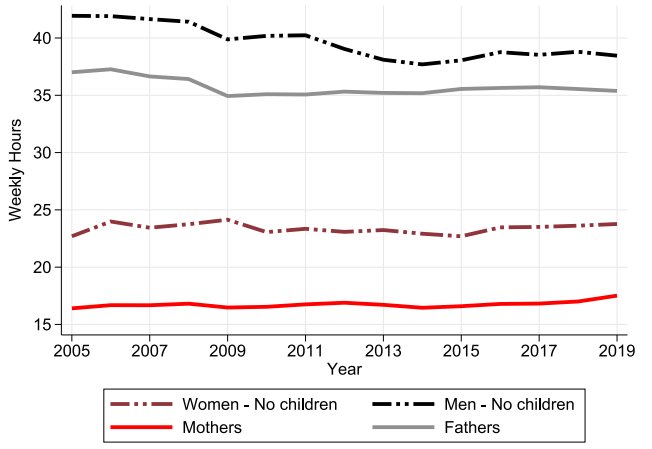
[10] Measures of unpaid work might underestimate the total burden if they do not account for the mental load of planning and supervising household management. To the extent that this is the case, our estimates of changes in unpaid work represent a lower bound.

[11] Maternity leave is paid by social security contributions in the following way: Employers pay 70%, employees pay 25%, and the federal government pays the remaining 5% (Pérez-Hernández and Escobedo, 2019).

[12] Data retrieved on September 12, 2022, from http://www.imss.gob.mx/conoce-al-imss/cubos.



(a) Weekly unpaid hours worked



(b) Weekly paid hours worked

Fig. 1. Hours of paid and unpaid work.
Notes: The figures depict the trends in average weekly hours of paid and unpaid work for parents and childless individuals in ENOE households, ages 16–45, using all ENOE data from 2005 to 2019.

3. Empirical strategy

Our main identification strategy is an event study centered on the birth of a child. Although the data come from a rolling panel where households are observed for up to five quarters, we employ a stacked analysis that pools households based on their relative timing around childbirth. Specifically, we use the month and year of each interview and the child's date of birth to align observations across different households, constructing an event study that spans up to 12 months before the birth and up to two years after it.[13] Hence, despite the panel's five-quarter structure, we can analyze outcomes over a longer event window by pooling multiple cohorts of households at different points in their observation periods. This allows us to assess whether pretrends in the outcomes of interest could generate bias in our results. Furthermore, the high frequency with which we observe individuals in our sample allows us to uncover relevant rearrangements of time use that are unobservable in yearly data. The estimating equation for our event study is as follows:

$$y_{it} = \overbrace{\sum_{j\neq -8} \alpha_j \cdot 1\left[t - E_h = j,\ s(i) = f\right]}^{child\ penalty\ on\ women} + \overbrace{\sum_{j\neq -8} \beta_j \cdot 1\left[t - E_h = j\right]}^{men's\ time\ use\ changes} + \overbrace{\gamma_{s(i)a(it)}}^{gendered\ age\ profiles} + \overbrace{\delta_{s(i)t}}^{gendered\ monthly\ shocks} + \Theta_i + \epsilon_{it} \quad (1)$$

In Eq. (1), the child arrives in the household of individual i at E_h.[14] The relative time of the child's arrival is defined as $j = t - E_h$. The parameters of interest α_j and β_j are the coefficients of a set of indicator variables, including every $j \neq -8$. We omit the event time dummy at $j = -8$ because we use the month of conception as the baseline to measure child penalties.[15] β_j measures men's time use dynamics around the childbirth and α_j the additional burden faced by women—what the literature commonly terms the child or motherhood penalty. We include men and women in the same regression, interacting all fixed effects with gender, plotting the net time use changes for men (β_j) and women ($\alpha_j + \beta_j$).[16] $s(i) \in \{m, f\}$ is the gender of individual i, $a(it)$ is the age of parent i at date t, and hence, $\delta_{s(i)t}$ represents gender-specific monthly shocks, $\gamma_{s(i)a(it)}$ gender-by-age fixed effects capturing gendered age profiles and Θ_i the individual-level fixed effects. The sample is restricted to mothers and fathers in heterosexual couples.

By including a complete set of age dummies interacted with gender, we control nonparametrically for underlying life-cycle trends that can vary between men and women,[17] and by including a full set of monthly date–gender dummies, we account nonparametrically for time trends such as wage inflation and business cycles and allow them to affect men and women differently.[18] Standard errors are clustered at the household level.

All members of the household are considered treated after $t = E_h$. We exploit the exact date of the interview to identify the relative time to childbirth, $j = t - E_h$, at a monthly scale $j = -12, \ldots, 15$. For instance, if a household is interviewed in t = March 2018 and the youngest member was born in April 2017, then $j = 11$ for all the household members. Since the data are quarterly, we have one observation every three months for each i. Hence, the timing of when cohorts become treated, as understood in the recent difference-in-differences literature, depends on when the household enters the rotating panel relative to the arrival of the child in the household.[19] The fifteen-year coverage of the nationwide surveys gives us the statistical power to calculate α_j and β_j for every $j \in \{-12, 15\}$ for every household member. While this is a case of staggered treatment because childbirths occur at different waves of the panel, we assume no heterogeneity in the treatment effects

[13] Relative periods $j \geq 15$ are pooled for precision.

[14] Our sample includes all births to increase the statistical power of our analysis, instead of only the birth of the first child. Furthermore, since many of our main results refer to effects on the newborn's siblings, not restricting the sample to the first child improves comparability between sections.

[15] Please note that this date is labeled $j = -8$; the birth occurs at time 0. Hence, there are nine months between the baseline period and the month marked as the event. While the notation is tricky, we accurately use the approximate time of conception as the baseline.

[16] The results from separate regressions for men and women are almost identical and are available upon request.

[17] It is important to note that the $\gamma_{s(i)a(it)}$ terms are not redundant: Every person in our sample has between one and two birthdays during the observation period, and these have drastically different implications if, for instance, the birthday corresponds to a woman turning 21 or to a man turning 39. Furthermore, $\gamma_{s(i)a(it)}$, $\delta_{s(i)t}$, and Θ_i are all identified precisely because people enter the sample at different fractional ages, but age is measured in integers, and the time fixed effects are specified as month–year.

[18] We produce our estimates using the Correia (2017) algorithm, designed for high-dimensional fixed effects.

[19] Cohort 1 is observed in relative time $j = -12, -9, -6, -3, 0, 3$, cohort 2 is observed in times $j = -11, -8, -5, -2, 1, 4, 7$, and so on until cohort 28, which is observed in times $j = 0, 3, 6, 9, 12, 15$.

across different treatment cohorts (Sun and Abraham, 2021; Callaway and Sant'Anna, 2021; Roth et al., 2023). This assumption is sensible because treatment cohorts here are defined by the difference between their entry into the rotating panel and the time of conception. Since the rotating panel is designed by INEGI to make different cohorts comparable, treatment timing should not be a dimension along which we observe effect heterogeneity. Still, Section 4.3 shows that the child penalties in Mexico remained mostly stable during our observation period.

The parameter α_j captures the change in a mother's earnings in the months after birth relative to her earnings the year before birth, relative to the same change for a man with very similar fixed unobservables. Hence, the child penalty is a difference-in-differences estimate between men and women. The identifying assumption is that of parallel trends between these two groups. While the parallel trends assumption is fundamentally untestable, researchers often assess its plausibility by evaluating whether the pretrends or the estimates of $\alpha_{j<0}$ are significantly different from zero. Since, as we show, some men's time use patterns are also affected by children, the child penalty does not capture the full impact of children on mothers, only the differential impact relative to the one on fathers. In line with the difference-in-differences literature, we assume limited anticipation of the treatment (Roth et al., 2023). This means there exists a specific time point, denoted as δ, before which no anticipation of the treatment occurs. We assume that there is no anticipation before $\delta = -8$, the month of conception.

Our identification is valid if no other determinants of labor market outcomes—that is, factors unrelated to a child's arrival—experience a sharp discontinuity at childbirth that affects women exclusively.[20] In other words, although fertility choices are not exogenous, presumably, the event of having a child generates sharp changes in time allocation that are orthogonal to unobserved determinants of time use. Hence, we can interpret the corresponding gendered discontinuity in time use or earnings as the causal effect of having a child. Our event study framework exploits the timing of birth among heterosexual couples who have children at some point in the observation period instead of comparing households with children to those without them. We also restrict our sample to households with births of children to the household head or his or her spouse. This results in a final sample of 12,867 births.

