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Can Children's Education Enhance Formal Female Labor Force Participation?

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ABSTRACT

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Developing countries face significant challenges in increasing women's labor force participation and improving job quality, partly due to the substantial presence of the informal sector. This paper examines the case of Bolivia, which has the highest level of informality in Latin America. We empirically investigate whether the expansion of children's access to education in Bolivia provides an additional explanation for the reduction in female participation in the informal sector, as children attending school would require less parental supervision. Using a structural model in which mothers decide to participate in formal markets at a cost inversely related to the likelihood of their children being enrolled in school, we find that the rise in primary school enrollment in Bolivia explains up to 40% of the decline in female workers under age 40 in informal markets. Our findings contribute to the growing body of evidence on the positive impact of children's access to education on women's labor market outcomes in developing countries.

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1 INTRODUCTION

In recent years, there has been growing interest in understanding the sources of gender disparities, partly due to the stagnation of women's labor force participation in the developed world (Blau and Kahn, 2013; Wyrwich, 2019; Vlasblom and Schippers, 2006). However, a gap remains in understanding the dynamics of female labor force participation in developing countries, where labor markets are dominated by a large informal sector that offers women job opportunities at the expense of lower job quality. (Levy, 2010).

Despite the pivotal role women's labor force participation plays in driving economic growth, fostering development, increasing household income, improving living standards, and reducing poverty (Albanesi et al., 2023; Ishizuka, 2021), various cultural, social, economic, and individual factors impede their integration into formal employment structures, often pushing them toward informal labor markets (Amin, 2010; Sethuraman, 1998; Chant and Pedwell, 2008). Notably, women often shoulder a disproportionate share of caregiving responsibilities, including childcare and eldercare, a burden that is especially pronounced in developing countries. This is partly due to the limited availability of affordable, high-quality childcare and low enrollment rates in primary and secondary schools, which can further restrict women's ability to participate in employment outside the home or push them into jobs with greater flexibility, particularly during standard working hours (Berniell et al. (2021); Cavapozzi et al. (2021)). In the face of these constraints, women who enter the labor force in these contexts often find themselves in the informal sector, characterized by sub optimal job quality and limited opportunities for professional advancement (Hoyman, 1987; Fourie, 2020; Ghore et al., 2023).

The impact of children on women's labor market participation and career progression highlights a significant divergence between the career trajectories of men and women, particularly after the birth of children and extending through their secondary education. Mothers, in particular, experience limited recovery in their careers, both in the medium and long term. (Angelov et al., 2016; Goldin and Mitchell, 2017; Fitzenberger et al., 2013). This consistent empirical pattern underscores the need to investigate the reasons and mechanisms by which children disproportionately affect women's careers, not only in the short term but also in the long run. Such an exploration can offer valuable insights into the root causes of persistent gender disparities and inform the development of targeted policy interventions.(Kleven et al., 2019; Cortés and Pan, 2023; Kleven et al., 2021; Kuziemko et al., 2018).

An effective, mutually beneficial solution to address the high female labor force participation in

the informal sector involves freeing up time typically devoted to childcare. This approach should extend beyond the early years of children's lives and encompass both primary and secondary education. The rationale is that when children attend school they require less parental supervision, potentially freeing up time and overall availability for mothers to pursue employment opportunities outside home. This could include formal-sector employment with fixed hours aligned conveniently with the school schedule. Therefore, promoting primary and secondary education not only benefits children but also acts as a strategic intervention to empower women, enabling their integration into more structured and secure employment environments.

In this paper we investigate the potential effects of increased school enrollment on women's decisions regarding labor force participation in a predominantly informal labor market. The existing literature in developing countries is limited, with studies such as those conducted by Berniell et al. (2021) in Chile, Heath (2017) in Ghana, Jiang and Yang (2022) in China, and Berniell et al. (2023) in Chile, Peru, and Uruguay and Villanueva and Lin (2020) for a set of Latin American countries. This body of work consistently reveals that motherhood leads to a significant decline in women's employment, accompanied by a shift towards part-time jobs, self-employment, and informality. The existing literature concentrate on short-term effects—examining the impact of having children—rather than delving into the long-term consequences, such as the effects of children in primary or secondary education.

Bolivia provides a suitable context for examining the implications of rising school enrollment on women's participation in the informal sector. With more than two-thirds of its labor force engaged in the informal sector, Bolivia has the highest level of informality in Latin America and ranks among the highest worldwide. However, a notable trend has emerged in female employment within the informal sector over the past two decades. As depicted in Figure 1, there has been a significant decline, averaging 12 percentage points per age group, in the prevalence of female workers in informal markets from 2000 to 2013. At the same time, Bolivia has witnessed a remarkable increase in children's school enrollment. Canelas and Niño-Zarazúa (2019) provides strong evidence of a significant increase in enrollment for both primary and secondary school-aged children, highlighting a marked upward trajectory in school enrollment for grades 1 to 3, growing from 60.4% in 2006 to 94.3% in 2013. Similarly, enrollment for grades 4 to 6 experienced an increase from 52.6% to 72.4% during the same period.

