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Gender Gaps in Labor Informality: The Motherhood Effect

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Abstract

Recent work has quantified the large negative effects of motherhood on female labor market outcomes in Europe and the US. But these results may not apply to developing countries, where labor markets work differently and informality is widespread. In less developed countries, informal jobs, which typically include microenterprises and self-employment, offer more time flexibility but poorer social protection and lower labor earnings. These characteristics affect the availability of key inputs in the technology to raise children, and therefore may affect the interplay between parenthood and labor market outcomes. Through an event-study approach we estimate short and long-run labor market impacts of children in Chile, an OECD developing country with a relatively large informal sector. We find that the birth of the first child has strong and long lasting effects on labor market outcomes of Chilean mothers, while fathers remain unaffected. Becoming a mother implies a sharp decline in mothers' labor supply, both in the extensive and intensive margins, and in hourly wages. We also show that motherhood affects the occupational structure of employed mothers, as the share of jobs in the informal sector increases remarkably. In order to quantify what the motherhood effect would have been in the absence of an informal labor market, we build a quantitative model economy, that includes an informal sector which offers more flexible working hours at the expense of lower wages and weaker social protection, and a technology to produce child quality that combines time, material resources and the quality of social protection services. We perform a counterfactual experiment that indicates that the existence of the informal sector in Chile helps to reduce the drop in LFP after motherhood in about 35%. We conclude that mothers find in the informal sector the flexibility to cope with both family and labor responsibilities, although at the cost of resigning contributory social protection and reducing their labor market prospects.

JEL Code: J13, J16, J46.

Keywords: gender pay gap, child penalty, developing countries, labor informality, Chile.

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1 Introduction

In developing countries, informality is a pervasive and in many cases gendered characteristic of labor markets. For instance, in Latin America around one half of total employment belongs to the informal sector, where women are overrepresented since their informality rate is almost 20% higher than for males.¹ Jobs in the informal sector differ from formal ones in several dimensions: in addition to weaker social protection, labor earnings in the informal sector as well as career prospects are worse, while working hours are typically shorter.² Thus, informal employment offers some attractive characteristics –flexible working hours–, along with many other undesirable ones. Given that the greatest burden of childcare still falls on mothers, informal jobs may be attractive to them in their quest for flexibility in the workplace, especially when alternatives remain scarce.

Recent literature for developed countries shows that full-time jobs and raising children are hardly compatible, since both time and material resources are key inputs in the technology to raise children (Del Boca et al., 2014). This literature shows that in their labor market decisions, parents take into account the trade-off between working hours and financial resources offered by many full-time and long-hours jobs, resulting in that usually mothers and not fathers choose to reduce working hours or even opt out of the labor force in order to devote more time to raise children (Goldin, 2014; Kleven et al., 2018, 2019; Kuziemko et al., 2018). In addition, parents also take into account the bundle of child-related benefits that they can receive tied to their labor market decisions. In developing countries, children whose parents work in the informal sector are entitled to a quality of social protection that is similar to non-working parents. Therefore, the trade-off behind labor market and child investments is not only related to the tension between working long-hours –and receiving higher wages– and having time availability to invest in children, but it also includes considerations regarding the quality of social protection

¹These figures result from the analysis of national household surveys in 16 Latin American countries circa 2015 (SEDLAC, CEDLAS and The World Bank). This definition of labor informality includes salaried workers in small firms as well as non-professional self-employed and zero income workers in the population aged 25 through 64. Similar sources for other developing regions, like Sub-Saharan Africa, offer a similar pattern (Otoabe, 2017).

²According to ILO (2002), the term informal economy refers to “*all economic activities by workers and economic units that are – in law or in practice – not covered or insufficiently covered by formal arrangements*”.

that children are entitled to.

The aim of this work is to explore the role of informal sector job opportunities on labor market decisions at the onset of parenthood. We focus the analysis in a developing OECD country, which has a relatively large informal sector: Chile. According to SEDLAC (CEDLAS and The World Bank), an average of 17% of Chilean salaried workers aged 25 through 64 in the period 2000-2015 did not have the right to a retirement pension linked to his/her job. The percentage was even higher among women: 21%, which implies a gender gap in labor informality of 6.6 percentage points (46%).³ Using data from the Social Protection Survey carried out by the Ministry of Labor and Social Protection in Chile and based on an event study approach, we show that motherhood explains a considerable part of the observed gender gap in labor informality rates.

The analysis begins with the estimation of the short and long-term impacts of parenthood on mothers' and fathers' labor market trajectories. We find that the birth of the first child has strong and long lasting effects on labor market outcomes of Chilean mothers, while fathers remain unaffected. Becoming a mother implies a sharp decline in women's labor supply, both in the extensive and intensive margins, and in hourly wages: women's labor force participation and employment decline by 17% and 20%, respectively, hours worked fall by 4-5%, employment in part-time jobs increases by 40%, and the hourly wage decrease by 10-15%. All these effects remain relatively stable ten years after the birth of the first child.

We then explore possible mechanisms behind these impacts of motherhood on labor market outcomes. In particular, we assess whether after the first child is born there is a change in women's occupational structure towards more family-friendly jobs (public sector), or towards those offering more flexible work arrangements, in particular, in the informal sector. We find no statistically significant changes in the probability of working in the public sector. However, we do find that the fall in employment after motherhood is basically explained by a decline in formal employment, leading to an increase in informality rates among women after becoming

³This measure of informality is usually referred as the legal or social protection definition of labor informality. The informality rate in Chile for the same age group and period was 34% considering the productive definition—defined as salaried workers in small firms, non-professional self-employed and zero income workers. The gender gap in labor informality was 32% according to this alternative definition (SEDLAC, CEDLAS and The World Bank).

mothers.

We also analyze whether these motherhood effects differ across educational levels of mothers. We find that the negative effects of motherhood on labor market outcomes are smaller for mothers with higher educational attainment. However, while education protects women from the motherhood penalty, it is not enough to totally compensate for it.

The empirical approach we use allows for comparisons with similar studies focused on more developed countries. Interestingly, our results indicate that the motherhood effect on labor force participation in Chile (-17%) is smaller than in countries like the US and the UK (around -40%, Kuziemko et al., 2018; Kleven et al., 2019), but it is larger than in Sweden and Denmark (-7% and -13%, Kleven et al., 2018, 2019). We argue that part of this seemingly low effect in Chile could be accounted for the existence of informal job opportunities. In order to quantify what the motherhood effect would have been in the absence of an informal labor market, we build a quantitative model economy and perform a counterfactual experiment that shuts down the channel of informality. The economy is a simple occupational choice model that includes the possibility of both formal and informal employment –with the latter characterized by more flexible working hours, lower wages, and weaker social protection– and a technology to raise children that combines time, material resources and the quality of social protection services. The counterfactual exercise indicates that the existence of an informal sector in Chile helps to reduce the drop in labor force participation after motherhood in about 35%. In other words, our model implies that the drop in labor force participation after the birth of the first child would have been 23% in absence of the informal sector. This magnitude is in line with the average motherhood effect for 18 European countries we find in a related work (Berniell et al., 2019).

Our work is related and contributes to three strands of literature. First, we add to the literature that quantifies the effects of children on maternal labor outcomes, which previously has mainly concentrated on developed countries. Within this literature our paper is closely related to those studies that focus in the impact of the first child, which generally find large and persistent effects on labor market outcomes of mothers (Cristia, 2008; Fernández-Kranz

et al., 2013; Kleven et al., 2018, 2019; Kuziemko et al., 2018; Lundborg et al., 2017). One exception that finds no effects is Nix et al. (2019) for same-sex couples.⁴ Second, our study contributes to the literature that studies gender differences in the demand for flexibility in the workplace, which shows that mothers place family amenities before pecuniary rewards, as they tend to choose more family-friendly and part-time jobs (Fernández-Kranz et al., 2013; Kleven et al., 2018; Bertrand et al., 2010; Goldin, 2014; Goldin and Katz, 2016). Related work, by quantifying the willingness to pay for workplace amenities, finds that women value flexibility or shorter working hours more than men (Mas and Pallais, 2017; Wiswall and Zafar, 2017).

Third, we contribute to the literature analyzing the interplay between fertility and mothers' labor market outcomes in developing countries (Agüero and Marks, 2011; Cáceres-Delpiano, 2012; Cruces and Galiani, 2007; De Jong et al., 2017; Tortarolo, 2014). In particular, our work is close to Cáceres-Delpiano (2012) who analyzes the effect of additional children (the intensive margin of fertility) on proxies of formal and informal employment. Using different Demography and Health Surveys' cross sections for 40 countries from different developing regions (e.g. Sub Saharan Africa and Latin America, among others), he finds -unlike us- that the types of job that are more affected by a fertility shock (multiple births) are those identified with a greater degree of informality, such as unpaid and occasional jobs. With regard to self-employment -one of the most common forms of informal work in Latin America, especially among low-skilled workers, and which we will analyze for the case of Chile-, Cáceres-Delpiano (2012) finds no effect of an unexpected fertility shock at a first birth.

Additionally, and to the best of our knowledge, our study is the first to establish a clear link between motherhood and the gender informality gap. Our results indicate that motherhood greatly contributes to the formation of the observed gender gap in informality. The flexibility implied by informal jobs (e.g. more flexible working hours), seems to act as a buffer that prevents some women from leaving the labor market after becoming mothers. However, this flexibility comes at a high cost for women: resigning contributory social protection as well as

⁴Other studies look at the effect of family size or second and third child on labor market outcomes of mothers, and generally find only short term and smaller effects (Agüero and Marks, 2011; Angrist and Evans, 1998; Bronars and Grogger, 1994; Cruces and Galiani, 2007; De Jong et al., 2017; Jacobsen et al., 1999; Rosenzweig and Wolpin, 1980; Tortarolo, 2014).

possibly suffering a depreciation –or lack of accumulation– of some skills that are valuable in the labor market. These costs may in part explain the persistence of poor labor market outcomes for mothers even long after having their first child.

