Child Penalty and Maternity Leave: The Case of Colombia♦

Juan Miguel Gallego, Luis Miguel García, Andrés García, Carlos Medina*

Abstract

We provide causal evidence of negative effects of having a first child on formality and formal earnings of women and men. The negative effect on women takes place both in the short and the long run -9.2 pp lower formality rates-. We estimate heterogeneous effects on various covariates, and find that in most cases, women do not recover the levels they had before childbirth. The data allows us to assess the strategic behavior of women and men once they realized they were going to have a baby. Women working in small firms, with high socioeconomic status, and self-employed, are the ones most likely to strategically increase their labor participation in the formal economy to become eligible to the maternity leave benefit. Finally, we find a negative and significant effect on the labor market outcomes when we compare the outcomes of couples having a girl versus a boy: it both increases formality a few months after conception, and reduces both, formality and formal earnings, within the first year after the childbirth. Our evidence points to the existence of liquidity constraints preventing some of the subpopulations considered to respond similarly.

Keywords: *Child Penalty, Gender Gap, Discrimination, Fertility, Maternity Leave, Wage Differentials, Labor Supply*.
JEL Codes: D63, J13, J16, J22, J31, J71

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Recently, there has been an increase in evidence showing the important role that having a first child plays in explaining the gender gap in labor market outcomes such as labor force participation, formality, and earnings. This is observed in both developed economies (Berniell, Berniell, de la Mata, Edo, and Marchionni, 2021; Cortés and Pan, 2023; Kleven, Landais, and Søgaard, 2019; Kleven, Landais, Posch, Steinhauer, and Zweimüller, 2019) and developing economies (Aguilar-Gomez, Arceo-Gomez, and De La Cruz, 2021; Caro, 2023; Querejeta and Bucheli, 2021). The effect of having the first child on these outcomes is referred to as the child penalty. The literature on this topic has evolved from merely providing evidence of its magnitude to exploring potential mechanisms driving it (Andersen and Nix, 2019; Berniell, Berniell, de la Mata, Edo, and Marchionni, 2021; Kleven, Landais, and Søgaard, 2021; Lundborg, Plug, and Würtz, 2024). Quantifying and understanding the child penalty can help us better assess the determinants of the gender gap in each particular labor market, and it could also shed light on potential institutional, cultural, or other interventions aimed at reducing it.

We combine rich household data from a census of the poorest 60 percent of Colombian population, with the census of formal employees, allowing us to construct a panel of individuals covering more than a decade after the childbirth event. We estimate the effects of having a first child on the probability of being formally employed, formal real earnings, and the percentage change of earnings, by means of an event study. We assume that having a child is not something previously planned or anticipated by individuals, and provide evidence supporting this assumption.

We find that women's formality rates and formal real earnings, decrease a few months after childbirth, but it has negligible effects on men. The negative effect on women is larger within the first year after childbirth, but it remains significant event more than a decade later. The probability of being formal in the long run (121 to 132 months after childbirth) is reduced by 9.2 pp, meanwhile their earnings are reduced by COP 136,800, nearly 30% of the baseline earnings of childless women.

Our monthly data allows us to provide evidence that shows the parents behavior around the months of conception and childbirth, in labor market, and assess the strategic behavior of women and men once they realized they were going to have a baby. In particular, we show that formality rates right after conception, respond to institutional incentives conducting individuals nor formally contributing to health insurance, to become eligible for maternity leave by beginning to contribute once they realized they were going to have a baby. This response is particularly large for women than for men, in line with the larger maternity leave they are eligible for.

The estimated heterogeneous effects show that women working in small firms, with high socioeconomic status, and self-employed, the ones most likely to strategically increase their labor participation in the formal economy to become eligible to the maternity leave benefit. Whether women at the baseline had a partner, were more or less educated, or lived in an urban or rural area, does not make any difference at the moment to identify which are the ones who begin to contribute after conception.

We also estimate heterogeneous effects that allows us to quantify the important role that has for women, having a partner at the baseline: when they do, they suffer much larger and permanent loses in their labor market outcomes than when they don't have it, suggesting the potential role of the income effect in the occupational choice between going to the labor market versus dedicating to home production or informal activities that might offer them more flexibility for simultaneously caring their child.

Our study contribute to the empirical literature by assembling both labor market data and household survey data, which allows us to assess heterogeneous effects on a broad range of dimensions, beyond most that is found in the literature which mostly focus merely on a single dimension like education (Berniell, Berniell, de la Mata, Edo and Marchionni, 2021), or wages (Querejeta and Bucheli, 2021). Furthermore, our monthly data allows us to contribute to the literature on maternity leave (Fallon, Mazar and Swiss, 2017; Ruhm, 1996; Schönberg and Ludsteck, 2014; Baker and Milligan, 2008; Tribín, Vargas and Ramírez, 2019), by characterizing month by month, and evaluate, the strategic response of individuals facing institutional incentives related to their eligibility to maternity leave, and by also shedding light on the populations most likely to experiment such response.

The remining or the article begins by describing previous work on this topic, some background about the Colombian gender gap in the labor market, describing the data and the empirical strategy we use, to finally present the results and conclusions.

Related Literature

Economics theory could predict fertility from socioeconomic conditions (Becker, 1960; Galor & Weil, 1993), also, parenthood modifies individuals' expectations in labor market participation and its reserve wages, especially, in the women case (Felfe, 2011; Brown & Taylor, 2008; Pertold-Gebicka, et. al, 2016; Bhalotra, et, al, 2021). However, the analysis of parenthood over labor outcomes is a challenge because the decision of conform a family is potentially endogenous and depends on multiple unobservable factors as skills capacities or future expectations (Angelov, et. al, 2016; Kleven, et. al, 2019a; Bhalotra, et, al, 2021).

In this way, there is a recent international literature that analyze empirically the causal effect of children penalty in the parent´s labor market trajectory. Some conclusions are reported. First, the similar work trends in the previous periods before the parenthood event for both genders (Kleven, et. al, 2019a).

Second, the "child penalty" has a persistent effect in women. In contrast, the effect is close to cero for men. Also, the heterogeneity of the impact in labor market variables depends on factors such as economic sector, income level, education background or public policy arrangements (Angelov, et. al, 2016) & (Abraham, et. al, 2021).

For example, some differences in the results for Scandinavian countries could be explained by governments policies like childcare provision (Kleven, et. al, 2019b). In this way, the gender gap in Sweden on income drops to 28% in the long term (Angelov, et. al, 2016), in Finland goes to 0.25% (Sieppi & Pehkonen, 2019) and 0.19% for the Denmark case (Kleven, et. al, 2019a).

In the same way, other develop economies shows higher levels of long-run gap penalties on earnings respected to Scandinavian countries and a large variance within this group. This is the case of United States with 31%, United Kingdom 44%, Austria 51%, and Germany 61% (Kleven, et. al, 2019b), 0.28 for Spain (Quinto et. al, 2021), and 46% for Netherlands (Rabaté & Rellstab, 2021).

For developed economies, the conclusion is of interest because the penalty can largely respond to the family's decision about the childcare and labor market equilibriums, given the closed of the gap in other variables as education level of parents (Kleven, et. al 2020). This considering recent advances in equity policies in social security for men and women.

Although most of the works have been concentrated in developed economies, some papers study the case of developing countries. (Abraham, et. al, 2021) for example, shows not decrease in women participation after the first childbirth in India. They argue the predominance of informal institutes, employment arrangements before the marriage and childbirth for women and have a highly rural sample dataset as the causes of the findings.

Caro (2023) studies the effects of the first childbirth on men and women's labor market outcomes based on cross sectional data for Colombia…

For Mexico, (Aguilar-Gomez & Arceo-Gomez, 2019) the gender penalty reduces the income of women in the long-term 34%. In Chile, (Berniell, et. al 2021) shows a decrease of 28% in earnings. A similar conclusion in these studies is the role of informal-flexible markets and the return of women to labor partially in the long-term.

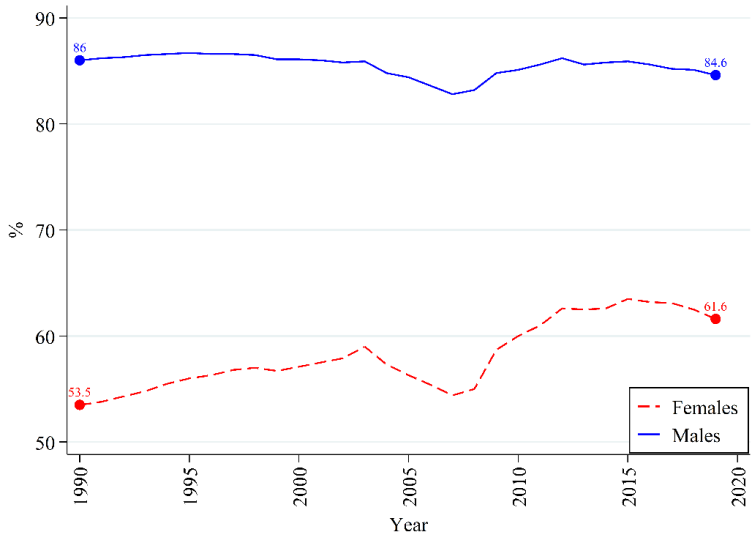
In Colombia, there is a lack of literature that include the causal effect of children penalty in labor market. However, there is a literature that analyze the roll of gender and the gap in the labor market. For example, (Gavis-Aponte, 2010) shows substantial differences in earnings between/within departments, cities, and income levels. (Cepeda-Emiliani & Barón, 2012) exposes variation in the gender gap depending on the education degree level and area, and (Badel & Peña, 2010) find a U-shaped form in the gender gap according to income distribution. Table 1 shows a summary of gender gap for some countries.

