Child Penalties in Time Use: A Global Perspective

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March 2026

Abstract

Child penalties have been measured almost entirely through labour-market outcomes, yet paid work accounts for less than 15 per cent of adult waking time and global evidence on how the full day responds to parenthood is largely absent. We build harmonised time-use microdata spanning more than 80 countries and estimate pseudo-event studies around first childbirth to document the reallocation of time across paid work, domestic work, childcare, and leisure. The first child generates around four additional hours of daily active time for the couple — a 20–25 per cent increase — financed mainly from leisure and sleep, and this cost has not dissipated fifteen years after birth. Along the development path, parental childcare rises sharply and changes in kind. These costs are highly gendered: women undergo a complete reallocation of the day while men adjust modestly, and domestic work contributes as much as childcare to the gender divergence. A simple model of household task allocation shows that rationalising observed gender specialisation requires perceived-productivity norms exceeding five to one in favour of mothers. In high-income countries, women's return to paid work is associated with a large decline in maternal domestic work, not a reduction in parental childcare, consistent with a productivity revolution in domestic work as the central mechanism.

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1 Introduction

A recent literature shows that child penalties — the effects of parenthood on women relative to men — are a central driver of gender inequality in labour market outcomes, and in high-income countries account for most of it (Kleven et al., 2019, 2025). Child penalties have now been estimated for more than 130 countries and are a pervasive global regularity: men and women follow parallel trajectories until the birth of the first child, then diverge sharply and persistently. This literature has established parenthood as the central driver of gender inequality in the labour market. Yet it measures the impact of children almost entirely through a single lens: paid work.

Paid work accounts for less than 15 per cent of total waking time for adults aged 20–60 (Gethin and Saez, 2025). What parents do with the remaining 85 per cent is largely invisible to existing research. The child penalty in employment captures whether a mother reduces her hours in the labour market; it is silent on whether she absorbs additional domestic work, whether she loses sleep, whether the tasks she takes on are physically more demanding than those she displaces, and how all of this varies across societies at very different levels of development. Understanding the full time cost of children — how much additional work they create, who bears it, what kind it is, and how the answers differ across the world — requires data that no existing cross-country infrastructure provides.

This paper builds that infrastructure and uses it to study child penalties in the full allocation of time. In partnership with the Centre for Time Use Research at University College London, we construct a global harmonised time-use database covering more than 210 surveys across 80 countries, representative of approximately 90 per cent of the world population (Lamote de Grignon Perez et al., 2026). The database goes substantially beyond existing cross-country sources — such as the Multinational Time Use Study and the Harmonised European Time Use Surveys — by harmonising directly from raw country files, which allows a consistent and flexible set of activity categories across countries and over time. We apply the pseudo-event study methodology of Kleven (2022), adapted to time-use outcomes, to document what parenthood does to the full allocation of time around the birth of the first child. Three questions organise our analysis: what parental time investments do children require? How are those investments allocated within the household? And how do these patterns vary across countries and over the course of development?

We document five facts about parental time investment. First, the arrival of a first child is associated with around four additional hours of daily active time for the couple — a

20–25 per cent increase — financed entirely out of leisure including sleep. This cost is large and persistent: fifteen years after the first birth, the elevated time burden has not dissipated. Second, parental childcare intensifies sharply over the development path. Couple childcare time roughly triples between low- and high-income countries, a gradient that holds continuously from the world's poorest economies to the richest. Third, the nature of childcare undergoes a qualitative transformation over development. In Tanzania, almost all parental childcare is physical care — feeding, washing, keeping the child safe; in the United States, play, educational support, and leisure activities account for the majority of childcare time. Fourth, the broad alloparental care network that characterised most of human evolutionary history has been replaced at high income by an intensive nuclear-family model. In Sub-Saharan Africa, siblings, grandparents, and other household members perform more than 30 per cent of all childcare; in advanced economies, alloparental care has almost entirely disappeared. Fifth, all of these time costs are highly gendered. Women absorb around two additional hours of daily active time at first birth while men absorb around one and a half hours; women's paid work declines persistently while men's rises modestly in some contexts; and women bear almost the entire increase in domestic work and the majority of the increase in childcare.

These five facts reveal a deep and persistent gender divergence in task allocation at childbirth. A striking feature of this divergence — one overlooked by the existing child-penalty literature — is that domestic work matters as much as childcare in driving it. The existing literature implicitly attributes the mechanism to paid work and childcare alone. We show that unpaid domestic work (e.g., food preparation, cleaning, laundry) surges for women at childbirth and contributes to the total gender divergence in active time as much as childcare does. Food preparation alone accounts for roughly one additional hour per day for women. Beyond the quantity of time, the character of work changes: we assign each activity a physical-effort score following Cornwell et al. (2019) and show that average daily physical effort rises by around 20 per cent for women at first birth and remains persistently elevated, while men's physical-effort profiles are essentially flat. Standard child-penalty measures based on employment or earnings are therefore silent on a welfare divergence that operates through the nature of work, not just its duration.

We embed these patterns in the development path and study the within-household mechanisms that sustain them. Across countries, maternal paid work traces a U-shape over the development path while maternal domestic work traces an inverse-U, and childcare rises monotonically for both parents throughout. Within households, we study task complementarities in six countries spanning the income distribution and find a striking asymmetry.

When fathers work fewer paid hours, they reallocate time almost entirely to leisure — a two-task problem. When mothers work fewer paid hours, time flows into domestic work, childcare, and leisure simultaneously. Across spouses, fathers increase paid work when mothers do more home production, but do not absorb domestic work or childcare when mothers increase paid work. Households do not rebalance symmetrically, and this rigidity is consistent across income levels.

To discipline these mechanisms, we set up a unitary household model of task allocation. The model yields three insights. First, the observed gender specialisation in childcare, with female-to-male ratios ranging from 2.5 to 7 across countries, cannot be rationalised by wage differences alone: the implied perceived-productivity ratio of mothers to fathers must exceed five to one, pointing to social norms rather than biological comparative advantage. Second, rising parental investment in childcare over the development path requires the household's valuation of childcare to outpace rising wages, and when combined with strong norms, this force can widen rather than narrow gender specialisation, consistent with the first phase of the U-shape in maternal paid work. Third, the recovery of female labour force participation at high income requires a productivity revolution in domestic work, not cheaper market childcare. When parental and market childcare are complements, policies that expand outside care may have limited effects on maternal labour supply; the binding constraint is the domestic-work burden.

Our paper contributes to three literatures. It contributes most directly to the literature on child penalties, which has established the effects of parenthood on labour market outcomes at global scale (Kleven et al., 2019, 2025) and has begun to document related time-use patterns for a small number of countries (Aguilar-Gomez et al., 2026; Cuevas-Ruiz et al., 2026). We extend this agenda to the full allocation of time on a global scale. We also contribute to the literature on parental investment and human capital formation, dating from Becker (1960) and developed by Doepke and Tertilt (2018) to study how the nature of parenting varies over the course of development. Our evidence on the transformation of childcare from physical care to educational investment, and the collapse of alloparental networks, speaks directly to the distinction between survival-oriented and developmentally-oriented parenting at the heart of that literature. Finally, we contribute to the literature on gender inequality over the long run and over the course of development, which has used time-use data to study trends in leisure (Aguiar and Hurst, 2007), the role of household appliances in freeing women for market work (Greenwood et al., 2005), and the global evolution of working hours (Gethin and Saez, 2025). Our findings on the domestic-work revolution provide new cross-country evidence on the mechanism through which female labour force participation recovers at high

income.

The paper proceeds as follows. Section 2 describes the data and the time-use infrastructure. Section 3 presents the pseudo-event study methodology. Section 4 documents five facts on parental time investment. Section 5 characterises gender specialisation across activities, physical effort, and the development path. Section 6 presents the household task-allocation model and its quantitative implications. Section 7 concludes.

2 Data

2.1 Building a global map of time use

To document global patterns of time use around childbirth, we build a new global time-use database in partnership with the Centre for Time Use Research (CTUR-UCL). The database encompasses more than 210 surveys covering over 80 countries and is representative of approximately 90% of the world population. It goes substantially beyond existing cross-country harmonized time-use sources—such as the Multinational Time Use Study (MTUS) and the Harmonised European Time Use Surveys (HETUS)—by re-harmonizing data directly from individual country files, which allows for a more consistent and flexible set of activity categories across countries.

Our database draws on three types of sources. The first consists of existing cross-country harmonized time-use surveys, which we re-process from their underlying country files to impose our classification scheme. The second consists of individual country-level time diaries, obtained directly from national statistical offices. The third consists of household surveys with time-use modules, which provide recall-based information on time spent in broad activity categories. We treat diary-based data as the gold standard. In diary surveys, respondents record all activities over a full 24-hour period in short time intervals, producing a high-resolution record of the full daily time allocation. Recall-based surveys are included where diaries are unavailable, but are clearly distinguished from diary data in our coverage map.

Figure 1 presents a map of our data coverage by survey type. The map illustrates the breadth of our database across world regions. A striking feature is the extent of diary-based coverage—the gold standard for measuring time use—beyond the high-income world: diary surveys account for the majority of our country observations, and a substantial share of these are in low- and middle-income countries that have been largely absent from prior comparative work on time use.

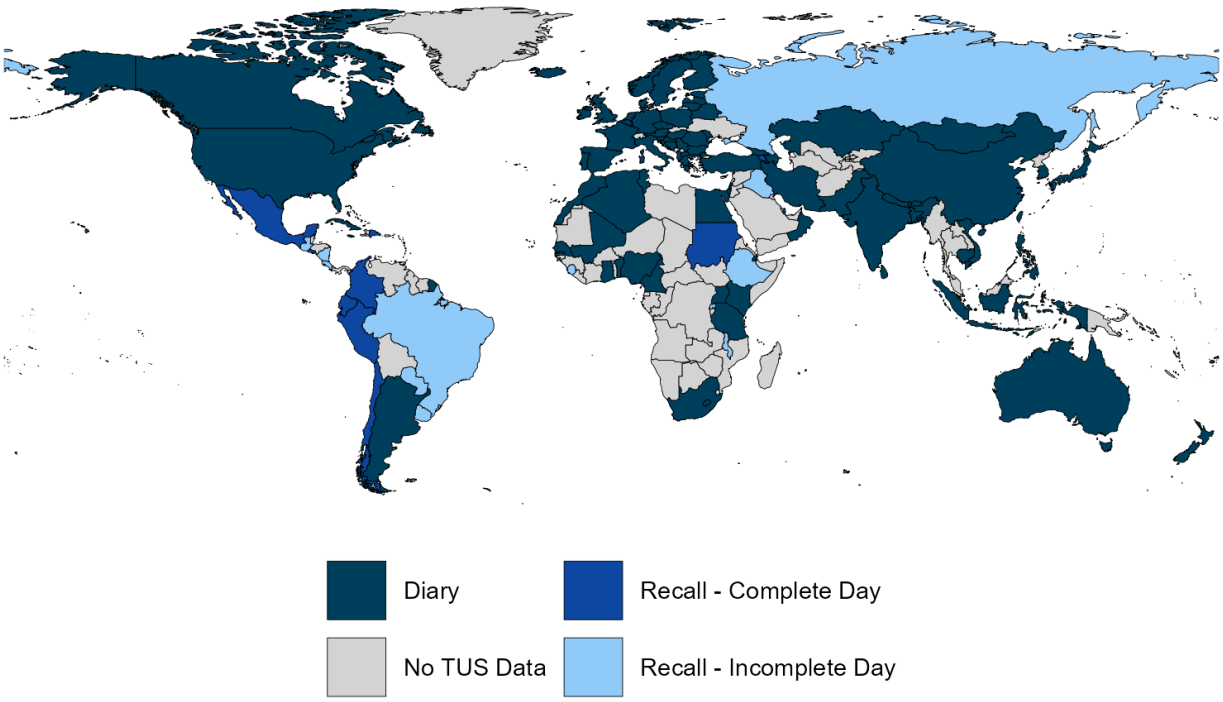


Figure 1: Map of Data Sources

Notes: Countries are classified as diary-based, recall (summing to 24 hours), incomplete recall, or no data. The database covers more than 210 surveys across 80+ countries, representing approximately 90% of the world population.

Three features distinguish our database from prior harmonization efforts. First, it offers broader geographic and historical coverage than any existing source. Our database includes surveys from the 1960s onward (see Figure A1 in the appendix) and reaches countries that have been largely absent from comparative time-use research. Second, it is designed for versatility. Because we retain the full spell structure of the original diaries—rather than collapsing activities into pre-specified totals, as existing harmonized sources do—researchers can recombine activity categories freely, extract spell-level information such as co-presence with children or time-of-day patterns, and construct novel attributes of each time unit. Third, the database is open source. In partnership with CTUR-UCL, we are releasing the harmonized microdata as part of the MTUS+ data release (Lamote de Grignon Perez et al., 2026), making the full infrastructure available to the broader research community.

2.2 Harmonisation

To harmonize time-use data across countries and survey formats, we convert all sources into a common long diary format. The unit of observation is an individual × time-slot × activity code: for diary surveys, each observation corresponds to a short interval and the activity recorded during that interval; for recall surveys, each observation corresponds to an activity episode with a reported duration. This common format allows us to apply a consistent classification scheme across all sources and is the input for all subsequent analyses.[1]

We classify activities using a three-level hierarchy, which is reported in full in Table A1 of the appendix. At the one-digit level, all time is allocated to one of three mutually exclusive categories: Active Time, which comprises both paid work and home production; Education; and Leisure, which includes basic personal care such as sleep and eating. At the two-digit level, Active Time is disaggregated into paid work, unpaid domestic work, unpaid care work, and voluntary work, while Leisure is broken down into leisure basics (sleep, eating and drinking, and personal care), entertainment, active leisure, and social activities. At the three-digit level, activities are classified at a finer grain: domestic work, for example, is separated into food preparation and clean-up, cleaning and upkeep, laundry and garment care, shopping and budget management, and production of goods for own use, while care work distinguishes dependent child care, dependent adult care, and care for non-dependent adults. Categories at every level are mutually exclusive and exhaustive: by construction, they sum to 1,440 minutes per day.

2.3 Validation

We validate our measure of paid work hours against the global labour-force survey database constructed by Gethin and Saez (2025), which provides estimates of average hours worked separately for men and women across a large set of countries and years. For each country in our database, we identify the closest matching survey year in the Gethin–Saez database and compare average weekly hours of paid work by gender.

Figure 2 presents a scatterplot of this comparison. Our measure of paid work hours is on the horizontal axis and the Gethin–Saez labour-force survey estimate is on the vertical axis; men and women are shown in different colours, and a 45-degree line is included for reference.

[1]Mapping the activity codes used by each national statistical office to our three-level hierarchy is a substantial undertaking given the diversity of classification systems across countries and survey waves. We address this using a large language model (LLM) classification pipeline that maps country-specific activity descriptions to our hierarchy in a consistent and scalable way. The output of the pipeline is reviewed and corrected manually for each country.