The rest of the paper is organized as follows. Section 2 describes the data set and the empirical strategy. Section 3 shows the main results, while Section 4 presents the model and its parametrization. Section 5 concludes.

2 Motherhood and labor market outcomes: Context and empirical strategy

2.1 Data

We use longitudinal data from the Social Protection Survey (SPS), carried out by the Ministry of Labor and Social Protection in Chile. Our analysis is based on 5 waves gathered between 2004 and 2016, following around 16,000 individuals in each wave.⁵ This survey includes demographic and socioeconomic information at the individual and household level. More importantly for our purposes, the survey recovers labor market trajectories since individuals turn 15 years old. This survey also includes information on the exact dates of children’s births, which allows for studying the dynamics of labor outcomes for individuals who become parents between 2002 and 2015. Even though life history interviews typically suffer from recall bias, the SPS mitigates this problem by asking individuals about their labor market trajectories in more than one wave. To reduce recall bias we use information on the closest report and restrict the analysis to labor outcomes from the year 2002 onwards.

Our goal is to estimate the effect of motherhood on labor outcomes based on an event study approach around the birth of the first child. To that aim, we define the event as the month of birth of the first child. We restrict the sample to mothers whose age at first childbirth is

⁵Data gathering took place in the years 2004/05, 2006/07, 2008/09, 2012/13, and 2016. The SPS have an additional wave of data (collected in years 2002/03), which we do not use since that sample is not representative of the Chilean population aged 18 years and older because it only includes affiliates to the Pension System (i.e. informal workers are not represented).

between 18 and 50 years old, and to fathers whose age at first childbirth is between 18 and 60 years old. All individuals in the sample are observed at least once before and at least once after becoming a parent, resulting in an unbalanced panel of 3228 women and 2740 men.

The event study analysis requires that we define time units relative to the date of birth of the first child. Therefore, for each individual i in our sample, E_i denotes the calendar month in which he or she became a parent and $e_{it} = t - E_i$ is the number of months since (or until) birth. Letter τ indexes time (in months) relative to the child's birth or 'event time': τ equals zero in the month of birth and takes on negative (positive) values in pre-child (post-child) months. In our sample τ runs from -60 (five years before) to +120 (10 years after).

We estimate the effect of having the first child, henceforth the 'motherhood effect', on: i) total earnings, ii) labor force participation, iii) employment, iv) hours worked, v) part-time employment, vi) hourly wages, vii) employment in the public sector, viii) employment in the formal sector, ix) employment in the informal sector, and x) self-employment. Appendix A provides the detailed definitions of these outcome variables.

Table 1 presents descriptive statistics of our sample, one year before women and men become parents. Men are older than women, on average, but less likely to have some college degree. Labor force participation gap at that moment is 29 percentage points and the unconditional wage gap is 18%.⁶ Additionally, women work less hours than men, are more likely to work in the public sector and less likely to work as self-employed. Finally, labor informality, which in our sample is measured as not contributing to the social security system, is about 19% and does not differ by gender one year before the birth of the first child.⁷

⁶To put this numbers in perspective, the labor force participation gap in Chile for adults between 25 and 54 years old in 2015 was 26 percentage points while the unconditional wage gap was 8% (Marchionni et al., 2019).

⁷Our measure of informality does not have a perfect correlate to measures reported in other sources (such as SEDLAC database). We consider a worker to be informal when not contributing to social security, independently if she is a salaried or a self-employed worker. The SEDLAC database, which is based on national household surveys, computes two measures of informality: one similar to ours, but only restricted to salaried workers (usually known as the legal or social protection definition), and a second measure which considers a worker as informal if she is a salaried worker in a small firm, a non-professional self-employed, or a zero-income worker (called the productive definition). Unfortunately, not all the waves of the SPS have information on the size of the firm where individuals work to build alternative measures of informality.

2.2 Methodology

In this paper we estimate the impact of children on mothers' labor outcomes based on an event study approach around the birth of the first child. This quasi-experimental methodology allows treatment effect estimation when all units in the panel receive treatment but at (as-good-as) random times. In our case, the event study methodology allows overcoming the problem of endogeneity of fertility with the key identification assumption that the timing of the child's birth is not correlated with labor outcomes, conditional on having a child during our observation period and on the included controls. It is possible to think of two different effects of motherhood on labor outcomes. One is the effect of anticipated decisions prior to the birth of the child -the pre-child effect-, and the other is the effect of children on mothers' labor outcomes after the actual birth of the first child -the post-child effect. While the event study methodology allows identifying the latter, it does not allow for the identification of the former, which determines the pre-child levels of the outcomes. For instance, suppose that women decide to invest less in education in anticipation of motherhood; the event study not only does not capture this pre-child effect but also the post-child effect we are able to capture will be a lower bound of the total effect of children on mothers' labor outcomes. Kleven et al. (2018) provides a detailed discussion regarding this point. In other words, the timing of the event is assumed to be orthogonal to the unobservable determinants of labor outcomes, which should change smoothly over time.⁸

Consider a panel of $i = 1, \dots, N$ individuals observed for all or some $t = 1, \dots, T$ calendar periods (months). We model outcome Y for individual i in calendar time t as

$$Y_{it} = \sum_{\tau \neq -12} \beta_{\tau} I(e_{it} = \tau) + \sum_j \gamma_j I(j = age_{it}) + \delta_t + \epsilon_{it}. \quad (1)$$

The first term consists of a set of event time dummies. The event time coefficients β_{τ} for $\tau \geq 0$ capture the post-child dynamic effects, i.e. the effects of parenthood on outcome Y for

⁸While the identification of short-term effects relies on the smoothness assumption, the identification of long-term effects requires stronger assumptions. Moreover, long-term effects will capture the impact of children born after the first child.

each period τ after the birth of the first child.⁹ Since the omitted category corresponds to $\tau = -12$, the coefficients measure the impact of children relative to the year before they are born, i.e. relative to the same month of the previous year. Coefficients β_τ for $\tau < 0$ capture pre-trends, i.e. trends on outcomes prior to the birth of the child. The remaining terms include non-parametric controls for age (one dummy variable for each age-in-years cohort) and calendar year and month fixed effects (denoted just by δ_t to keep notation simple). We estimate model (1) for mothers and fathers separately.

As in Kleven et al. (2018), we present our results as the percentage effect relative to the counterfactual outcome without children. Formally, the percentage effect for each event time τ is given by $P_\tau = \frac{\hat{\beta}_\tau}{\tilde{Y}}$ where \tilde{Y} is the average predicted outcome across t from model (1) when omitting the event time terms.

Some of the outcomes we analyze (hours worked, part-time employment and hourly wages) will be conditioned on being employed, so in those cases we must be cautious about the interpretation of the motherhood effect since our estimates may also capture selection effects. However, if individuals were positively selected into employment, our estimates would be a lower bound of the true impact of the first child on these labor market outcomes.

One way to gain credibility on the key identifying assumption is by examining trends in labor outcomes prior to the birth of the first child. The presence of pre-trends would call into question the validity of the assumption. For instance, if women's employment falls before child's birth, it may be that women decide to have children when faced with job loss. Instead, the absence of pre-trends lends support to the assumption that outcomes do not respond before the child is born. As we discuss in the next section, estimates of β_τ provide a visual test that suggests the absence of pre-trends.¹⁰

⁹It is important to note that the long-term effects may include also the effect of subsequent children.

¹⁰Note that our model (1) does not include individual fixed effects. The reason is that age, calendar time fixed effects and individual fixed effects are not independently identified in this setting, a problem similar to the well-known age-cohort-time problem that arises because for a given calendar time (knowing when a cohort was born implies knowing its age). See Borusyak and Jaravel (2018).

3 Impacts on labor supply, wages, and occupational structure

In this section we present the figures that show the evolution of labor market outcomes before and after the birth of the first child, which result from the estimation of equation (1) for mothers and fathers separately. Point estimates for every event time τ should be interpreted as the difference in the value of the outcome of interest between that period and $\tau = -12$, i.e. one year just before the birth of the first child. As explained before, instead of the event time coefficients' estimates, the figures show the percentage change relative to the predicted counterfactual outcome without the impact of the birth of the first child.

Figure 1a shows the evolution of the extensive margin of labor supply, while Figure 1b shows the evolution of employment. Regarding the intensive margin, Figures 1c and 1d show the trajectories of hours worked and part-time jobs, respectively. The evolution of all these four labor outcomes for women and men do not differ in the pre-child period, but differences become very large after childbirth. While men do not experience any important change after becoming fathers, women's labor outcomes trajectories start diverging immediately after motherhood: their labor force participation and employment decline by 17% and 20%, respectively (Figures 1a and 1b), hours worked fall by 4-5% (Figure 1c), and the share of employed women working in part-time jobs increases by 40% (Figure 1d). Additionally, Figure 2 show that the hourly wages of women and men are also affected in different manners, as wages of mothers show a drop of about 10-15% and wages of fathers do not change. Importantly, these sharp and strong effects on mothers persist in the long run.