Finally, the mentioned investigations are coherent with the gender gap index for Colombia. (World Economic Forum, 2020) shows that gender gap in education attainment and health survival is closed. On the other hand, the economic participation and opportunity is far from an equality scenario. The report shows that in labor force participation, Colombia is located 97 between 153 countries. The wage equality for similar work presents a worst situation, Colombia is settled 122 in this topic.

II. Background on gender gap and context of the labor market in Colombia

As most of the Latin America countries, the Colombian labor market is affected by high levels of informality and unemployment rate, also by a large heterogeneity for these indicators between areas, education, and income levels. From a gender perspective, labor market statistics for women show significant differences comparing to men.

FIGURE 1. LABOR FORCE PARTICIPATION RATE



Source: The World bank

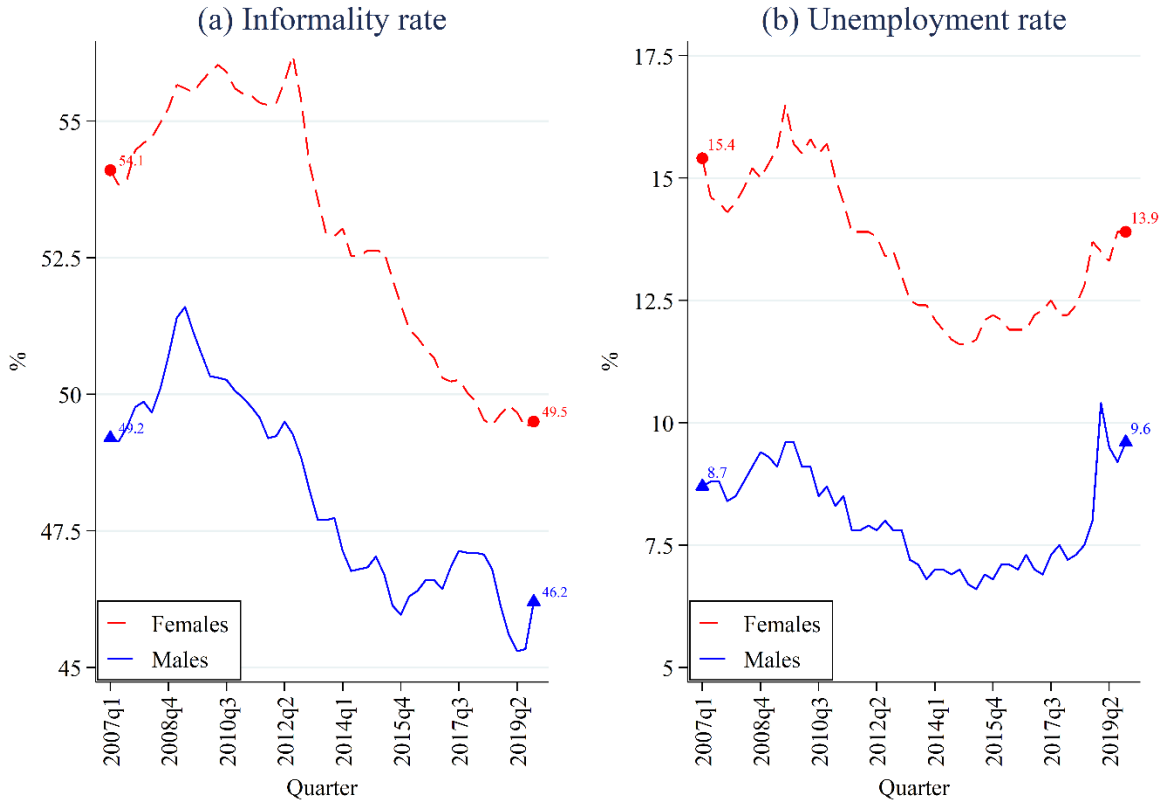
Figure 1 shows in the labor force participation by sex from 1990 to 2019. For women, the positive trend indicates the evolution of women accessing to labor market, for men there is no change in the trajectory. The gap is still considerable, in 1990 it was 32.5% and for 2019, it closed 10% going to 23%. The behavior of these trends has been widely detected in the literature (Aguilar-Gomez & Arceo-Gomez, 2019; Quinto, et. al, 2021).

Figure 2 shows a gender gap of 4.9% and 6.7% at beginning of 2008 for informality and unemployment respectively. At the end of 2019, this difference is reduced 3.3% and 4.3%. Although there is progress in reducing the gender gap, numerous gender institutions such as childcare can explain these differences and their evolution over time (López & Lasso, 2016) (Galván, et. al, 2021).

At the same time, having the status of a formal employee in Colombia implies access to benefits such as the health and pension system, financial system, and unemployment benefits in some cases through family compensation funds (FCF). The FCF offer educational and recreational services to employees and their families. For firms, the effect of formality is being in more productive environments, more access to markets and banking.

In addition, there is progress in terms of laws on gender equality and newborn care in recent years. For example, the maternity license increased the pay weeks from 12 to 14 in 2011 (Law 1468 from 2011) and from 14 to 18 weeks (Law 1822 from 2017). However, it has also been detected in the literature that the increase in maternity leave can have negative effects on probability of unemployment, self-employment, and informality (Tribin & Ramírez, 2019). For fathers, it was legislated a paternity leave granting the father two weeks of remuneration (Law 2114 from 2021).

FIGURE 2. NATIONAL INFORMALITY AND UNEMPLOYMENT RATE



Note: Quarterly Moving Average Seasonally Adjusted.
Source: The National Administrative Department of Statistics (DANE)

III. Data

To assess the effect of childbirth on the gender gap in the labor market we need to know the date men and women's children were born, and we need to observe their labor market outcomes before and after that date. We use two main data sources for our analysis. First, we use the third wave of the *Sistema de Identificación de Potenciales Beneficiarios de Programas Sociales* (SISBEN 3 survey, System for the Identification of Potential Beneficiaries of Social Programs) from the Department of National Planning, which is a census of nearly the 60 percent of the poorest Colombian households. The survey was collected between March 2009 (70 percent in year 2009) and December 2010, and it contains a rich socioeconomic characterization of households that is used to estimate a livings standard score, the Sisben score (Department of National Planning, 2021). The SISBEN 3 allow us to identify couples that cohabit at the moment they were interviewed by the SISBEN 3 between 2009 and 2010, and those that had a childbirth.

Second, we use the *Planilla Integrada de Liquidación de Aportes* (PILA by its acronym in Spanish for Integrated Register of Contributions) dataset. The PILA contains the administrative records of all worker's monthly contributions to health, pensions and labor risks, including their wage, number of days worked, and both the worker's and firms identifiers. The PILA is provided by the Ministry of Health and Social Protection of

Colombia (Ministry of Health, 2018). For each month, we define a worker as "formal", if he/she appears in the PILA in that specific month. We construct the employee panel with the PILA from July 2008 to March 2021. We use as outcomes the sum of real earnings intra-month (COP of December 2018), their percentage change, and their formality status.

Merging these datasets allows us to obtain causal estimates of both, the aggregated effects of having a child, and the heterogeneous effects of having a child by education levels, firm size, socioeconomic status, type of worker, zone of residence, and by whether the person had a partner or not at baseline. We also obtain causal estimates of whether the gender of the child affects the gender gap. Our dataset is formed by 42,356 individuals, 18,670 women and 23,686 men. The data is restricted to couples that cohabit and had a childbirth between October 2009 and December 2010. Once we standardize the data based on the date of conception, we end up with a total of 139 periods, six periods before conception, and 133 since conception.

IV. Empirical Strategy

To estimate the causal effect of childbirth on labor market outcomes for men and women, we estimate an event study. Rather than just using men as controls for women, which under effects on men would allow us to identify only the net effect on the gender gap but not the effect on each gender's labor outcomes, we construct a control group by gender following approach by Kleven, Landais and Søgaard (2019). We then compare, by gender, the gap in our labor outcomes among people that had a child versus those of the same gender who never have a child, at any date *t* with respect to the date immediately before the child was conceived, which is normalized to t = -1. The procedure requires us to assign placebo births to individuals who never had children, based on the observed birth distribution among the population who had children, which we describe in the Appendix. The periods before childbirth allow us to test for the existence of pre-trends in our labor market outcomes, while the periods after childbirth describe the dynamics of the effects of having had a child (Callaway and Sant'Anna, 2021; Sant'Anna and Zhao, 2020; Kleven, et. al, 2019a; Kuziemko, et. al, 2018; Sieppi & Pehkonen, 2019; Aguilar-Gomez & Arceo-Gomez, 2019; Rabaté & Rellstab, 2021; Berniell, et. al 2021). We first model the outcomes for an individual i in month t according to:

$$y_{i\tau} = \alpha_i + \alpha_\tau + \sum_{\substack{-6 \le k \le k^{max} \\ k \neq -1}} \beta_k \cdot Child_{i,\tau-k} + \epsilon_{it} \qquad (1)$$

where $y_{i\tau}$ is our outcome of interest of individual *i* in period τ, α_i and α_τ are individual and period fixed effects, respectively, and ϵ_{it} is the error term. Since our period of frequency is monthly, we define the event date as the month of conception, which is the case when τ - k = 0. This implies that $\tau = k$ in the month of conception, and we exclude $\tau = k$ -1 to normalize the parameters in relation to the period right before conception. The parameters β_k are defined between k = -6 and $k = k^{max}$ = 132. Having statistically insignificant lead coefficients can be interpreted as evidence that the β_k coefficients, our parameters of interest, represent a causal effect of childbirth on $y_{i\tau}$, since they would suggest that treated and control individuals' outcomes were not evolving under different trajectories, neither were they strategically changing their behavior before conception.