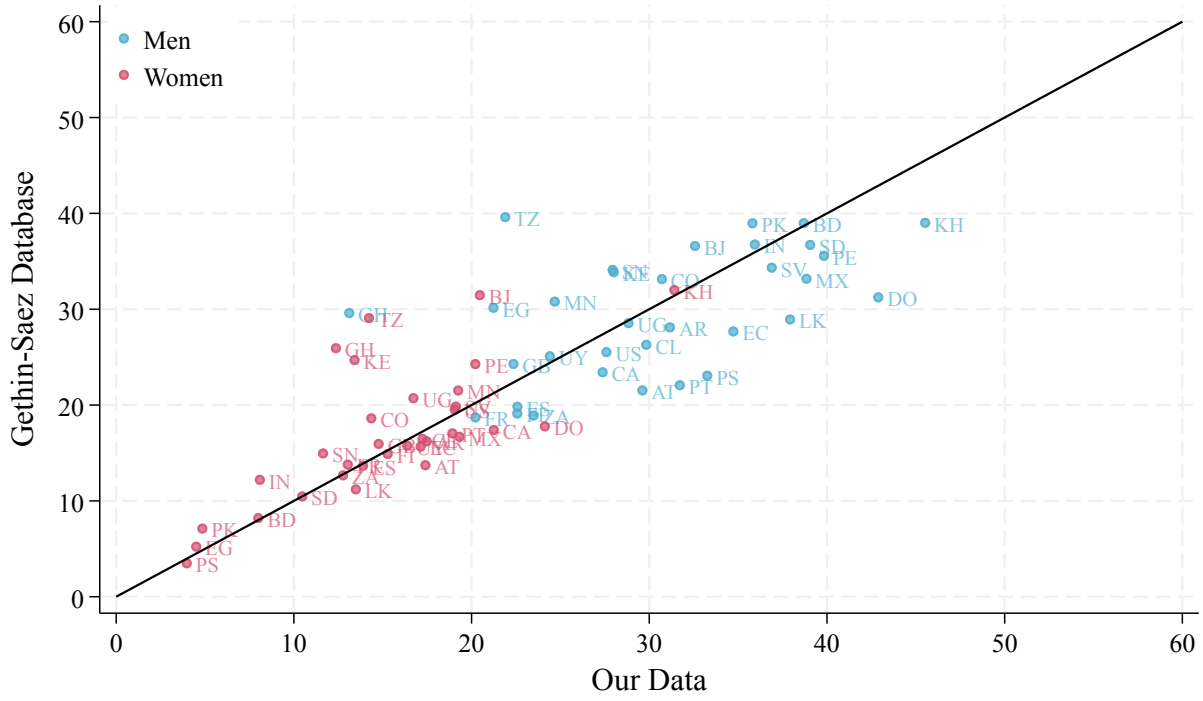


Figure 2: Validation of paid work hours against labour-force survey data

Notes: The horizontal axis shows average weekly hours of paid work in our time-use database; the vertical axis shows the corresponding estimate from Gethin and Saez (2025). Men and women are shown in separate colours. The 45-degree line is shown for reference. Deviations from the 45-degree line are driven by differences in survey timing and seasonality.

Across countries and genders, the observations cluster tightly around the 45-degree line, confirming that our harmonized database captures patterns of paid work consistent with those observed in dedicated labour-force surveys. The remaining deviations are driven by differences in survey timing and seasonality.[2]

3 Methods

Our global time-use database is cross-sectional: individuals are observed at a single point in time, either as parents or as childless adults, but never as both. The standard approach to estimating the effects of childbirth on outcomes—which traces individuals over time around the birth of the first child—requires panel data (Kleven et al., 2019). Panel time-use data are extremely rare even in high-income countries. To document global patterns of parental time allocation, we adopt the pseudo-event study approach of Kleven (2022), which was

[2]For instance, the survey timing in Tanzania in 2020 is likely to be affected by the Covid-19 pandemic.

applied on a global scale to employment outcomes by Kleven et al. (2025). We provide a brief description here; a full treatment of the approach, including validation against true event-study estimates for employment outcomes, is in Kleven et al. (2025).

The idea is to use matching to convert cross-sectional data into a synthetic panel. For individuals observed with children, the age of the oldest child directly determines their position in positive event time ($t \geq 0$). The challenge is constructing the pre-birth counterfactual: these individuals are never observed without children. For each parent at event time $t = 0$ with age a and characteristics X_i, we match a childless individual observed at age $a - n$ with the same characteristics, providing a surrogate observation for event time $t = -n$. Repeating this for $n = 1, \ldots, 5$ yields a pseudo-panel covering five years of pre-birth history. The matching variables are age, education (four categories), and marital status (four categories)—a parsimonious set that is consistently available across all of our data sources.

We estimate the following specification separately for each activity a and gender $g \in \{w, m\}$:

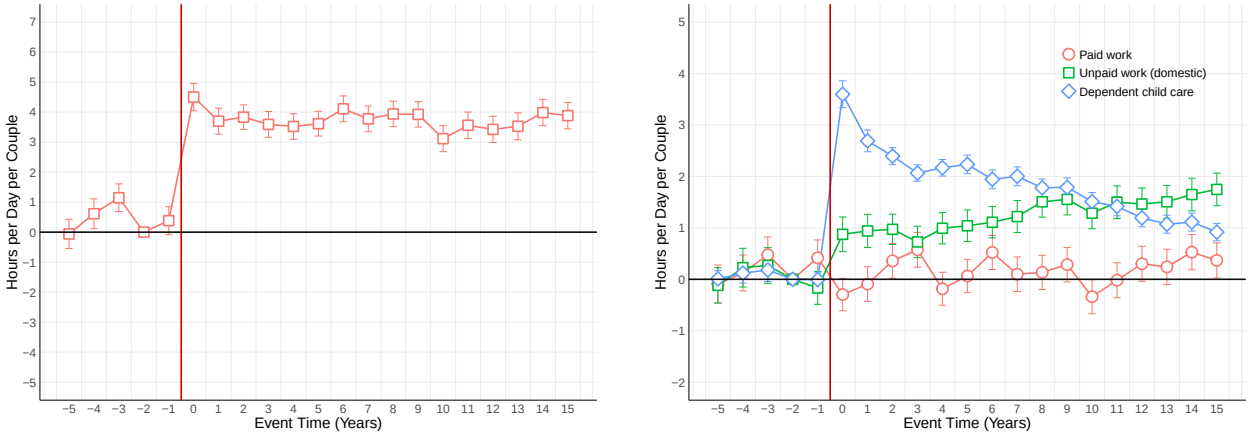
$$y_{ita}^{g} = \sum_{t \neq -2} \alpha_t^{a,g} \cdot \mathbf{1}[T_i = t] + \delta_{age} + \delta_{age \times c} + \delta_{year} + \delta_c + v_{ita}^{g}, \tag{1}$$

where y_{ita}^{g} is minutes per day spent on activity a by individual i of gender g at event time t, and T_i denotes years since the first birth. The equation is estimated separately for each gender and each activity. The event-time dummy at $t = -2$ is omitted, so the coefficients of interest, $\alpha_t^{a,g}$, measure the change in time use relative to two years before the first birth. δ_{age}, $\delta_{age \times c}$, δ_{year}, and δ_c denote age, age-by-country, survey-year, and country fixed effects, which together absorb life-cycle profiles, country-specific age patterns, and time trends.

For couple-level analyses of time investment in Section 4, we sum the event-study coefficients for men and women at each event time, $\hat{\alpha}_t^{a,m} + \hat{\alpha}_t^{a,w}$, to obtain the total household response. For the gender specialisation analyses in Section 5, we estimate equation (1) separately for men and women, which allows us to directly compare the event-time profiles.

4 Time Investment in Children

In this section we document five facts about the time costs of parenthood. We begin at the household level, establishing how large those costs are, how they vary across the development path, and how the broader care network absorbs them; we then show that within the couple, the costs fall very unequally on mothers and fathers.



(a) Total active time

(b) Decomposition of active time

Figure 3: Effect of first birth on active time

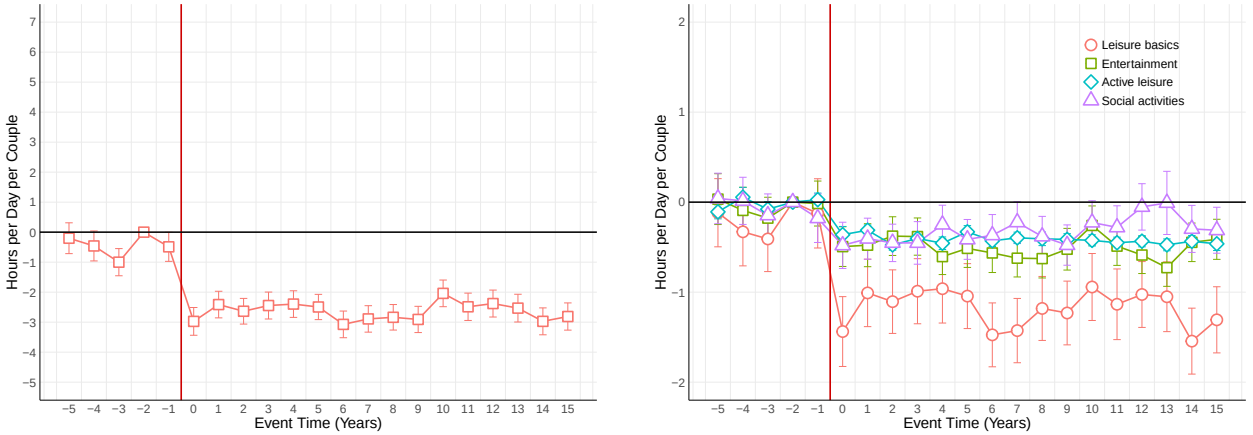
Notes: Couple-level event studies around first childbirth, pooling all countries. Active Time is defined as the sum of paid work, unpaid domestic work, care work, production for own use and work commute. Panel A shows total active time. Panel B decomposes active time into its main components: childcare, unpaid domestic work, and paid work. The horizontal axis shows years relative to the birth of the first child; the vertical axis shows minutes per day relative to $t = -2$. Bands show 95% confidence intervals.

Fact 1: Time investment in children is large

The first child creates a large and persistent increase in daily active time at the couple level. Panel (a) of Figure 3 presents the couple-level event study for total active time around first childbirth, pooling all countries in our database. At the moment the first child arrives, total active time increases by around four hours per day, a 20–25% increase over the pre-birth baseline. The effect is not transitory: the event study shows no meaningful convergence back toward pre-birth levels over the fifteen years that follow.

What accounts for this large increase in active time? Panel (b) of Figure 3 decomposes this aggregate increase into its major components. Two patterns stand out clearly. The first is an immediate and sharp rise in childcare that peaks around birth and then declines gradually as the child ages, while remaining substantially above pre-birth levels throughout the observation window. The second is a sustained rise in unpaid domestic work that is less front-loaded than childcare but comparably persistent. Fifteen years after the first birth, unpaid domestic work is almost two hours per day above pre-birth levels. Paid work, by contrast, shows little net change at the couple level. This last finding masks large heterogeneities between men and women, which we document fully in Section 5.

The additional four hours of active time per day come at the expense of leisure. Figure 4 presents the couple-level event studies for leisure and its components. Panel (a) shows an



(a) Total Leisure

(b) Decomposition of Leisure

Figure 4: Effect of first birth on leisure

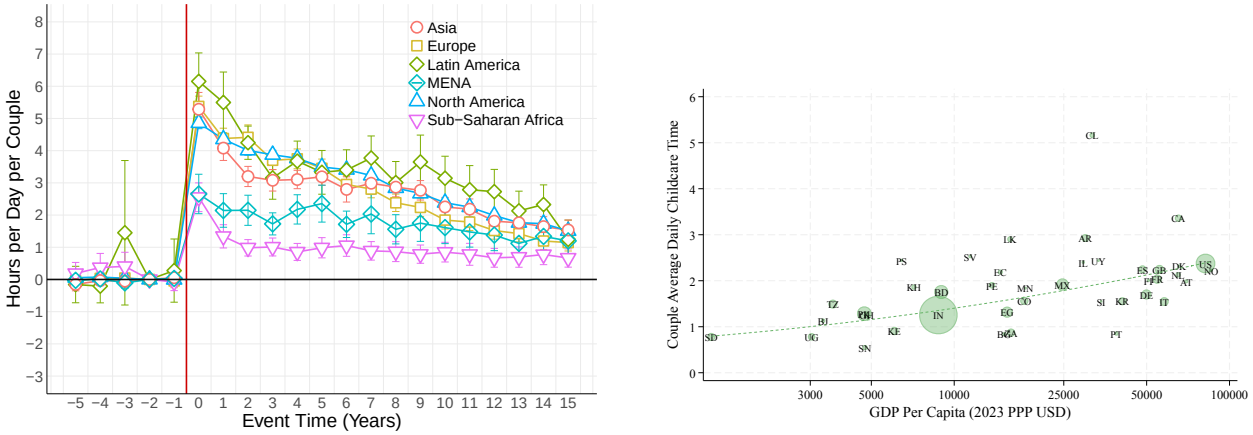
Notes: Couple-level event studies for Leisure around first childbirth, pooling all countries. Panel A shows total Leisure. Panel B disaggregates into the four two-digit components: basics (sleep, eating, personal care), entertainment, active leisure, and social activities. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals.

immediate and sustained decline in total couple leisure at birth. Panel (b) disaggregates leisure into its four two-digit components and documents that the decline is broad-based: basics (sleep, eating, personal care), entertainment, active leisure, and social activities all fall at birth and remain below pre-birth levels in the years that follow. Within basics, the decline is driven primarily by sleep, which falls by around one hour and remains persistently depressed (see Figure A2 in the appendix). The time cost of a first child is distributed across every component of rest and discretionary time.

Fact 2: Parental investment in childcare rises over development

The couple-level average documented in Fact 1 conceals enormous regional heterogeneity. Panel (a) of Figure 5 presents the childcare event study separately for six world regions. Sub-Saharan Africa shows the smallest response, with the couple total remaining below one hour per day. The Middle East and North Africa are somewhat higher but still modest. Asia, Europe, North America, and Latin America show much larger responses: in the first year after birth, couples in these regions devote 5–6 hours per day to childcare, around three times more than in Sub-Saharan Africa and the MENA region.

Panel (b) of Figure 5 presents this gradient as a scatterplot across all countries in our database. The figure shows a strong and monotone positive relationship between GDP per capita and parental childcare investment that holds across all major world regions and is not



(a) Event study for childcare by world region

(b) GDP per capita and couple childcare time

Figure 5: Childcare investment over development

Notes: Panel A presents couple-level event studies for childcare around first childbirth for six world regions. Panel B presents a scatterplot of GDP per capita (2023 PPP USD, horizontal axis) against couple daily childcare time (vertical axis); each dot is a country and dot size is proportional to population.

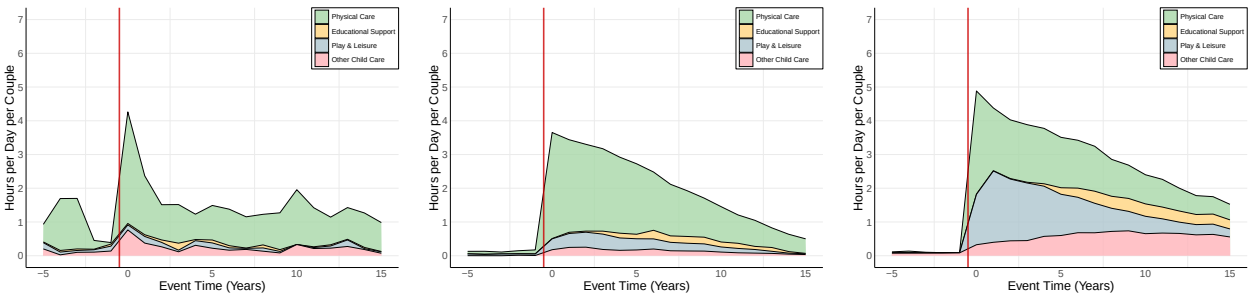
driven by any particular country or population group.

Fact 3: The nature of childcare changes over development

The quantitative increase documented in Fact 2 is accompanied by a qualitative transformation in what childcare consists of. We disaggregate childcare into four types: physical care, educational support, play and leisure, and other childcare. Figure 6 presents stacked event studies for three representative countries at sharply different levels of development.

Panel (a) presents Tanzania. At birth, childcare rises sharply and the increase is composed almost entirely of physical care—feeding, bathing, and keeping the child safe. Physical care remains the dominant component throughout the post-birth window. Panel (b) presents India. Physical care remains large, but it is now joined by a growing share of play and some educational support, particularly as the child ages out of infancy. Panel (c) presents the United States, where the composition is reversed: play, educational support and other childcare together account for the majority of the childcare increase, and physical care, though large, is no longer dominant.

This progression reflects the distinction between survival-oriented and developmentally-oriented parental investment identified by Doepke and Tertilt (2018). At low income levels, the primary function of parental time is physical survival; as income rises, parents shift toward activities designed to build the child's human capital. The three-fold increase in



(a) Tanzania (b) India (c) United States

Figure 6: Composition of childcare over development

Notes: Stacked event studies for the composition of childcare around first childbirth in Tanzania (Panel A), India (Panel B), and the United States (Panel C). Childcare is disaggregated into physical care, educational support, play and leisure, and other. Each stack shows minutes per day relative to $t = -2$.

childcare documented in Fact 2 therefore understates the full transformation in the parent–child relationship over the development path.