Figure 3 presents the gender-specific impact of the birth of the first child on total earnings (after taxes and excluding transfers, in constant Chilean pesos) over event time. The impact on earnings arises both from changes in labor supply (both in the extensive and intensive margins) and changes in hourly wages. We observe that earnings evolve in a similar way for men and women before they become parents, but the trajectory for mothers changes dramatically after the first child is born. Moreover, the gap that opens between mothers and fathers' earnings

immediately after the birth of the first child never closes: during all months in the post event period, the impact of the first child is negative and statistically significant for women, and it is basically zero for fathers. This drastic reduction for mothers starts during pregnancy and persists after birth, implying a reduction of around 20-30% of earnings, which remain relatively stable over the 10 years following the birth of the first child.

The methodology we use allows for comparisons with similar studies focused on more developed countries. Our results indicate that the motherhood effect in Chile is smaller than in countries like the US and the UK (Kuziemko et al., 2018; Kleven et al., 2019), but it is larger than in Northern European countries like Denmark or Sweden (Kleven et al., 2018, 2019). Interestingly, the drop in labor force participation in Chile is closer to the results obtained for the Northern European countries. The motherhood effect in Chile implies a reduction in LFP of mothers that is only 4 percentage points larger than what Kleven et al. (2019) estimates for Denmark. Given the generosity of the Danish social protection system, this rather small difference may seem paradoxical.¹¹

We argue that part of this seemingly low effect in Chile could be accounted for the existence of informal job opportunities. The flexibility implied by informal jobs (e.g. more flexible working hours), could offer a buffer for women after motherhood, and up to a point prevent exits from the labor market. However, this flexibility comes at a high cost for women: resigning contributory social protection as well as to possibly incur in a depreciation –or lack of accumulation– of some skills that are valuable in the labor market, which, in turn, may in part explain the persistence of poor labor market outcomes for mothers even long after having had their first child. In order to explore this hypothesis, we analyze in the next subsection whether after the first child is born there is a change in mothers’ occupational structure towards more

¹¹Family policies –job-protected leave and public provision of child care– are much more generous in Denmark than in Chile. In Denmark, and since 2002, parents are offered 18 weeks of maternity leave and 32 weeks of shared parental leave, combined with publicly subsidized universal child care services (Kleven et al., 2018). In contrast, maternity leave in Chile was extended from 12 to 24 weeks only in 2011, in a context where the main alternative to maternal care still is informal child care, since formal child care only covers a fraction (18%) of children between 0 and 2 years old (OECD, 2013). Regarding this relative recent expansion of the maternity leave in Chile, Albagli and Rau (2018) find that it caused an increase in the probability that mothers remain employed after maternity leave. In fact, when we replicate our analysis restricting the sample to women who became mothers after the expansion of benefits (2012 onwards), the estimated motherhood effects fall. Results available upon request.

family-friendly jobs (public sector), or towards jobs offering more flexible work arrangements, in particular, those in the informal sector.

3.1 The role of the informal sector

There is a growing body of evidence showing that women value characteristics of jobs that favor family-work balance (Bertrand et al., 2010; Goldin, 2014; Goldin and Katz, 2016; Kleven et al., 2018; Mas and Pallais, 2017; Wiswall and Zafar, 2017). Kleven et al. (2018) contributes to this evidence by showing a causal link between motherhood and choosing family-friendly occupations, like part-time jobs or employment in the public sector.¹² In Figure 4 we investigate the existence of changes in the share of public sector jobs on total employment for Chile, and we do not find statistically significant effects of parenthood in the probability of working in the public sector, neither for fathers nor for mothers.¹³

We next turn to study how the shares of formal and informal jobs change with the birth of the first child. The existence of a relatively large informal sector is a crucial aspect in which the Chilean labor market differs from those of developed countries and in this market women are overrepresented. According to the legal or social protection definition, which defines informal workers as salaried workers who do not have the right to a retirement pension linked to his/her job, an average of 17% of Chilean salaried workers aged 25 through 64 in the period 2000-2015 were informal. The percentage was even higher among women: 21%, which implies a gender gap in labor informality of 6.6 percentage points (46%). Following the productive definition, on the other hand, the percentage of informal workers -salaried workers in small firms, non-professional self-employed and zero income workers- on total Chilean workers was 34% on average over the same period, with informality rates 9.6 percentage points higher among women, i.e. a gender gap of 32% in labor informality (SEDLAC, CEDLAS and The World Bank).

¹²Kleven et al. (2018) show that Danish women are 12% more likely than men to work in the public sector as a result of parenthood. They also find that mothers are 20% less likely than fathers to become a manager, which is often associated with longer working hours. In a related work, Fernández-Kranz et al. (2013) find that Spanish women transitioning to part-time jobs after the birth of the child is one of the reasons behind mother's lower earnings track.

¹³For fathers, however, although not statistically significant, there seems to be a downward trend in public employment.

As we argued before, job opportunities in the informal sector could offer more flexible working hours arrangements, which could be thought as a desirable characteristic to balance family and work.¹⁴ For instance, the Chilean formal labor market basically offer jobs that are full-time, while part-time jobs are very rare (Montero and Rau, 2015). Figure 5 uses our sample to show the distribution of hours worked per week by sector -formal and informal- and gender, before the birth of the first child. Both for men and women the distributions in the formal sector are bunched around 45 hours per week.¹⁵ On the other hand, the informal sector seems to offer many more opportunities for adjusting working hours, as the distribution is more dispersed.

In Figures 6 and 7 we explore the effects of the birth of the first child on the share of formal and informal jobs. Figures 6a and 6b show, for outcomes that are unconditional on working, that while formal and informal employment are parallel for women and men before the first child is born, there is a drastic and persistent drop afterwards only in women's probability of having a formal job. According to Figure 6a, this probability declines by 25-30% and the effect persists in the long run. Importantly, except for the months closer to the birth of the first child, mother's informal employment does not change over time.

Taken together, the unconditional effects we show in Figures 6a and 6b imply that, conditional on working, after the first child is born the probability of working in the informal sector increases for mothers and not for fathers, as we show in Figures 7a and 7b.¹⁶ The increase in mother's informality rate at the birth of the first child is about 26% and remains stable afterwards, while it does not change for fathers. This novel result indicates that motherhood

¹⁴While here we will focus on the flexibility of working hours arrangements offered by the informal sector, other studies have studied how this sector also offers other margins of flexibility, in particular regarding labor adjustments as a consequence of macroeconomic shocks or changes in crucial labor market institutions (Dix-Carneiro and Kovak, 2018; Ponczek and Ulyssea, 2017). The evidence that emerges from those works suggests that workers' ability to switch from the formal to the informal labor market attenuates the negative impact of macro shocks on employment.

¹⁵Consistent with jobs that require 5 days a week and 9 hours worked per day, or 6 days a week and 7.5 hours worked a day.

¹⁶There are two types of transitions across occupations that are consistent with this pattern. First, the share of informal workers among women remains fairly constant because most women who had an informal job in the pre-child period return to the informal sector after their first child is born. In this case, the decline in female employment is basically explained by former formal workers leaving the market. Figure 6a is also consistent with a change in the composition of the group of women working in the informal sector: some of the women who had formal jobs in the pre-child period switch to the informal sector afterwards, while some women previously working in the informal sector leave the labor force.

notably contributes in the formation of the gender gap in labor informality. Reinforcing the idea that only women demand flexibility after the arrival of the first child, Figures 8a and 8b show that the share of self-employment steeply rises for mothers while remains unaffected for fathers.

3.2 Heterogeneous impacts of motherhood on labor outcomes

According to the results described so far, motherhood causes a large and persistent drop in women's labor supply in Chile. In this section we investigate whether certain characteristics of women that are associated with their labor market attachment, such as education, provide some sort of protection against the motherhood effect.

Figures 9a to 9d show that education attenuates the effects of motherhood both in the extensive and intensive margins of labor supply. We compare women with some college education versus women who never went to college. While the drops in labor force participation and employment are about 25% and 30%, respectively, for the less educated women, the drops are about 10% and 12%, respectively, for the group of more educated women (Figures 9a and 9b). Higher educational attainment is also associated with a lower effect of motherhood on the number of hours worked and with a lower probability of being in a part-time job. Figure 9c shows that, conditional on working, less educated women work 5% less hours relative to the pre-child period, and that this reduction persists and even becomes slightly larger in the longer run. Consistent with this, the probability of working in a part-time job increases by 50% for the group of less educated women (Figure 9d). It is interesting to note that, as it is the case for fathers, hours worked and the probability of working part-time do not change after motherhood for employed mothers with some college education.

Figures 9e and 9f show the trajectories of hourly wage and the probability of working in the public sector by education level. None of these outcomes change after the event for both groups of women. However, education does play a role in determining the effects of motherhood on the probability of being employed in the formal sector. The drop in the probability of having a formal job is large (about 35%) and persistent for the less educated group of women,

while for the more educated, although negative, the effect on formal employment is not always statistically significant (Figure 9h). Instead, motherhood does not alter the probability of being employed in the informal sector for any of the two groups, except during a few months around the birth of the first child (Figure 9g). As a result of these patterns, we show in Figure 9i that, conditional on being employed, the probability of working in the informal sector increases after motherhood only for the less educated women.

Last, in Figure 10 we present the heterogeneous responses of earnings in the two educational groups. This figure indicates that after motherhood both less and more educated women experience a decrease in their earnings, and although the effect seems to be larger for the less educated the difference is not always statistically significant.

To sum up, according to our results, motherhood seems to have a larger negative effect on labor outcomes for the group of less educated women: their probability of exiting the labor force or accepting informal jobs to balance family and work increases after their first child is born. Moreover, since less educated women are less likely to retain formal jobs after becoming mothers, their chances of accumulating more skills that are valuable in the labor market are reduced in the long run.