4. Results

The arrival of a child transforms time use patterns within a household and significantly affects the income received by its members. Many of these effects arise during pregnancy. This section presents four sets of results organized as follows: Section 4.1 presents the estimates for our baseline specification, comparing mothers' and fathers' shifts in time use and labor market outcomes in response to the arrival of a child. Section 4.2 documents the gendered impacts of the arrival of a child on household members who are not the parents. Section 4.3 examines the evolution of the child penalties over time for mothers and coresident women in the home. In Section 4.4, we show that these patterns translate into heterogeneity in the child penalties by household structure.

Unless otherwise noted, all figures show the child penalty on the outcomes of interest for both men and women. Each dot represents the estimated coefficient α_j^s (men) and $\alpha_j + \beta_j$ (women) from Eq. (1) for the month j, where $j = \{-12, -11, \ldots, 14, 15\}$ are the months before and after the birth of a child. The coefficients are interpreted vis-à-vis the outcome in the month of conception. The pregnancy period is marked between the two red vertical lines in every graph to highlight previously unobserved dynamics during pregnancy.

[20] While the bulk of the literature employs event studies, previous work has shown that using different instrumental variable (IV) approaches as an alternative identification strategy yields results consistent with the magnitude of child penalties being economically relevant (Cools et al., 2017; Lundborg et al., 2017; Kleven et al., 2019b).

4.1. Gendered shifts in parents' time use patterns

4.1.1. Paid work

Our first finding, consistent with the evidence from other regions, is that maternity impacts Mexican women's labor force participation. In addition to expanding the geographic scope of analysis in the literature, we contribute to existing knowledge on this particular stylized fact by taking advantage of the monthly frequency of our data to show that decreased participation in the labor force at the extensive and intensive margins can be observed clearly from the third month of pregnancy ($j = -6$).

Fig. 2 shows the impact of the arrival of a child on labor supply at the extensive and intensive margins, measuring changes in labor force participation and hours worked. Men's outcomes remain unaffected regardless of the dependent variable of interest. In Panel (a), the dependent variable is the respondent's probability of self-declaring that he or she is in the workforce. Throughout the rest of the paper, this is our measure of labor force participation, unless otherwise explicitly noted, since it accounts for the market attachment of women who took maternity leave and thus remain employed.

Women's labor force participation is 7.9 pp lower at the end of the first trimester of pregnancy ($j = -6$) than in the month of conception ($j = -8$) (Panel (a)). This decrease reaches 12.5 pp at the end of the second trimester ($j = -3$). Importantly, none of the point estimates for periods before $j = -8$ are statistically significant, supporting the plausibility of the parallel trends assumption. We later show that unpaid labor exhibits significantly different dynamics, with no visually evident or statistically significant changes until after childbirth ($j \geq 0$).

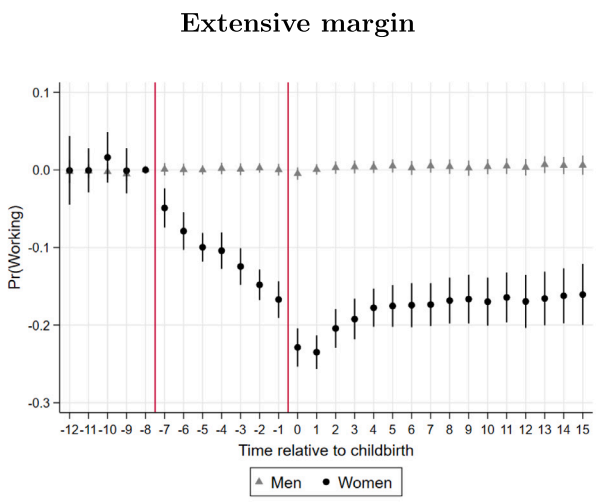
Right at childbirth, participation decreases by 22.4 pp from its level in $j = -8$. Shortly after the child's arrival, some women return to the labor force, and the relative drop in participation starts decreasing in magnitude. However, the participation rates remain at a much lower level than those at conception: Fifteen months after birth, there is still a 38% decrease from the preconception average participation rate of 0.44 ($\alpha_{15} + \beta_{15} = -0.17$). In terms of magnitude, this result is higher than the one that Berniell et al. (2022) estimate for a pooled sample of 29 countries (25%) and aligns with what Kuziemko et al. (2018) find for the U.K. (38%).[21]

To accommodate scheduling conflicts postbirth, some mothers may reduce their labor supply on the intensive margin instead of dropping out of the labor force. Fig. 2 (b) shows that fifteen months after the birth, women reduce their hours worked by 6.4 h. When we scale these results (see Appendix Figure A.1),[22] we find that the effect amounts to a 35% fall in labor supply. Appendix Figure A.2 shows that women's earnings begin dropping at the onset of pregnancy and display limited recovery on either the intensive or the extensive margin.

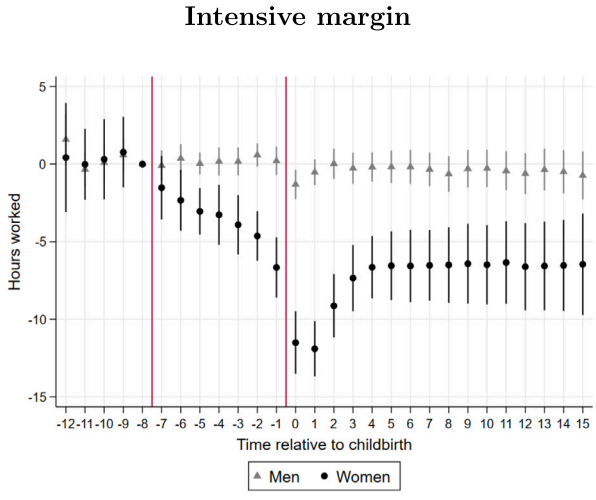
In Fig. 3, we also examine the role of the formal sector and associated maternity leave in shaping pre- and postbirth employment. To do so, we use two measures of labor supply. First, as before, we use self-reported participation in the workforce (Panels (a) and (b)) as our dependent variable. We then complement this with Panels (c) and (d), where the dependent variable is the probability of having a positive number of hours worked in the week prior to the interview. Comparing the trajectories of labor supply defined in these two ways allows us to examine the role of maternity leave as a buffer against labor force exit.

[21] Fathers' participation rates do not vary much before or after childbirth, except for the 2.9 pp decrease in the probability of having positive hours worked on $j = 0$ shown in Fig. 2 (b). Paternity leave is one week long in Mexico; more research is needed to see how large this effect would be if men were entitled to a more extended paternity leave.

[22] We follow Kleven et al. (2019a) and convert the estimated coefficients into percentages by scaling the dependent variable. The transformation is the following: $P_j = y_{it}/[\gamma_{s(i)a(it)} + \delta_{s(i)t} + \hat{\Theta}_i]$. The denominator is the predicted outcome when the contribution of the event dummies is omitted. Hence, it can be interpreted as a counterfactual trajectory.



(a) Pr(in the workforce)



(b) Hours worked

Fig. 2. Impacts of the arrival of a child on labor force participation: Extensive and intensive margins.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The graphs show the impacts of the arrival of a child on women's outcomes as defined in Eq. (1). y_{it} is (a) the probability of self-reporting participating in the workforce and (b) the number of hours worked in the past week. The x-axis represents the months before and after childbirth, where the birth occurs at month $j = 0$. The sample is restricted to people aged 15–45 years who had a child during the observation period.

Panel (a) shows that formally employed women experience a sharper drop in labor force participation after $j = 2$. Since maternity leave typically spans from $j = -1$ to $j = 1$ or from $j = 0$ to $j = 2$, these results are consistent with some women waiting until the end of their leave to exit the workforce. The buffering effect of maternity leave is particularly evident when we compare Panels (a) and (c): Between months −1 and 2, formally employed women reduce their hours worked by nearly 80% while maintaining their labor force participation and thus access to social security benefits.

Panels (b) and (d) of Fig. 3 show that women in the informal sector follow a markedly different trajectory. Informal workers, who make up 61% of the employed women in our sample, exhibit a much larger drop in labor force participation, regardless of the measure used. In contrast to formally employed women, informal workers display clear pretrends, consistent with their anticipating childbirth and workforce exit or with their endogenously timing childbirth during periods of declining work engagement—both mechanisms indicative of weaker labor force attachment.

We also examine transitions between sectors. Figure A.3 shows that, at least during the first fifteen months after the birth, men are likelier to switch to the formal sector, while no such pattern is evident for women (Panels (a) and (b)). While there is an increasing pattern from before conception, formalization among new fathers would be consistent with how social security functions in Mexico: A single formal worker in the household grants the entire family access to social security, housing credit, and healthcare. Under this institutional setting, women may remain in or switch to the informal sector to retain flexibility without forgoing these benefits. However, Panel (c) of Figure A.3 shows that, in the short run, women do not shift toward the informal sector to gain this flexibility—even when we restrict the sample to individuals who remain in the labor force throughout (Panel (d)).[23]

Overall, the reallocation of time away from market work is accompanied by a reduction in labor income. Figure A.2 shows that total income and hourly wage exhibit very little recovery.