Fact 4: The role of alloparental care declines with development

Childcare in low-income settings is shared across a much broader network of household members than the parental couple, and this sharing largely disappears as income rises. Cooperative breeding—the systematic sharing of childcare beyond the biological mother—is a defining feature of human reproduction. Anthropological evidence on contemporary hunter-gatherer societies shows how pervasive this arrangement is: among the Aka of Central Africa, infants have on average 14 different caregivers besides their mother, and by 18 weeks they spend more time held by alloparents than by their mothers (Hrdy, 2024; Rilling, 2024).

We measure the contribution of alloparental care by constructing total childcare time per capita among all household members aged 15 and above, split into three groups: parents, young alloparents (siblings and other non-parent household members), and old alloparents (grandparents and extended family members). Figure 7 presents this decomposition by world region. In Sub-Saharan Africa, more than 30% of all childcare is provided by alloparents, with young alloparents accounting for the majority of that contribution. Alloparental involvement remains significant in Asia and Latin America. In advanced economies, by contrast, childcare is concentrated almost entirely within the parental couple; the alloparental contribution is close to zero.

The village-based, cooperative model of child-rearing that characterised most of human evolutionary history has been progressively replaced, at higher income levels, by an intensive

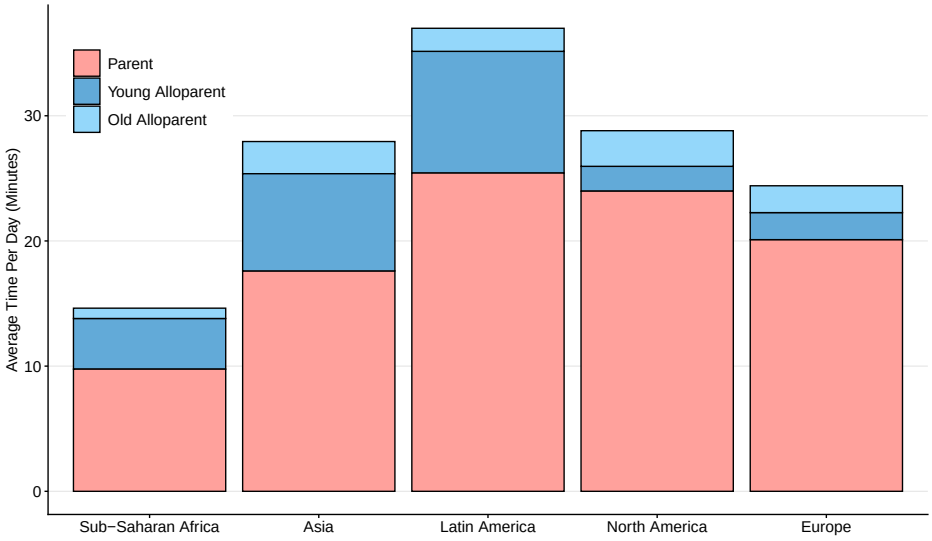


Figure 7: Role of alloparental care over development

Notes: Average daily childcare time per person aged 15 and above, by carer type (parents, young alloparents, old alloparents) and world region. Young alloparents are siblings and other non-parent household members; old alloparents are grandparents, extended family members, and older community members.

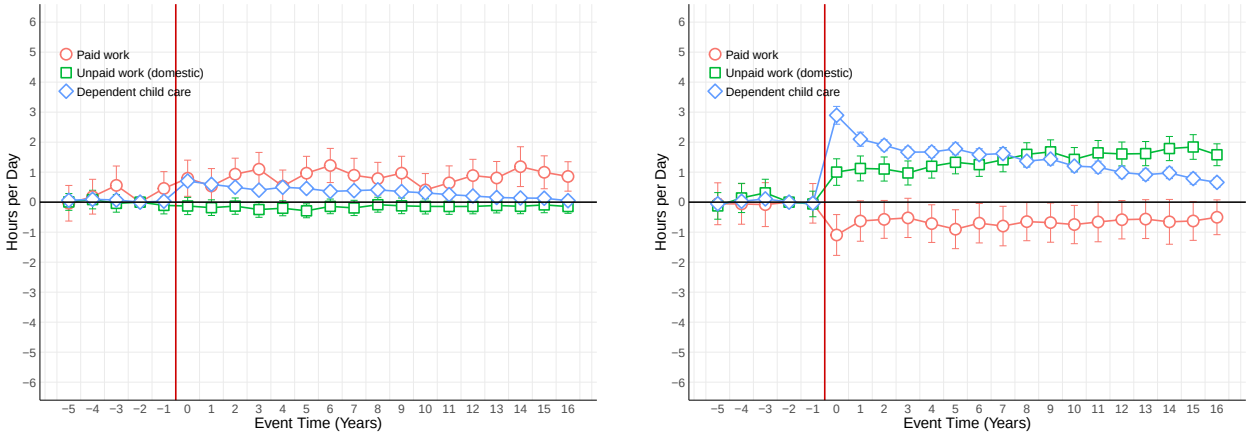
nuclear family model in which the parental couple bears the full burden of childcare. This decline in alloparental care amplifies the finding in Fact 2: advanced-economy parents face both more childcare in total and a larger share of it falling on themselves rather than on a wider network of household members.

Fact 5: The time implications of parenthood are highly gendered

The household-level time costs documented in Facts 1–4 are distributed very unequally between men and women. Figure 8 presents event studies around first childbirth separately for men and women in the same couple, showing paid work, unpaid domestic work, and childcare.

Panel (a) presents the results for men. Paid work rises modestly at birth, a pattern partly driven by high-fertility settings such as India where male labour market participation increases at the time of first birth. Childcare rises, but by less than an hour. Unpaid domestic work is flat or slightly declines. The arrival of a first child does not substantially disrupt the prior time-use profile of fathers.

Panel (b) presents the results for women, and the contrast is stark. At birth, women experience an immediate and large decrease in paid work, a large increase in childcare, and a large increase in unpaid domestic work. The four additional hours of daily active time at the



(a) Men (b) Women

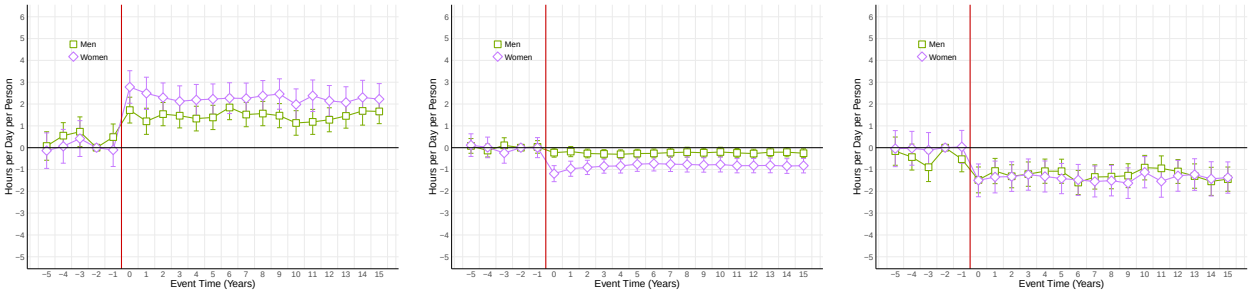
Figure 8: Effect of first birth on time use by gender

Notes: Event studies around first childbirth for men (Panel A) and women (Panel B) in the same couple, showing paid work, unpaid domestic work, and childcare. The vertical axis shows minutes per day relative to $t = -2$. Estimates pool all countries.

couple level documented in Fact 1 fall almost entirely on mothers, through all three channels simultaneously: less paid work, more childcare, and more domestic work. This complete reallocation of women's time at first birth is the time-use foundation of the child penalties documented in the employment literature and motivates the detailed gender specialisation analysis in Section 5.

5 Gender Specialisation

In this section we characterise the divergence between mothers and fathers documented in Fact 5. We proceed in four steps. First, we present event studies by gender across the full hierarchy of time-use categories, from broad categories to granular tasks. Second, we show that the divergence extends beyond time quantities, using a measure of physical effort and a synthetic index of activity-portfolio similarity. Third, we embed these patterns in the development path, comparing the time allocations of mothers and fathers across the cross-country income distribution. Fourth, we ask whether households rebalance internally when female labour supply changes, through the lens of within-person and cross-spouse task complementarities.



(a) Active time (b) Education (c) Leisure

Figure 9: Effect of first birth by gender: broad categories

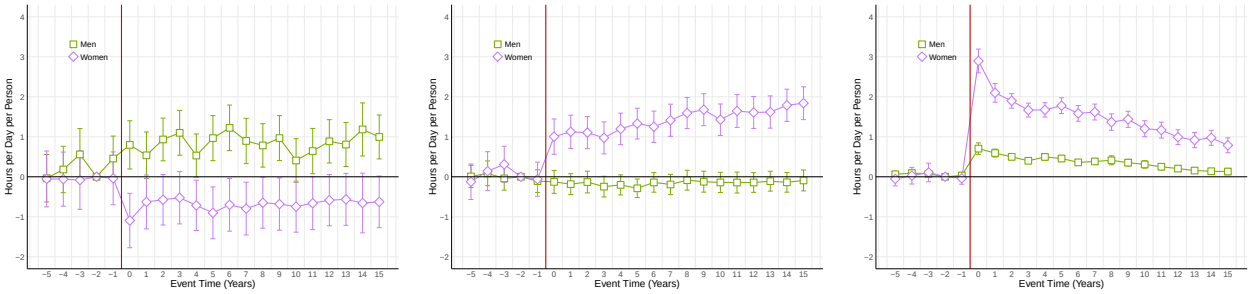
Notes: Event studies around first childbirth for men and women, showing one-digit time-use categories: total active time (Panel A), education (Panel B), and leisure (Panel C). The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates pool all countries.

5.1 Event studies by gender

We begin at the highest level of aggregation. Figure 9 presents event studies for active time, education, and leisure separately by gender, pooling all countries. Panel (a) shows total active time. Men and women both increase active time at childbirth, but by different amounts: active time rises by around two hours per day for women and around one and a half hours for men. The pre-birth trends for both genders are flat, confirming that the divergence is driven by the arrival of the child rather than pre-existing differences in trajectories. The gap—around half an hour per day, sustained over the full post-birth window—is a first measure of the gendered burden of parenthood. Panel (b) shows education. Women reduce education time at childbirth while men's education is essentially flat. Panel (c) shows leisure. Leisure falls for both parents by 1–1.5 hours per day at birth and remains persistently below pre-birth levels. Figures A3, A4 and A5 in the appendix present the event studies by region.

Figure 10 decomposes active time into its main components. Three patterns stand out. Panel (a) shows paid work. Women experience an immediate and persistent decline at childbirth, while men's paid work rises modestly—a pattern partly driven by high-fertility settings such as India, where male labour market participation increases at the time of first birth. This pattern is consistent with the child penalty in employment documented by Kleven et al. (2025) across 134 countries: the gendered divergence in paid work at parenthood is a global regularity.

Panel (b) shows unpaid domestic work. At childbirth, domestic work surges for women and remains elevated throughout the observation window. For men, domestic work is flat or, if anything, slightly declines. Panel (c) shows childcare. Women provide around four times



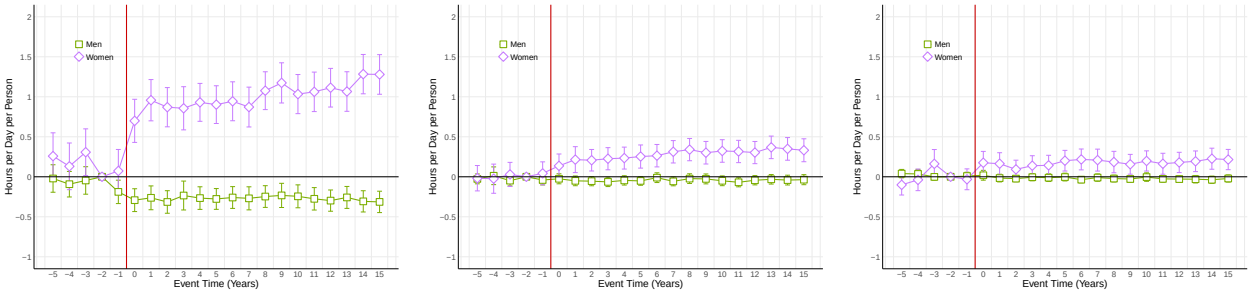
(a) Paid work (b) Unpaid domestic work (c) Childcare

Figure 10: Effect of first birth by gender: decomposition of active time

Notes: Event studies around first childbirth for men and women, showing two-digit decomposition of active time: paid work (Panel A), unpaid domestic work (Panel B), and childcare (Panel C). The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates pool all countries.

more childcare than men worldwide. This ratio is established at birth and remains stable throughout the post-birth window. A striking finding emerges from comparing Panels (b) and (c): domestic work is as quantitatively important as childcare in explaining the total divergence between mothers and fathers. Prior work, which relies on employment data, captures only the paid-work margin and therefore misses this equally large domestic-work margin entirely. Figures A6, A7 and A8 in the Appendix present these event studies by region.

Figure 11 decomposes domestic work into food preparation, cleaning, and laundry. The largest component is food preparation: women add around one hour per day at childbirth, and this increase persists for at least fifteen years. Cleaning and laundry both increase more modestly but persistently. Together, these three components account for the bulk of the domestic-work gap documented in Panel (b) of Figure 10, and all of them fall almost exclusively on women. For men, none of the three shows a meaningful response to childbirth.



(a) Food preparation (b) Cleaning (c) Laundry

Figure 11: Effect of first birth by gender: decomposition of domestic work

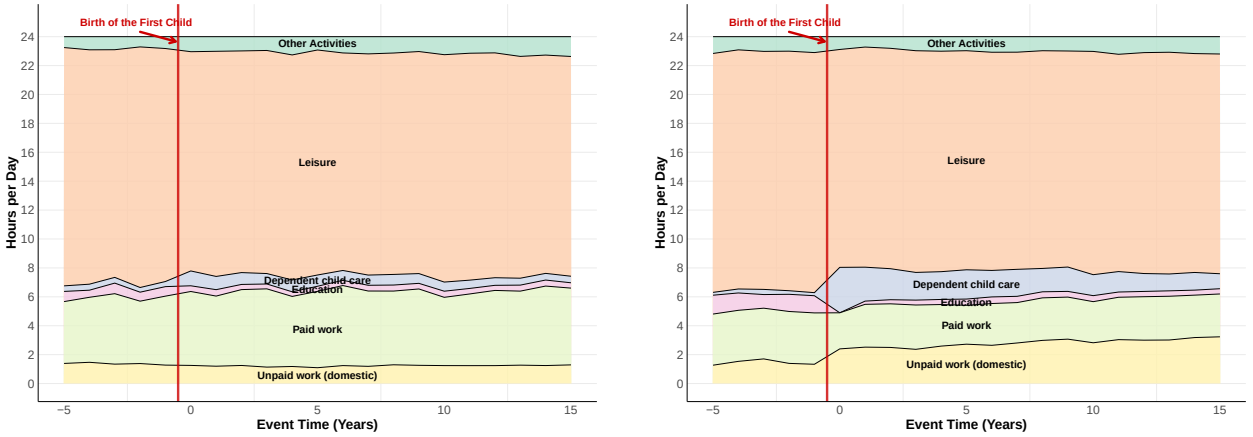
Notes: Event studies around first childbirth for men and women, showing three-digit components of unpaid domestic work: food preparation (Panel A), cleaning (Panel B), and laundry (Panel C). The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates pool all countries.

Figure 12 presents stacked event studies that show the full reallocation of the 24-hour day. Panel (a) shows men. The reallocation is modest: time shifts primarily from leisure into childcare, with little change in paid work and essentially no change in domestic work. Fathers adjust along a single margin. Panel (b) shows women, and the picture is fundamentally different. At birth, women undergo a complete reallocation of their 24-hour day: paid work and leisure both compress sharply, while childcare and domestic work expand to fill the space created. This is not a marginal adjustment—it is a reorganisation of the entire activity portfolio, established at birth and persistent for at least fifteen years. The same stacked 24-hour design appears separately by country Figure A9 in the Appendix.

5.2 Beyond time quantities

The event studies above measure time quantities. But not all activities impose the same physical burden. To capture this dimension, we assign each activity a physical-effort score following the framework of Cornwell et al. (2019) and track the evolution of average daily effort around first birth, separately for men and women.