4 The Model

4.1 Main assumptions

In order to illustrate the key forces that connect having children with labor market outcomes of mothers in the presence of an informal sector, we build a simple model of occupational choice that includes both an extensive and an intensive margin for labor supply, and in which occupations differ in some conditions related to the technology to raise kids. We model two types of occupations, which together represent the relevant labor market options of women in developing countries. The first occupation is formal salaried work and the second is work in the informal sector, either as self-employed or as salaried worker in small informal firms.

As we discussed before, formal and informal work differ in several dimensions, which we

try to resemble with our modeling choices. First, we include the well-documented earnings gap across these two occupations (Tornarolli et al., 2014). Second, we model the occupation in the informal sector as offering a more flexible time-schedule than formal salaried work. This assumption is backed up by Figure 5, and also by the results obtained from official household and labor surveys for many countries in Latin America.¹⁷ Last, since in the context of developing countries formal and informal workers are entitled to different qualities of social protection services (contributory versus non-contributory social protection), we include this feature in the model by allowing formal workers the access to a higher quality bundle of such services. In our model, the quality of social protection services impact on the production of child quality, from which parents derive utility.

Although labor supply as well as fertility decisions are dynamic in nature, we choose a one-period model economy not only for its simplicity but also because when credit and savings constraints are important -as it is the case in most developing countries- both labor and fertility decisions become more dependent on current earnings. Additionally, and according to the evidence presented in Lagakos et al. (2018), since the life-cycle wage growth is considerably slower in poorer countries, dynamic considerations in occupational choices are likely to be less important there.

For the aim of simplicity, and according to the null impacts observed for fathers in the Chilean case, we only model mothers. In addition, and since in our empirical analysis all individuals have children, we consider fertility as exogenous. Last, and given that the empirical part focuses on the effect of the first child, we abstract from modeling aspects related to the quantity of children.

4.2 Model setup

In this simple one-period model individuals (women) differ in their levels of ability z . These ability levels are distributed according to a function $\Gamma(z)$, and higher levels are associated with

¹⁷These surveys indicate that, on average, informal workers work around 20% less hours a week than their formal counterparts (LABLAC, 2018).

higher labor productivity.¹⁸ All individuals are endowed with one unit of time and an amount of unearned income, Y .¹⁹ Fertility is exogenous and every woman has a child.

Mothers face a typical consumption-leisure trade-off, but also make occupational choices and invest resources to produce child quality. Occupational choices result in one of three possible outcomes: not working ($j = OLF$), working in the formal sector as a salaried worker ($j = F$), or working in the informal sector ($j = I$). For every unit of time devoted to work, workers in sectors $j = F$ and $j = I$ generate labor earnings according to their ability levels, $\omega_j(z) = w_j z$, where $w_F > w_I$. The formal sector offers less flexible time schedules than informal employment, since $t_F = \bar{t}_F$ is fixed (full-time jobs) while the exact amount of time devoted to informal employment can be chosen from a continuum of alternatives ($0 < t_I < 1$).

The utility of the parent is a function of her own consumption (c_m) and leisure (l), and of child quality (q). The child quality production process uses three types of inputs: time (t_q), monetary inputs (c_q), and a bundle of social protection services (s_i). Such social protection services are key for child development, and for example include paid parental leaves, paid vacations or health insurance. In this model economy, s_i can be of two qualities: high quality, s_H , to which only individuals working in the formal sector are entitled, or low quality, s_L , that is the default option for those not working or working in the informal sector. Child quality is produced through a Cobb-Douglas function that combines these three inputs²⁰

$$q = c_q^\alpha t_q^\beta s_i^{1-\alpha-\beta}.$$

We first describe the maximization problem of a woman with ability z that has a child. These values, $V^j(z)$, correspond to the three available occupations: out of the labor force ($j = OLF$), informal ($j = I$), and formal ($j = F$).

The value resulting from the maximization problem of a mother with ability z who chooses

¹⁸Another way to interpret this source of heterogeneity is that each individual is born with a given education level, z .

¹⁹This amount of income can be interpreted as the earnings of other individuals in the household.

²⁰Modeling choices regarding preferences and technology to form child quality are standard in the literature analyzing the links between fertility and labor market outcomes of parents. See for instance Del Boca et al. (2014) or Heath (2017).

not to work is

$$\begin{aligned}
V^{OLF}(z) &= \max_{t_q, l, c_m} \phi_c \log(c_m) + \phi_l \log(l) + \phi_q \log(q), & (2) \\
\text{subject to } & t_q + l \leq 1, \\
& c_m + c_q \leq Y, \\
& q = c_q^\alpha t_q^\beta s_L^{1-\alpha-\beta}, \\
\text{and } & t_q, l, c_m, c_q \geq 0.
\end{aligned}$$

The value for a mother with ability z in the case of choosing to work as a salaried worker in the formal sector is

$$\begin{aligned}
V^F(z) &= \max_{t_q, l, c_m} \phi_c \log(c_m) + \phi_l \log(l) + \phi_q \log(q), & (3) \\
\text{subject to } & t_q + \bar{t}_F + l \leq 1, \\
& c_m + c_q \leq \omega_F(z) \bar{t}_F + Y, \\
& q = c_q^\alpha t_q^\beta s_H^{1-\alpha-\beta}, \\
\text{and } & t_q, l, c_m, c_q \geq 0.
\end{aligned}$$

Last, the value for a mother with ability z who chooses to work in the informal sector is

$$\begin{aligned}
V^I(z) &= \max_{t_q, t_I, l, c_m} \phi_c \log(c_m) + \phi_l \log(l) + \phi_q \log(q), & (4) \\
\text{subject to } & t_q + t_I + l \leq 1, \\
& c_m + c_q \leq \omega_I(z) t_I + Y, \\
& q = c_q^\alpha t_q^\beta s_L^{1-\alpha-\beta}, \\
\text{and } & t_q, t_I, l, c_m, c_q \geq 0,
\end{aligned}$$

where her choice regarding the amount of time devoted to informal work is such that a woman

with ability z will choose a positive amount of working time ($t_I^* > 0$) if

$$\frac{\omega_I(z)}{Y} \geq \frac{\beta\phi_q + \phi_l}{\alpha\phi_q + \phi_c}, \quad (5)$$

otherwise $t_I^*(z) = 0$. This condition is likely to be satisfied for ability levels z high enough, if monetary inputs in the production of child quality are very productive (α is relatively high), and/or if time inputs are not very productive (β is relatively low).²¹

To be able to compare labor market decisions of women after having a child, it is useful to also describe the values for childless women with ability z in each possible occupation j , $W^j(z)$. While the value for a childless woman that does not work is just $W^{OLF}(z) = \phi_c \log(Y) + \phi_l \log(1)$, the value for a woman working in the formal is $W^F(z) = \phi_c \log(\omega_F(z)\bar{t}_F + Y) + \phi_l \log(1 - \bar{t}_F)$. A woman of ability z working in the informal sector solves

$$W^I(z) = \max_{t_I} \phi_c \log(\omega_I(z)t_I + Y) + \phi_l \log(1 - t_I),$$

which results in a value

$$W^I(z) = \phi_c \log\left\{\frac{\phi_c[\omega_I(z) + Y]}{(\phi_l + \phi_c)}\right\} + \phi_l \log\left\{\frac{\phi_l[\omega_I(z) + Y]}{\omega_I(z)(\phi_l + \phi_c)}\right\}.$$

The occupational choices of mothers of ability z results from comparing $V^{OLF}(z)$, $V^F(z)$ and $V^I(z)$. Similarly, childless women of ability z compare $W^{OLF}(z)$, $W^F(z)$ and $W^I(z)$. As shown in section 4.3, we can construct a quantitative version of this model economy in which we can further characterize the cutoffs that determine which z -types will end up choosing each one of the three possible occupations.

4.3 A parametrized version of the model economy

In this section, we briefly discuss how we can assign parameter values to endowments, preferences, and technology parameters in the benchmark economy. We then comment on the

²¹This condition is likely to be satisfied also if the valuation for leisure is low (low ϕ_l) and/or for private consumption is high (high ϕ_c).

implications derived from this simple quantitative version of the model economy, which are all in terms of variables of interest for the main questions of this paper.

In this quantitative exercise, we set a number of parameters *a priori* and we calibrate the remaining four parameters to produce an equal number of key model moments that are similar to the corresponding moments obtained from the data (targets). Table 2 list the set of parameters that we choose to set *a priori* and the list of calibrated ones.

First, we model education types as a continuum, $z \in [0, 1]$, and each individual gets an initial draw for this type from a uniform distribution $\Gamma(z) = U(0, 1)$. Since we set the length of a day (24 hours) to one, the length of a regular workday in the formal sector is $\bar{t}_F = 1/3$ (8 hours). We next set the formal sector wage premium per hour of (adjusted by skill level) work to 17%, so the wage in the formal sector is $w_f = 1.17w_i$. This wage premium was obtained from a standard Mincer regression obtained using the same working sample that we use in previous sections.²²

For preference and technology parameters, we rely on Del Boca et al. (2014). According to their estimation results, and after normalizing $\phi_q = 1$, we set the value for $\phi_c = 0.728$. Since we only model mothers, and the estimates for the weights of leisure in Del Boca et al. (2014) are estimated separately for fathers and mothers, we leave ϕ_l as one of the parameters to be calibrated.²³ Regarding technology parameters, we use the results in Del Boca et al. (2014) to construct a ratio between α and β . According to their results, this ratio is about $\frac{\alpha}{\beta} = 0.2$ (Table 2).

We choose four moments from the data to proceed with the calibration of the four remaining parameters (see Table 3). First, we use the labor force participation of mothers, a target very closely related to the unearned income (Y). Second, we use the change in the labor force participation of women after motherhood as a moment that is very much conditioned by the contribution of parental time in the production of child quality (parameter β). Third, we use the rate of labor informality of mothers to calibrate the relative weight of leisure in the utility

²²Notice that the absolute values of s_H and w_i are not relevant by themselves, since what matters for decisions are the ratios w_I/w_F and s_L/s_H .