4.1.2. Unpaid work

In parallel with the reduction in mothers' labor supply, our analysis reveals a significant increase in hours dedicated to unpaid work for both parents, but with a large gender gap (Fig. 4).

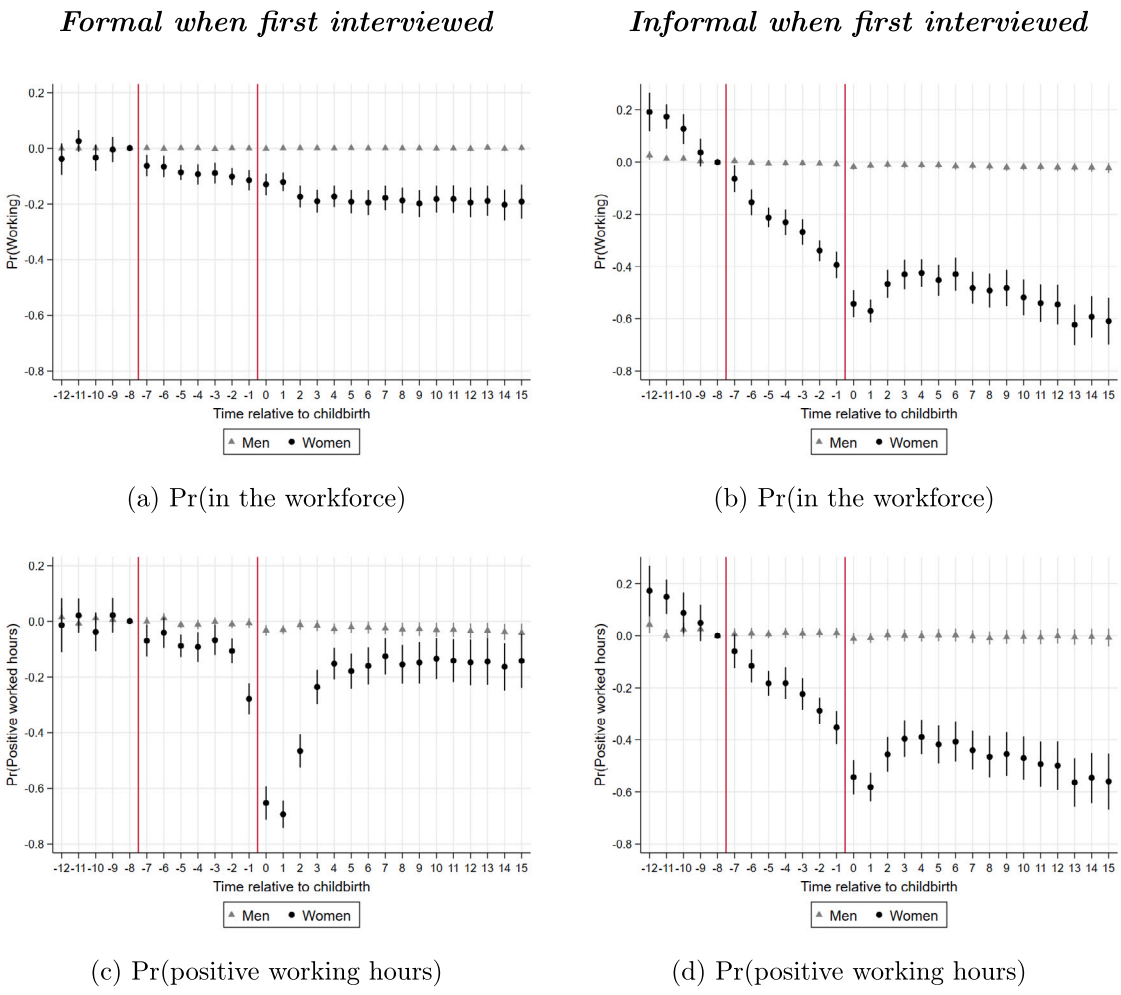
Men work 0.6 more weekly unpaid hours during the last month of their partner's pregnancy than at $j = -8$. The effect size quickly climbs to 3.9 in the month of the birth. Five months after the birth, their increased burden of unpaid work stabilizes at approximately 3.3 h per week. At $j = 0$, there is no gender gap in the impact of the child's arrival on unpaid labor. The pattern observed in the initial month may be explained by the postpartum period, in which some women undergo physical recovery. However, women massively increase their hours of unpaid work very shortly after birth—by 15.4 h per week at $j = 2$. Thus, the motherhood penalty on unpaid labor, understood as the differentiated impact of a child's arrival on this variable, grows to 11.2. Five months after the birth, the penalty plateaus at approximately 10 h.[24]

In our sample, women who do market work perform, on average, 8 fewer hours of unpaid work per week than women who do not. However, the change in unpaid labor that arises because of the arrival of a child is starker for women who were in the workforce when first interviewed (Fig. 4(b)). This pattern suggests that while, in general, women's access to labor income might allow them to outsource or negotiate over some of the hours of unpaid work they provide, this situation changes drastically after the arrival of a child. The lack of impact on men's paid work hours, shown in the previous section, implies that the burden they take on at home is such that it does not affect their work life.

A relevant feature of Fig. 4 is the timing of the increase in unpaid labor. The labor supply responses described in Fig. 2 happen during pregnancy, consistent with the effects arising from the health shock of pregnancy itself. In contrast, hours of unpaid work (Fig. 4) do not soar until *after* the new household member has arrived. Our results are consistent with the finding of Jessen (2022) that, in Germany, after the arrival of the child, mothers predominantly take over the extra work and, in the long run (6 years postbirth), women's share in housework remained higher than men's.

[23] Our conditioning on women's never leaving the workforce leads to endogenous selection into the estimating sample, so Panels (b) and (d) should be interpreted with caution and only as robustness checks for Panels (a) and (c).

[24] Appendix Figure A.1 shows that men and women increase their unpaid labor supply by a higher proportion than women. However, the percentage change veils the total extent of the gender gap in unpaid labor and caregiving hours because men start from a much lower basis.



(a) Pr(in the workforce) (b) Pr(in the workforce)

(c) Pr(positive working hours) (d) Pr(positive working hours)

Fig. 3. Impacts of the arrival of a child on labor force participation, by sector.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The x-axis represents the months before and after childbirth, where the birth occurs at month $j = 0$. The sample is restricted to people aged 15–45 years who had a child during the observation period.

4.1.3. Total hours of work

Fig. 5 unveils the net changes in time use around childbirth. The coefficients are interpreted as the difference in total hours worked per week (paid and unpaid) each month compared to those at $j = -8$. Once again, time use does not exhibit a significant pretrend before the month of conception, and for fathers, the trends remain relatively flat until after the child has arrived. In contrast, the shifts in mothers' time use patterns are consistent with biological constraints on working during pregnancy: There is a sharp decrease in the total prebirth burden of work, which reaches its lowest point in the month of childbirth. At $j = 0$, mothers' total time use budget includes 7.5 fewer work hours (paid and unpaid) than at the time of conception.

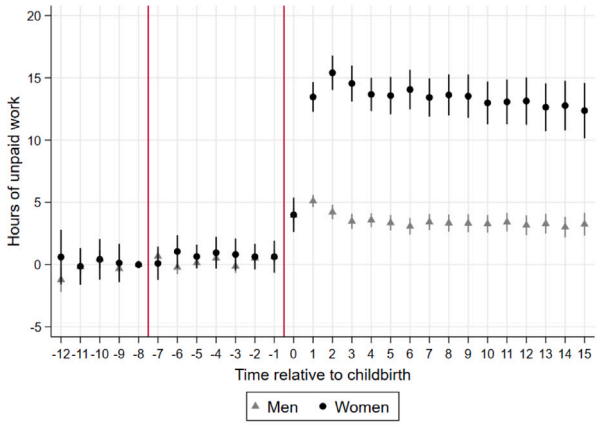
The parental gap in total hours quickly reverses after the birth. Beyond the initial two months ($j > 2$), we observe the emergence of a gender gap that favors fathers in terms of its impact on total time allocation. Our estimations indicate that this gap fluctuates between 3.4 and 4.5 h per week. More research is needed on the implications of these findings for gender differences in access to leisure, sleep, and mental health. In Section 5, we estimate the economic value of this gender gap in time use.