Figure 1: Share of Employed Female Workers in Informal Markets
Periods 2000-2003 and 2013

Source: Encuesta de Hogares (EH) 2000-2003 and 2013. Informal Market Jobs are defined as those allowing for pension fund contributions.
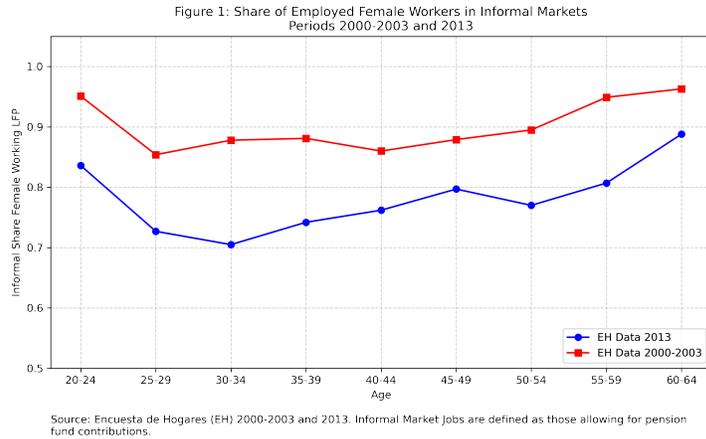
We propose that the rise in school enrollment allowed mothers to shift from informal to formal labor markets, as formal employment typically offers higher wages and becomes more feasible when children attend school. For instance, a significant portion of the decline in female participation in the informal sector for women aged 30-34 coincides with the average age of mothers with children aged 6-8 during the period 2000-2010 (34 years old). We posit this is in part due to the increase in school enrollment for this age group, which rose from 60.4% to 94.6%.[1]

To examine the influence of children's school enrollment on female labor force participation decisions, we develop a dynamic programming model inspired by the works of Cubeddu and Ríos-Rull (2003), Attanasio et al. (2008), and Fernández and Wong (2014). This model, tailored to the Bolivian context, enables us to explore how households balance women's involvement in the informal and formal labor markets. We include a utility cost for mothers who participate in the formal sector, acknowledging their disproportionate childcare responsibilities that may conflict with formal sector demands. This cost is then inversely proportional to the likelihood of the household's children being enrolled in school. Moreover, the attractiveness of formal sector employment is contingent upon women's inherent formal job skills, and the probability of obtaining formal sector employment is determined by a woman's level of education. To establish a synthetic cohort of households, we calibrate the model parameters to align with the proportion of female workers in informal markets during the 2000-2003 period—a timeframe marked by relatively low children's school enrollment. Subsequently, while keeping other parameters constant, we adjust the parameters associated with children's school enrollment to reflect more recent periods characterized by higher enrollment rates. We emphasize that our analysis does not target profiles within the informal sector during the recent periods characterized by a decrease in the share of female workers in informal markets. Instead, our objective is to capture the impact of recalibrated school enrollment

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[1] Canelas and Niño-Zarazúa (2019)). Primary school enrollment from 2006 to 2013.

parameters on our model regarding the share of female workers in informal markets in previous years, specifically for cohorts observed in the 2000-2003 period.[2]

Using a combination of data from the Bolivian household survey (*Encuesta de Hogares*) and parameter estimates of previous studies of informal markets in Bolivia, we find that the increase in both primary and secondary school enrollment had an effect on the decline of the share of female workers in informal markets. In particular, among women between ages 25 to 34, the upsurge in the school enrollment of children accounts for 33% of the observed decrease in the share of employed female workers in informal markets, and around 40% for the observed decrease among women between ages 35 to 39. These results underscore the significance of the availability of mothers to engage in formal markets and elucidate how the enhancement of school enrollment of their children, as reflected in the data showing increased school enrollment, can foster women's participation in formal markets.

For example, in Bolivia the conditional cash transfer program for school-aged children, known as *Bono Juancito Pinto (BJP)*, was introduced to enhance primary school enrollment, potentially influencing female labor force participation indirectly. This initiative involved annual cash transfers to households contingent upon children's enrollment in public schools, with an requirement of at least 80% of attendance. In its inaugural year, the BJP program achieved nearly universal coverage, benefiting approximately 90% of eligible households. These transfers were typically received by mothers and constituted a significant portion of their earnings, providing substantial support for household education expenses. However, while the BJP program is often linked to the observed increase in school enrollment, the relationship between the program and its desired outcomes remains uncertain.[3] It is plausible that various factors contributed to the positive trends in school enrollment, such as an increase in national income and overall improvements in the education system. Despite this, there is evidence indicating that the concurrent rise in school enrollment, as seen with initiatives like the BJP program, could have a substantial impact on the development of parents' human capital. For instance, Vera Cossio (2019) demonstrated that exposure to the BJP program increased employment among parents of eligible children, reinforcing the notion of a direct relationship between children's school enrollment and parents' labor market decisions..

The remainder of the paper is structured as follows: Section 2 outlines the model, Section 3 provides details on its parameterization, Section 4 presents the model results, and Section 5

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[2]In the model women cannot opt not to not work and childcare services are unavailable. Moreover, pension taxes associated with formal jobs do not fully fund pension benefits during retirement years and therefore a general equilibrium effect in this respect cannot be exactly determined.

[3]For instance, Canelas and Niño-Zarazúa (2019) find a positive effect of BJP on school enrollment rates but finds no effect on child labor measures.

concludes with some final remarks.

2   MODEL

We develop a model in which households aim to maximize the expected lifetime combined utility of both husband and wife. This model is designed to capture the various incentives that female workers confront when contemplating a shift from the informal to the formal sector. Our approach assumes an intertemporally separable utility function for each individual, where instantaneous utility depends on the consumption per adult equivalent within the household. However, for the wife, utility is additionally influenced by the labor supply decision regarding whether to work in formal or informal markets. To simplify the model, we maintain the assumption that the male partner consistently remains employed throughout the female partner life cycle's working years. Additionally, we assume the couple stays married throughout their life, shares the same age, lives until age T, and both enter the economy and retire at the same age.