Identification is a challenge because often, several individuals' decisions are taken jointly with the decision to have a child, and those decisions are not observed in our context. However, if when we model the maternity decision we control by the age-time dummies, and if we assume that the parenthood decision is not fully determinate by labor market outcomes, it is possible to identify the causal effect of having a child.[1] Furthermore, as argued by Cortés and Pan (2023), the absence of pre-trends in our outcomes before the child's conception, and the overwhelming evidence found by other authors with similar techniques, would suggest that the estimated effects we can obtain by using a model like the one expressed in (1) would be causal.

In our data, individuals conceive their children at different point in time. Such a staggered design poses additional challenges which we address by implementing the Callaway and Sant'Anna (2021) estimator, which allows the inclusion in the control group of not-yet treated individuals, the existence of heterogeneity since the time of treatment, and also, allows the use of control variables to gain power and comparability between the treatment and control groups (Roth, Sant'Anna and Poe, 2023).

IV. Results

Before expose the estimations, we show empirical evidence for men and women in labor market outcomes around conception and childbirth. Also, we show the evolution of these in the long term.

A. *Aggregated Effects of Childbirth on Formal Labor Outcomes*

In this section we present the effects of having a child on the probability of being formal, real earnings, and the percentage change in earnings

Figure 3 shows the effect of the first childbirth on women's formality rates in Panel A, and on real earnings (left right *y*-axis) and the percentage change in earnings (righ *y*-axis) in Panel B. First of all, notice that there is no pre-trend in any of the three estimations, which according to our previous discussion, implies the empirical absence of any anticipation effect or previous significant relative changes in our outcomes prior to the child's conception, which suggests that any potential presence of endogenous responses would have a magnitude unlikely to explain the sharp fluctuations observed in our outcomes right after the time of conception, reassuring our interpretation of our estimated coefficients as causal.

Secondly, right after the date of conception, the probability of being a formal employee suddenly begins to constantly increase, up to a level of more than five percentage points higher than right before conception (left-most vertical shaded line), and it begins to constantly decrease right after the child's birthdate (right-most vertical shaded line), and until

[1] (Kleven, et. al, 2019a) considered differents estretegies as a differences-in-differences model and IV specification using as instrument the mixed sex of the previous two child, they showed that (3) could perform well in the way to estimate the causal effect of gender gap and labor market. This methodology has been used extensively in the literature to calculate the long-run effect.

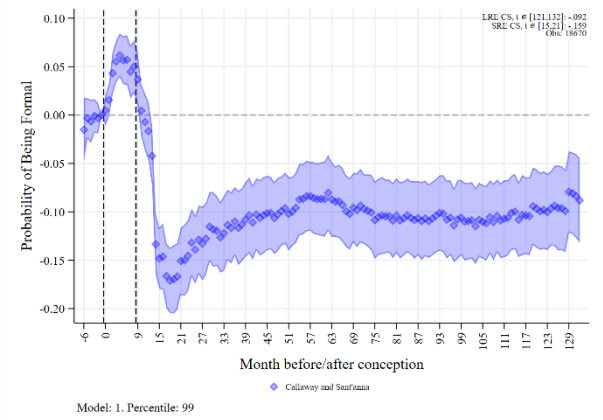
it attains an average level of -0.159 between periods 15 and 21, which we denote the short run effect (SRE) in the levels at the top-right of the figure in Pannel A. Ten years after conception, there is still a negative and significant average effect of -0.092 in the probability of being formal, between periods 121 and 132 after conception, which we denote the long run effect (LRE) in the levels at the top-right of the figure in Pannel A.[2]

Figure C1 shows the estimates for men, for which we only find a positive and marginally significant effect of child conception in the moment of childbirth, although of about half as large as the one found for women in that period.

The shapes of the event study estimates for the probability of being a formal employee, real earnings, and the percentage change in earnings, illustrated in Figure C1, are very similar.

For women, real earnings increase up to more than COP 50,000 six months after conception, while those of men increase half as much by the child's birthdate (Figure 3). These magnitudes represent increase in the earnings gap of about 50 and 25 percent for women and men respectively. Nonetheless, just less than a year after childbirth, the real earnings of mother versus those women that did not have children, become COP 136,800 smaller than at the baseline, representing a reduction in the baseline earnings gap of 117.4%.[3] In the long run (months [121 to 132]), real earnings for women are still COP 78,500 lower than before conception.

A. Event study estimates on formality



B. Event study estimates on earnings

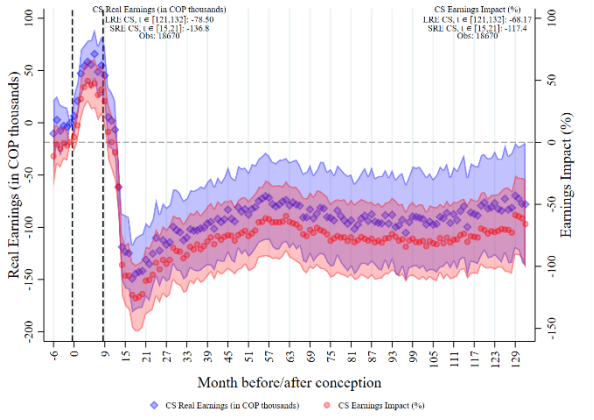


FIGURE 3. IMPACT OF THE FIRST CHILDBIRTH ON FORMAL LABOR OUTCOMES: WOMEN

[2] Figure C1 presents the results of estimating equation (1) by both Two-Way Fixed Effect (TWFE) and by Callaway and Sant'Anna (2021) (CS) for each of our three outcomes, and for both women and men. In both cases the estimated coefficients obtained by CS have smaller absolute magnitudes and are obtained with much more precision than those obtained by TWFE, even though both describe similar patterns. Since TWFE limitations related to the possibility of comparing treated individuals also with already treated individuals, under heterogeneous treatment effects, might lead to misleading inferences, we continue presenting only the CS estimates for both women and men.

[3] COP 100,000 are equivalent to 13% of the 2018 minimum wage, or USD 33.82 at the average exchange rate of that year.

Notes: Panels A and B show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Panel A shows the effect on the probability of being a formal employee while panel B shows the effect on formal real (inflation-adjusted) earnings (left hand *y*-axis), and on the percentage change in earnings (right hand *y*-axis). Number of observations: 18,670 individuals × 139 months. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

B. *The Strategic Response of Individuals after Conception*

The response of women, and that of men (although of much smaller magnitude) right after conception, can be taken as evidence of their strategically responding to their new information of having become pregnant. Individuals seem to have sought to contribute to become eligible to the three months of maternity license (Law 755 of 2002).

Colombian legislation gives working women contributing to health, regardless of whether they are employed or self-employed, the right to have a maternity license compensated at the full wage she was receiving in the moment of conception, provided they had contributed to the health system all the months of their pregnancy, or otherwise, for an amount proportional to the number of months they contributed.[4]

Although the length of the maternity license varied during the analyzed period, the relevant length of the license for our population under study was 12 weeks, and it was in place until June 2011.[5] Given this legal framework, women who in the moment of conception, were not enrolled in the health system, had the incentives to begin to contribute immediately after they became aware of their pregnancy.

On the other hand, right after the maternity license expires, which takes place three months after childbirth, the only incentive women have for keeping contributing to their health insurance, would be to guarantee their access to health services. Nonetheless, they could also get that access if they become inactive workers and get enrolled in health insurance as beneficiaries of their spouses whenever their spouses are either employed, or contributing as self-employed. This might help explain why in the three months after childbirth, women's formality rates attain their baseline levels, they become lower in their fourth month, plummets between months fourth and fifth, and then continues reducing during the subsequent months, until they reach a level that is nearly 15.9 pp below the one they had in the baseline ($k = -1$).

A similar response is observed for men, although of a much smaller magnitude, since legislation in force in the period individuals in our sample had their children, allowed men to enjoy four days of paternity license (eight days if both, he, and his spouse, contributed to health insurance), so there was also an incentive for men to contribute to health insurance if

[4] See Sentences T-223 of 2008 and T-576 of 2007.

[5] Law 755 of 2002. The length of the maternity license was increased to 14 weeks in June 2011, and they became 18 weeks in January 2017.

they were not already doing it, and for both men and women to do it simultaneously, even though in the case of men that incentive was much smaller. The results are consistent with a couple splitting tasks, with men working harder after childbirth while women staying at home taking care of the newborn, as it is found by Caro (2023).

The evidence of this strategic response by individuals is additional evidence of the largely unexpected nature of the timing of conception, since under the anticipation scenario, most individuals could have began to contribute to health insurance to become eligible for the three months maternity leave. This evidence adds to the lack of pre-trends, as evidence of our parameters identifying a causal effect.

C. *Heterogeneous Effects*

In this session we estimate heterogenous effects of the first childbirth on the labor market outcomes of women and men. We split the sample based on seven variables: firm size (more than 5 employees vs 5 or less), socioeconomic status (*high* -socioeconomic stratum 1 and less than the median of the Sisben score, or socioeconomic stratum 2- vs *low* -more than the median of the Sisben score and in socioeconomic stratum 2, or socioeconomic stratum 3 or higher-), worker type (self-employed vs employee), marital status (single vs with partner), education1 (secondary or less vs higher or more), education2 (grade 10 or less vs more than grade 10), area of residency (urban vs rural).[6]

Child penalty by firm size

We begin assessing the effects of having a child on labor market outcomes, by firms size, splitting the sample between large (more than 5 employes) and small firms (5 employees or less). The estimated effects of having a child on the probability of being a formal worker are shown in Panel A of Figure 4. Only individuals working for small firms experience the strategic response right after conception and before childbirth, and only they experience negative significant effects that last all throughout the analyzed period. In general, the estimated effects on individuals working in large vs small firms in statistically similar all through the analyzed period, although the estimates for individuals working in small firms have much lower power since they are obtained with about a quarter of the observations.