4.2. Other household members

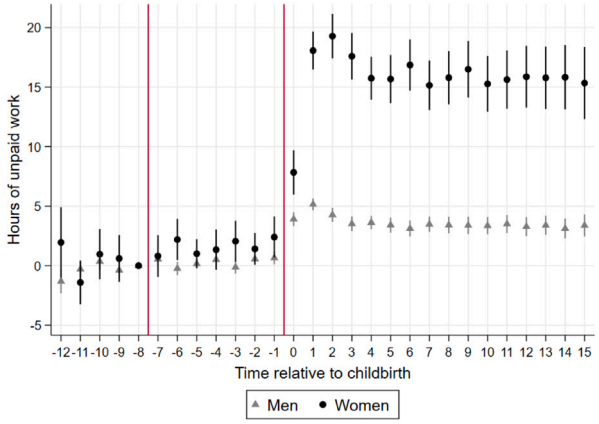
The disproportionate impact of children on women is partially driven by biological factors, such as the health shock of pregnancy and childbirth. In this section, we examine the time use patterns of other members of the household who do not give birth and thus do not undergo the associated health shock. The sample includes siblings, aunts and uncles, and grandparents of the newborn. We exclude people unrelated to the newborn, such as visitors, roommates, and domestic workers. In ENOE, among the 64,002 births recorded in our sample, 26,923 occur in households with at least one household member that meets these criteria.

We identify 690 births of grandchildren of the household head or spouse and 176 births to siblings of the household head that fall within the event study window. We drop these 866 births from the sample so that only children of the head and spouse are considered as the events of interest. Given that the sample size is significantly reduced when we analyze the outcomes for other household members, we estimate a simplified model with the relative periods categorized into (i) preconception ($j < -8$), (ii) pregnancy ($j \in (-8, 0)$), (iii) 0–3 months old, (iv) 4–12 months old, and (v) > 12 months old. The omitted category is once again the month of conception ($j = -8$).

A potential concern in analyzing the effects of births on the time use of coresident household members is that household structure itself may be endogenous to the arrival of a child. This could bias our results if, for instance, female family members with weaker job prospects are likelier to move into the household to provide childcare. In such a case, we might overestimate the impact of children on these new household members, as they would likely have a lower opportunity



(a) Full sample



(b) Conditional on the respondent's working when first interviewed

Fig. 4. Impacts of the arrival of a child on weekly hours of unpaid work.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The graphs show the impacts of the arrival of a child on weekly hours of unpaid work. The x-axis represents the months before and after childbirth, where the birth occurs at month $j = 0$. The sample is restricted to people aged 15–45 years who had a child during the observation period.

cost of time than those who do not endogenously join the household. Later, we explore the effect of caregiving by other household members on the child penalties. If mothers with good jobs tend to welcome other relatives into their homes to share in caring responsibilities, we would also overestimate the effect of other members on motherhood penalties. Appendix Figure A.4 shows no significant changes around childbirth in the presence in the household of (a) women other than the mother, (b) men other than the father, (c) a grandmother, or (d) a grandfather. Thus, any potential bias introduced by these behaviors is likely minimal.

Fig. 6 documents substantial child penalties for coresident women across paid and unpaid work dimensions. Panels (a) and (b) focus on adult household members to examine their labor market participation on the extensive and intensive margins, respectively. Panel (a) shows a decline in labor force participation among female household members following the birth of the new child, with the effects becoming more pronounced over time. The probability of employment decreases by approximately 5.4 pp in the first three months postpartum and by 6.2 pp at 4–12 months ($p < 0.1$). This decline persists beyond one year, reaching 6.6 pp ($p < 0.1$), suggesting that childbirth leads to sustained workforce exits rather than temporary interruptions, as previously shown for mothers. Panel (b) shows that reductions in hours worked by adult women other than the mother in the household follow a similar pattern. The decline becomes statistically significant after the child's birth ($p < 0.05$ for all postbirth point estimates), starting at 2.8 h per week in the first three months and 2.9 h at 4–12 months and reaching 3.4 h beyond one year after the relative's birth. The labor market outcomes for other men in the household, similarly to fathers', remain unaffected by the arrival of the child.

Panels (c) and (d) reveal that the burden of unpaid work following childbirth does not fall solely on mothers but extends to other female household members, including underage girls. Once again, the pattern for other household members is remarkably similar to that for parents: Men and women other than the new parents in the home display increases in unpaid work, but there is a substantial gender gap in this adjustment. Specifically, Panel (c) shows that coresident adult women experience a sharp increase in unpaid work, which rises by approximately 4 h per week in the first three months after birth, but the increases for coresident men are statistically insignificant. This increase surpasses 5 h at 4–12 months and remains elevated beyond one year after the event.

Crucially, Panel (d) shows that this pattern extends to children in the household, with underage female household members also taking on a substantial share of the additional unpaid work. The increase in unpaid hours for girls mirrors that of adult women, reinforcing how gendered expectations of care work emerge early. Interestingly, we observe increased unpaid work for male children in the house, but this increase never surpasses 1.5 additional hours. These findings suggest that when a new child is born into the household, the redistribution of unpaid labor is not limited to the mother and other adult women but is also absorbed by girls, likely shaping long-term gender disparities in work and care responsibilities.

Our findings carry significant implications for our understanding of the formation and persistence of gender roles. Among young household members, comparative advantages and preferences are still in the formative stage. Consequently, gendered household time allocation rules can substantially influence future life outcomes. Similarly, coresident adult relatives cannot be affected by discrimination from employers or by biological factors associated with motherhood. Hence, our results provide compelling evidence that gender norms are a primary driver behind gender disparities in time allocation.

In Fig. 7, we further disaggregate the sample of nonparents by kinship to measure whether there is a sisterhood penalty or a grandmotherhood penalty in unpaid work. Grandmothers of the new child experience a roughly 5-h increase while grandfathers remain mostly unaffected, although the estimation is noisier, as the sample of grandparents is significantly smaller than that of siblings. When we focus on children, our results indicate that a year after the birth of the new baby, girls in the household do ≈5 additional hours of unpaid work per week (Panel b), with brothers of the newborn taking up ≈1.5 h. The sisterhood penalty is evident even among children in school, although we do not find a gender gap in changes in hours dedicated to study among siblings of the child (Appendix Figure A.5). While we do not have data on recreational activities, our results suggest that the arrival of a sibling opens a potential gender gap in leisure or sleep, both elements relevant for mental health and human capital formation (Gibson and Shrader, 2018; Costa-Font et al., 2024; Nijhof et al., 2018).

4.3. Evolution of child penalties over time

In some contexts, child penalties have decreased over time. This is expected in places where the labor market has become more flexible, often through institutional and cultural change that leads to greater gender equality in the workforce. For instance, Kleven et al. (2019a) find that the child penalty for mothers in the United States almost halved between the 1970s and the 1990s, remaining stable after that

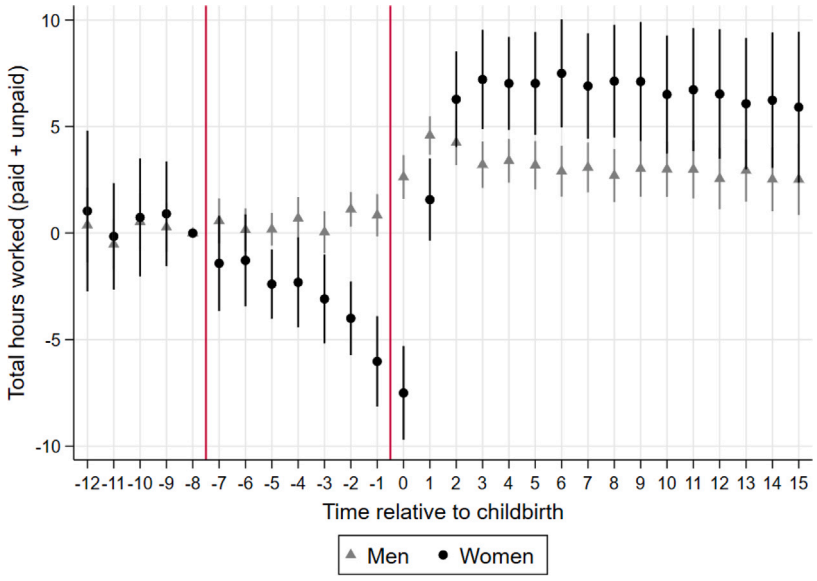


Fig. 5. Impacts of the arrival of a child on total hours worked per week.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The graphs show the impacts of the arrival of a child on weekly hours of work, including paid and unpaid labor. The x-axis represents the months before and after childbirth, where the birth occurs at month $j = 0$. Standard errors are clustered at the household level. The sample is restricted to people aged 15–45 years who had a child during the observation period.

period. However, these findings might not reflect a global pattern. Researchers have found that in China, the child penalty *rose* between 1982 and 2015 (Zhou et al., 2022), with the relaxing of the one-child policy and state-owned enterprise reform being potential explanations. We investigate whether the child penalties on parents and other household members in Mexico exhibit an increasing or decreasing pattern over time.