We depart from instantaneous utility functions of the form

$$u_t^f(c_t, F_t) = \frac{c_t^{1-\gamma}}{1-\gamma} - F_t B \ , \ u_t^m(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma},$$

where u_t^f and u_t^m are the utility functions for the wife and the husband, respectively; c_t is consumption; B is the wife's disutility for participating in the formal sector; and $F_t \in \{0,1\}$ is the formal sector participation indicator for the wife. As will be explained later, we assume that children's school enrollment is negatively associated with B. In other words, children's school enrollment diminishes the wife's disutility when she participates in the formal sector. Childcare services are not available for households in this environment. Additionally, we assume $\gamma > 1$ and is identical for both utility functions; we assume infinite marginal utility of consumption at zero consumption.

Before their 65th birthday (i.e. the working years) households recursively engage in savings behavior by allocating their resources to a risk-free asset represented by a_t. Households through their wife worker are heterogeneous in two important dimensions. First, the wife's education level E, which by being either high or low, i.e., $E \in \{H, L\}$, is assumed to be already determined at the time she enters the economy. In this regard, we will use education level to define the wife's probability of finding a job in the formal sector, p_E. Secondly, we assume there exists an idiosyncratic formal-job skill level for the wife, z_t, that depreciates over time. However, we model it to never

fully depreciate. To this end, we assume z_t follows a Markov process that will be specified in the next section. Thus, the household intertemporal constraint is given by

$$c_t + a_{t+1} = a_t(1+r) + W + W_t^m, \tag{1}$$

with

$$W = \begin{cases} p_E \left[W^f (1 + [\omega_t z_t])(1 - \tau) \right] + (1 - p_E)W^f & if \ F_t = 1 \\ W^f & if \ F_t = 0 \end{cases},$$

where W^f is the average income for the wife in the informal sector, ω_t is an age-dependent market premium associated to the formal sector, τ is the pension tax that the wife must pay if she holds a formal job, W_t^m is the average income for the husband, and r is the interest rate the risk-free asset pays. The trade-off the household faces through the wife's utility function is evident now, given that the formal sector potentially pays a premium to the wife. In this manner, the magnitude of the idiosyncratic premium $\omega_t z_t$ is determined by her formal job skills z_t, but in addition, the probability of her finding a formal job once she has begun to participate in the formal sector, p_E, depends exclusively on her education level. Finally, we do not make a formal-informal income distinction for the husband and make the single assumption that W_t^m increases non-stochastically over the correspondent household life cycle years.

Because the budget constraint is considered at the household level, we assume consumption in the utility functions above takes the deflated form of:

$$\hat{c}_t = \frac{c_t}{\eta}, \tag{2}$$

that is, each utility function will be evaluated with deflated consumption $\hat{c}$, $u_t^f(\hat{c}_t, F_t)$ and $u_t^m(\hat{c}_t)$, with a constant deflating factor η.

The disutility for participating in the formal sector B depends on the current children's school enrollment probability q_t, and a parameter $\varphi^Y(E)$ that varies itself according to the education level of the wife E. Specifically,

$$B = \begin{cases} \varphi^Y(E) \left[(q_t)b^l + (1 - q_t)b^h \right] & for \ t \in Y \\ \varphi^X & for \ t \in X \end{cases}, \tag{3}$$

where Y is the set of wife ages t during which she rears children of school age, and X is the set of wife ages t during which she does not rear children of school age. For t in Y, b^l is the (lower) burden associated with children enrolled in school and b^h is the (higher) burden associated with children not enrolled in school—that is, $b^h > b^l$. Additionally, for t in X, φ^X is a child-unrelated burden of participating in formal markets.

Recursively, the household maximizes the value function

$$V(a_t, z_t) = \max_{c_t, a_{t+1}, F_t \in \{0,1\}} (\phi) u_t^m(\hat{c}_t) + (1 - \phi) u_t^f(\hat{c}_t, F_t) + \beta E\{V(a_{t+1}, z_{t+1}) \mid z_t\}$$

s.t. (1), (2), and (3), and where β is the time discount factor.

In this formulation the household maximizes a combination of the wife's and husband's individual utilities using Pareto marriage weights defined by the parameter ϕ. The expectation in the household value function is taken with respect to the wife's next period skill; women in our environment are heterogeneous with respect to their total formal market premium level, making households heterogeneous in this respect, too.

During retirement years, i.e., from age 65 to the age of death T, both the husband and wife are not able to work anymore. As will be explained in the next section, the retirement income of both the husband and wife consists of a pension, which is a function of their respective formal wages and a government transfer. In many developing economies, pensions and social security may play a minor role in the labor market decisions of individuals; this uncertainty is exacerbated in Bolivia due to the many pension policy transitions the country experienced in the 1990s and 2000s. Such transitions cause the individuals we aim to model to experience more than one pension regime during their life cycle. As a consequence, in the model we adopt a simplified retirement scheme where pension benefits are independent of pension taxes. This retirement scheme mirrors the pension reform that took place in Bolivia in 1996, where the goal was to fund retirement income through a system akin to a defined contribution plan (*Sistema de Capitalizacion Individual*) in tandem with a direct government transfer not funded through contributions (*Bonosol*).[4] This scheme was likely the most important one for the cohort observed in the 2000-2003 period. Recursively, during retirement years the household maximizes the value function

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[4]The Bonosol was a non-contributory lifetime pension whose objectives are to protect the income of this vulnerable population. The Bonosol continued as Renta Dignidad, which is an annual monetary transfer to all people aged 65 or over.

$$V^R(a_t) = \max_{c_t, a_{t+1}} (\phi)u_t^m(\hat{c}_t) + (1 - \phi)u_t^f(\hat{c}_t, F_t = 0) + \beta\{V^R(a_{t+1})\}$$

s.t.

$$c_t + a_{t+1} = a_t(1 + r) + ben^f + ben^m \tag{4}$$

and (2), where ben^f and ben^m are the retirement income of the wife and the husband, respectively.