²³The estimates in Del Boca et al. (2014) for the parameters related to utility derived from child quality and private consumption are: $\phi_c=0.254$ and $\phi_q=0.353$.

function (parameter ϕ_l). Last, we also use the change in this rate of labor informality of women after they become mothers to calibrate the parameter quantifying the relative quality of social protection services (s_L/s_H). As shown in Table 3, data and model moments are quite close.²⁴

Figure 11 shows occupational choices in the benchmark economy, both for women with and without children. The cutoffs on the support of z that define who chooses each type of occupation are \hat{z}_{OLF}^I for going from sector $j = OLF$ to sector $j = I$, and \hat{z}_I^F for going from $j = I$ to $j = F$. Both for mothers and for childless women, these cutoffs are such that $\hat{z}_{OLF}^I < \hat{z}_I^F$, which implies that the least able women choose to remain out of the labor force.

The model is able to produce a number of other results that are comparable to the data, and which have not been used in the calibration procedure. For instance, the share of non-labor income in the income of mothers is 69% in the data and 70% in the model.²⁵ The model also produces a fall in labor earnings, for women that were working before the birth of the child, of around 14%, which is in line with the short-run drop in the earnings of mothers that we obtain in the empirical part.²⁶ In addition, this quantitative version produces an order of cutoffs for occupations that is consistent with the average educational levels in the three occupations: both mothers and childless women that are out of the labor force have on average lower educational levels than informal workers, and informal workers have, on average, lower educational attainment than formal workers. In addition, the model can also produce the heterogeneous impacts of motherhood across educational groups, discussed in section 3.2. For instance, comparing Figures 11b and 11a it can be observed that the greatest costs of motherhood (either in terms of opting out of the labor force or in switching to the informal sector) are borne by less educated mothers, which is consistent with our estimates.

We use this parametrized model economy to perform a counterfactual experiment in which we shut down the possibility of choosing to work in the informal sector. With this exercise we try to recover what in the absence of an informal sector would have been the motherhood effect in the LFP of mothers in Chile. The first row of Table 4 shows the drop in mothers' LFP in

²⁴All values for the data moments were obtained from the same sample of mothers (before and after becoming mothers, correspondingly) included in the empirical analysis of section 3.

²⁵This non-labor income of mothers obtained from the data includes the earnings of the rest of household members, which can be thought to be represented by parameter Y in our model economy.

²⁶In the longer run the drop in labor earnings is about 20-30%.

the benchmark economy (Chile with informal sector), which was discussed in section 3.

In the counterfactual scenario, the economy only differs from the benchmark case in that the only two possible occupations are $j = OLF$ and $j = F$. The second row in Table 4 shows that in that case the drop in the LFP of mothers would have been 23%. Interestingly, in a related work (Berniell et al., 2019) we study the motherhood effect in a group of 18 European countries and find an average long-run motherhood effect of about the same magnitude (-22%) as the counterfactual case (Chile without an informal sector). Comparing the two economies in Table 4 we obtain that the drop in LFP of mothers is smaller in the benchmark case, and that the informal sector contributes to reduce this drop in 35% (17% versus 23%). This result points at the informal sector as a buffer mechanism, which prevents the exit of some mothers from the labor force but at the cost of lower quality employment opportunities.²⁷

5 Conclusion

Despite substantial improvements over the last century, large gender gaps are still present in domains such as labor supply, earnings and wage rates. Motherhood stands out as one of the key factors driving this gap, given that women still get the lion's share when it comes to childcare. By and large, studies identifying the causal effect of children on mother's labor outcomes have focused on developed countries. Those results may not be extrapolated to developing countries, where female labor force participation rates are lower, labor regulations to balance work and life are weaker, informal sectors are relevant and the provision of public childcare services is insufficient. The evidence of the motherhood effect for such countries is scarce or, to the best of our knowledge, even inexistent regarding some of these dimensions.

In this paper we provide evidence of the effects of motherhood on women's labor outcomes in a developing OECD country, which has a relatively large informal sector: Chile. Following an event-study methodology, we are able to estimate the impact of motherhood on several women's labor outcomes in the short and long run. Our results show that becoming a mother implies a

²⁷Moreover, simulating a country with no informal sector and no distinctions in the social protection for workers and non-workers ($\frac{s_L}{s_H} = 1$) the motherhood effect in the LFP of mothers is about 39%, a fraction that is very close to what has been found as the long-run drop in the LFP of mothers in the US (Kleven et al., 2019).

drastic and persistent decline in women's earnings (of about 20%) right after their first child is born, and this gap remains fairly stable during the following ten years. More importantly for our analysis, this reduction in mother's earnings is explained by changes in labor supply, as well as in hourly wages: labor force participation declines by 17%, hours worked fall by 4-5%, while part-time jobs increase by 40%, and hourly wages fall by 10-15%. Furthermore, the evidence shows that the reduction in labor supply (both in the extensive and in the intensive margins) is related to an increase in the informality rate after the birth of the first child. Finally, our results show that although the negative impact of motherhood on labor market outcomes is present for women regardless their educational attainment, the effects are larger for those less educated.

Thus, our evidence provides support to the hypothesis that motherhood is behind not only the usual gender labor market gaps (labor supply and earnings) but that in developing countries it is also very much connected to the gaps in the quality of jobs that men and women have access to. Our results show that the informal sector operates as a buffer, providing the flexibility that parenthood demands but that is only chosen by mothers and not by fathers. That is, this flexibility at work comes at a high cost for women: no contributory social protection and the possible depreciation (or lack of accumulation) of some skills that may hinder the path to the formal sector.

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Table 1: Descriptive statistics. Event period -12.

	Men	Women
Age (years)	27.42	24.62
Have some college	0.290	0.325
Labor force participation	0.843	0.553
Employment (unconditional on participating)	0.790	0.471
Hours worked per week	46.96	42.27
Work less than 30 hs. per week	0.0561	0.157
Real wage per hour (2015 Chilean pesos)	1,846	1,635
Share of public employees	0.0532	0.143
Share of informal workers	0.187	0.189
Share of self-employed workers	0.117	0.0652
Observations	2,402	2,864

Source: Own calculations based on the Social Protection Survey (SPS).

Table 2: Parameter values

Parameters	Values	Source
<i>Set a priori</i>		
\bar{t}_F	1/3	8 hours a day
w_f/w_i	1.17	Mincer regression
ϕ_e	0.728	Del Boca et al. (2014)
α	0.2β	Del Boca et al. (2014)
<i>Calibrated</i>		
Y		2.447
β		0.748
s_L/s_H		0.415
ϕ_t		0.905

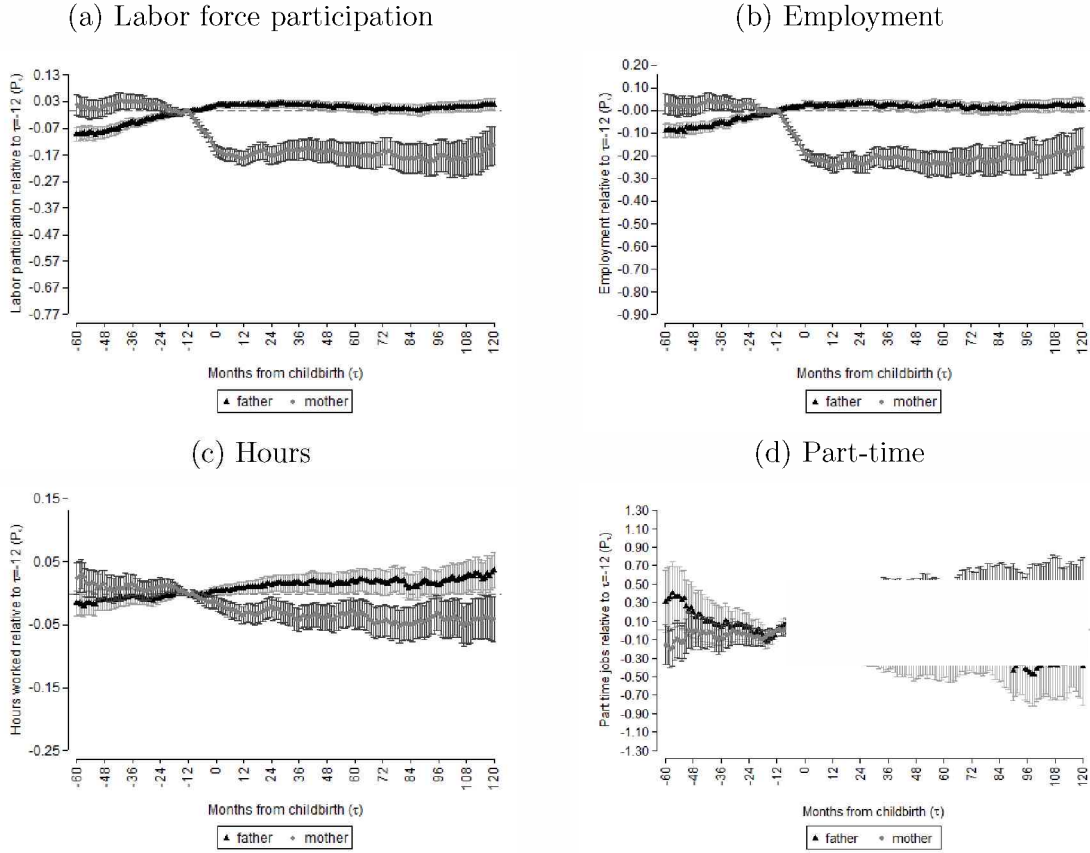
Table 3: Data and model moments for calibrated parameters