Figs. 8 and 9 display the results of our implementing Eq. (1) but condensing the postbirth periods into one dummy variable and splitting the sample into two-year periods. The coefficients of the $post \times female$ interaction for the included periods, which quantify the evolution of the gender gap in postchild time use, are shown in these graphs. Pregnancy and perinatal months ($j \in [-7, 2]$) are omitted from the analysis, as the findings in this paper reveal that several short-lived paid and unpaid work rearrangements happen during this period. Hence, we compare time use during the first two years postbirth with time use in the months before conception.

We do not find a reduction in the child penalties over time for Mexican mothers. Fig. 8 shows that relative to fathers, mothers experience reductions in paid work during the first two years of the child's life that oscillate between 5 and 11 weekly hours on average, while the increases in their unpaid work fluctuate between 9 and 13 h, leading to increases in total hours worked throughout the years in our sample. The point estimates for unpaid hours exhibit a slightly increasing trend, but the 3-h difference between 2005–6 and 2017–18 is not statistically significant at conventional levels ($t = -1.3$).

For coresident women other than the new mother, changes in paid work remain consistently statistically insignificant, with the point estimates hovering around zero across all the biennial subsets we examine. In contrast, for unpaid work, our estimates indicate that coresident female, relative to male, relatives exhibit increases of approximately seven hours for most of the years in our sample, and we detect no discernible time trend.[25]

[25] Because the biennial estimations draw from a smaller pool of approximately 12,000 observations (versus roughly 100,000 for the parents), statistical power becomes a greater concern. Although some estimates do not reach conventional thresholds of significance, we cannot reject the possibility that unpaid work for coresident women relatives, relative to coresident men, increases by five hours in any given subset of years.

4.4. Household structure and the motherhood penalty

If other women in the household adjust their time use in response to the arrival of a child, then they potentially mitigate the costs that mothers face. In this section, we provide evidence of effect heterogeneity between parents in households with different prechild structures. We estimate the following equation:

$$y_{it} = \overbrace{\sum_{j\neq -8} \xi_j \cdot 1\left[t - E_h = j,\ n_f > 0\right]}^{household\ structure\ heterogeneity} + \overbrace{\sum_{j\neq -8} \phi_j \cdot 1\left[t - E_h = j\right]}^{time\ use\ dynamic\ around\ childbirth} + \overbrace{\chi_{a(it)}}^{age\ fixed\ effects} + \overbrace{\lambda_t}^{date\ fixed\ effects} + \theta_i + \nu_{it} \quad (2)$$

where n_f is the number of female household members other than the mother at the time of the first interview. θ_i contains individual fixed effects, and ν_{it} represents the error term. Standard errors are clustered at the household level. The relative time periods are categorized into (a) preconception (omitted category), (b) pregnancy, (c) 0–3 months old, (d) 4–12 months old, and (e) > 12 months old. As before, the sample is restricted to mothers and fathers in heterosexual couples who had a child up to two years before their last interview. To improve comparability, we further restrict the sample to households that have either $n_f > 0$ or a positive number of men in the household other than the father when the respondent is first interviewed ($n_m > 0$). Thus, among households that have coresident relatives, ξ_j captures the change in the child penalties when there are women among these additional household members. We obtain separate estimations for mothers and fathers.

In principle, household structure might be partially driven by prechild gender roles, which is a limitation in our analyses. In addition, relatives might move to the household to care for the newborn. Appendix Figure A.4 shows no significant changes around the child's birth in the presence in the household of female/male relatives in general, and specifically of grandmothers/grandfathers. Still, all our heterogeneity analyses are conducted using prechild structure to mitigate any potential bias from endogenous structure.

Table 1 shows that in households with more than one woman, the time use shifts resulting from the arrival of a child are smaller. Column (1) shows that a year after birth, mothers with at least one live-in