3 PARAMETERIZATION

In this section, we elaborate on the model parameterization and its rationale. The primary objective of the model, as discussed in the preceding section, is to encapsulate the diverse economic incentives faced by households during the years 2000-2003, utilizing the available data sources for Bolivia in the first half of the 2000s. The model is employed to simulate the conditions and incentives for women in Bolivian households during the 2000–2003 period, characterized by a high proportion of female workers in informal markets. Our parameterization involves a combination of out-of-model estimates, direct estimates from Bolivia's Encuesta de Hogares household survey data, and calibrated parameters tailored to specific targets. Notably, we calibrate the parameters related to the disutility of participating in the formal sector to align with the profile of female workers exclusively engaged in informal markets, after determining the rest of the parameters.

The model operates with a time span of 1 year per period. Individuals initiate their working stage at the age of 20, denoted as $t = 1$, and continue working until the age of 64. The predetermined age of death is set at 100, concluding the model at the end of period $T = 80$. Consistent with established values in the literature, the constant relative risk aversion (CRRA) parameter γ is set to 3. The interest rate for the risk-free asset is established at 5.52% per annum, paid in the local currency (Bolivianos), in accordance with the real savings interest rate for the year 2003.[5]

As specified in the previous section, we assume a constant deflator factor for consumption throughout the wife's life cyle. For this purpose, following Attanasio et al. (2008), we deflate consumption with scale factor η using the McClements scale.[6] Because we do not explicitly model fertility decisions, we adopt a simplified form of the deflating factor, assuming a scale value correspondent to a couple with a child between ages 8 and 12: 2.07. We cannot estimate the Pareto

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[5]Unidad de Analisis de Politicas Sociales y Economicas (UDAPE), Statistics Dossier; www.udape.gob.bo.
[6]McClements (1977).

marriage weight ϕ and to the best of our knowledge no previous studies have estimated it for Bolivia. We set it a priori to $\phi = 0.5$, following previous studies such as Fernández and Wong (2014).

3.1 LABOR MARKET

Using the Encuesta de Hogares survey, we estimate the average income for the wife in the informal sector W^f to be 5,148 Bs for the 2000–2003 period. The age-dependent formal sector premium series ω_t is also estimated using this period. Figure 2 presents the estimated formal premium profile for the correspondent groups of ages studied. As can be seen in this figure, the premium varies per age group and takes a steep increase from ages 50-54 to ages 55-59.
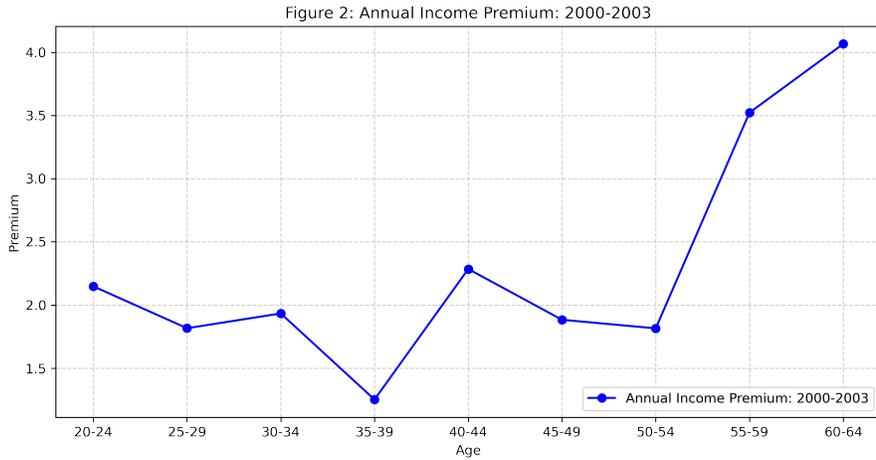
Figure 2: Annual Income Premium: 2000-2003

Source: Encuesta de Hogares (EH) 2000-2003 and 2013. Informal Market Jobs are defined as those allowing for pension fund contributions.

As mentioned above, idiosyncratic formal job skills depreciate over time. We calibrate the Markov process so the average decrease of the formal job wage premium for women in the model matches the rate of decrease of the formal job premium for women from 2000 to 2001: -2% per year. To this end we use the grid $\vec{z} = [0.9, 0.5, 0.3, 0.09, 0.001]$ and the transition matrix

$$\Gamma(z_{t+1}, z_t) = \begin{bmatrix} 0.883 & 0.117 & 0 & 0 & 0 \\ 0 & 0.85 & 0.15 & 0 & 0 \\ 0 & 0 & 0.955 & 0.045 & 0 \\ 0 & 0 & 0 & 0.965 & 0.035 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}.$$

The relationship between education level and the probability of finding a formal job for women has not been measured for Bolivia to the best of our knowledge. As a proxy, we use estimates from Valencia (2020) regarding the shares of workers in the formal and informal sectors, per education level and irrespective of gender. Low education, $E = L$, is defined as 12 years of education or less and characterized 76% of the labor force in 2003. High education, $E = H$, is defined as more than 12 years of education and characterized 24% of the labor force in 2003. We use this distribution to differentiate women's education level in our model. The probability of finding a job in the formal sector if education is low is set to $p_L = 0.3$, while the probability of finding a job in the formal sector if education is high is set to $p_H = 0.7$.