Parameters	Data moments	Model moments
Labor force participation of mothers (Y)	60%	61%
Change (%) in labor force participation after motherhood (β)	-17%	-17%
Labor informality rate (%) of mothers (ϕ_l)	20%	22%
Change (%) in labor informality rate after motherhood (s_L/s_H)	26%	26%

Table 4: Labor market outcomes of women with and without a child, in three different economies

Variables	Female LFP Change (%)
Benchmark economy (\approx Chile)	-17%
Economy without informal sector and $\frac{s_L}{s_H} = 0.415$ (\approx Europe (average))	-23%

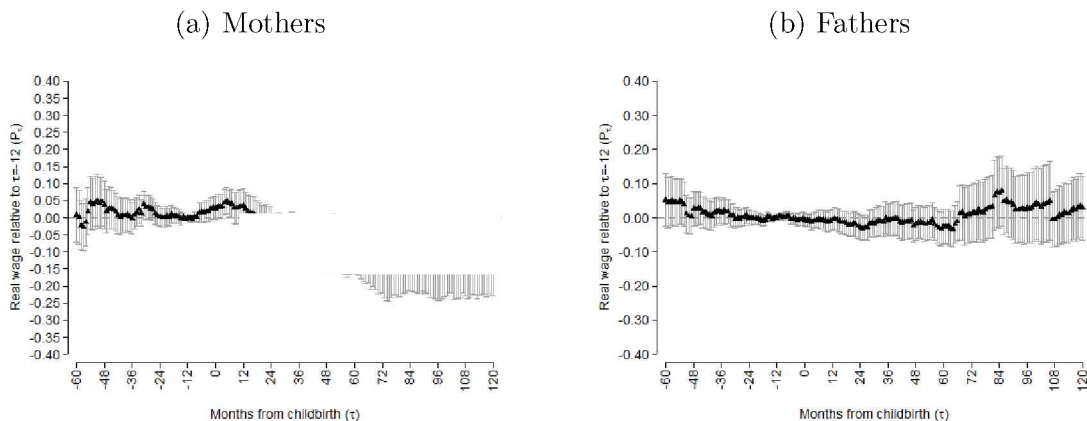
Figure 1: Impacts on labor supply



Source: Own calculations based on the Social Protection Survey (SPS).

Note: These figures show, for men and women, the estimated impact of children (coefficients $P_\tau = \frac{\hat{\beta}_\tau}{\tilde{Y}}$, where $\hat{\beta}_\tau$ are estimated from equation (1) and \tilde{Y} is the estimated counterfactual of the outcome variable, as it is explained in Section 2.2) on labor force participation (Figure 1a), employment (Figure 1b), hours worked (Figure 1c), and on the probability of working part-time. The omitted category is $\tau = -12$, i.e. the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The effects on hours and probability of working part-time is estimated conditional on working. The 90% confidence intervals are constructed based on standard errors clustered at individual level.

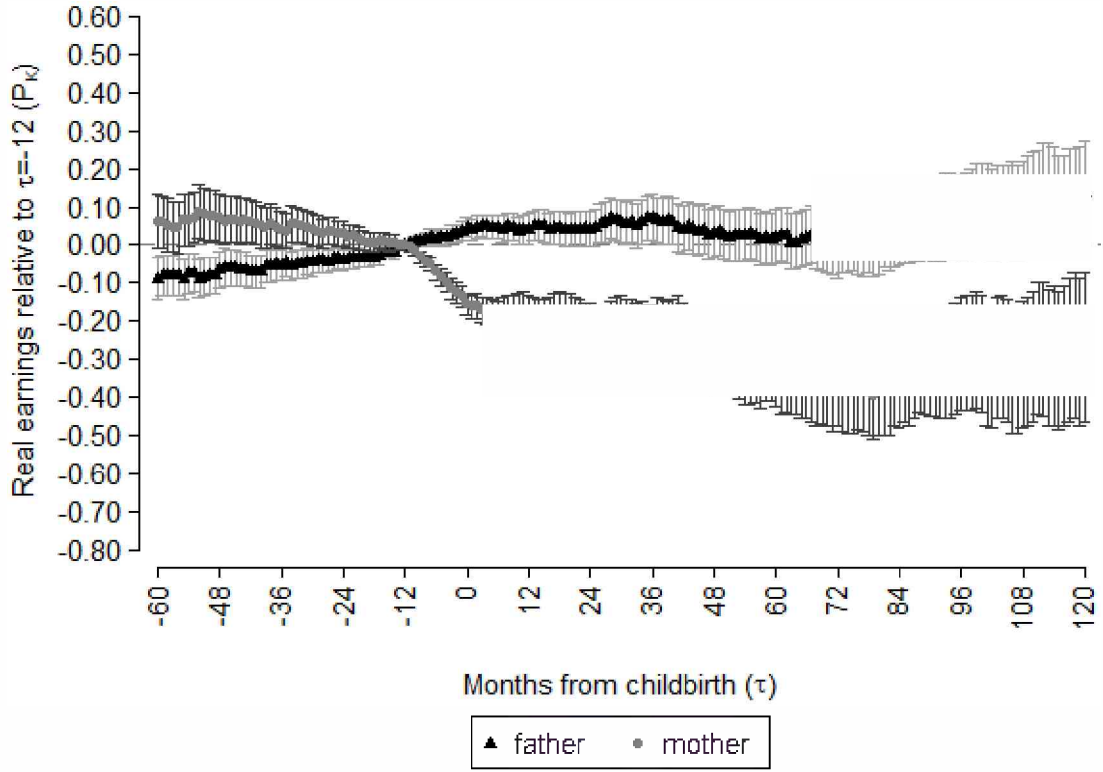
Figure 2: Impacts on hourly wage



Source: Own calculations based on the Social Protection Survey (SPS).

Note: These figures show, for men and women, the estimated impact of children (coefficients $P_\tau = \frac{\hat{\beta}_\tau}{\hat{Y}}$, where $\hat{\beta}_\tau$ are estimated from equation (1) and \hat{Y} is the estimated counterfactual of the outcome variable, as it is explained in Section 2.2) on hourly wage, conditional on working. The omitted category is $\tau = -12$, i.e. the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

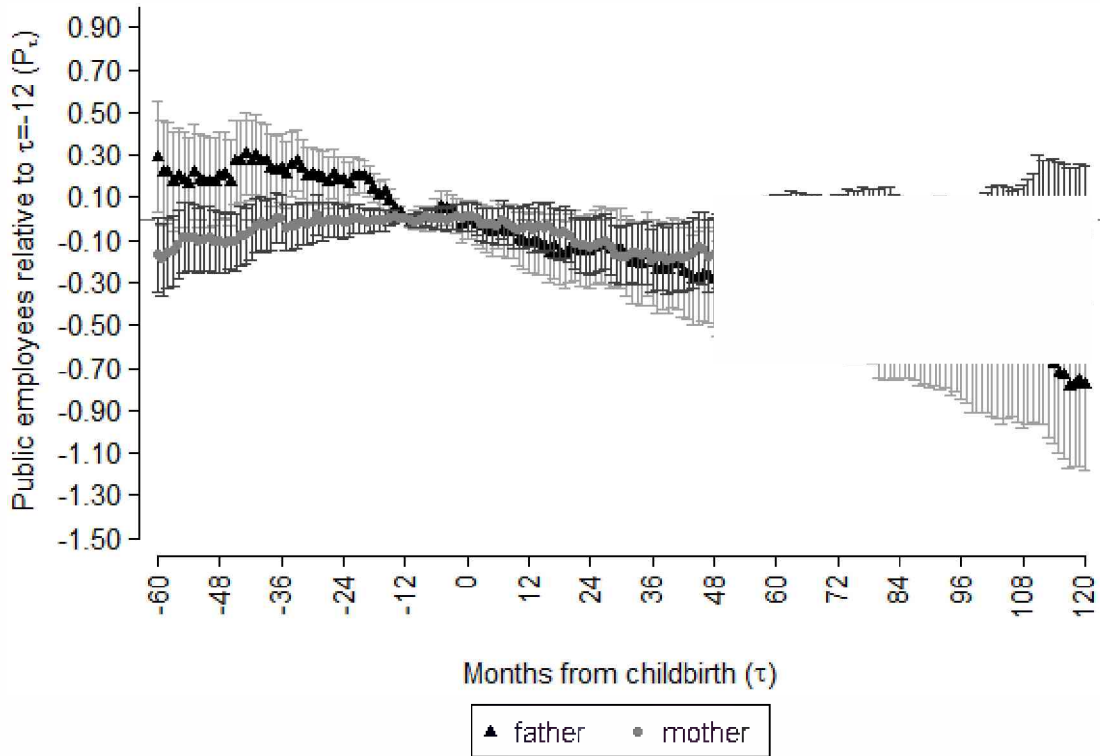
Figure 3: Impacts on Earnings



Source: Own calculations based on the Social Protection Survey (SPS).

Note: This figure shows, for men and women, the estimated coefficients P_τ that measure the impact of children on earnings as a percentage of a counterfactual value of the outcome without children ($P_\tau = \frac{\hat{\beta}_\tau}{\hat{Y}}$, where $\hat{\beta}_\tau$ are estimated from equation (1) and \hat{Y} is the estimated counterfactual of the outcome variable, as it is explained in Section 2.2). The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The effects on earnings is estimated unconditional on employment status. The 90 confidence intervals are constructed based on standard errors clustered at individual level.