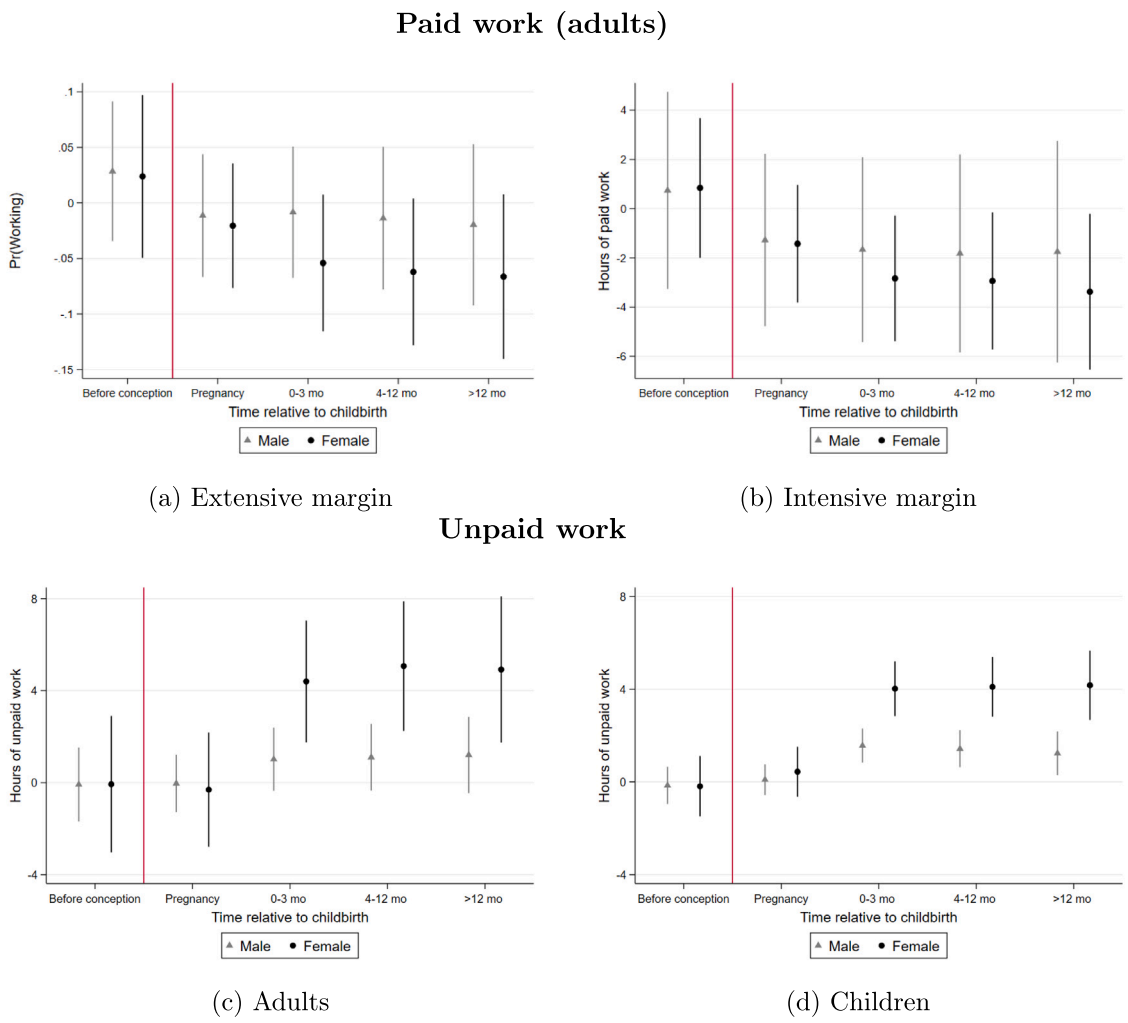


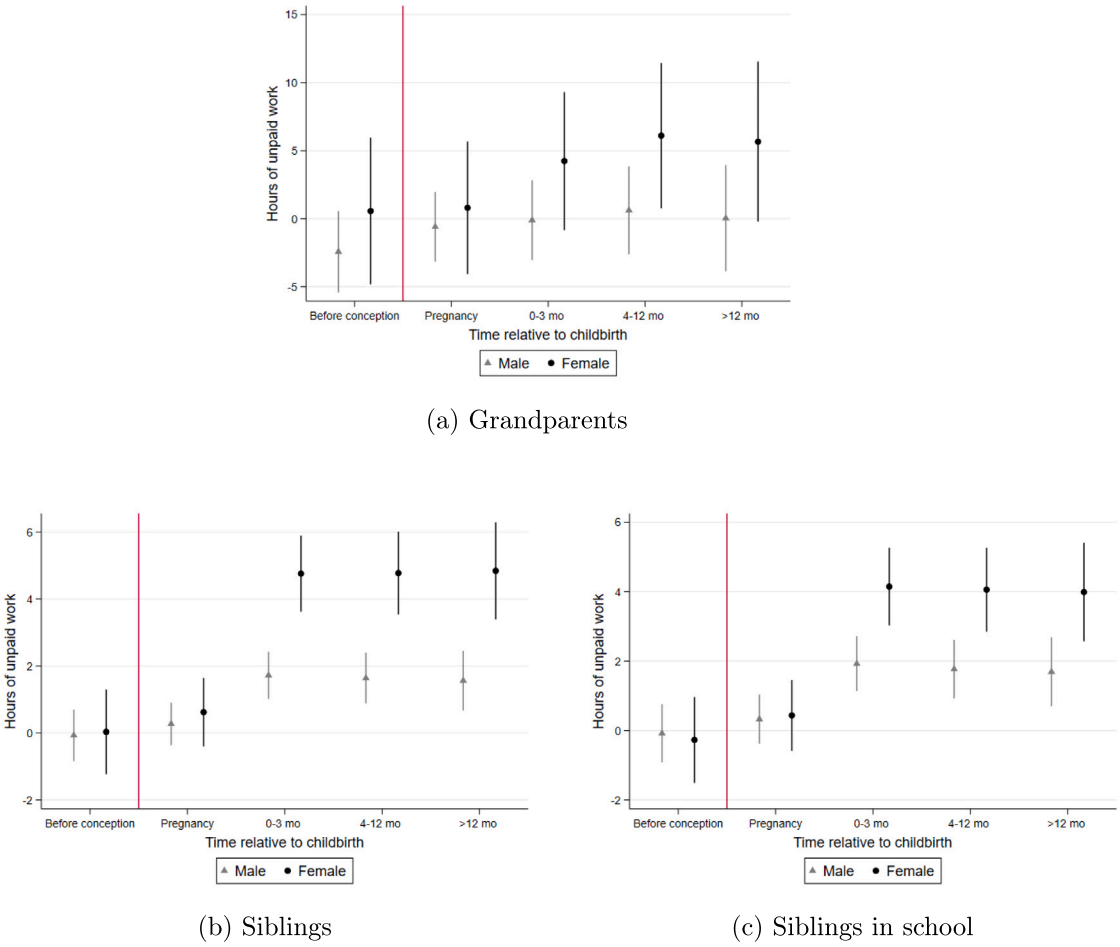
Fig. 6. Impacts of the arrival of a child on coresident relatives' time use.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The graphs show the impacts of the arrival of a child on coresident adult relatives' labor force participation on the extensive (a) and intensive (b) margins. The intensive margin is measured as the probability of the respondent declaring that he or she is employed and (b) the number of hours worked in the past week. Panels (c) and (d) show the number of hours of unpaid work in the past week for adults and children, respectively. The relative time periods are categorized into (i) preconception ($j < -8$), (ii) pregnancy ($j \in (-8, 0)$), (iii) 0–3 months old, (iv) 4–12 months old, and (v) > 12 months old. The sample is restricted to household members other than the parents of the newborn in a treated household.

female household member have a 1.8-h smaller decline in labor supply than mothers with only male live-in household members. Similarly, Column (2) shows that mothers with at least one live-in female household member experience an increase in unpaid work after childbirth that is up to 6 h smaller than that of mothers with only at least one live-in male household member. Columns (3) and (4) show the results for fathers. Once again, the paid work of fathers is not affected by the birth of a child, regardless of the presence of other household members (Column (3)). For unpaid work, Column (4) shows that the presence of female household members is associated with a postchild increase in fathers' unpaid work that is 1.4–1.8 h smaller than the increase for fathers in households where all live-in household members are male.

In Table 2, we focus on unpaid work to further investigate the roles of different women in the household—grandmothers and sisters of the new baby—in mitigating the effect of children on time use. Columns (1)–(4) restrict the sample to households with at least one child at the time of the first interview. The interaction terms in these columns associate the relative time variables with the presence of at least one female child in the household. The results indicate that sisters of the new child play a significant role in easing the burden of unpaid work for both parents. The effects are stronger and statistically significant for sisters under 10 years old. Specifically, mothers with at least one daughter take on significantly less additional unpaid work after childbirth—up to 6 h less—than those with only sons.

When we restrict the sample to households with children between 10 and 17 years old (see Columns (3) and (4) in Table 2), the results decrease in magnitude and statistical significance. The contrast with Columns (1) and (2) is surprising and could be partially driven by limitations in statistical power; after all, in Fig. 6, we show that female family members between ages 12 and 17 experience strong increases in their unpaid work burden after a new sibling is born. However, it is important to note that Columns (1) and (2) are consistent with the reality of a high prevalence of inadequate care in Mexico.[26] According to the 2021 round of the National Health and Nutrition Survey (ENSANUT), 8% of children under 5 years old reported having been left under the care of a child under 10 years old the week before the interview was conducted (INSP, 2021). While we cannot directly measure the gender differences in care work for children under 12 years old because of the age restrictions in ENOE's time use questionnaire, Table 2 suggests that female siblings bear most of this burden.

[26] Inadequate care is measured in ENSANUT as the share of children under five left alone or under the supervision of a child under 10 (INSP, 2021).



(a) Grandparents

(b) Siblings

(c) Siblings in school

Fig. 7. Impacts of the arrival of a child on coresident relatives' time use.
Notes: Authors' estimates using ENOE data from 2005 to 2019. The graphs show the impacts of the arrival of a child on unpaid work for (a) grandparents, (b) siblings, and (c) siblings currently in school. The relative periods are categorized into (i) preconception ($j < -8$), (ii) pregnancy ($j \in (-8, 0)$), (iii) 0–3 months old, (iv) 4–12 months old, and (v) > 12 months old. The sample is restricted to household members other than the parents of the newborn in a treated household.

Columns (5) and (6) focus on three-generation households, conditioning on the presence in the household of at least one grandparent at the time of the first interview. Here, we use the grandparent's gender as a source of heterogeneity by interacting the period variables with the presence of a grandmother. Our findings reveal that the presence of grandmothers is particularly beneficial for fathers' unpaid work: The coefficients are statistically significant and larger in magnitude, almost reversing the impacts of the child's arrival in most periods. Our findings underscore the relevance of the grandmother's support in enabling fathers to engage without interruption in the labor market, reinforcing gender segregation in household and market work.

5. Value of the child penalty

In this section, we provide a back-of-the-envelope valuation of the intrahousehold rearrangements in time use that emerge after the arrival of a child. These estimations answer the question: How much would it cost to outsource to the market the extra work that mothers assume, thereby avoiding the child penalties?

The market-cost calculation assumes that household members save money by doing unpaid work themselves instead of buying the goods and services in the market or hiring someone to perform these tasks (Folbre, 2008; Blau and Winkler, 2021; Jokubauskaitė and Schneebaum, 2022). It imputes wages that reflect the market price of the respective tasks, either using the average wage rate of a general housekeeper (generalist approach) or including multiple wage rates of specialists in matched occupations (specialist approach). Using both approaches, we find that the value of the child penalties in Mexico ranges between 23.6% and 29.9% of median household income.

Following Folbre (2008), let the total time budget of an individual be V_t^i defined as:

$$V_t^i = \sum_{a=1}^{n} \left[(C_{ait}) * (H_{ait}) \right] \tag{3}$$

where V_t^i is the value of all the tasks (paid or unpaid) performed by individual i in month t, C_{ait} is the hourly cost of outsourcing such activity $a \in 1, \ldots, n$ to the market for individual i in month t, and $H_{ait} =$ is the total hours that individual i dedicated to activity a in month t. The Mexican Satellite Account of Unpaid Work in Mexican Households (CSTNRHM) (Instituto Nacional de Estadística Geografía e Informática [INEGI], 2013) provides yearly estimates for most unpaid work categories (C_{at}) under the generalist and specialist approaches, using average market wages. We use the 2019 estimates in our calculations.[27]

[27] Following EUROSTAT recommendations, the agency uses the market replacement cost to value unpaid domestic labor. The value calculated by the National Statistical Agency reflects the market labor costs incurred to

Table 1
Heterogeneity by presence of women relatives in the household.