The husband's income increases at a constant rate throughout the life cycle in a nonstochastic manner. Using the Encuesta de Hogares survey, we use the growth rate of men's income and set it at 3%, without making a distinction on the basis of type of labor market. We match the average income of this process in the model to the average annual earnings of men in the period 2000–2003, which amounts to 12,660 Bs.

3.2 Child-rearing

As explained in the previous section, the disutility associated with children's enrollment and the enrollment rate itself are age dependent. We assume the burden associated with children being enrolled in school, b^l, as the share of working days in a year that would overlap with nonschool days, i.e., days on which children do not have to attend school if enrolled. We calculate in total 250 working days in a year, and there are 50 days in a year on which children do not have to attend school if enrolled. We assume that these 50 days occur during the 250 working days, resulting in a burden fraction of 50/250 = 0.2, that is, $b^l = 0.2$. On the other hand, for children who are not enrolled in school, we take into account the maximum number of school days in a year, which amounts to 200. In order to be conservative in our calibration, we use this maximum number of days as a proxy of all the days the household's children have to be taken care of at home if not enrolled in school, and therefore calibrate this fraction as 200/250 = 0.8, that is, $b^h = 0.8$.

In the model we do not account for fertility decisions. Instead, using the Encuesta de Hogares survey for the years 2000–2003, we calculate the average age of children by the mother's age brackets, as shown in the first two columns of Table 1. In the last three columns of Table 1 we complement and match this information with estimates from Canelas and Niño-Zarazúa (2019) regarding enrollment rates for the years 2006 and 2013 through the link of mother's age and child's

age. For the benchmark model, reflecting the scenario in 2000–2003, we use the 2006 enrollment estimates from Canelas and Niño-Zarazúa (2019) as a proxy of the 2000–2003 period.[7]

TABLE 1: School enrollment rates, 2006 and 2013, by mother's and children's age*

Age Mother	Age Children (average)	School	2006 Enr. rate	2013 Enr. rate
25-29	5	Primary	0.604	0.943
30-34	7	Primary	0.604	0.943
35-39	10	Primary	0.526	0.724
40-44	13	Secondary	0.435	0.61
45-49	15	Secondary	0.357	0.524

* *Source:* Enrollment rates are taken from Canelas and Niño-Zarazúa (2019) and Mother's age from the Encuesta de Hogares survey.

Once all these parameters are chosen, we calibrate the parameters $(\varphi^X(E = H), \varphi^X(E = L))$ to $(-6.07 \times 10^{-8}, -1.74 \times 10^{-9})$ to match the profile of women's participation in informal markets in 2003. In this sense, the impact of the burden in the utility function is higher for women with low education than for women with high education. Lastly, the the parameter φ^Y is set per age group to match the profile of informal markets' share of female workers for ages in which there is no child-rearing. These parameters then are intended to capture all other exogenous factors that affect the disutility of participating in formal sector per age group.

3.3   RETIREMENT

As mentioned, retirement is imperfectly modeled due to the many regimes that governed Bolivia in the 1990s and 2000s. We adopt a simplified version of the scheme implemented in Bolivia in 1996. In this pension scheme, individuals were supposed to fund retirement income from two sources. First, through a system akin to a defined contribution plan (Sistema de Capitalizacion Individual), individuals were supposed to accumulate their own individual savings—stemming from the pension tax defined above—by the time they retire. In reality, for this mechanism to take place, many aspects of a worker's journey would have to be considered; this task is beyond the scope of the present work.[8] The simplification adopted here consists of assuming workers believed the intention of the 1996 scheme, which aimed at achieving a 70% replacement rate of a formal job wage through this plan; furthermore, in the model we do not tie pension tax collections to the benefit

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[7]Since this proxy choice only risks overestimating the actual enrollment rate in 2000–2003, an impact of the change in enrollment rates by 2013 can only be larger than the one we intend to account for with the parameters chosen.

[8]For more information on the 1996 reform, see Evia Vizcarra and Fernández Moscoso (2005).

paid during retirement years. Instead, we adopt the following formula, which we believe captures the expectation of the average retirement income workers had in the period 2000–2003:

$$Pension = Replacement\ Rate * Average\ Formal\ Wage * P(Formal)$$

In this formulation $P(Formal)$ is the probability of working in a formal sector job, with the average Formal Wage varying by gender. Therefore we calculate the $Pension$ measure differently for men and women as $Pension^m$ and $Pension^f$.

Secondly, we assume workers also took as granted a direct transfer that was not funded through pension taxes or contributions—the Bonosol, which consisted of 1,800 Bs. Combining these two measures, we obtain the total benefits paid during retirement years:

$$ben^m = Pension^m + 1,800$$
$$ben^f = Pension^f + 1,800.$$

We estimate $Average\ Formal\ Wage$ from the Encuesta de Hogares survey for both men and women and set them at 28,224 and 19,404 Bs., respectively. The probability of working in a formal sector job, $P(Formal)$, is taken from Valencia (2020) and set at 20%, corresponding to the years 2002–2003.