Socioeconomic status

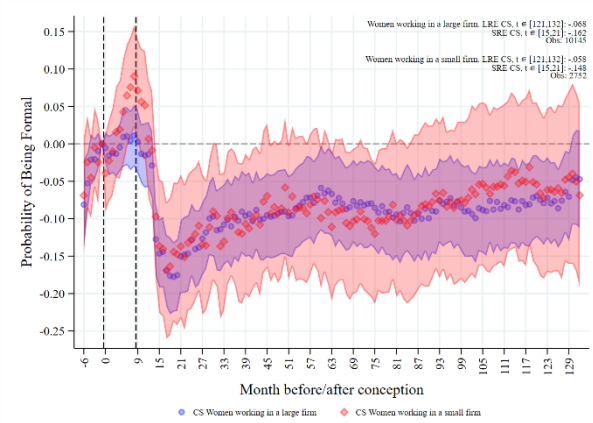
Here we split the sample between individuals considered to belong to a *high* vs a *low* socioeconomic status. Individuals belong to a *high* status, is he or she belongs to the socioeconomic stratum 1 and his Sisben score is below the sample median, or if he belongs to the socioeconomic stratum 2. They belong to a *low* socioeconomic status if her or his

[6] Residencial areas in Colombia are split into six socioeconomic strata, which have been traditionally used to target subsidies to the provision of residential public utility services (electricity, piped water, natural gas). These strata are based on both the housings and characteristics and their amenities. The lowest socioeconomic stratum is de first and the highest is the sixth. Since our sample is constrained to people included in the Sisben survey, that is, about the 60% poorest population of the country, it households belong mostly to socioeconomic strata 1 to 3.

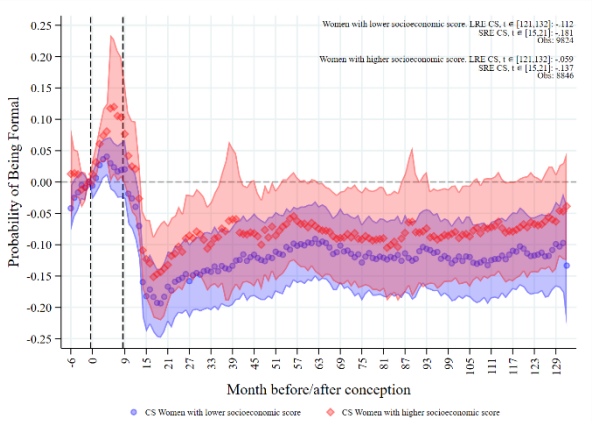
Sisben score is higher than the sample median and also belongs to socioeconomic stratum 2, or if belongs to socioeconomic stratum 3 or higher.

The estimated effects of having a child on the probability of being a formal worker by socioeconomic status are shown in Panel B of Figure 4. Only individuals having *high* socioeconomic status working experience the strategic response right after conception and before childbirth, although only those in *low* socioeconomic status experience negative significant effects that last all throughout the analyzed period, even though the number of observation used in both estimations are similar, implying that only the most vulnerable population is prevented from catching up to their baseline formality levels.

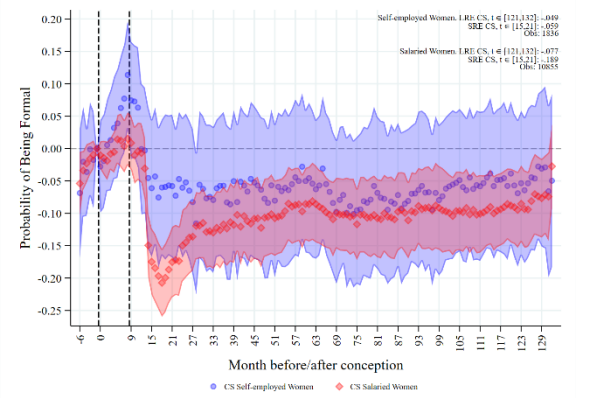
A. Firm size



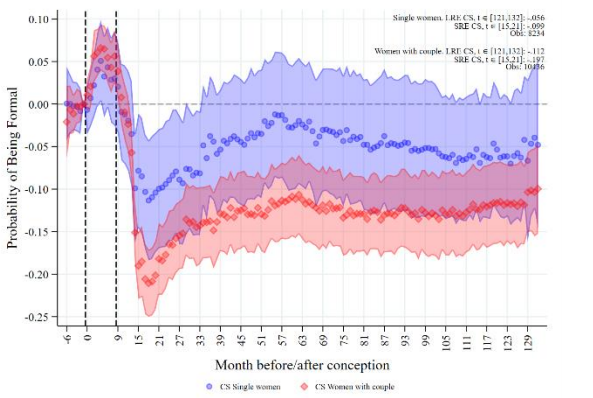
B. Socioeconomic status



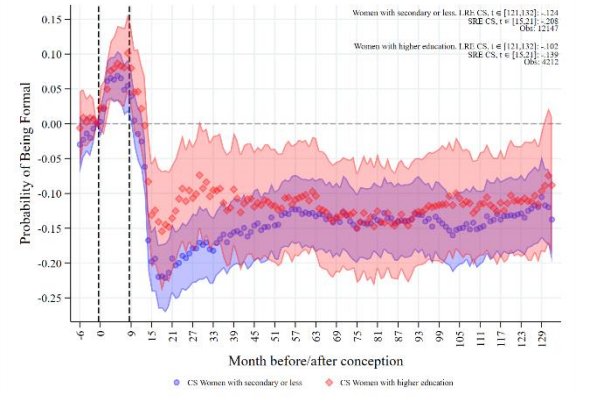
C. Worker type



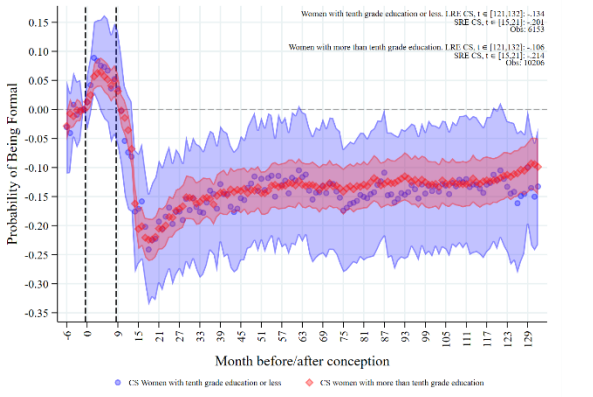
D. Marital status



E. Secondary vs higher education



F. Grade 10 or less vs more



G. Living in urban vs rural area

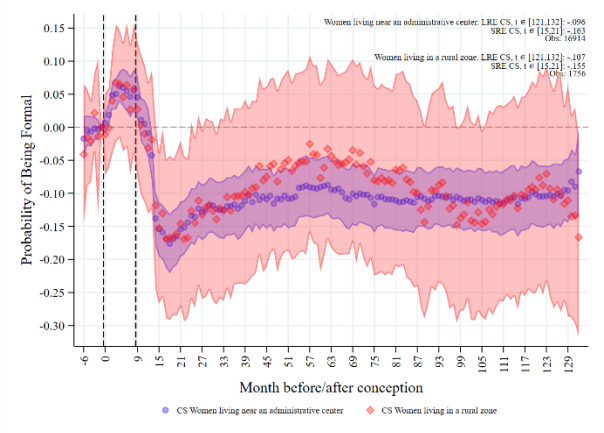


FIGURE 4. IMPACT OF THE FIRST CHILDBIRTH ON THE PROBABILITY OF BEING A FORMAL EMPLOYEE: HETEROGENEOUS EFFECTS FOR WOMEN

Notes: Panels A to G show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

Worker type

We now split the sample between self-employed individuals and salaried workers. The estimated effects of having a child on the probability of being a formal worker by these two worker types are shown in Panel C of Figure 4. Only self-employed individuals experience the strategic response right after conception and before childbirth, although only those salaried workers experience negative and significant effects that last all throughout the analyzed period. In this case though, the number of self-employed individuals is much smaller, substantially limiting the power of the estimation.

Marital status

We assess the importance of women having a partner by splitting the sample between single women vs women with partner in the baseline. The estimated effects of having a child on the probability of being a formal worker by these two populations are shown in Panel D of Figure 4. Only women with a partner experience the strategic response right after conception and before childbirth, and these are also the only ones that experience negative and significant effects that last all throughout the analyzed period, despite the similar sample size to the group of single women. This result provides evidence suggesting the very important role the household conformation has at the moment it assesses its individual's assignment of labor to the market vs home production.

Child penalty by educational level

In this session we split our evaluation sample in two groups. First, we split the sample between those individuals with a maximum of high school degree, and those with at least some higher education. Secondly, we split the sample between those individuals with a maximum of tenth grade, and those with at least eleventh grade, that is, with at least complete secondary education. The estimates for the first education groups of the effect of having a child on the probability of being a formal worker are shown in Panel E, and those for the second education groups in Panel F, of Figure 4. In both panels E and F, we observe the strategic response of women beginning to contribute to health once they realized they are pregnant, and in both cases, there are negative and significant effects on the earnings all throughout the analyzed period. The negative effect is much higher for women that attain up to complete secondary education: their probability of being formal worker decreases by somewhat more than 20 percent, while that of women with at least some higher education decreases only 14 percent. That difference in the estimated effects between these two populations reduces significantly after ten years, to just 2 to 3 pp. Similar patterns are found for the estimated effects of childbirth on real earnings and it percentage change, which are presented in panel B and C of Figure C3.

This result shows the importance of women achieving educational attainment beyond secondary education. Colombia recently achieved gender parity in higher education enrollment rates. In addition, in 2019, 52.7% of people in higher education were women, and the country reached the first place shared with other countries in The Global Gender Gap Index for "Educational Attainment" (National Ministry of Education of Colombia[7], and World Economic Forum, 2019).