Figure 13 presents the result. For women, average physical effort rises at childbirth and remains persistently elevated: the increase amounts to around 20% relative to the pre-birth baseline. For men, the physical-effort profile is essentially flat around the event. The activities that women take on after childbirth — intensive physical childcare, food preparation, cleaning, laundry — are not only more time-consuming than the activities they displace, they are also more physically demanding. Standard child-penalty measures based on em-



(a) Men (b) Women

Figure 12: Full reallocation of the 24-hour day by gender

Notes: Stacked event studies around first childbirth showing the full 24-hour allocation for men (Panel A) and women (Panel B). Each stack shows minutes per day in each time-use category relative to $t = -2$; categories sum to 1,440 minutes per day. Estimates pool all countries.

ployment or earnings therefore understate the full welfare divergence between mothers and fathers. Women's days become not just longer but harder, while men's do not.

Physical effort captures the intensity of individual activities. We now ask a different question: how much do the overall daily routines of mothers and fathers diverge? To answer this, we construct a single index of within-household similarity. For each parent we represent daily time use as a vector in which each component is the total minutes spent in a given activity, excluding sleep. Within each couple, we compute the cosine similarity between the mother's vector $\mathbf{v}_f$ and the father's vector $\mathbf{v}_m$:

$$s_{hh} = \frac{\mathbf{v}_f \cdot \mathbf{v}_m}{\|\mathbf{v}_f\| \, \|\mathbf{v}_m\|}. \tag{2}$$

A value of one implies that both parents allocate their time identically; a value of zero implies completely orthogonal activity portfolios. We track the evolution of this index around the birth of the first child.

Figure 14 presents this event study by world region. Two insights emerge. First, cosine similarity declines at childbirth in every region we study. Gender specialisation in time use is a universal response to parenthood, not a feature of particular institutional or cultural settings. Second, the magnitude of the decline mirrors the childcare gradients documented in Section 4: the decline is largest in Latin America and Europe, where parental childcare investment is highest, and smallest in Sub-Saharan Africa, where the childcare response to

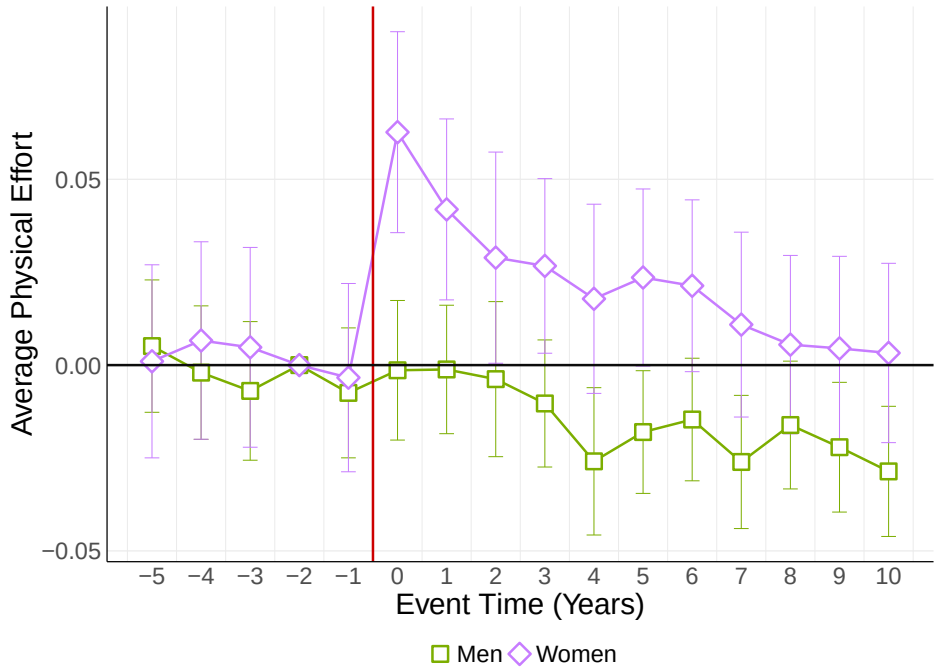


Figure 13: Physical effort around first birth, by gender

Notes: Event study of average daily physical effort around first childbirth, separately for men and women. Physical effort is a continuous score assigned to each activity and aggregated to the individual-day level by taking the mean over the activity portfolio, building on Cornwell et al. (2019). The vertical axis shows the change in the average score relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates pool all countries.

birth is modest. A further finding is that some degree of gender differentiation pre-exists parenthood: cosine similarity is already below one before $t = 0$. Gender segregation in daily roles is not created by the arrival of children but is amplified by it.

5.3 Parenthood and development: cross-country patterns

We now ask how the time allocations of mothers and fathers covary with the level of economic development across countries. Figure 15 presents scatterplots of average daily time by gender against GDP per capita for paid work, domestic work, and childcare.

Panel (a) shows paid work. The gradient for fathers traces a slight inverse-U over the development path. For mothers, paid work traces a U-shape: relatively high at low levels of development, declining at middle income, and recovering at high income. The first phase of development is therefore associated with a growing divergence between maternal and paternal paid work; the second phase with a partial convergence.

Panel (b) shows domestic work. For mothers, domestic work follows an inverse-U: it rises

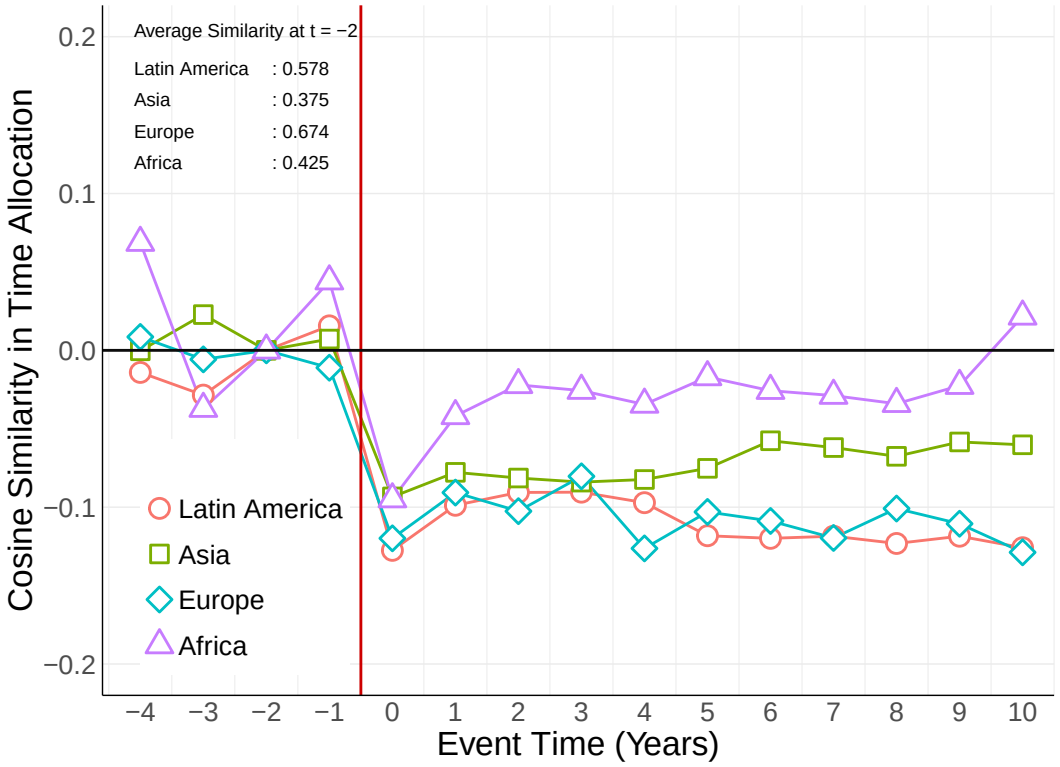
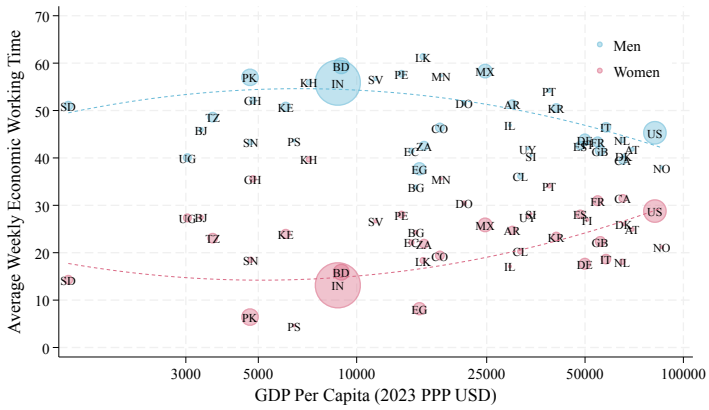


Figure 14: Within-household cosine similarity around first birth, by region

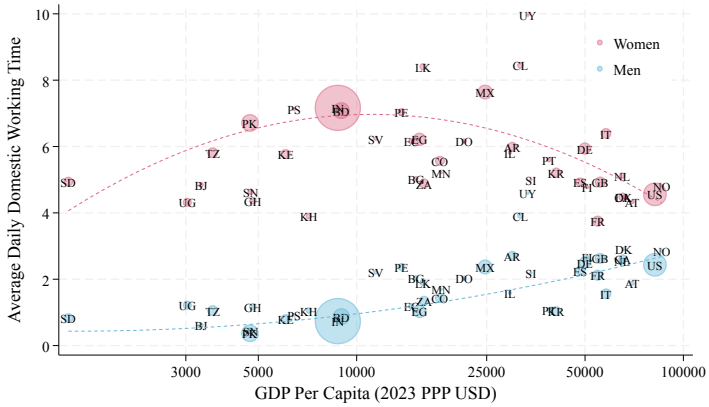
Notes: Event study of within-household cosine similarity of time-use vectors around first childbirth, presented separately for six world regions. For each couple, cosine similarity is computed between the mother's and father's time-use vectors projected into the full n-dimensional activity space, excluding sleep. A value of one implies identical activity portfolios; a value of zero implies completely orthogonal portfolios. The vertical axis shows the change in similarity relative to $t = -2$. Shaded bands show 95% confidence intervals.

with income, peaks at middle income, and then declines sharply. For fathers, domestic work is slightly increasing throughout. The decline in maternal domestic work at high income mirrors almost exactly the recovery of maternal paid work in Panel (a).

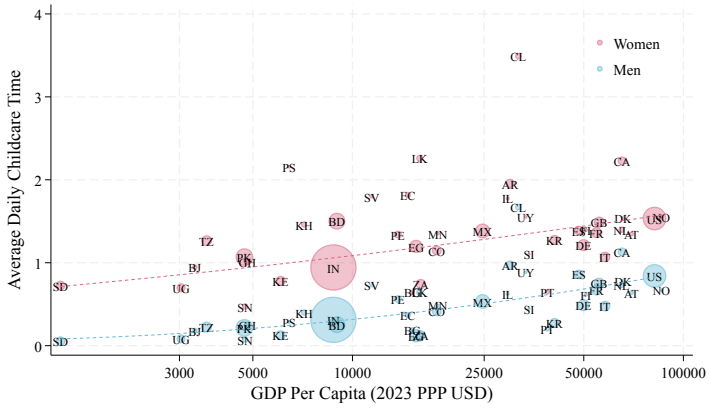
Panel (c) shows childcare. Both parents increase childcare monotonically over the development path, consistent with Fact 2. Women provide more childcare than men at all income levels, and the ratio, while narrower at high income, remains large throughout. Unlike domestic work, childcare does not decline — parents in advanced economies do more of it, not less. In Section 6 we use a simple household task-allocation model to account for these patterns.



(a) Paid work



(b) Domestic work



(c) Childcare

Figure 15: Parenthood and development: time allocations of mothers and fathers

Notes: Scatterplots of average daily time allocations for mothers and fathers against GDP per capita (2023 PPP USD), for paid work (Panel A), domestic work (Panel B), and childcare (Panel C). Each dot is a country; dot size is proportional to population. Mothers and fathers are shown in different colours.

5.4 Task complementarities

The cross-country evidence in the previous subsection shows that maternal domestic work declines and paternal domestic work rises modestly at higher levels of development. A natural question is whether this pattern reflects a reallocation within households — fathers absorbing domestic tasks as mothers move into paid work — or whether it is driven by other forces. To answer this, we study two types of within-household time complementarities. The first is within-person: when a parent works more paid hours, how do her or his own domestic work, childcare, and leisure change? The second is cross-spouse. For example, when one parent shifts time toward paid work, how does the other parent's time allocation respond?

We estimate these complementarities in six countries spanning the income distribution: Bangladesh and Kenya at low income; South Africa and India at middle income; Spain and the United Kingdom at high income. The sample in each country consists of couple households with a youngest child aged ten or below.

Let w_h^g denote daily hours of economic work for parent of gender $g \in \{f, m\}$ in household h, and let $x_{h,j}^g$ denote daily hours in activity $j \in \mathcal{J} = \{\text{domestic work, childcare, leisure}\}$. Let Z_h be a vector of controls comprising age, education, marital status, household size, number of children, and day-of-week dummies. We define residuals $\tilde{w}_h^g$ and $\tilde{x}_{h,j}^g$ as the residuals from separate OLS regressions of each variable on Z_h. The within-person complementarity for parent g is the slope from the following regression:

$$\tilde{x}_{h,j}^g = \alpha_j^g + \beta_j^g \, \tilde{w}_h^g + \varepsilon_{h,j}^g. \tag{3}$$

The coefficient β_j^g measures how parent g's own time in activity j co-moves with their own economic work, conditional on observables. The cross-spouse complementarity is the slope from:

$$\tilde{x}_{h,k}^m = \alpha_{jk} + \gamma_{jk} \, \tilde{x}_{h,j}^f + \eta_{h,jk}, \tag{4}$$

where j indexes the mother's activity and k indexes the father's activity. We focus on four (j, k) pairs: (i) mother's childcare → father's economic work; (ii) mother's domestic work → father's economic work; (iii) mother's economic work → father's childcare; and (iv) mother's economic work → father's domestic work. Pairs (i)–(ii) test whether fathers shift toward paid work when mothers absorb more home production; pairs (iii)–(iv) test the converse. Both equations are estimated by OLS on a 100-bin binscatter of the residualised variables.

Figure 16 presents within-person slope coefficients for each of the six countries and the cross-country average, separately for men and women. For men, the substitution is concentrated

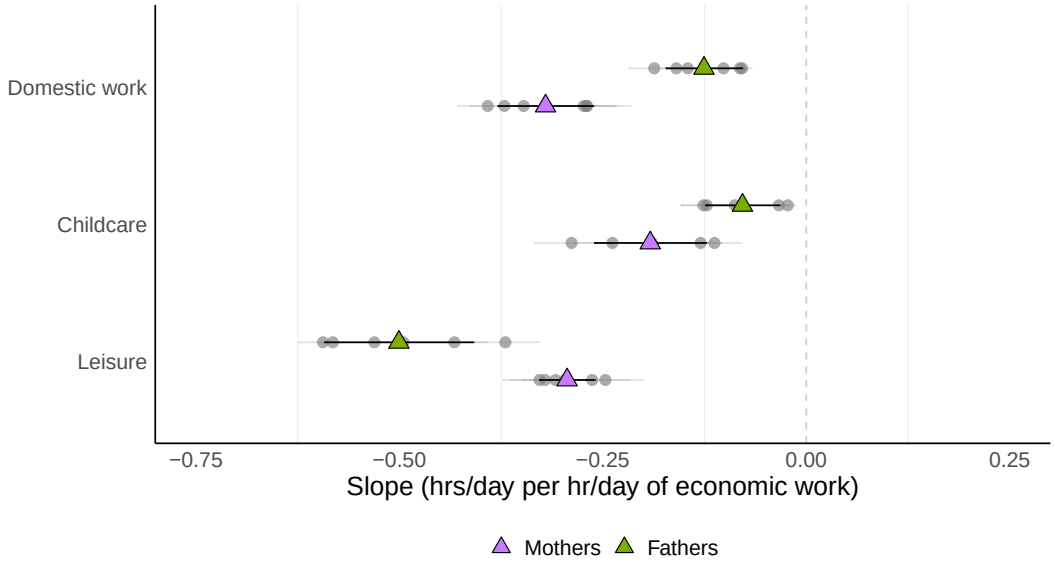


Figure 16: Within-person task complementarities, by country and gender

Notes: Within-person slope coefficients (equation 3) from a binscatter of residualised time use on residualised economic work hours, for six countries spanning the income distribution and for the cross-country average. Each coefficient shows the substitution between a parent's own economic work and their own domestic work, childcare, and leisure, separately for mothers and fathers. Estimates condition on age, education, marital status, household size, number of children, and day of week. Sample: couple households with youngest child $\leq$ 10 years old.

almost entirely in leisure: when fathers work fewer paid hours, they reallocate the time to leisure, with little or no change in domestic work or childcare. Fathers face a two-task problem—paid work or leisure—and changes in their paid-work hours do not propagate into home production. For women, the pattern is different. When mothers work fewer paid hours, time flows simultaneously into domestic work, childcare, and leisure. A change in paid work triggers a reallocation across the full task portfolio.