To solve the model we discretize the state space and solve the value function through backward iteration. We simulate the model using the initial distribution of women's education as explained in section 3.1.

Table 2 presents a summary of the parameters being calibrated.

4   RESULTS

To investigate the influence of increased enrollment rates on the proportion of female workers in informal roles, our analysis commences by fine-tuning the model to align with the characteristics of female workers engaged in informal employment during the 2000-2003 period, as elucidated in

Parameter		Value	Source
Time of death	T	80 (age 100)	-
CRRA parameter	γ	3	-
Time discount factor	β	0.95	-
Risk-free asset return	r	5.52%	UDAPE, Stats Dossier
Consumption deflator factor	η	2.07	McClements (1977)
Pareto marriage weight	ϕ	0.5	see section 3
Informal Average Income, wife	W^f	5,148 Bs	Encuesta de Hogares Survey
Formal sector premium	ω_t	see section 3.1	Encuesta de Hogares Survey
Formal job skill	z_t	see section 3.1	Encuesta de Hogares Survey
Low education formal job prob.	p_L	0.3	Valencia (2020)
High education formal job prob.	p_H	0.7	Valencia (2020)
Husband income	W_t^m	see section 3.1	Encuesta de Hogares Survey
Children in school burden (Low)	b^l	0.2	see section 3.2
Children not in school burden (High)	b^h	0.8	see section 3.2
Enrollment Rate	q_t	see section 3.2	Canelas and Niño-Zarazúa (2019)
Wife retirement income	ben^f	see section 3.3	see section 3.3
Husband retirement income	ben^m	see section 3.3	see section 3.3

the preceding section.

Having established this baseline, we proceed to manipulate the school enrollment parameters to scrutinize their impact on the observed 2000-2003 profile. Our methodology involves determining the fraction of employed female workers occupying informal labor positions as predicted by the model. This encompasses individuals who actively chose to participate in the informal sector and those who initially aimed for the formal sector but, with a probability of $1 - P_E$, encountered difficulties securing formal employment, ultimately leading them to accept informal positions.

For the purpose of this investigation, we utilize the 2006 enrollment rates as a proxy for the 2000-2003 period, as delineated in Table 1. The resulting insights, illustrated in Figure 3, demonstrate the model's capability to effectively approximate the profile corresponding to the 2000-2003 period. It is noteworthy that our analysis acknowledges the possibility that even if school enrollment does not translate into perfect year-round attendance, the mere act of children being enrolled in school could still contribute to freeing up time for mothers. This is a significant aspect, as it suggests that the benefits of enrollment extend beyond the classroom, potentially influencing the labor dynamics of female workers in informal roles.

Figure 3: Share of Employed Female Workers in Informal Markets
2000-2003 Period and Benchmark Model
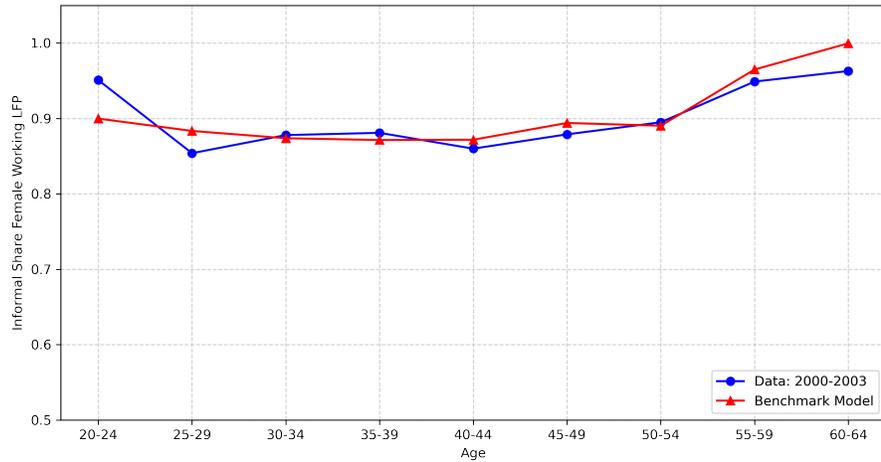
Source: Encuesta de Hogares (EH) 2000-2003 and 2013. Informal Market Jobs are defined as those allowing for pension fund contributions.

4.1 INCREASE IN SCHOOL ENROLLMENT

To examine the repercussions of the escalating enrollment rates, we rely on the enrollment data presented by Canelas and Niño-Zarazúa (2019) for the year 2013. Table 1 delineates a noteworthy surge in primary school enrollment, averaging 30 percentage points, juxtaposed with a comparatively moderate increase in secondary school enrollment, averaging 20 percentage points. In fact, primary school enrollment in Bolivia is approaching to an universal coverage for urban and rural areas, in part explained by the transfer (bono juancito pinto) that the government implemented (Vera Cossio, 2019).