Finally, in a similar exercise for the chilean case, (Berniell, et. al, 2021) shows a long run gender gap related to childbirth of 13% for more educated couples and 27% for less educated. The mechanism discused about the differences in the results by education levels is related to the opportunity cost of changing workplaces, the needed of flexible work, and social protection benefits (Berniell, et. al, 2020). Other works with comparable results are (Rabaté & Rellstab, 2021) for Netherlands, and for a wide of countries (Berniell, et. al, 2020).

Area of residence

We final assess the importance of women living in a urban vs a rural area. The estimated effects of having a child on the probability of being a formal worker by these two populations are shown in Panel G of Figure 4. Most women in our sample live in an urban area, and thus, not surprisingly, is that population the one both experiencing the strategic response right after conception and before childbirth and having a negative and significant effect that last all throughout the analyzed period.

C. *The role of the Gender of the child*

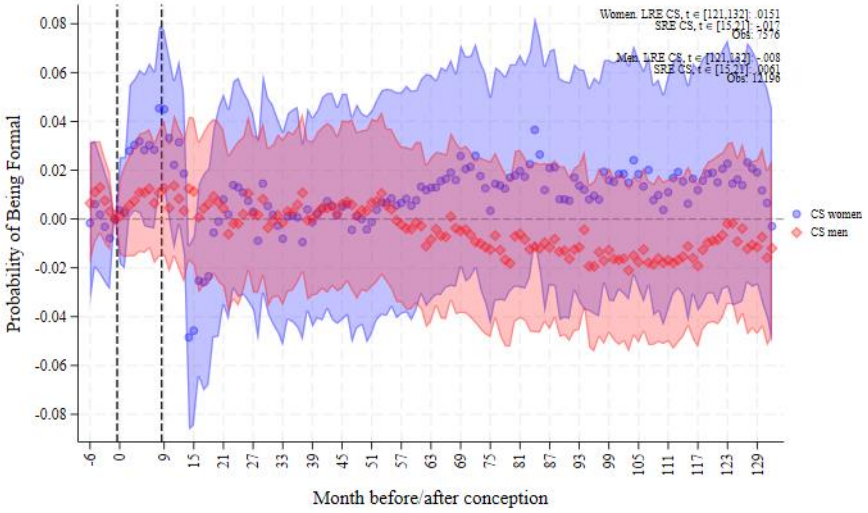
In this section we explore the role of the gender of the child on the gender gap

[7] https://hecaa.mineducacion.gov.co/consultaspublicas/content/poblacional/index.jsf

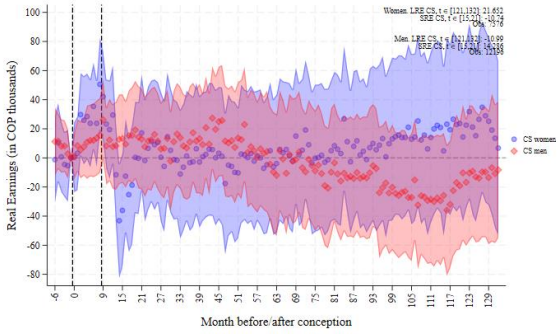
$$y_{i\tau} = \alpha_i + \alpha_\tau + \sum_{\substack{-6 \le k \le k^{max} \\ k \neq -1}} \beta_k \cdot Child_{i,\tau-k} + \sum_{\substack{-6 \le k \le k^{max} \\ k \neq -1}} \tilde{\beta}_k \cdot Child_{i,\tau-k} \cdot gender_Child_i + \epsilon_{it} \quad (2)$$

Where $gender_child_i$ is the gender of the child of individual i. The parameters of interest in (2) are the coefficients $\tilde{\beta}_k$. The results of estimating equation (2) are presented in Figure 5 for both women and men. While there is no significant effect of the gender of the child on labor market outcomes for men, there is a consistent reduction in the probability of being a formal worker, real earnings and the percentage decrease in earnings, during the following 12 months after childbirth. We find that women giving birth a girl are 6.1 percent less likely to be a formal worker between months 15 and 21 after conception (Panel A). In that period, their real earnings are reduced an average of COP 14,286 (Panel B), which represents a 5.6 percent reduction in their earnings (Panel C).

A. Probability of being a formal worker



B. Formal real earnings



C. Percentage change in formal earnings .

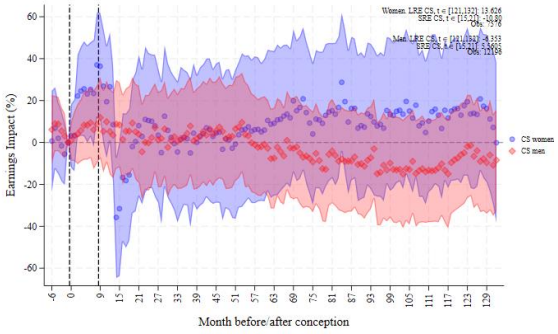


FIGURE 5. IMPACT OF THE FIRST CHILDBIRTH ON FORMAL LABOR MARKET OUTCOMES: WOMEN AND MEN

Notes: Panels A to C show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained

using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

We also estimate heterogeneous effects of the gender of the child on our labor market outcomes according to several baseline covariates. Figure 6 shows the results of estimating equation (2) using only the sample of women that have children, and after conditioning for the baseline characteristics described in each of the A to F panels. The figure only includes those the characteristics that made a difference on whether the gender of a child had an impact on the probability of women being formal workers.

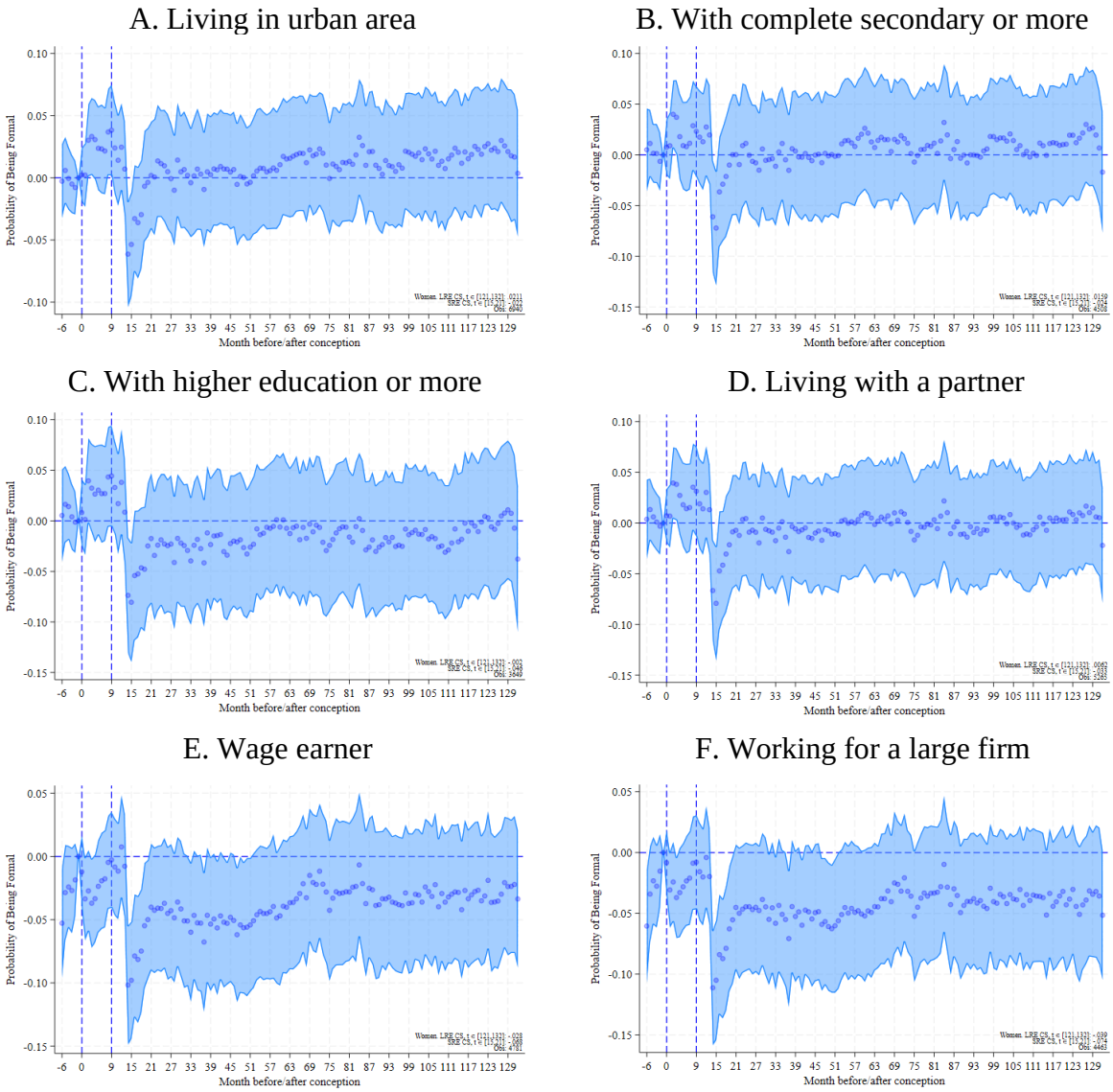


FIGURE 6. HETEROGENEOUS EFFECTS OF HAVING A GIRL VERSUS A BOY AS A FIRST CHILD ON THE PROBABILITY OF BEING A FORMAL WORKER: WOMEN

Notes: Panels A to F show the effect of having a girl versus a boy as a first child from 6 months before conception (the *event*) to 132 months after conception, on the probability of being a formal worker (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

Panels A to D of Figure 6 show characteristics that contribute to the overall effects shown in Figure 5, on the increase in formality a few months after conceptions, and on its reduction about six months after birth. Among our population, which only includes about 60% of the poorest population, being somewhat better off, meaning living in an urban versus rural area, having higher education or more, or just complete secondary or more, and living with a partner, allows women to both strategically contribute to health right after conception care in order to achieve the benefit of maternity license, and reduce their formality rates around six months after childbirth, whenever they had a girl versus a boy. In addition, the ones which could be considered as being more formal among the formal workers, i.e., those who are wage earners or work for large firms (panels E and F), are twice as likely to reduce their formality rates six months after childbirth than those in the previous categories described in panels A to D. These women nonetheless are much more likely to have already been contributing to health care, and that is why there is no strategic increase in their formality rates right after conception. It is not evident why there is a differential response according to the gender of the first childbirth, it might be due to cultural reasons that aim to relatively protect more the girls than the boys. Conditional on all populations considered had the same cultural trait, and to the extent that those relatively better off in our sample are the ones more likely to make an effort to contribute right after conception to become eligible for maternity leave, and later, take more time off to take care of their girls versus their boys, it would become plausible the potential existence of liquidity constraints that would not allow the other populations to act likewise.