Figure 17 presents the cross-spouse slope coefficients. When mothers devote more time to home production—domestic work and childcare—fathers increase their paid work correspondingly. But the complementarity is not symmetric. When mothers increase their paid work hours, fathers' domestic work and childcare do not increase in response. The adjustments that households make when a mother shifts toward the labour market are not the mirror image of the adjustments made when she shifts toward home production.

This asymmetry has a concrete implication. When female labour supply rises, the home-production tasks that mothers previously performed do not redistribute to fathers. The within-person evidence shows why: fathers who gain non-market time allocate it to leisure,

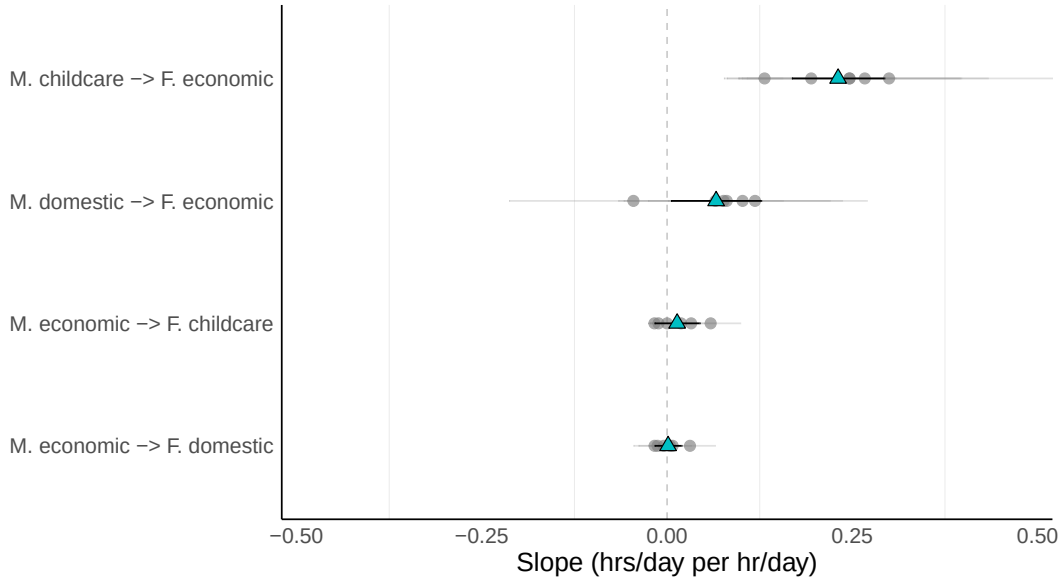


Figure 17: Cross-spouse task complementarities, by country

Notes: Cross-spouse slope coefficients (equation 4) from a binscatter of residualised time use on the partner's residualised economic work hours, for six countries spanning the income distribution and for the cross-country average. The four pairs shown are (i) mother's childcare → father's economic work, (ii) mother's domestic work → father's economic work, (iii) mother's economic work → father's childcare, and (iv) mother's economic work → father's domestic work. Estimates condition on age, education, marital status, household size, number of children, and day of week. Sample: couple households with youngest child ≤ 10 years old.

not to domestic work or childcare. The cross-spouse evidence shows the same from the other direction: fathers do not absorb more home production when mothers shift toward the market. The two findings together document a structural rigidity in the household division of labour that holds across all six countries and at both ends of the income distribution.

6 Model and Implications

The empirical patterns documented in the preceding sections are consistent with a wide range of stories about household behaviour. A mother who reduces paid work at childbirth may be responding to comparative advantage, to social norms, to the price of outside care, or to some combination of all three. To discipline which forces are quantitatively necessary to rationalise the data, we interpret the facts through a unitary household model of task allocation. The model is deliberately simple: its purpose is not structural estimation but rather to clarify the intuitions that the data deliver and to make precise the conditions under which the observed patterns can arise.

6.1 Setup

Two spouses $k \in \{m, f\}$ allocate time $x_i^k \geq 0$ across four tasks $i \in \{c, d, \ell, w\}$: childcare, domestic work, leisure, and paid work. Each spouse faces a time constraint, and the household faces a budget constraint:

$$x_c^k + x_d^k + x_\ell^k + x_w^k = T \quad \forall\, k \tag{Time}$$

$$w^m x_w^m + w^f x_w^f = y + p_c m_c \tag{Budget}$$

where w^k is the exogenous wage of spouse k, y is household consumption, and m_c is market childcare purchased at price p_c.

Childcare and domestic work produce household public goods via CES aggregators:

$$Q_c = \left[\alpha_c^m (x_c^m)^{\rho_c} + \alpha_c^f (x_c^f)^{\rho_c} + \alpha_c^o (m_c)^{\rho_c}\right]^{1/\rho_c} \tag{5}$$

$$Q_d = \left[\alpha_d^m (x_d^m)^{\rho_d} + \alpha_d^f (x_d^f)^{\rho_d}\right]^{1/\rho_d} \tag{6}$$

The parameters $\alpha_i^k \in (0, 1)$ are spouse k's *perceived productivity weight* in task i. These weights capture a combination of real productivity differences, social norms, and stereotypes — a point we return to below. The parameter $\sigma_i = 1/(1-\rho_i)$ is the elasticity of substitution between spousal inputs in task i, and α_c^o captures the productivity of market-purchased childcare.

The household maximises a joint utility function:

$$U = W(Q_c, Q_d) + \beta_m v(\ell^m) + \beta_f v(\ell^f) + \beta_y z(y) \tag{7}$$

where $W(Q_c, Q_d) = [\beta_c Q_c^\psi + \beta_d Q_d^\psi]^{1/\psi}$ aggregates the two household public goods, β_c and β_d are preference weights on childcare and domestic output, and $v(\cdot)$ and $z(\cdot)$ are CRRA sub-utilities over leisure and consumption: $v(\ell^k) = (\ell^k)^{1-\gamma_k}/(1-\gamma_k)$ and $z(y) = y^{1-\eta}/(1-\eta)$.

We model the arrival of children as a discrete shift in the preference weight: $\beta_c : 0 \to \bar{\beta}_c$. When $\psi < 1$ — so that childcare output and domestic output are complements — this raises the marginal utility of both Q_c and Q_d, consistent with the simultaneous rise in childcare *and* domestic work that we document in Fact 1.

6.2 Key results

At an interior optimum, the shadow prices of time are proportional to wages: $\lambda^m/\lambda^f = w^m/w^f$. This is a standard result in unitary household models and pins down how the opportunity cost of non-market time varies across spouses.

Taking the ratio of first-order conditions for parental and market childcare yields the substitution margin between the two inputs:

$$\frac{m_c}{x_c^k} = \left(\frac{\alpha_c^o}{\alpha_c^k} \cdot \frac{w^k}{p_c}\right)^{\sigma_c} \tag{8}$$

A rise in spouse k's wage relative to the price of market care shifts the household toward outside childcare, with elasticity σ_c. This expression captures the standard intuition that cheaper or more productive market care reduces parental time in childcare.

The most informative result for our purposes is the cross-spouse ratio of time inputs within each household-production task. Taking the ratio of first-order conditions across spouses, all terms common to both — the preference shifters β_c and β_d, the complementarity parameter ψ, and the level of market care m_c — cancel, leaving:

$$\frac{x_i^m}{x_i^f} = \left(\frac{\alpha_i^m}{\alpha_i^f} \cdot \frac{w^f}{w^m}\right)^{\sigma_i}, \quad i \in \{c, d\} \tag{9}$$

This expression has three implications. First, wages matter: a higher male-to-female wage ratio w^m/w^f reduces the father's relative time in task i, with elasticity σ_i, because his opportunity cost of non-market time rises. Second, perceived productivities matter: a higher α_i^m/α_i^f raises the father's relative time in task i. Third, for childcare specifically, a decline in the price of market care p_c reduces *both* parents' time proportionally, leaving the within-task gender split unchanged. Crucially, the ratio in equation (9) is invariant to the preference shifters β_c and β_d and to the complementarity parameter ψ. These parameters affect the *levels* of childcare and domestic work but not the *within-task gender split*.

6.3 Three quantitative insights

We now show that, combined with the empirical facts, the model delivers three quantitative insights about the forces driving gender specialisation. Figure 15 presents the cross-country gradients that Section 5 documents — scatterplots of mothers' and fathers' paid work, domestic work, and childcare against GDP per capita — and the three insights below state

what norms, preferences over childcare, and productivity in domestic work must look like if the unitary model is to rationalise those panels.

Insight 1: Observed gender specialisation requires very strong norms

Panel (c) of Figure 15 shows that the female-to-male childcare ratio x_c^f/x_c^m ranges from 2.5 to 7 across countries. The gender wage ratio w^f/w^m is around 0.8 in low-income countries (International Labour Organization, 2024) and higher in more advanced economies, so setting $w^f/w^m = 0.8$ yields conservative lower-bound estimates of the required norm ratio. The elasticity of substitution σ_c is likely low: mothers and fathers perform *different types* of childcare — mothers concentrate on physical and routine care, while fathers are disproportionately involved in play and educational activities (Yeung et al., 2001; Lamb, ed, 2010) — suggesting strong complementarities rather than easy substitution, and hence $\sigma_c < 1$.

Given these parameter values, equation (9) implies that the only way to rationalise the observed childcare ratios is a perceived-productivity ratio α_c^f/α_c^m of at least 2 under the most conservative assumptions ($\sigma_c = 1$, $R^{\text{data}} = 2.5$), and substantially larger — exceeding 5 across most of the empirical range — when the inputs are complements ($\sigma_c < 1$), as the evidence suggests (see Appendix C.2 for details). A ratio of this magnitude is difficult to reconcile with biological comparative advantages alone, given that the underlying tasks — feeding, bathing, reading, playing — involve no inherent female advantage. The model therefore points to a central role for social norms and gender-stereotyped beliefs about who is more productive in childcare.

Insight 2: Critical role of β_c

The second insight addresses a tension in Figure 15. Panel (c) shows parental childcare rising monotonically in GDP per capita for both mothers and fathers, yet higher income also raises the opportunity cost of time at home. Holding β_c fixed, both spouses should substitute away from parental childcare as wages grow. The fact that they do the opposite requires the household's valuation of childcare to shift outward fast enough to dominate the opportunity-cost pressure. Appendix C.3 states the restriction formally: along the development path, β_c must grow faster than w^f (condition (A12)).

This rising β_c also helps explain Panel (a), where the paid-work gender gap widens over the first phase of development as mothers' market hours trace the downward leg of a U-shape. The key is that $R_c \equiv x_c^m/x_c^f$ is independent of β_c (equation (9)): an increase in β_c raises both spouses' childcare proportionally, leaving the within-couple split unchanged. Because

the mother's baseline childcare is higher whenever $R_c < 1$, she absorbs a larger absolute increase and, through the time constraint, a larger loss of market time. The mechanism therefore requires three ingredients jointly: rising wages for both spouses, β_c outpacing w^f, and $R_c < 1$ — which, in the calibration, is driven primarily by the perceived-productivity asymmetry of Insight 1, with relative wages also entering through equation (9).

Insight 3: Closing the gender gap requires a domestic-work revolution

The most striking pattern at high levels of development is the large decline in mothers' domestic work time (Figure 15, Panel (b)). Childcare, by contrast, continues to rise throughout the development path for both parents. This means that outside childcare and parental childcare appear complementary rather than substitutable: cheaper market care cannot be the main driver of women's return to paid work.

Within the model, the only force that can rationalise the rise in female labour force participation at high income is a productivity revolution in domestic work. This could take the form of household appliances, market substitutes for cooking and cleaning, or changes in domestic infrastructure — all of which raise the effective productivity of domestic work and free up maternal time for the labour market. Critically, this insight is available only because our data separately identify domestic work and childcare. Conflating the two categories, as most labour-market analyses implicitly do, would obscure the mechanism entirely.

7 Conclusion

This paper constructs a global harmonised time-use database covering more than 210 surveys across 80 countries and uses it to document what parenthood does to the full allocation of time. The existing child-penalty literature measures these costs almost exclusively through paid work. We show that restricting attention to the labour market misses dimensions of the child penalty that are at least as large and more consequential for welfare. We have presented three main sets of findings.

First, the time costs of parenthood are both larger and more heterogeneous than employment-based measures suggest. The arrival of a first child imposes around four additional hours of active time per day on the couple, financed entirely by leisure including sleep, and this cost is persistent: it has not dissipated fifteen years after birth. The aggregate cost intensifies sharply with development — parental childcare roughly triples between low- and high-income countries — and undergoes a qualitative transformation from physical survival tasks in low-income settings to play, education, and developmental investment in richer ones. The broad

alloparental care networks that absorbed more than 30% of all childcare in Sub-Saharan Africa have almost entirely disappeared in advanced economies, so high-income parents face not only more childcare in total but a higher share falling exclusively on themselves.

Second, domestic work matters as much as childcare in generating the gap between mothers and fathers. We show that unpaid domestic work surges for women at childbirth and contributes to the total gender divergence in active time as much as childcare does. Our task-allocation model shows that the only way to rationalise the observed degree of gender specialisation is a perceived-productivity ratio of mothers to fathers exceeding five — a magnitude that points to norms and gender-stereotyped beliefs rather than biological comparative advantage. The welfare cost extends further still: average physical effort rises by around 20% for women at birth and remains persistently elevated, while men's physical-effort profiles are essentially flat. Standard child-penalty measures based on employment or earnings are therefore silent on a welfare divergence that operates through the character of work, not just its duration.

Third, the cross-country and within-household evidence together explain why gender specialisation persists and what it would take to undo it. Over the development path, the recovery of female labour force participation at high income is associated with a large decline in maternal domestic work, not a decline in childcare — parental childcare continues to rise throughout. Policies that expand the availability or reduce the cost of market childcare may therefore have limited effects on female labour supply if parental and market childcare are complements rather than substitutes. Within the household, the task complementarity evidence shows why the domestic-work burden is so hard to dislodge: when mothers shift toward paid work, fathers do not absorb more domestic work or childcare. Households do not rebalance symmetrically. This asymmetry holds across income levels and all six countries in our sample, and it implies that the path to greater gender equality in time use runs through changes in the production technology of domestic work — appliances, infrastructure, market substitutes — rather than through changes in wages or childcare policy alone.

To conclude, by documenting these patterns across settings with fundamentally different institutions and levels of development, our analysis allows for richer investigation of mechanisms than within-country analyses of a single institutional setting. Identifying and quantifying the forces that make the domestic-work burden so hard to dislodge — whether normative, related to perceived productivity differences, or reflecting coordination failures — is the central next step for the economics of gender inequality and household task allocation. We hope the data and descriptive architecture assembled here will provide a foundation for that work.

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A Appendix Tables

Table A1 presents the full three-level activity classification used in the harmonisation of our global time-use database. All time is allocated to one of three mutually exclusive one-digit categories—Work, Education, and Leisure—which are in turn disaggregated into two-digit groups and three-digit activities. By construction, the three-digit codes cover all 1,440 minutes of a day.

Table A1: Activity classification hierarchy (three-digit codes).