Figure 4: Model Prediction Share of Employed Female Workers in Informal Markets, 2000-2003 Period with 2013 Enrollment Rates
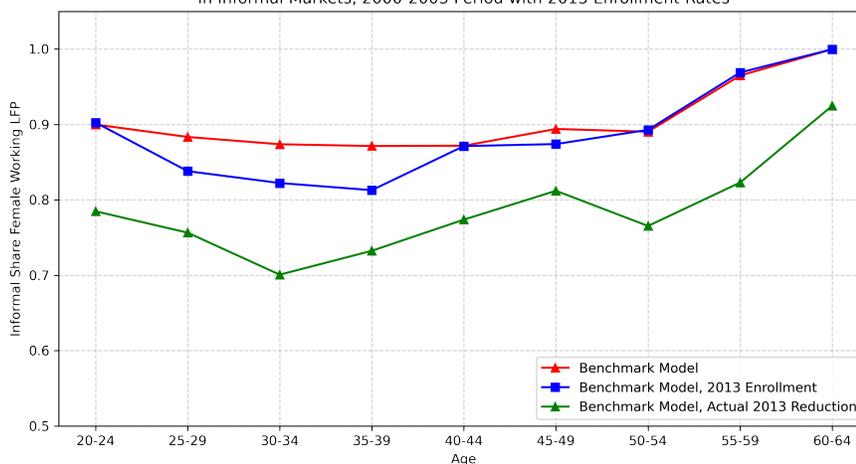
Note: For the benchmark model with actual 2013 reduction the difference between the 2000-2003 and 2013 data profiles was applied to the profile generated by the benchmark model.

The outcomes of this analysis are depicted in Figure 4. For individuals aged 25 to 34, the augmentation in enrollment rates results in a 5-percentage-point reduction in the share of employed female workers in informal markets, constituting approximately 33% of the actual drop observed in 2013. Similarly, for the age group of 35 to 39, the informal share experiences a 6-percentage-point decline, accounting for around 40% of the observed drop in 2013. The recalibrated profile aligns with the more substantial increase in primary school enrollment. Our model, attuned to the critical early years in the labor market for women, recognizes that skills experience less depreciation during this period. Consequently, the impact of the rise in primary enrollment outweighs that of secondary school enrollment. This effect is particularly pronounced as women benefit from engaging in formal markets during these productive years, coinciding with the time when they are most likely to be caring for children of primary school age. Thus, the enrollment effect during the first half of the life cycle becomes a pivotal determinant in reshaping the labor dynamics.

Figure 5: Savings Profile, Before and After Enrollment Effect
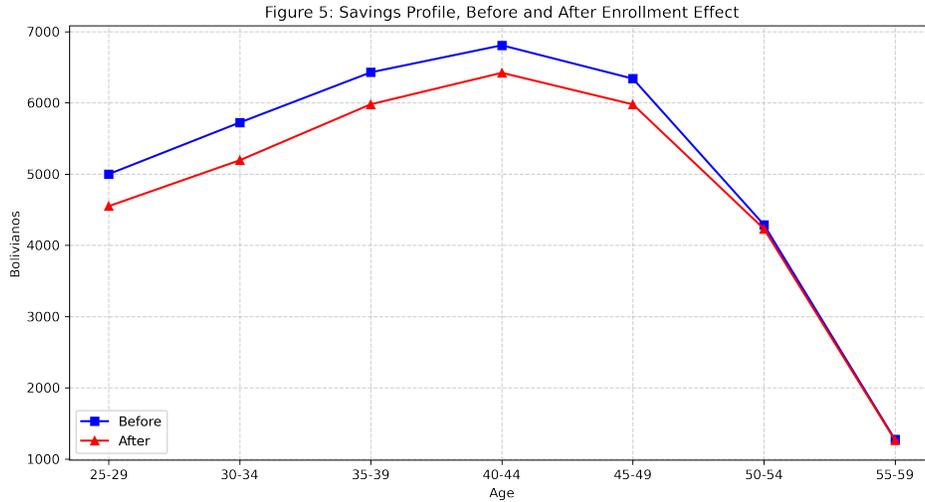
Furthermore, Figure 5 delineates the mean household savings profile both before and after the enrollment effect. Notably, the post-effect savings profile exhibits a discernible decrease in comparison to its pre-effect counterpart. This observed shift provides gives evidence of enhanced certainty attributed to the increase in children school enrollment, wherein households find it less imperative to resort to saving for future income fluctuations buffering. This arises from an augmented confidence in the secure retention of the wife's formal employment.

Figure 6: Before and After Enrollment Effect, Decompostion by Enrollment Type
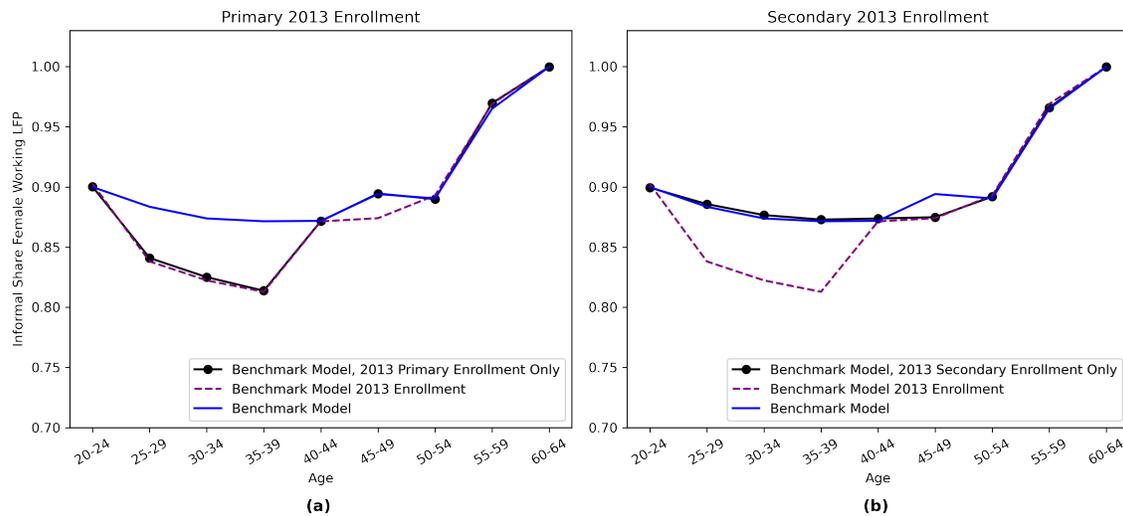
Expanding our analysis to delineate the differential impacts of primary and secondary school enrollment, Figure 6 provides a nuanced perspective. As depicted in Figure 6(a), the discernible