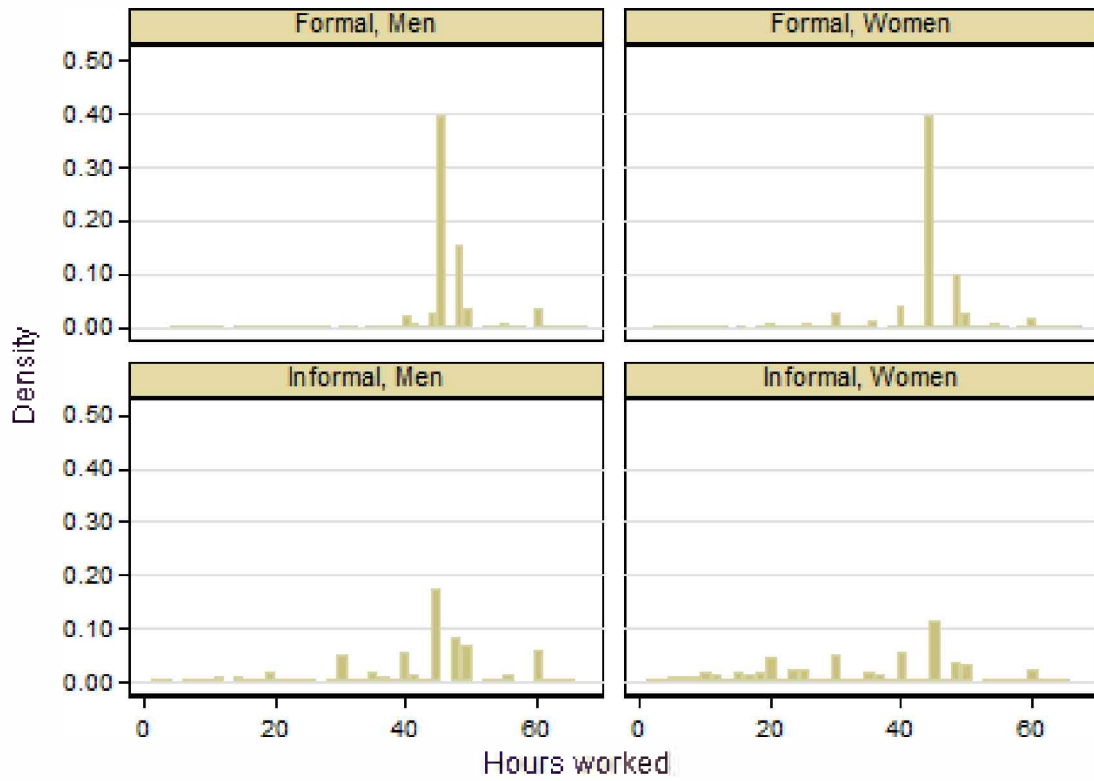
Figure 4: Impacts on occupational structure (conditional on working): Public sector employment



Source: Own calculations based on the Social Protection Survey (SPS).

Note: As in Figure 3, this figure shows, for men and women, the estimated impact of children (coefficients $P_\tau = \frac{\beta_\tau}{Y}$ from equation 1) on the probability of working in the public sector, conditional on working. The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

Figure 5: Distribution of hours worked per week, by sector and gender



Source: Own calculations based on the Social Protection Survey (SPS).

Figure 6: Impacts on occupational structure: formal and informal employment (unconditional on working)

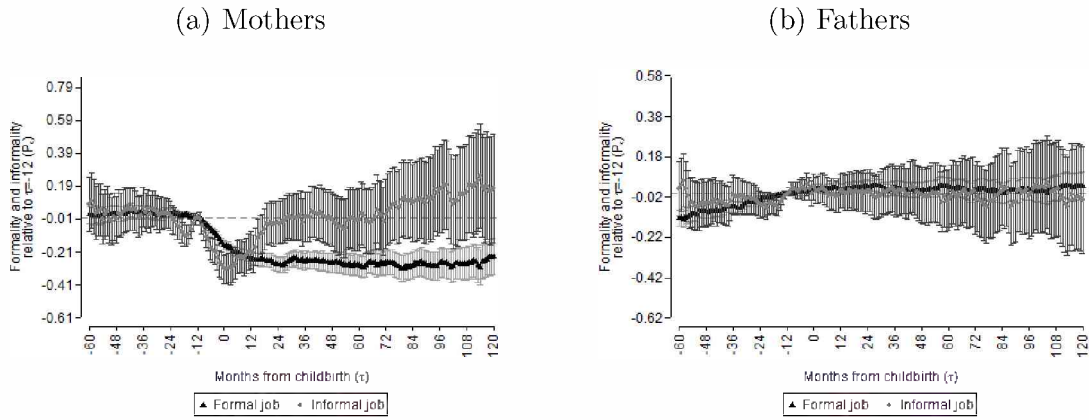
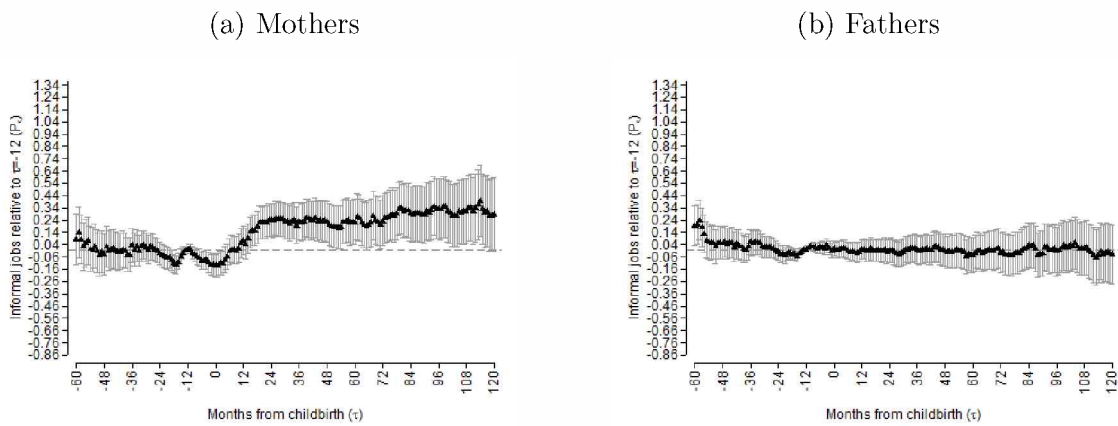


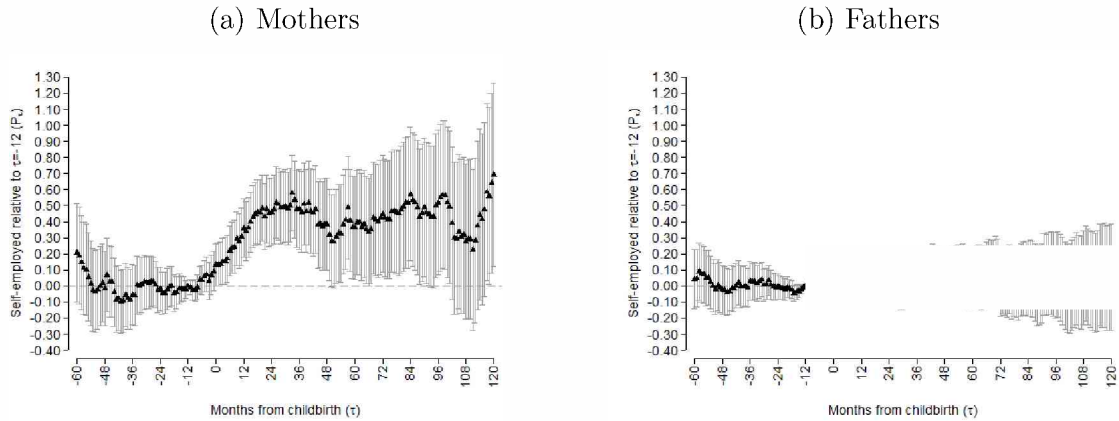
Figure 7: Impacts on occupational structure: informal employment (conditional on working)



Source: Own calculations based on the Social Protection Survey (SPS).

Note: These figures show, for women and men, the estimated impact of children (coefficients $P_\tau = \frac{\hat{\beta}_\tau}{\hat{y}}$ from equation 1) on the probability of working in the formal (Figures 6a and 6b) or the informal labor market (Figures 7a and 7b). In Figures 6a and 6b the estimations are unconditional on employment status. The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

Figure 8: Impacts on occupational structure: Self-employment (conditional on working)

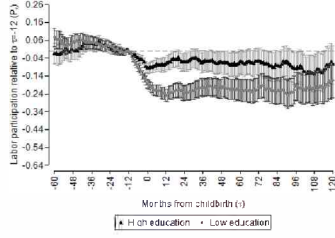


Source: Own calculations based on the Social Protection Survey (SPS).