	(1) Paid work	(2) Unpaid work	(3) Paid work	(4) Unpaid work
Before conception	−0.227	1.396*	0.524	−0.0474
	(0.682)	(0.780)	(0.775)	(0.439)
Pregnancy	−5.078***	0.486	0.533	0.567
	(0.582)	(0.625)	(0.646)	(0.354)
0–3 mo	−11.92***	15.50***	0.203	5.631***
	(0.604)	(0.679)	(0.667)	(0.378)
4–12 mo	−7.803***	16.97***	0.139	4.958***
	(0.615)	(0.699)	(0.690)	(0.392)
>12 mo	−7.676***	15.70***	−0.179	4.797***
	(0.648)	(0.762)	(0.746)	(0.431)
Before conception* > 1 woman	0.0757	−0.507	−0.329	0.218
	(0.762)	(0.894)	(0.886)	(0.503)
Pregnancy* > 1 woman	1.021	−0.0310	−0.441	−0.0628
	(0.643)	(0.719)	(0.733)	(0.405)
0–3 mo* > 1 woman	2.308***	−5.101***	−0.910	−1.482***
	(0.664)	(0.766)	(0.749)	(0.426)
4–12 mo* > 1 woman	1.744***	−6.023***	−0.583	−1.828***
	(0.666)	(0.769)	(0.757)	(0.428)
>12 mo* > 1 woman	1.813***	−6.076***	−0.395	−1.768***
	(0.685)	(0.801)	(0.785)	(0.448)
Sample	Mothers	Mothers	Fathers	Fathers
Mean of dep. var.	10.33	50.25	44.91	9.812
N	301,755	301,755	282,998	282,998
R^2	0.674	0.422	0.479	0.368

Notes: Authors' estimates using ENOE data from 2005 to 2019. Before conception covers months $j = -12$ to $j = -9$. The omitted category is $j = -8$. Regressions include age, date and individual fixed effects. Sample is restricted to people aged 15–45 years old who had a child during the period of observation and have other household members present. Standard errors are clustered at the household level. *** p < 0.01, ** p < 0.05, * p < 0.1.

We define the replacement value of the additional postchild work of mothers V^m and fathers V^f as follows:

$$\Delta\hat{V}^f - \Delta\hat{V}^m = [\hat{V}^f{}_{j=12} - \hat{V}^f{}_{j=-8}] - [\hat{V}^m{}_{j=12} - \hat{V}^m{}_{j=-8}] \quad (4)$$

which is equivalent to:

$$\Delta\hat{V}^f - \Delta\hat{V}^m = \sum_{a=1}^{n} \left[\left(\hat{C_{at}} \right) * \left(\hat{\alpha_{12}}_a \right) \right] \quad (5)$$

where $\hat{\alpha_{12}}_a$ captures the gender gap in time use a year after birth for activity a relative to the prebirth levels. Under the specialist approach, the average salary of specialized workers is used for each activity. For example, for food preparation activities, the average salary of a paid cook would be assigned, and for cleaning and laundry care, the salary of a laundry worker would be. We favor the generalist approach, which assigns the average salary of a domestic worker for all tasks that can usually be performed by such a worker. The values estimated based on these two approaches are comparable, but the generalist estimate serves as a lower bound.

For paid work, we use the market-wide average hourly wage for individuals in our sample with positive working hours, rather than person-specific wages. Since many women who do not participate in the workforce do so because their market wage would be too low, this choice represents an upper bound on mothers' potential earnings and thus yields once again a conservative lower bound on the net cost of outsourcing unpaid work.

Because care work is a broad category covering various tasks with different market values and ENOE does not distinguish which type of care work is performed, we first estimate the average composition of care work using data from the National Time Use Survey (ENUT). From the ENUT, we obtain the percentage of care activities undertaken by Mexican women in each category. Using these percentages as weights, we then estimate the value of an average hour of care work by calculating a weighted average of the mean task-specific wages from CSTNRHM (2019). Table A.4 describes this imputation and weighting process in detail.

Table 3 shows the results under the generalist approach. Our estimates suggest that it would cost the median household at least 23.6% of its monthly income to outsource enough unpaid work to avoid the motherhood penalty. Our estimates also highlight an empirical regularity: In Mexico, the wage rates for people dedicated to care work (56.34 MXN/h) (Instituto Nacional de Estadística Geografía e Informática [INEGI], 2013) are above the average wage (32.31 MXN/h). Consequently, most households cannot afford to purchase this care in the market, which partially explains why someone in the household typically undertakes it. This paper shows that gender roles are an important determinant of why women assume these tasks. The results also underscore the challenges households face in privately closing gender gaps in time use without access to affordable and widely available public childcare.

Children are, in many ways, household public goods (Edlund, 2006; Weiss and Willis, 1985; Besley and Ghatak, 2001; Rasul, 2006, 2008; Folbre, 2008). There is potential for free-riding if social norms assign women most child-rearing responsibilities. An alternative way to interpret this valuation exercise is that the arrival of a child generates a gender gap in household economic contributions that favors men by 17.5% of average household income (almost a quarter of median household income). This gap accounts for women's reduced labor supply and their lower monetary contribution to the household. Appendix Table

produce these goods and services (Instituto Nacional de Estadística Geografía e Informática [INEGI], 2013).

Table 2
Household structure and parental time use: Sisters and grandmothers of the new baby.

	(1) Unpaid work	(2) Unpaid work	(3) Unpaid work	(4) Unpaid work	(5) Unpaid work	(6) Unpaid work
Before conception	1.191*	0.214	1.621	0.498	−1.736	4.140
	(0.693)	(0.391)	(1.210)	(0.583)	(4.533)	(2.667)
Pregnancy	0.782	0.782**	0.773	0.587	−2.802	2.337
	(0.553)	(0.319)	(0.979)	(0.450)	(3.893)	(2.043)
0–3 mo	15.61***	5.621***	11.97***	4.637***	10.87**	6.950***
	(0.606)	(0.342)	(1.061)	(0.494)	(4.610)	(2.183)
4–12 mo	16.74***	4.939***	12.82***	3.400***	12.37***	7.296***
	(0.629)	(0.356)	(1.111)	(0.525)	(4.467)	(2.271)
>12 mo	15.49***	4.809***	11.44***	3.308***	11.89**	7.068***
	(0.693)	(0.395)	(1.246)	(0.609)	(4.823)	(2.516)
Before*sister	−0.297	−0.130	−1.397	−0.187		
	(0.829)	(0.467)	(1.577)	(0.784)		
Pregnancy*sister	−0.478	−0.371	0.219	0.183		
	(0.667)	(0.379)	(1.264)	(0.623)		
0–3 mo*sister	−5.672***	−1.577***	−0.253	−0.911		
	(0.711)	(0.398)	(1.333)	(0.655)		
4–12 mo*sister	−6.191***	−1.935***	−0.771	−0.442		
	(0.714)	(0.401)	(1.338)	(0.657)		
>12 mo*sister	−6.292***	−1.918***	−0.513	−0.402		
	(0.743)	(0.419)	(1.391)	(0.691)		
Before*gm					1.675	−5.165*
					(5.271)	(3.024)
Pregnancy*gm					3.950	−3.544
					(4.414)	(2.341)
0–3 mo*gm					2.038	−5.180**
					(5.087)	(2.479)
4–12 mo*gm					1.247	−6.561***
					(4.884)	(2.492)
>12 mo*gm					1.711	−6.769**
					(5.088)	(2.632)
Sample	Mothers	Fathers	Mothers	Fathers	Mothers	Fathers
Subsample	With children (<10 yo)	With children (<10 yo)	With children (≥10 yo)	With children (≥10 yo)	Three gen.	Three gen.
Mean of dep. var.	50.26	9.812	50.33	7.838	45.08	8.654
N	301,539	282,830	75,945	66,527	9803	9288
R^2	0.422	0.368	0.416	0.345	0.417	0.343

Notes: Authors' estimates using ENOE data from 2005 to 2019. The omitted category covers the month before conception. The sample is restricted to people aged 15–45 years old who had a child during the period of observation. The sample in Columns (1)–(2) is restricted to couples with at least one child in the selected age range, regardless of the child's gender. The sister variable indicates whether there is at least one girl in the household in the relevant age range. The sample in Columns (5)–(6) is restricted to households with live-in grandparents. The gm variable indicates whether there is a live-in grandmother in the household. Regressions include age, date and individual fixed effects. Standard errors are clustered at the household level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

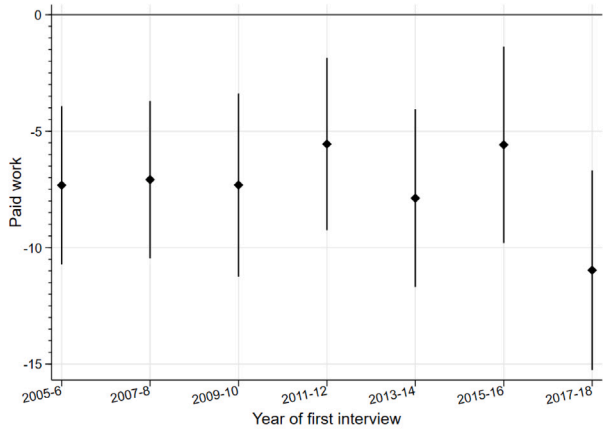
A.3 displays the specialist-wage results, which reach up to one-third of median household income.