V. Discussion and conclusions

We provide causal evidence of negative effects of having a first child on the labor market outcomes of women, and to a much lower extent, of men. The negative effect on women takes place both in short and the long run, and they represent sizable magnitudes on the probability of being a formal worker, their formal real earnings, and their percentage change in earnings. In some cases, the gap is reduced only within the following year after childbirth, but in most cases, women did not recover the levels they had before the conception. The gap for probability of being formal in the long run (121 to 132 months after childbirth) is reduced by 9.2 pp, meanwhile their earnings are reduced COP 136,800, nearly 30% of the baseline earnings of childless women (see Table B.2).

Ours is one of the first article in this literature estimating monthly effects (See also Aguilar-Gomez, Arceo-Gomez, and De la Cruz Toledo, 2020; and Querejeta and Bucheli, 2021). So, it provides evidence that show the parents behavior around the months of conception and childbirth in labor market. The monthly periodicity of the data allows us to assess the strategic behavior of women and men once they realized they were going to have a baby. Colombians not formally contributing to the Contributive Regime of health insurance, who

are not allowed to apply for a maternity leave, begin to contribute once they realized they were going to have a baby. This response is particularly large for women, but it is also significant although of a much smaller magnitude for men, who also can be eligible to much fewer days of maternity leave. The correspondence between the differences in the magnitude of the eligible days for maternity leave between women and men and their strategic response, ae in line with our hypothesized response to those incentives.

The estimated heterogeneous effects show that women working in small firms, with high socioeconomic status, and self-employed, the ones most likely to strategically increase their labor participation in the formal economy to become eligible to the maternity leave benefit. Whether women at the baseline had a partner, were more or less educated, or lived in an urban or rural area, does not make any difference at the moment to identify which are the ones who begin to contribute after conception.

Finally, we find a negative and significant effect when the child is a girl, on the labor market outcomes: it reduces both formality and formal earnings within the first year after the childbirth. There might be cultural reasons why the population under study aims to relatively protect more their girls than their boys, and we argue that the evidence presented points to the existence of liquidity constraints preventing some of the subpopulations considered to respond similarly.

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Appendix

A. Estimations using counterfactual

In this part, we present the main estimates in percentages relative to non-having children as commonly showed in child-birth related gender gap literature (Kleven, et. al, 2019a; Aguilar-Gomez & Arceo-Gomez, 2019; Berniell, et. al, 2020). Thus, we convert the estimations from (1) into percentages with the next expression:

$$p_\tau = \frac{\hat{\beta}_\tau}{\mathrm{E}[\tilde{y}_{it}|\tau]} \quad (2)$$

By calculating the contrafactual of not having children:

$$\tilde{y}_{it} = \sum_{\mathrm{a}} \gamma_{\mathrm{a}} \cdot \mathbb{1}[a = Age_{it}] + \hat{\delta}_{it} + \hat{\theta}_{it}$$

Consequently, $E[\tilde{y}_{it}|\tau]$ represents the predicted outcomes mean conditioned to event time τ of the contrafactual.

B. Literature review and descriptive statistics

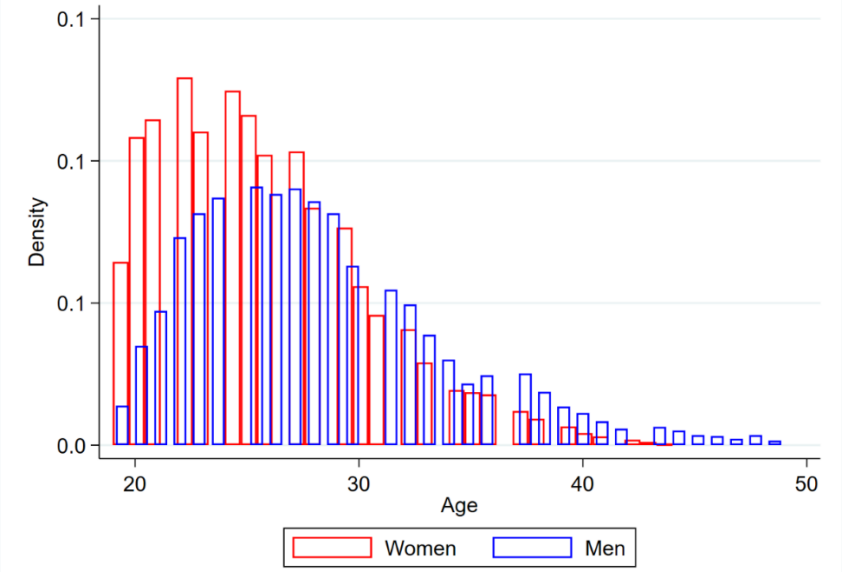
Table B.1. Literature Review

Country	**Coverage years**	**Gender gap after childbirth (%)**				**Authors**
		Earnings		Labor participation		
		t=5	t=10	t=5	t=10	
Denmark	1985-2003	21	19	11	11	Kleven, et. al, 2019 a
Sweden	1997-2011	31	27	7	5	Kleven, et. al, 2019 b
Germany	1989-2005	63	61	34	30	
Austria	1985-2007	58	56	31	27	
Finland	1987-2017	9	2	12	25	Sieppi & Pehkonen, 2019
Spain	2005 - 2018	26	28	26	29	de Quinto, et. al, 2021
United States	Five Cohorts, from 1975 to 2016	34	39			Cortés & Pan, 2020
Netherlands	1999 2016	43		12		Rabaté & Rellstab, 2021
Chile	1997–2016	30	28	26	19	Berniell, et. al, 2021
Sample mean		**35**	**33**	**20**	**21**	

Table B.2. Descriptive statistics at $k = -1$

	Women		Men	
	With children	**Childless**	**With children**	**Childless**
Formality - mean	0.633	0.561	0.554	0.567
	(0.482)	(0.4963)	(0.497)	(.495)
Real Earnings (in COP thousands) - mean	607.498	556.613	541.198	551.42
	(696.418)	(745.628)	(752.396)	(735.587)
Earnings Impact (%) - mean	468.097	416.288	405.955	416.29
	(359.97)	(371.222)	(369.397)	(368.73)
Total (obs)	8,651	12,901	14,036	13,305
Rural (obs)	686	1240	2080	1824
Urban (obs)	7,965	11,661	11,956	11,481
Tenth grade education or less (obs)	784	6,007	5,453	7,476
More than tenth grade (obs)	5,222	6,894	8,373	5,829
Secondary education or less	3,908	9,370	11,879	11,538
Higher education	2,098	3,531	1,947	1,767
Lower socioeconomic status (obs)	3,702	7,151	8,849	8,309
Higher socioeconomic status (obs)	4,949	5,750	5,187	4,996
Small firm (obs)	1,279	1,860	8,628	8,096
Large firm (obs)	5,252	6,906	1,240	1,298
Salaried (obs)	5,623	4,234	8,947	8,377
Self employed (obs)	790	1,317	836	965
Single (obs)	2,645	6,987	210	5,938
With couple (obs)	6,006	5,914	13,826	7,367

Figure B.3. Age distribution before conception ($\tau = -1$)



C Construction of the control group

In this section, we describe the procedure followed to construct the control group used to estimate, for men and women, the causal effect of having a child on labor market outcomes. We adapt to our data the procedure proposed by Kleven, et. al (2019a) in their appendix B.2. Their main idea is selecting a control group of parents that did not have a child, and use their characteristics so that they could be included in the control group of the individuals who had one child (treated group). Also, we based our analysis imputing a placebo birthdate for the contrafactual or control group using the distribution of birthdates from the treated group. After that, we get the causal effect using a DD Event Study.

As Kleven et. al (2019a), our sources present some challenges to create the control group related with truncated information. That is, we have access to the SISBEN survey, which was collected between March 2009 and December 2010, for the rest of years, we only have the individual's labor market variables that are contained in the PILA, but not its households' characteristics.[8] We observe the individuals' socioeconomic characteristics in the month they were interviewed by the SISBEN 3 survey, and the birth dates of the children living in their households at that moment.

The first part of the process to get the control group is the assignment of the placebo childbirth dates based on the distribution of childbirth dates of the treated group. We split the population in cohorts as Kleven et. al (2019a), to increase the accuracy on its creation. The split the sample in two groups according to their education levels, those who have 10 or less years of education, and those with more than 10 years of education. Then, we impute the distribution of birthdates for each cohort c, sex s, and polled month m with a random uniform distribution $U_{c,s,m}(x; a, m)$, where a is October 2009. We require that $x <= m$, to make sure that nobody has a placebo childbirth date after the month he/she is polled.