Code	Group	Description
1. Active Time		
	Paid work	
111		Household enterprise paid work
112		Outside paid work
	Unpaid work (domestic)	
121		Food preparation & clean-up
122		Cleaning and upkeep
123		Laundry and garment care
124		Production of goods for own use
125		DIY, repair, and domestic services
126		Shopping and budget management
	Unpaid work (care)	
131		Dependent adult care
132		Dependent child care
133		Non-dependent adult care
	Voluntary work	
141		Community voluntary work
142		Voluntary work for other households
150	Production of goods for own use	Production of goods for own use
190	Work commute	Work commute
2. Education		
	Formal education	

continued on next page

Table A1 continued

Code	Group	Description
211		Formal education attendance
212		Homework
	Informal education	
221		Informal educational training
222		Other informal education
290	Education commute	Education commute
3. Leisure		
	Leisure basics	
311		Sleep
312		Eating & drinking
313		Personal care
	Entertainment	
321		Indoors entertainment
322		Outdoors entertainment
	Active leisure	
331		Reading & writing
332		Sports & exercise
333		Games & hobbies
	Social activities	
341		Religious activities
342		Social and community activities
343		Friends & family
390	Leisure commute	Leisure commute

B Appendix Figures

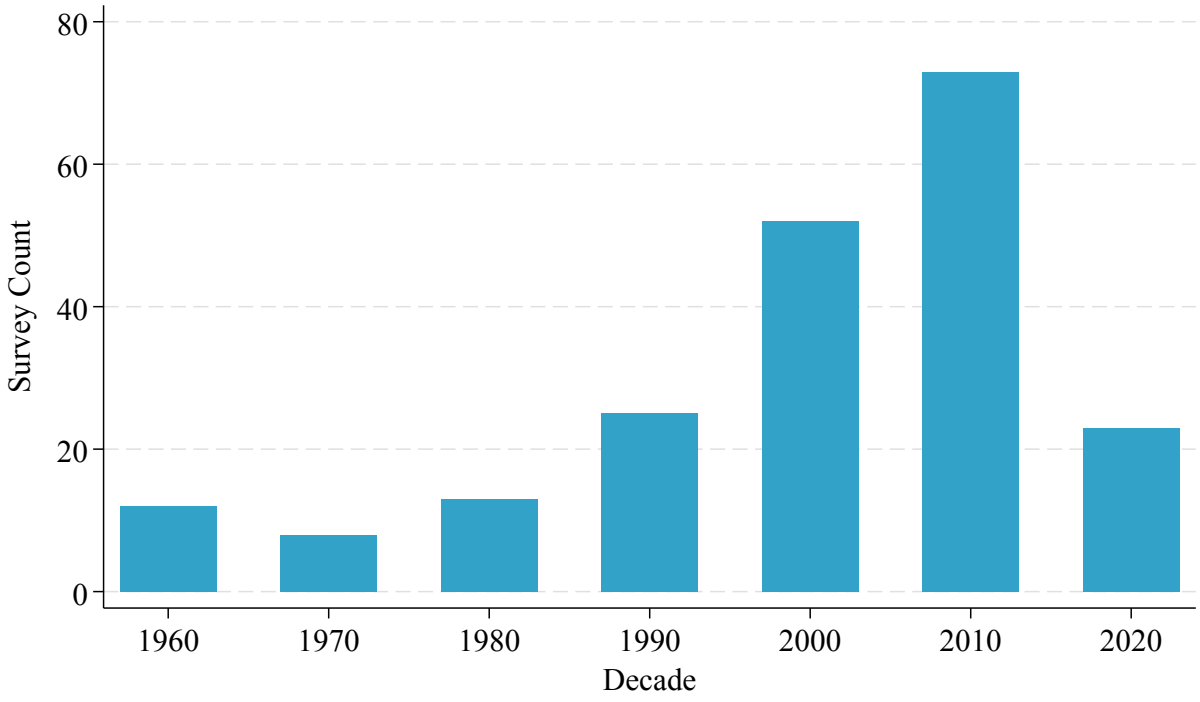


Figure A1: Historical coverage of the time-use database

Notes: Number of time-use surveys in our database by decade. Coverage is sparse before the 1980s, expands steadily through the 1990s and 2000s, and grows rapidly in the 2010s as more countries—particularly in Sub-Saharan Africa and South Asia—began fielding nationally representative time-use surveys for the first time.

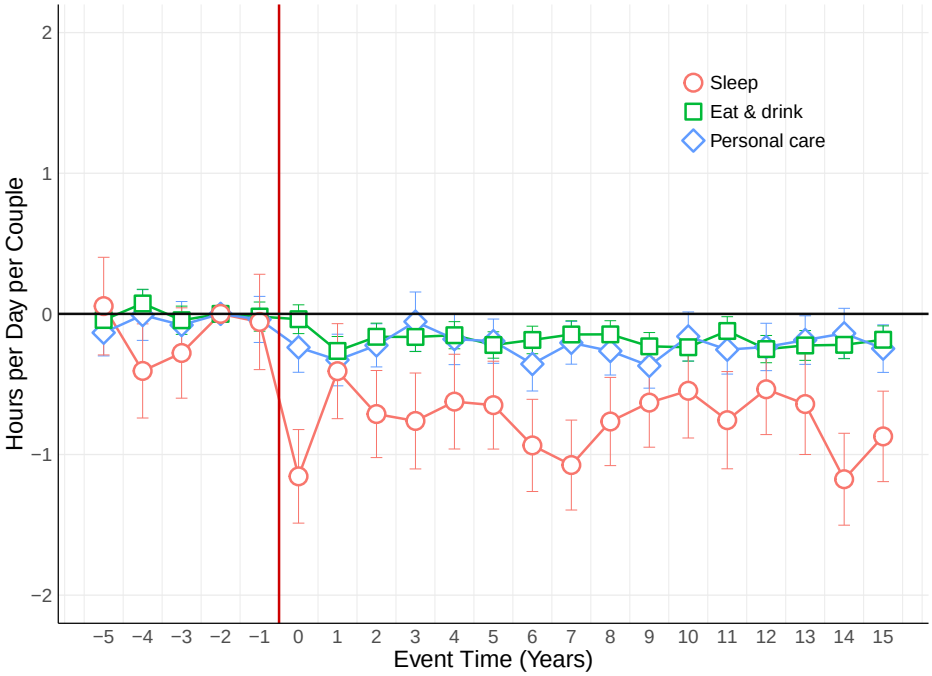


Figure A2: Decomposition of leisure basics

Notes: Couple-level event study around first childbirth decomposing leisure basics into sleep, eating and drinking, and personal care, pooling all countries. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals.

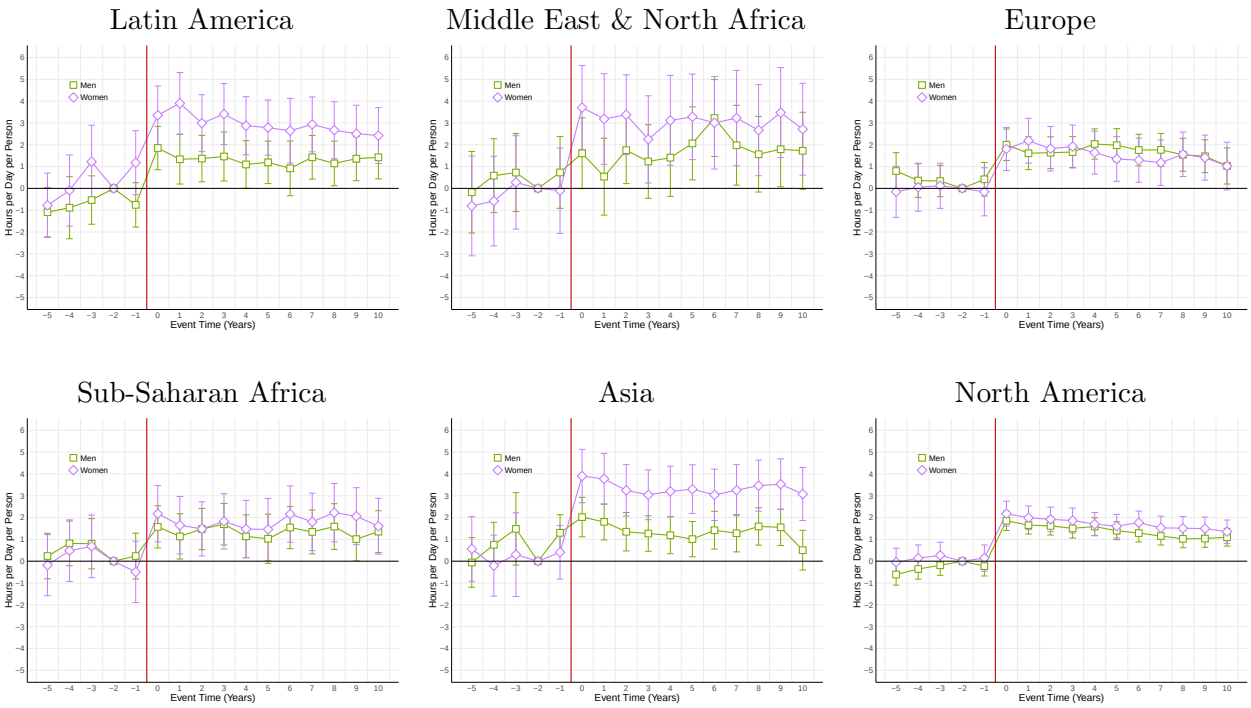


Figure A3: Event Studies for Active time by Region

Notes: Event studies of active time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

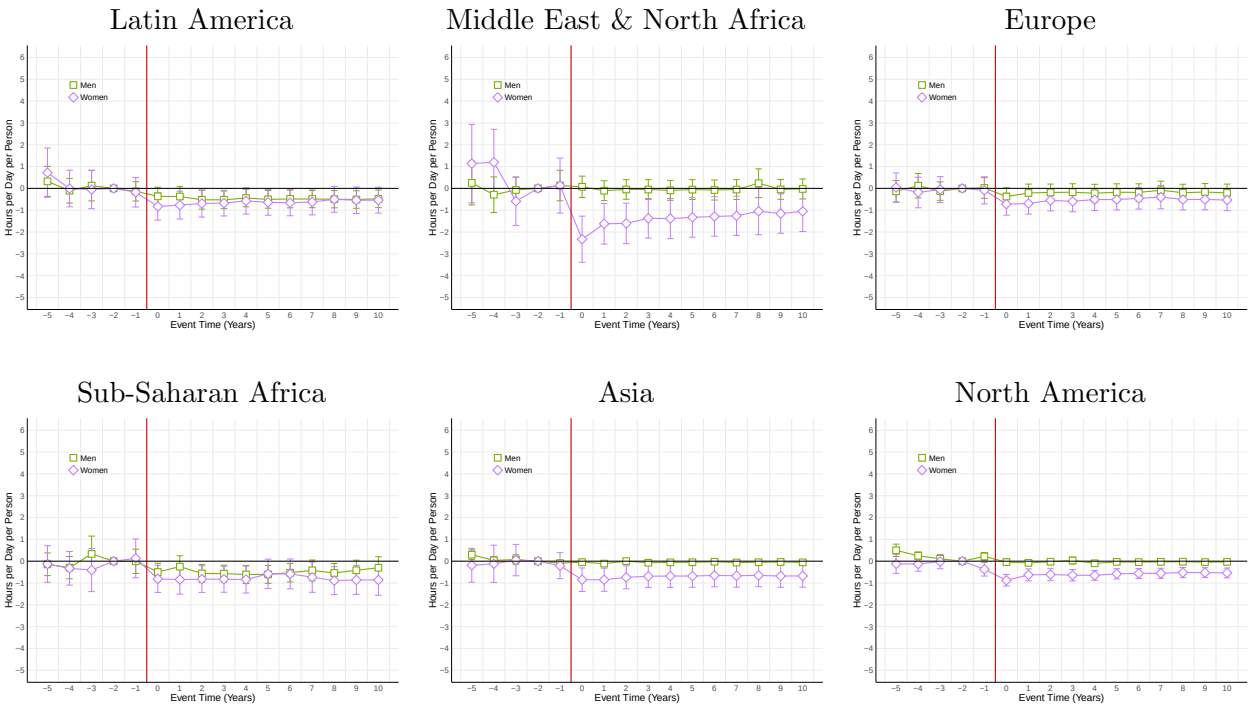


Figure A4: Event Studies for Education by Region

Notes: Event studies of education time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

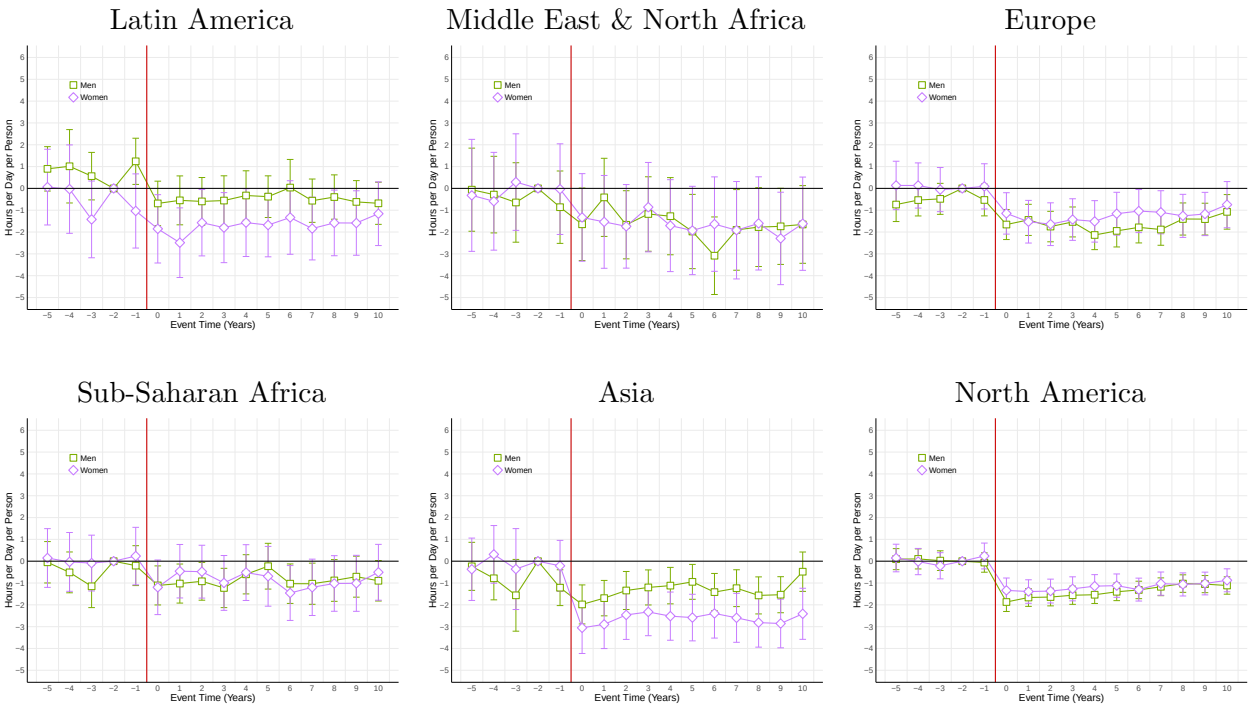


Figure A5: Event Studies for Leisure by Region

Notes: Event studies of leisure time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

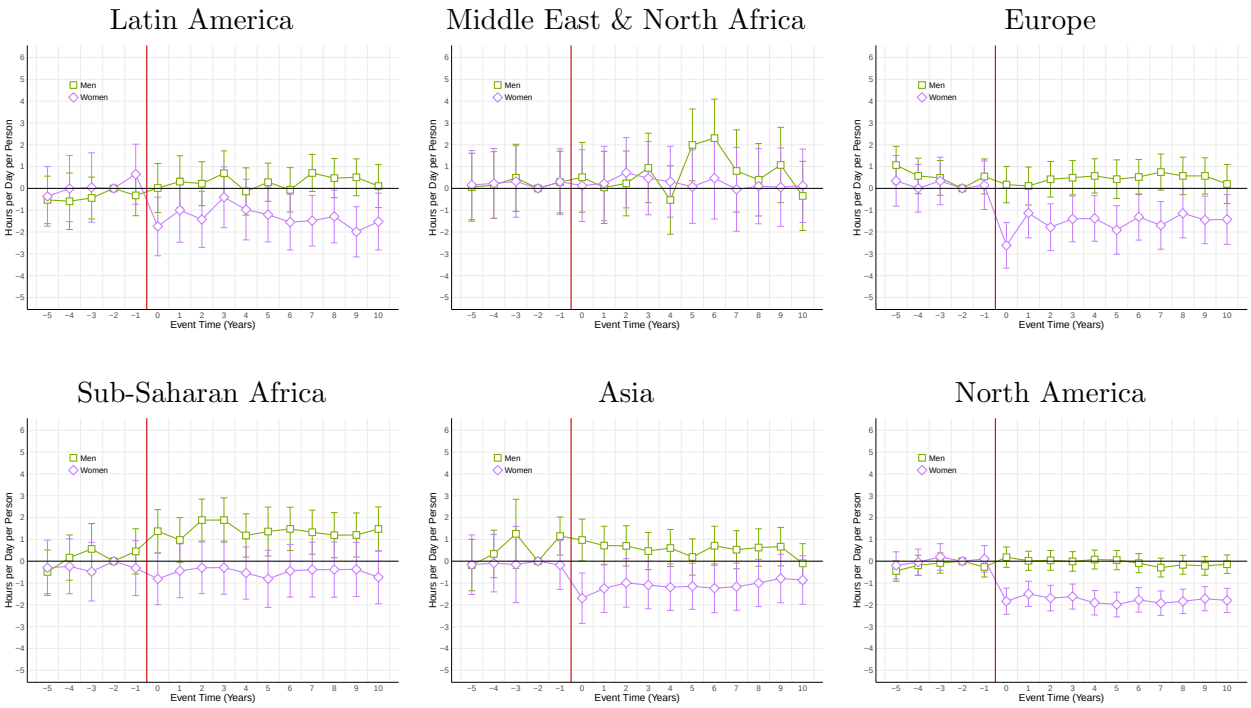


Figure A6: Event Studies for Paid Work by Region

Notes: Event studies of paid work time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