6. Discussion

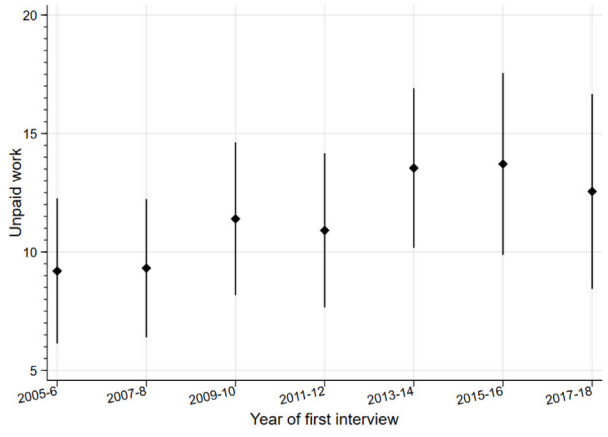
This study provides further evidence that the balancing act of combining market work and home responsibilities becomes more challenging once women have children. We reveal, in line with findings from other contexts, that women in Mexico decrease their labor supply—at both the extensive and intensive margins—after having a child while men do not. Importantly, we show that most of these time use changes precede the child's arrival, with significant shifts occurring from the second trimester of pregnancy. We further find that increased unpaid hours offset women's reduced paid hours.

Our novel results show that the arrival of a child impacts not only its parents. Exploiting the detailed family relationship information from ENOE, we quantify how a child's birth drives gender differences in the time use patterns of other family members, including children. By a year after the birth, women in the household who are not the mothers of the newborn have increased their weekly time allocated to unpaid labor by 4 h, more than twice the increase observed for fathers (up to 1.5 h, with statistically insignificant point estimates). Our results show that the gendered burden of caregiving starts in childhood: In households with newborns, girls' time use is also impacted twice as much as boys'. Theoretical arguments on mothers' comparative advantage in providing childcare and biological rationales do not apply to these household members. Nevertheless, the burden might contribute to the preference formation for unpaid tasks often discussed in the literature.

Households with different structures face distinct gendered impacts of parenthood. The presence of other women in the home mitigates the maternal labor supply impact of the arrival of a child. The unpaid work burden for both parents after childbirth in households with other women is nearly 40% lower than in households with only male coresident relatives. We provide suggestive evidence that the support of grandmothers disproportionately reduces the unpaid work burden of fathers while the newborn's sisters help mothers and fathers alike.

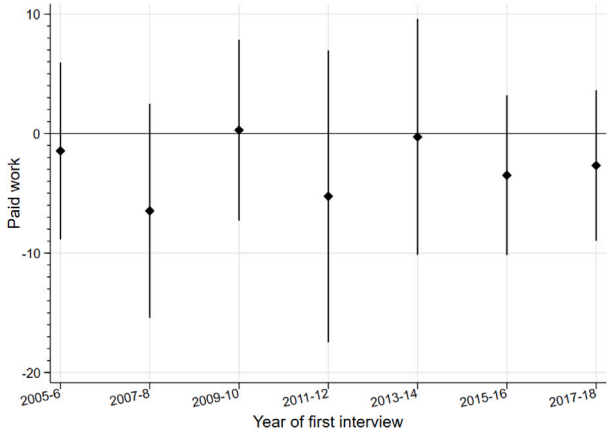


(a) Paid work

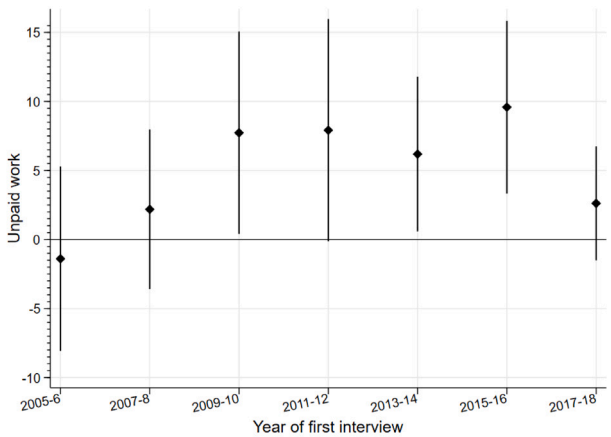


(b) Unpaid work

Fig. 8. Evolution of child penalties over time: New parents.
Notes: Authors' estimates using ENOE data from 2005 to 2018. The graphs show the differential impacts of the arrival of a child on mothers' weekly hours of paid and unpaid work, i.e., the coefficients of the $post \times female$ interaction. The reference periods are the months $j = 12$ to $j = -8$ (before conception). Pregnancy and maternity leave months are excluded ($j = -7$ to $j = -2$). The sample is restricted to people aged 15–45 years who had a child during the observation period.



(a) Paid work



(b) Unpaid work

Fig. 9. Evolution of child penalties over time: Other household members.
Notes: Authors' estimates using ENOE data from 2005 to 2018. The graphs show the differential impacts of the arrival of a child on coresident female relatives' weekly hours of paid and unpaid work, i.e., the coefficients of the $post \times female$ interaction. The reference periods are the months $j = 12$ to $j = -8$ (before conception). Pregnancy and maternity leave months are excluded ($j = -7$ to $j = -2$). The sample is restricted to people living in households where the head had a child during the observation period.

We find that the net value of the differences in contributions to the household is equivalent to approximately a fourth of household income. This valuation implies that if the extra work women provide in the house were outsourced, the household would need to forego a significant portion of its income. This would be prohibitive for low- and some middle-income households.

Our results have significant policy implications. The wide gender gap in unpaid hours and care is a potential factor delaying the recovery of all labor market outcomes for women. Large shifts in unpaid labor that increase scheduling conflicts for women should motivate policymakers to improve the availability and affordability of child-care services. A policy designed to retain women in the labor force throughout the childbearing process should consider that (a) current conditions are not favorable for pregnant women to remain employed and (b) women with young children never fully recover in terms of hours worked.

While we do not observe long-run trajectories, given the strongly stable results uncovered in this paper, large reversals are highly unlikely in the medium run. For instance, Angelov et al. (2016) and Kleven et al. (2019a) find little change between the outcomes 1 year after birth and those in the long run. In this vein, our results could be interpreted as good indicators of the long-run effects of having children. However, throughout this paper, we highlight contextual differences between developing countries such as Mexico and the settings of these papers. Hence, we suggest caution in extrapolating our results to the long run. Using data on formal workers in Mexico, Campos-Vazquez et al. (2022) find that child penalties on participation stabilize after one year but child penalties on wages deepen over time.

The impact of the arrival of a newborn on relatives in the household should motivate policy actions to foster change in traditional gender roles. More research is needed to study the implications of child penalties for gender differences in leisure, sleep, and mental health that might arise because of the gender imbalance in total work time.

CRediT authorship contribution statement

Sandra Aguilar-Gomez: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Eva O. Arceo-Gomez:** Writing – review & editing, Supervision, Data curation, Conceptualization. **Elia De la Cruz Toledo:** Writing – review & editing, Writing – original draft, Visualization, Formal analysis, Conceptualization.

Table 3
Market replacement cost of closing the gender gap in time use after childbirth, generalist approach.

Type of work	Value C_{at} (mxn/h)	Child penalty H_{at} (h/week)	Aggregate value $C_{at} * H_{at}$ (mxn/week)
Care work	56.39	10.08	605.48
Building	29.24	−0.36	0.00
Repairs/Maintenance	29.24	0.08	1.26
Housework	29.96	0.16	−7.93
Paid work	32.31	−5.73	−131.87
$\Delta V^f - \Delta V^m$ (weekly)			363.47
$\Delta V^f - \Delta V^m$ (monthly)			1577.46
Share of average monthly household income (2019)			17.5%
Share of median monthly household income (2019)			23.6%

Notes: Child penalties a year after childbirth, α_{12}, are calculated as described in Eq. (1). The value of the gender gap in time use (MXN/month) is calculated with the formula of Eq. (3), including both paid and unpaid work. C_{at} is obtained from CSTNRHM (2019) from INEGI, assigning to all the activities that can be performed by a domestic worker the average wage of domestic workers. Paid work is valued at the average hourly wage for people in our sample that reported a positive amount of hours worked in the past week. The value of an hour of care work is calculated from disaggregated data by category of care work from ENUT (2019) and value per task from CSTNRHM (2019) as described in Appendix Table A.4. The percentage that $\Delta V^f - \Delta V^m$ represents for the average and median household are calculated with total household labor income from ENOE (2019) as the denominator.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jdeveco.2025.103554.

Data availability

The replication package can be found at https://data.mendeley.com/datasets/s7zb5bzt77/1.

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