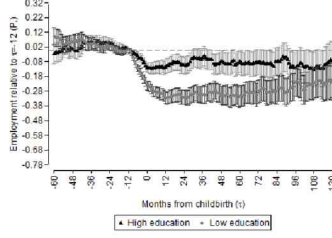
Note: These figures show, for women and men, the estimated impact of children (coefficients $P_{\tau} = \frac{\beta_{\tau}}{\gamma}$ from equation 1) on the probability of working as a self-employed worker (Figures 8a and 8b). The estimations are conditional on employment. The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old, fathers whose age at first childbirth is between 18 and 60 years old, and individuals observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

Figure 9: Impacts by education

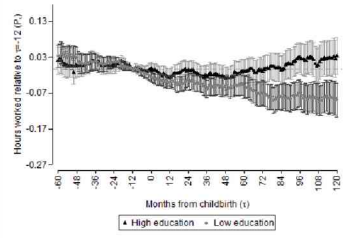
(a) Labor force participation



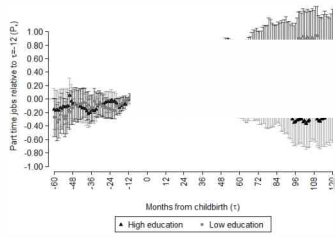
(b) Employment



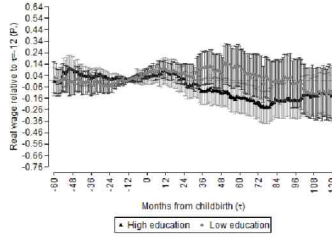
(c) Hours



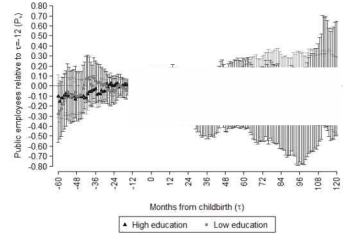
(d) Part-time



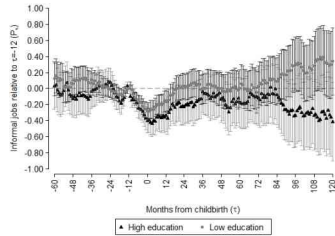
(e) Hourly wage



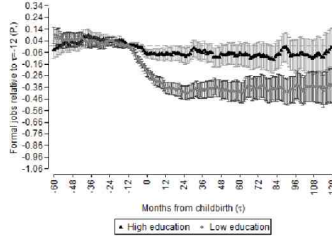
(f) Public sector



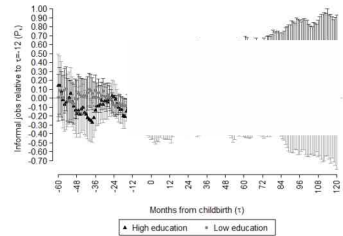
(g) Informality
(unconditional on working)



(h) Formality
(unconditional on working)



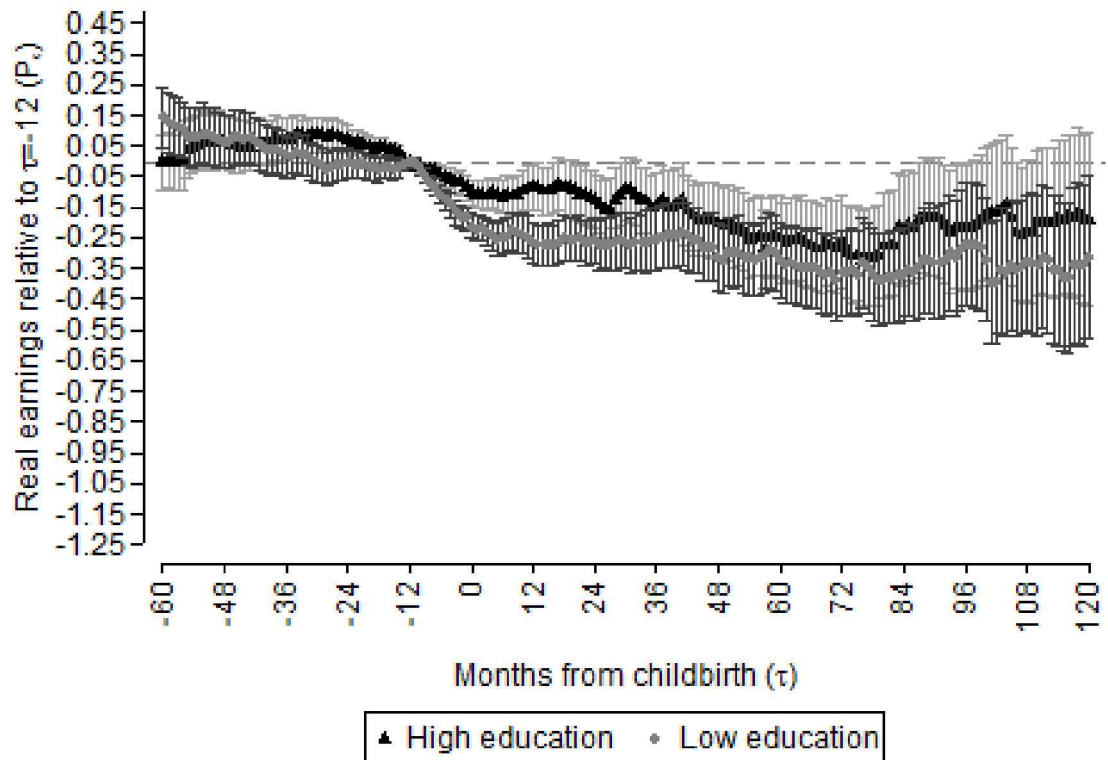
(i) Informality
(conditional on working)



Source: Own calculations based on the Social Protection Survey (SPS).

Note: The figures show, for less and more educated women separately, the estimated impact of children (coefficients $P_\tau = \frac{\beta_\tau}{Y}$ from equation 1) on different labor market outcomes. All estimations are conditional on working except those shown in Figures 9g and Figure 9h. The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old and observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

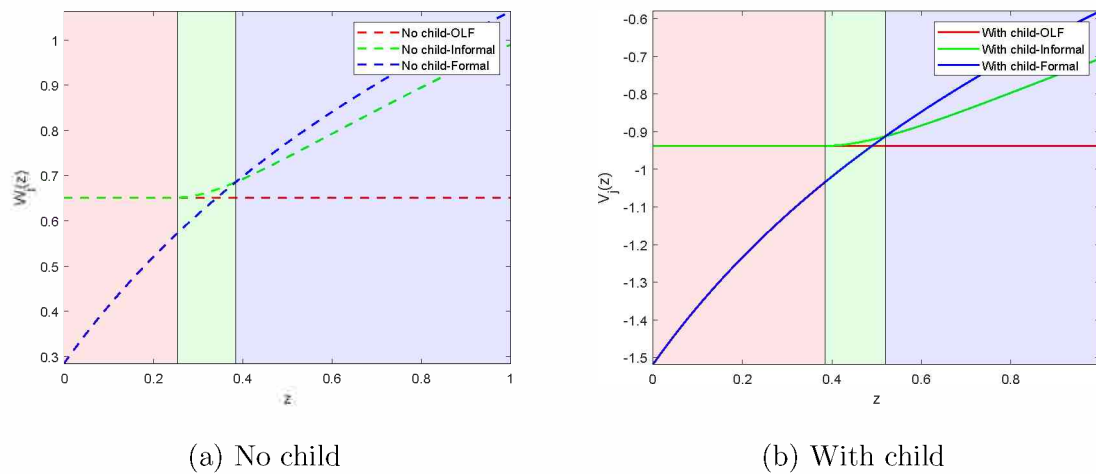
Figure 10: Impacts by education: earnings



Source: Own calculations based on the Social Protection Survey (SPS).

Note: This figure shows, for less and more educated women separately, the estimated impact of children (coefficients $P_\tau = \frac{\beta_\tau}{Y}$ from equation 1) on earnings. The estimations are unconditional on employment status. The omitted category is $\tau = -12$, i.e the coefficients measure the impact of children relative to the year before the birth of the first child. Controls include year, month and age fixed effects. Data covers the period 2002-2016 and the sample includes those parents whose first child was born during that period. The sample is restricted to mothers whose age at first childbirth is between 18 and 50 years old and observed at least once before childbirth and at least once after (unbalanced panel). The 90% confidence intervals are constructed based on standard errors clustered at individual level.

Figure 11: Values and cutoffs for occupational choices of women with and without a child in an economy with an informal sector.



Appendix A: Variable definitions

Labor outcomes in the SPS are obtained by means of recall questions that cover past labor market episodes (including periods of working, unemployment, leave of absence, and inactivity).

The precise definitions for the outcome variables that we analyze are:

- Total earnings: net monthly salary, or monthly earnings in the case of self-employed. Total earnings equals zero for unemployed or inactive individuals.
- Labor force participation: takes the value one if individual declares to have been working (including leave of absence), or actively looking for a job during the corresponding month, and it takes the value zero otherwise.
- Employment: takes the value one if individual declares to have been working (or on leave of absence) during the corresponding month, and it takes the value zero for unemployed or inactive individuals.
- Hours worked: number of weekly hours that the individual declares to have been regularly working in the corresponding month. This variable is only defined for employed individuals (missing for unemployed and inactive).
- Part-time employment: takes the value one if individual declares to have been working less than 30 hours a week during the corresponding month, and it takes the value zero for those employed individuals that work 30 or more hours a week.
- Hourly wages: ratio (monthly) total earnings to (monthly) hours worked.
- Employment in the public sector: takes the value one if individual declares to have been working (or on leave of absence) in the public sector during the corresponding month, and it takes the value zero if the individual declares to have been working in the private sector.
- Employment in the formal sector, unconditional on working: takes the value one if individual declares to have been working (or on leave of absence) and contributing to social

security during the corresponding month, and zero otherwise.

- Employment in the formal sector, conditional on working: takes the value one if individual declares to have been working (or on leave of absence) and contributing to social security during the corresponding month, and zero if the individual declares to have been working but not contributing to social security.
- Employment in the informal sector, unconditional on working: takes the value one if individual declares to have been working (or on leave of absence) and not contributing to social security during the corresponding month, and zero otherwise.
- Employment in the informal sector, conditional on working: defined as one minus the value of the variable *Employment in the formal sector, conditional on working*.
- Self-employment, conditional on working: takes the value one if individual declares to work independently during the corresponding month, and zero otherwise.