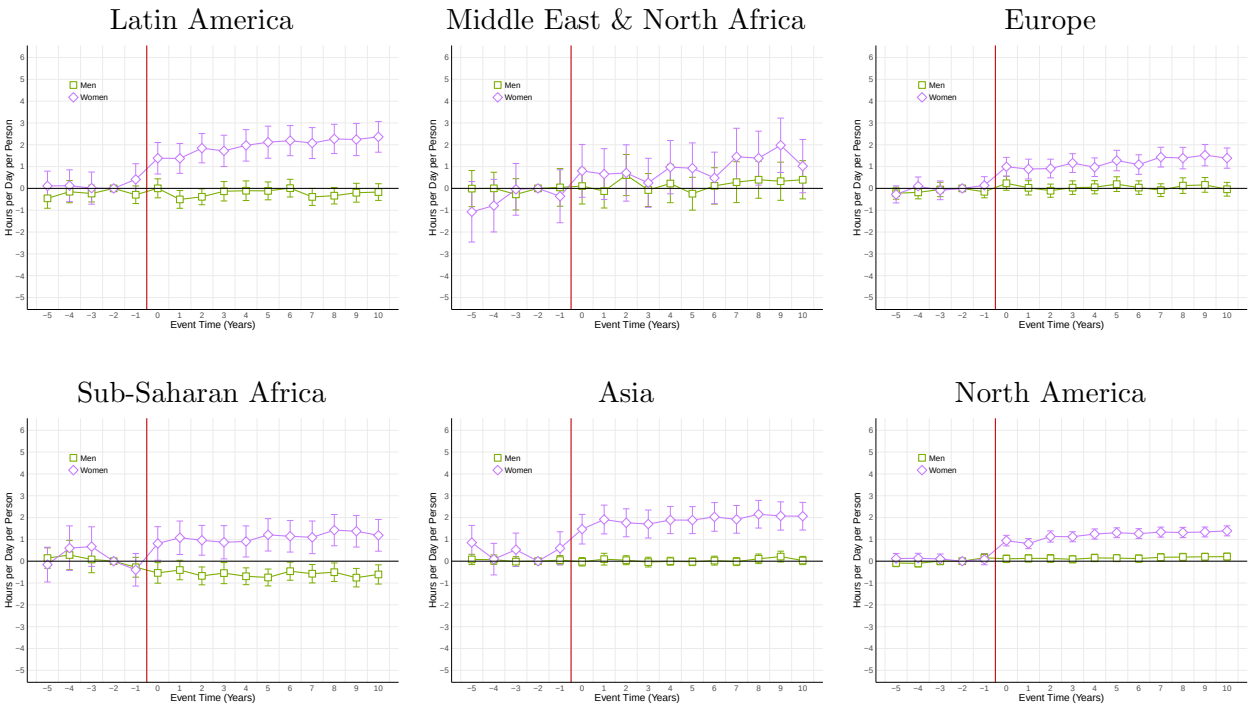


Figure A7: Event Studies for Domestic Work by Region

Notes: Event studies of domestic work time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

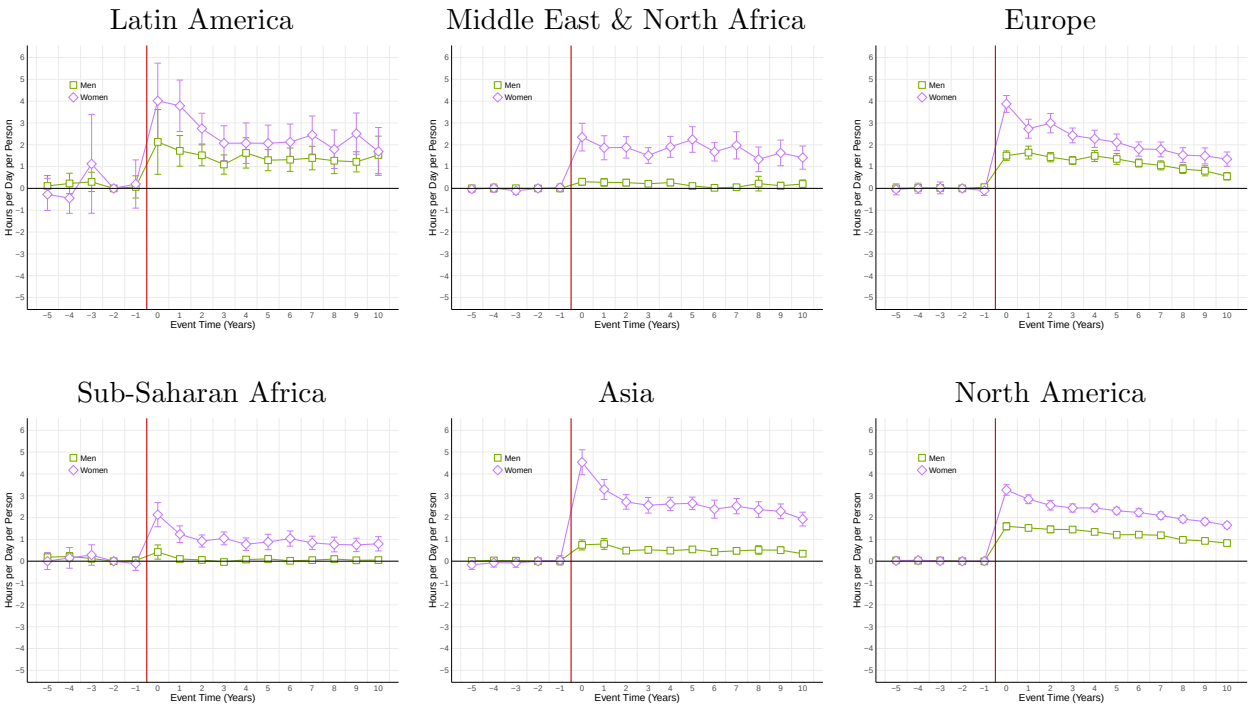


Figure A8: Event Studies for Childcare by Region

Notes: Event studies of childcare time around first childbirth for men and women. The vertical axis shows minutes per day relative to $t = -2$. Shaded bands show 95% confidence intervals. Estimates are pooled across different geographies.

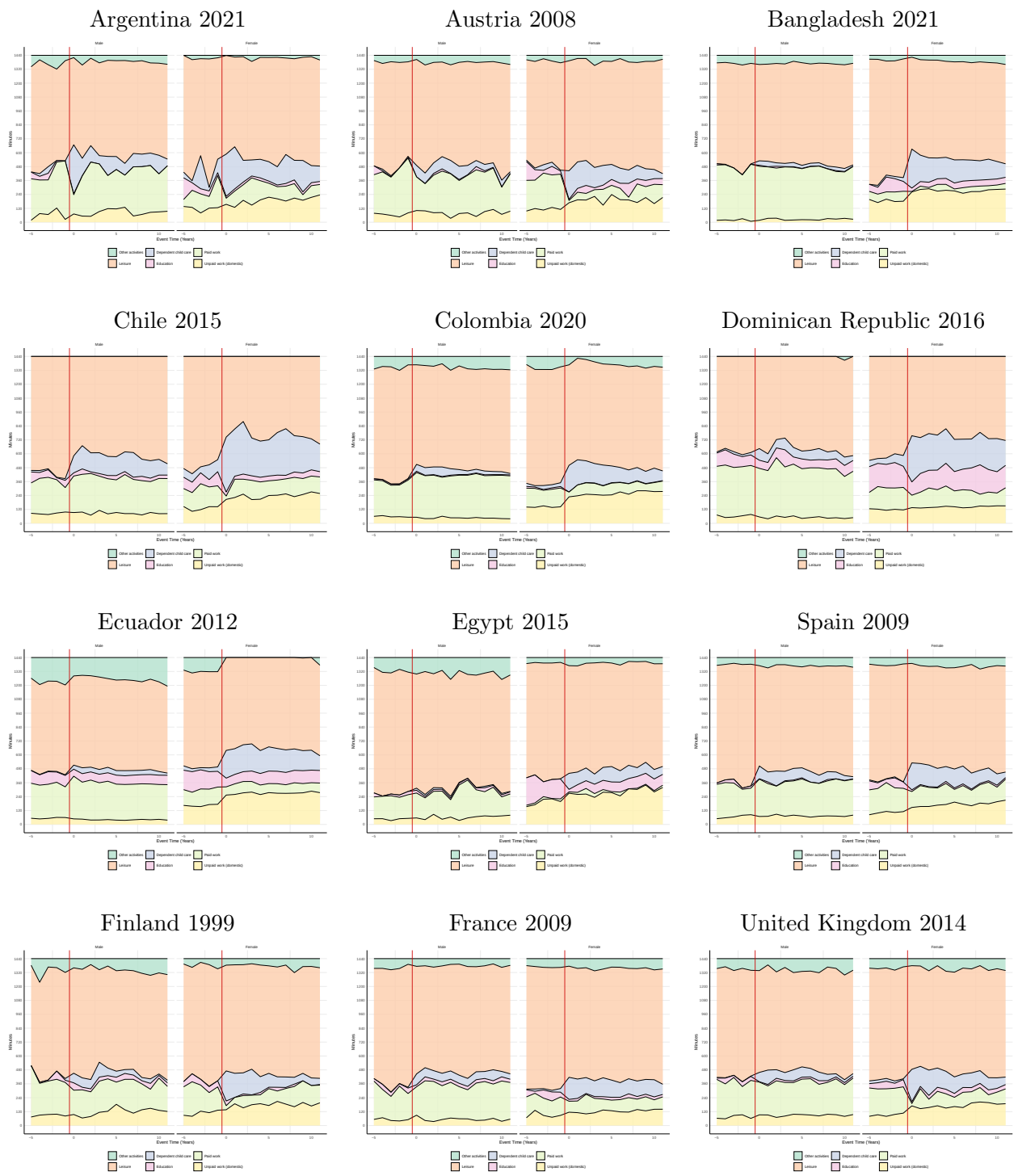


Figure A9: Event Studies of First Childbirth by Country

Notes: Stacked event studies around first childbirth showing the full 24-hour allocation for men (Panel A) and women (Panel B). Each stack shows minutes per day in each time-use category relative to $t = -2$; categories sum to 1,440 minutes per day.

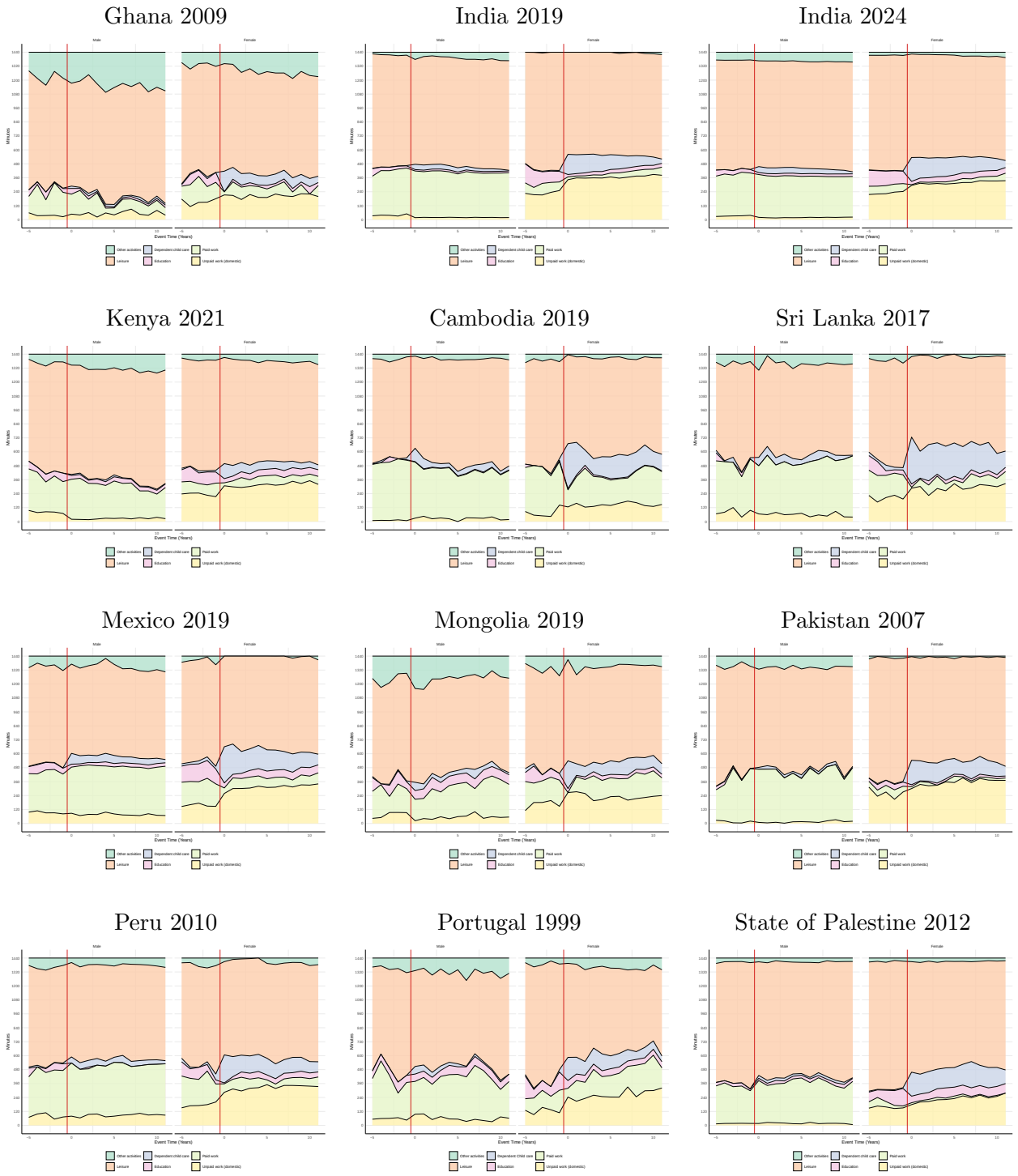


Figure A10: Event Studies of First Childbirth by Country, Continued

Notes: Stacked event studies around first childbirth showing the full 24-hour allocation for men (Panel A) and women (Panel B). Each stack shows minutes per day in each time-use category relative to $t = -2$; categories sum to 1,440 minutes per day.