The placebo dates are then assigned to the control group from the estimated distribution $\widehat{U}_{c,s,m}$, using the childbirth dates of the treated group. We select individuals who were between 40 and 60 years of age in the moment they were surveyed, based on their and their couple's covariates. Given that only a small proportion of people with that age or more have a child, we use this population to train a linear probability model to predict the probability of ever having a child for the truncated population (less than 40 years old). we also estimate exercise for two cohorts by sex. In this way, equation (1) represents the LPM estimated:

$$P[k_{isc} = 0] = \boldsymbol{X}'\beta$$

Where $k_{isc} = 0$ is a dummy for zero lifetime fertility, i is the individual index, s is the sex index, and c is the educational cohort. At the same time, $\boldsymbol{X}$ is the vector of covariables that include age of the individuals and their spouses in October 2010, their and their spouses' income, the SISBEN socioeconomic score, their spouses' education, the state of residence, and the zone of residence (rural or urban).[9] Consequently, we rank individuals on their estimated probability of having a child such that $\hat{P}_{sc} \leq \frac{n_{sc}}{N_{sc}}$, where n_{sn} is the number of

[8] We have access to SISBEN surveys from July 2009 to December 2010, but we considered the time lapse after October 2010 to have six periods of pre-trend.

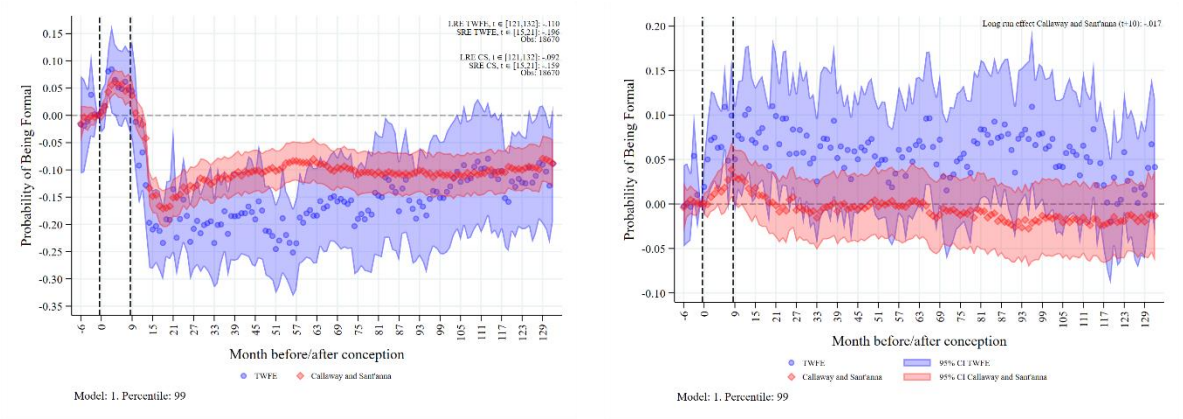
[9] The score is calculated by the Ministry of Social Protection of Colombia with SISBEN households' surveys mainly with variables associated with the household conditions and the access to public services.

individuals with low education c with more than 40 years old at the fixed month, and N_{sc} is the total of controls.

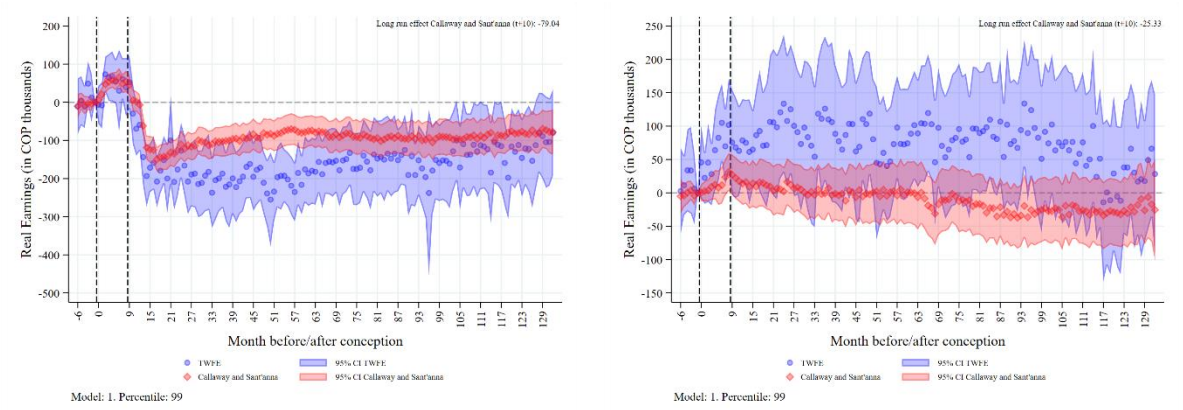
With this setup, we generate a control group that potentially match in its observable characteristics to the ones who has a child in the observed months. Also, the assignment of the placebo births by surveyed months, allows us to prevent estimations with pre-trend before the event, and get the causal effect of having the first child on the worker's labor market outcomes.

Panel A. Event study estimates on formality

(i) Women (ii) Men



Panel B. Event study estimates on formal real earnings



Panel C. Event study estimates on formal earnings: percentage change

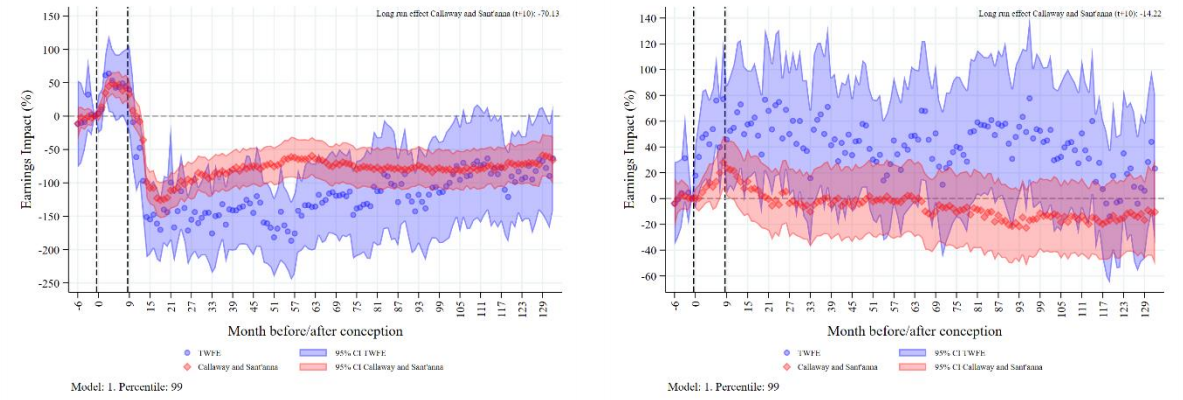
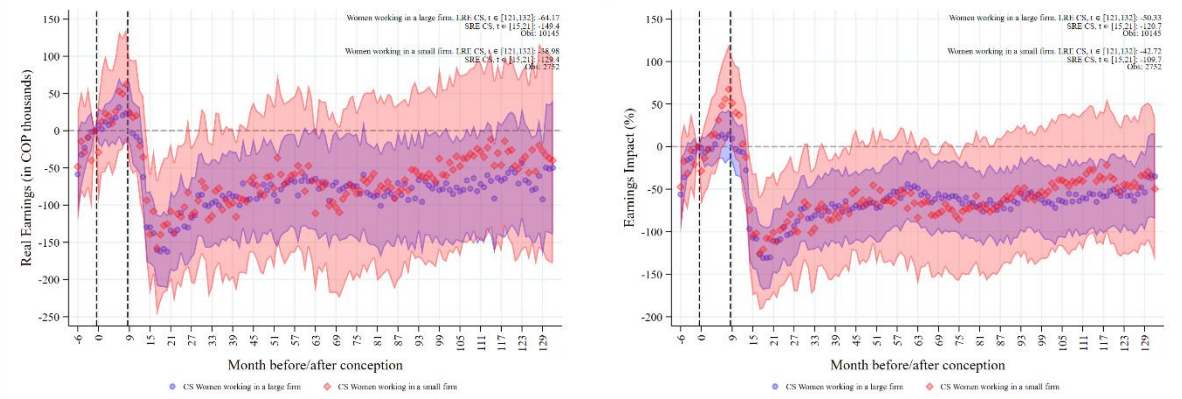


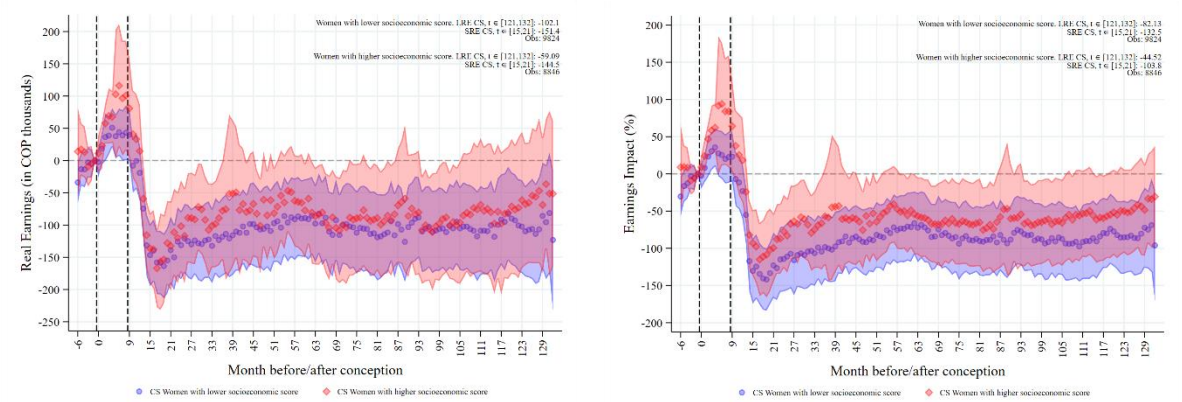
FIGURE C.1. IMPACT OF FIRST CHILDBIRTH ON FORMAL LABOR OUTCOMES: WOMEN AND MEN

Notes: Panels A and B show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations: 18,670 individuals × 139 months. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

Panel A. Firm size



Panel B. Socioeconomic status



Panel C. Worker type

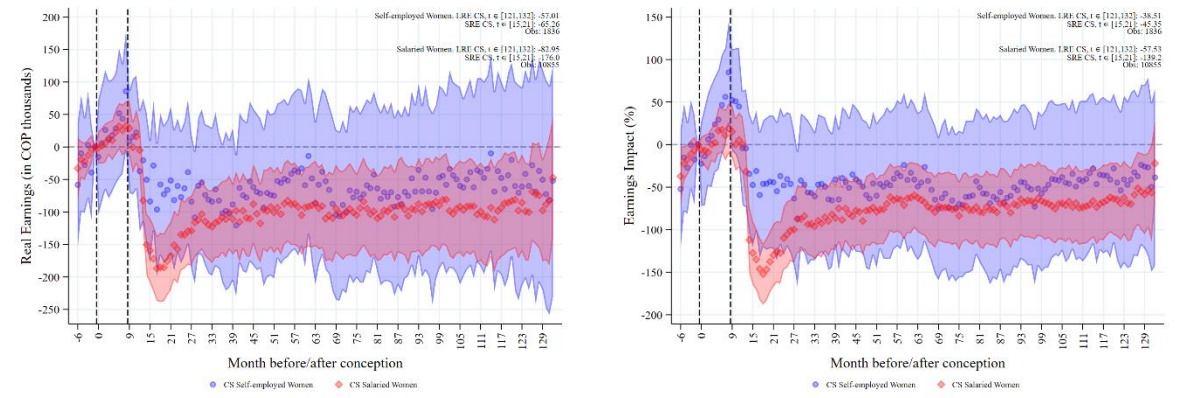
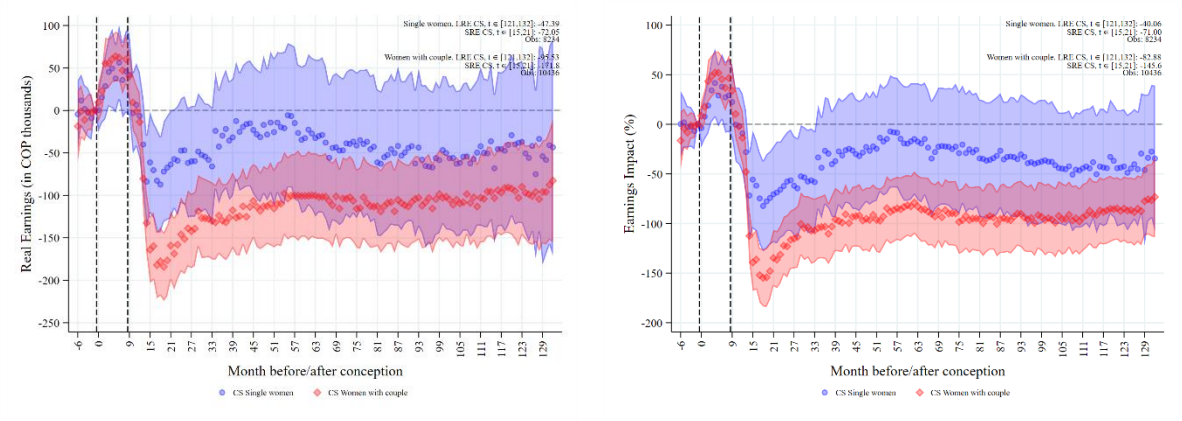


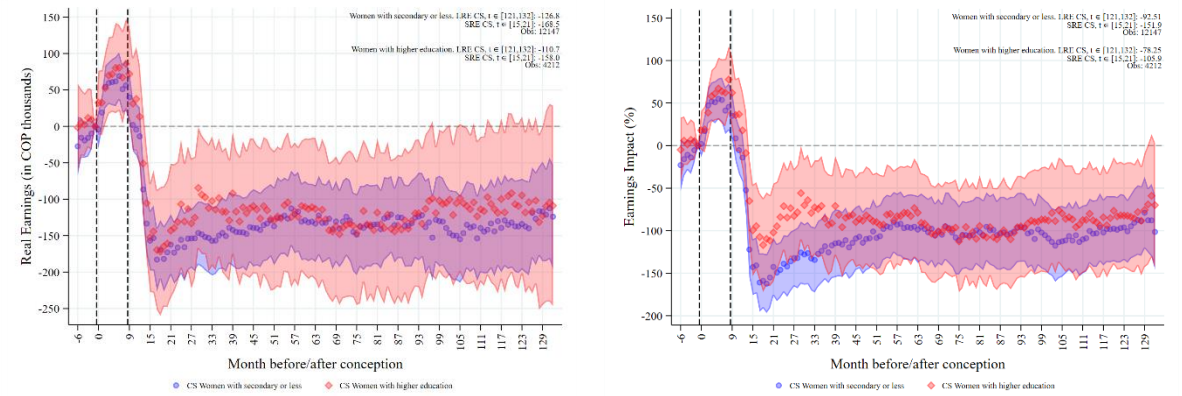
FIGURE C2. IMPACT OF THE FIRST CHILDBIRTH ON FORMAL EARNINGS: HETEROGENEOUS EFFECTS FOR WOMEN

Notes: Panels A to H show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

Panel A. Marital status



Panel B. Panel Secondary vs higher education



Panel C. Grade 10 or less vs more

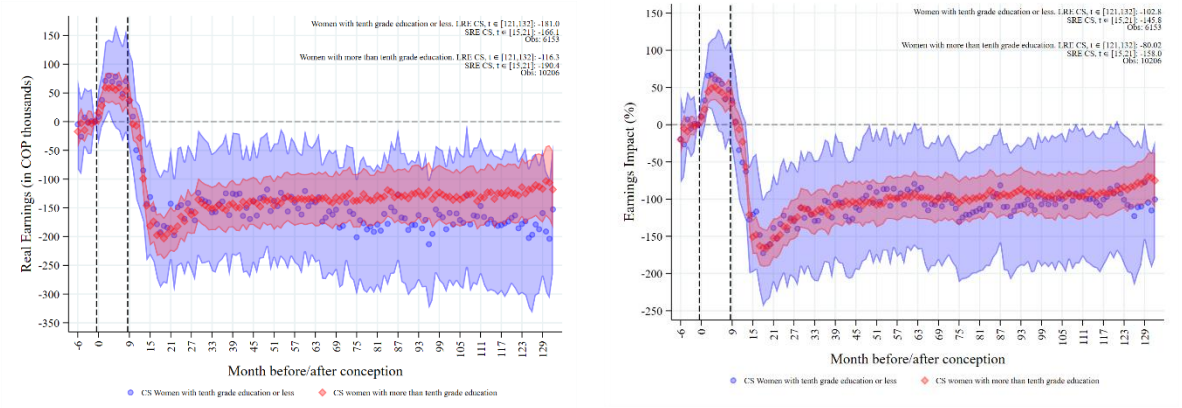


FIGURE C3. IMPACT OF THE FIRST CHILDBIRTH ON FORMAL EARNINGS: HETEROGENEOUS EFFECTS FOR WOMEN

Notes: Panels A to H show the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.

Panel A. Living in urban vs rural area

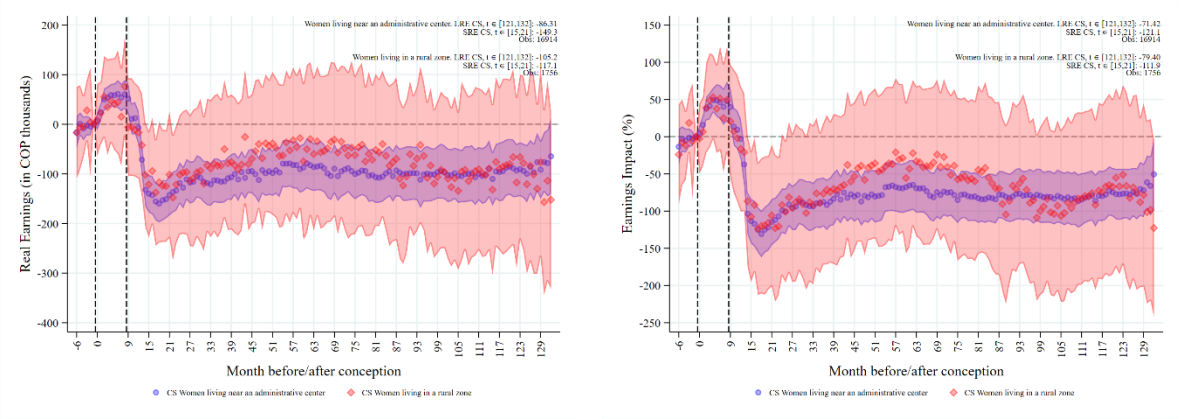


FIGURE C4. IMPACT OF THE FIRST CHILDBIRTH ON FORMAL EARNINGS: HETEROGENEOUS EFFECTS FOR WOMEN

Notes: Panel A shows the effect of having the first child from 6 months before conception (the *event*) to 132 months after conception, on formal outcomes (trimming earnings at the 99 percent). Number of observations by group are reported in each graph. Callaway and Sant'Anna doubly robust estimates obtained using both never treated and not yet treated individuals, and using as control variables the age, the state of residence, and the Sisben level. The regressions include individual and year fixed effects. 95% confidence intervals are presented in the figures. An individual is defined as formally employed if he or she contributes to health, pensions or disability risk.