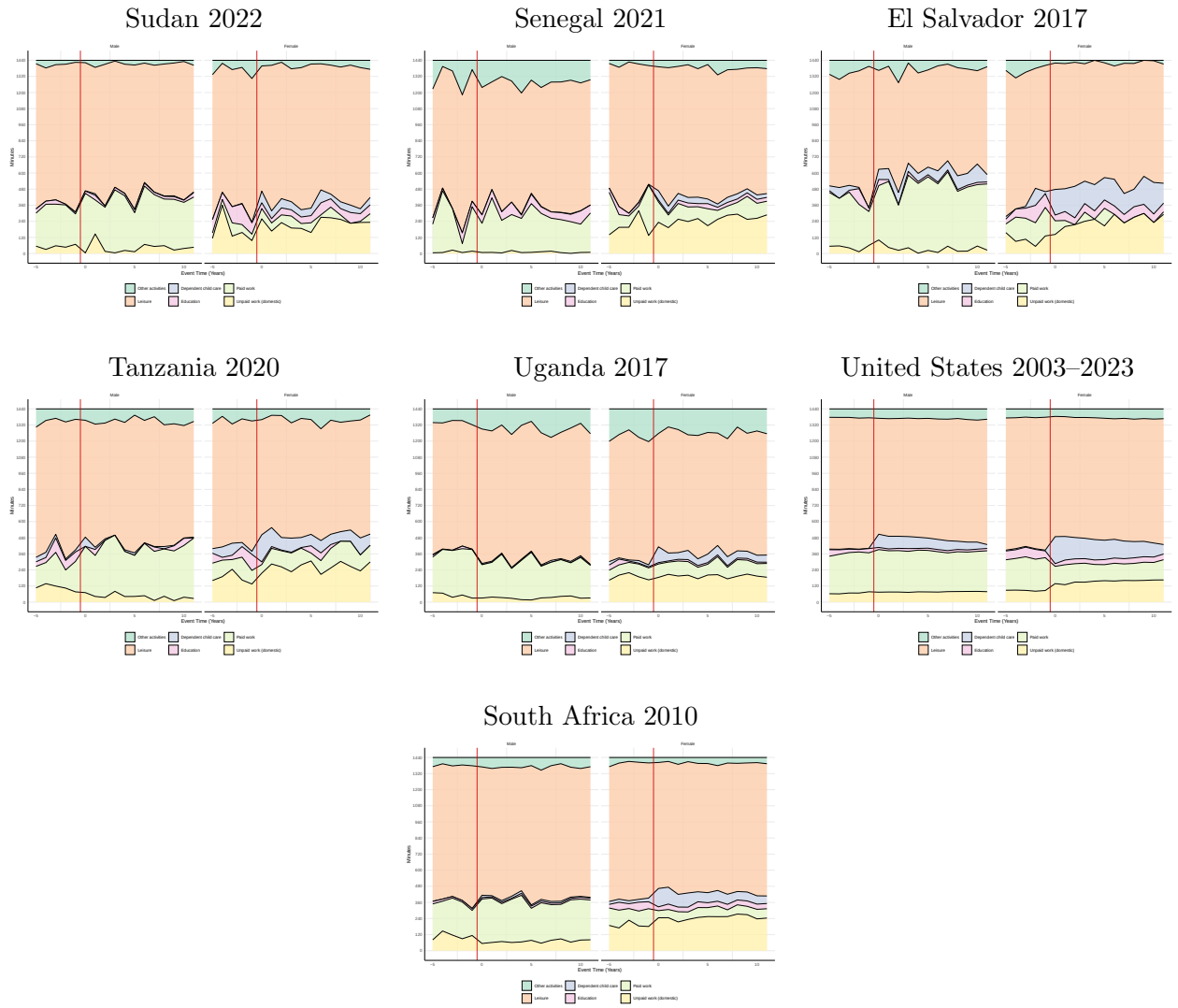


Figure A11: Event Studies of First Childbirth by Country, Continued

Notes: Stacked event studies around first childbirth showing the full 24-hour allocation for men (Panel A) and women (Panel B). Each stack shows minutes per day in each time-use category relative to $t = -2$; categories sum to 1,440 minutes per day.

C Model Derivations

This appendix provides formal derivations of the first-order conditions and the three quantitative insights discussed in Section 6.

C.1 First-order conditions

The household maximises

$$U = W(Q_c, Q_d) + \beta_m v(\ell^m) + \beta_f v(\ell^f) + \beta_y z(y)$$

subject to the time constraints $x_c^k + x_d^k + x_\ell^k + x_w^k = T$ for each spouse $k \in \{m, f\}$ and the budget constraint $w^m x_w^m + w^f x_w^f = y + p_c m_c$. We write $\ell^k \equiv x_\ell^k$ for leisure. Let λ^k denote the shadow price of time for spouse k and μ the multiplier on the budget constraint. The first-order conditions at an interior optimum are:

$$x_w^k: \quad \mu w^k = \lambda^k \tag{A1}$$

$$x_\ell^k: \quad \beta_k (\ell^k)^{-\gamma_k} = \lambda^k \tag{A2}$$

$$x_i^k,\ i \in \{c,d\}: \quad \frac{\partial W}{\partial Q_i}\, \alpha_i^k\, (x_i^k)^{\rho_i - 1}\, Q_i^{1-\rho_i} = \lambda^k \tag{A3}$$

$$m_c: \quad \frac{\partial W}{\partial Q_c}\, \alpha_c^o\, (m_c)^{\rho_c - 1}\, Q_c^{1-\rho_c} = \mu\, p_c \tag{A4}$$

$$y: \quad \beta_y\, y^{-\eta} = \mu \tag{A5}$$

where $\frac{\partial W}{\partial Q_i} = W^{1-\psi}\, \beta_i\, Q_i^{\psi - 1}$, so that (A3) can be written as

$$W^{1-\psi}\, \beta_i\, Q_i^{\psi - \rho_i}\, \alpha_i^k\, (x_i^k)^{\rho_i - 1} = \lambda^k. \tag{A6}$$

Shadow prices. From (A1) and (A5), $\lambda^k = \beta_y\, y^{-\eta}\, w^k$, so:

$$\frac{\lambda^m}{\lambda^f} = \frac{w^m}{w^f}. \tag{A7}$$

Market vs. parental childcare. Dividing (A4) by (A6) for $i = c$, then using (A1) to substitute $\lambda^k = \mu w^k$:

$$\frac{\alpha_c^o\, (m_c)^{\rho_c - 1}}{\alpha_c^k\, (x_c^k)^{\rho_c - 1}} = \frac{\mu\, p_c}{\lambda^k} = \frac{p_c}{w^k}$$

Rearranging and noting $1/(\rho_c - 1) = -\sigma_c$:

$$\frac{m_c}{x_c^k} = \left(\frac{\alpha_c^o}{\alpha_c^k} \cdot \frac{w^k}{p_c} \right)^{\sigma_c}. \tag{A8}$$

Cross-spouse ratio. Writing (A6) for task $i \in \{c, d\}$ for spouse m and spouse f and taking the ratio, the terms $W^{1-\psi}$, β_i, and $Q_i^{\psi-\rho_i}$ cancel; the last equality uses (A1) for each spouse ($\lambda^k = \mu w^k$):

$$\frac{\alpha_i^m \, (x_i^m)^{\rho_i - 1}}{\alpha_i^f \, (x_i^f)^{\rho_i - 1}} = \frac{\lambda^m}{\lambda^f} = \frac{w^m}{w^f}$$

Rearranging:

$$\left(\frac{x_i^m}{x_i^f} \right)^{\rho_i - 1} = \frac{w^m}{w^f} \cdot \frac{\alpha_i^f}{\alpha_i^m}$$

Raising both sides to the power $1/(\rho_i - 1) = -\sigma_i$:

$$\frac{x_i^m}{x_i^f} = \left(\frac{\alpha_i^m}{\alpha_i^f} \cdot \frac{w^f}{w^m} \right)^{\sigma_i}, \quad i \in \{c, d\}. \tag{A9}$$

C.2 Insight 1: Implied norm ratios

Inverting (A9) for $i = c$ and solving for the perceived-productivity ratio:

$$\frac{\alpha_c^f}{\alpha_c^m} = \left(\frac{x_c^f}{x_c^m} \right)^{1/\sigma_c} \cdot \frac{w^f}{w^m}. \tag{A10}$$

Let $R^{\text{data}} \equiv x_c^f / x_c^m$ denote the observed female-to-male childcare ratio and $\omega \equiv w^f / w^m$ the relative female wage. Table A2 reports implied values of α_c^f / α_c^m for a range of empirically relevant parameters.

The table covers the empirically plausible range of σ_c, from strong complementarity ($\sigma_c = 0.25$) to Cobb-Douglas ($\sigma_c = 1$), which serves as the conservative benchmark. Even at $\sigma_c = 1$, the implied norm ratio exceeds 2 for the lowest observed childcare ratios and reaches 5.6 at the high end. For $\sigma_c < 1$ — the case supported by developmental psychology, which documents that mothers and fathers perform qualitatively different types of childcare — the required ratios are substantially larger, reaching double digits at $\sigma_c = 0.75$ and $R^{\text{data}} = 7$. The conclusion that $\alpha_c^f / \alpha_c^m \gg 1$ is robust across the entire range.

Table A2: Implied perceived-productivity ratio α_c^f/α_c^m

	Elasticity of substitution σ_c			
$R^{\text{data}} = x_c^f/x_c^m$	0.25	0.5	0.75	1.0
2.5	31.2	5.0	2.7	2.0
4.0	204.8	12.8	5.1	3.2
7.0	1 920.8	39.2	10.7	5.6

Notes: Each cell reports $\alpha_c^f/\alpha_c^m = (R^{\text{data}})^{1/\sigma_c} \cdot \omega$. The empirical range $R^{\text{data}} \in [2.5, 7]$ is read from Panel (c) of Figure 15. The relative wage $\omega = w^f/w^m$ is set at 0.8, corresponding to the mean raw gender wage gap in low-income countries (19.5%) reported in International Labour Organization (2024), Table 5.1. In middle- and high-income countries the gap is smaller ($\omega \approx 0.87$–0.92), so the implied norm ratios reported here are a lower bound.

C.3 Insight 2: Critical role of β_c

The within-task ratio is invariant to β_c. Equation (A9) shows that the gender ratio of time inputs in task i depends only on perceived productivities α_i^m/α_i^f, relative wages w^f/w^m, and the elasticity σ_i. Preference shifters β_c, β_d, and the complementarity parameter ψ do not appear. Define $R_i \equiv x_i^m/x_i^f < 1$ for $i \in \{c, d\}$ as the (constant) male-to-female ratio in each task:

$$R_i = \left(\frac{\alpha_i^m}{\alpha_i^f} \cdot \frac{w^f}{w^m} \right)^{\sigma_i} < 1. \tag{A11}$$

Condition for childcare to rise despite rising wages. From the expanded FOC (A6) for $i = c$ and spouse f:

$$W^{1-\psi}\, \beta_c\, Q_c^{\psi-\rho_c}\, \alpha_c^f\, (x_c^f)^{\rho_c-1} = \beta_y\, y^{-\eta}\, w^f.$$

Log-differentiate this equation holding W, Q_c, and y fixed (a partial equilibrium that isolates the direct tension between the taste shifter β_c, female childcare time, and the female shadow value of time embedded in w^f). With $\rho_c < 1$,

$$(1 - \rho_c)\, \mathrm{d}\ln x_c^f = \mathrm{d}\ln \beta_c - \mathrm{d}\ln w^f,$$

so $\mathrm{d}\ln x_c^f > 0$ along a path with $\mathrm{d}\ln w^f > 0$ requires $\mathrm{d}\ln \beta_c > \mathrm{d}\ln w^f$. Mapping proportional shifts in an index of development to these log changes yields the benchmark inequality

$$\frac{\mathrm{d}\ln \beta_c}{\mathrm{d}\ln(\text{development})} > \frac{\mathrm{d}\ln w^f}{\mathrm{d}\ln(\text{development})}. \tag{A12}$$

Once W, Q_c, and y adjust endogenously, condition (A12) is not an implication of full comparative statics; it summarises the partial force needed for female childcare time to rise against rising opportunity cost. Since R_c is invariant to β_c, when x_c^f rises we have $x_c^m = R_c\, x_c^f$, so both parents' childcare move together.

A rise in β_c amplifies paid-work divergence. Since R_c is fixed, a rise in β_c that increases x_c^f by $\delta > 0$ increases x_c^m by $R_c\,\delta < \delta$. When $\psi < 1$, Q_c and Q_d are complements in $W(\cdot,\cdot)$, so an increase in Q_c raises $\partial W/\partial Q_d$ and shifts the marginal benefit of domestic time upward in (A6) for $i = d$. In the joint adjustment alongside a β_c-driven expansion of childcare, domestic hours move in the same direction as Q_d; we denote the mother's first-order increment by $\delta_d > 0$ and the father's by $R_d\,\delta_d$, with $R_d < 1$ as in (A11). From the time constraint:

$$dx_w^f = -\delta - \delta_d - d\ell^f \tag{A13}$$

$$dx_w^m = -R_c\,\delta - R_d\,\delta_d - d\ell^m \tag{A14}$$

Since $R_c, R_d < 1$, the reduction in women's paid work exceeds the reduction in men's paid work (for any equal change in leisure). The paid-work gender gap therefore widens:

$$dx_w^m - dx_w^f = (1 - R_c)\,\delta + (1 - R_d)\,\delta_d + (d\ell^f - d\ell^m) > 0 \tag{A15}$$

where the inequality follows from $R_c, R_d < 1$ and the fact that leisure changes are approximately symmetric across spouses. Crucially, when $R_c = R_d = 1$, the first two terms vanish: β_c raises home production equally for both spouses and paid-work divergence from the home-production margins disappears. This formalises the claim that $\beta_c \uparrow$ widens the paid-work gender gap in the direction observed in the data when $R_c < 1$ and $R_d < 1$, as in our calibration, and not when both ratios equal one so that marginal home production expands in lockstep across spouses.

C.4 Insight 3: Women's return to paid work requires a domestic-work revolution

Time-constraint accounting. From the female time constraint:

$$x_w^f = T - x_c^f - x_d^f - \ell^f. \tag{A16}$$

Over the development path we observe (i) x_c^f rising monotonically (Figure 15, Panel (c) and Insight 2), (ii) ℓ^f approximately constant, and (iii) x_w^f increasing at high levels of development (Figure 15, Panel (a)). Differentiating:

$$\underbrace{dx_w^f}_{>0} = -\underbrace{dx_c^f}_{>0} - dx_d^f - \underbrace{d\ell^f}_{\approx 0}. \tag{A17}$$

For $dx_w^f > 0$ to hold despite $dx_c^f > 0$, it must be that $dx_d^f < -dx_c^f$. In words, mothers' domestic work must fall by more than the increase in their childcare.

Cheaper market childcare cannot close the gap. One candidate mechanism is a fall in the price of market childcare p_c. From (A8), a decline in p_c raises the market-to-parental care ratio m_c/x_c^k with elasticity σ_c. When σ_c is low (parental and market childcare are complements), this substitution is limited: cheaper nurseries or preschools cannot easily replace parental time. Moreover, the cross-spouse ratio (A9) is invariant to p_c, so a decline in the price of market care reduces both parents' childcare proportionally and does not free up maternal time differentially. Empirically, the fact that total parental childcare *rises* throughout the development path is consistent with complementarity between parental and market care inputs.

A productivity revolution in domestic work. To allow for technological change in domestic work, augment the production function with a Hicks-neutral productivity parameter A_d:

$$Q_d = A_d \left[\alpha_d^m (x_d^m)^{\rho_d} + \alpha_d^f (x_d^f)^{\rho_d}\right]^{1/\rho_d}. \tag{A18}$$

An increase in A_d — representing the introduction of household appliances, market substitutes for cooking and cleaning, or improvements in domestic infrastructure — allows the household to maintain Q_d at a given level while reducing time inputs. Letting $Z_d \equiv [\alpha_d^m (x_d^m)^{\rho_d} + \alpha_d^f (x_d^f)^{\rho_d}]^{1/\rho_d}$ so that $Q_d = A_d Z_d$, the FOC for x_d^f becomes:

$$W^{1-\psi}\, \beta_d\, Q_d^{\psi-\rho_d}\, A_d^{\rho_d}\, \alpha_d^f\, (x_d^f)^{\rho_d - 1} = \lambda^f.$$

An increase in A_d raises the left-hand side both directly (through $A_d^{\rho_d}$) and indirectly (through $Q_d^{\psi-\rho_d}$), increasing the effective marginal product of time in domestic work. To restore equality, x_d^f must fall. Through the time constraint (A16), this freed-up time can be reallocated to paid work.

The cross-spouse ratio for domestic work remains governed by (A9) regardless of A_d, so

the productivity gain reduces *both* spouses' domestic work proportionally. However, since $x_d^f \gg x_d^m$ (due to norms $\alpha_d^f/\alpha_d^m \gg 1$), the absolute time savings are much larger for mothers. This is the domestic-work revolution: the mechanism through which rising female labour force participation at high income is achieved, not through a decline in childcare, but through a decline in the time cost of domestic work.