rise in female participation in informal labor markets in response to increased enrollment in primary school significantly surpasses the corresponding influence arising from enrollment in secondary school, as illustrated in Figure 6(b). These findings underscore the substantive role played by primary school enrollment in shaping the career profiles of mothers, elucidating its distinct impact on their engagement in informal labor markets. This nuanced exploration enhances our understanding of the multifaceted dynamics between educational policies, female labor force participation, and the specific influence of primary versus secondary school enrollment on informal labor market dynamics.

Lastly, in Figure 7, we undertake an examination of disparities within two distinct wealth strata for each enrollment scenario: specifically, the top 25% wealthiest and the bottom 50%. As depicted in Figure 7(a), during the age range of 20 to 40, the behavior of the top 25% wealthiest individuals in an environment characterized by low enrollment (2000-2003) closely mirrors that of their counterparts in a high enrollment setting (2013). Notably, a more pronounced distinction emerges within this demographic for individuals aged 44 to 54. This finding stands in stark contrast to the dynamics observed among the bottom 50% of the wealth spectrum. In an environment marked by low enrollment, the bottom 50% exhibit a markedly higher informality profile compared to their counterparts in a high enrollment environment. This analysis provides robust confirmation that policies designed to enhance formal market participation for younger women deliver the greatest advantages to economically disadvantaged households, primarily owing to the substantial engagement of low-educated women in informal markets.

Figure 7: Enrollment Scenarios, Decompostion by Wealth
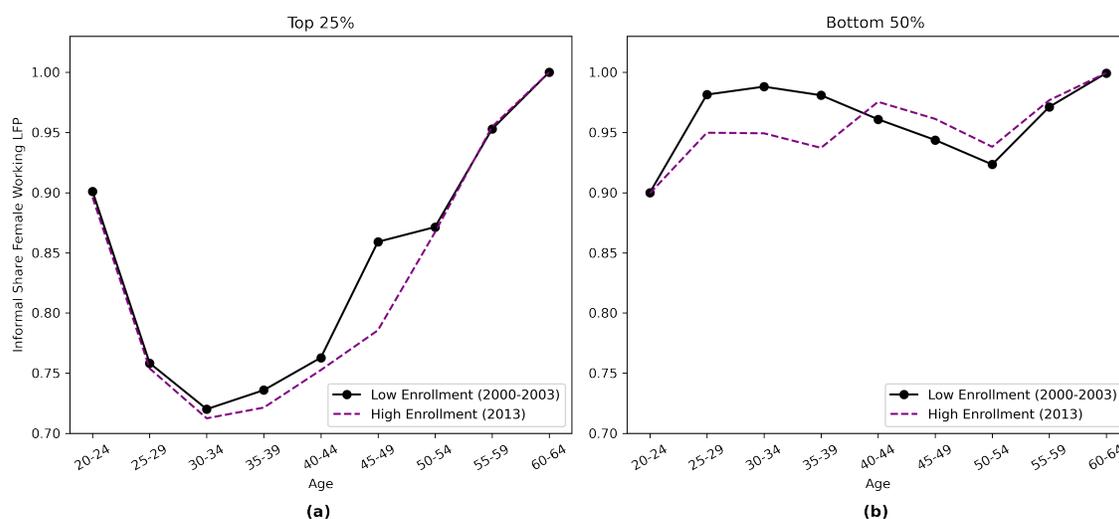
5   CONCLUSIONS

As educational gender gaps have diminished in recent decades, an increasing number of young women are entering the labor force, commencing their careers on a comparable footing to men. However, the trajectories of their labor market experiences sharply diverge upon the arrival of children, leading to enduring effects that extend to the children's secondary education. The differential impact of children on the career paths of men and women remains a primary explanation for the persisting gender gaps in the labor market. This disparity is further pronounced in developing countries due to the distinct characteristics of informal sectors. To unravel these dynamics, we propose a dynamic programming model that incorporates the utility cost associated with participating in the formal sector. This cost is inversely proportional to the likelihood of the household's children being enrolled in school. For Bolivia, we calibrate the model to the proportion of female workers in informal markets during the 2000-2003 period, marked by relatively low children's school enrollment. Subsequently, while keeping other parameters constant, we adjust the parameters linked to children's school enrollment to reflect more recent periods characterized by higher enrollment rates.

Through the combination of data from the Bolivian household survey and parameters coming from previous studies on informal markets in Bolivia, our findings suggest that increasing rates of children's school enrollment provide mothers with expanded opportunities to transition from informal to formal labor markets. This transition is particularly prominent among women aged 25 to 34, where a substantial surge in school enrollment significantly contributes to the decline in the proportion of female workers employed informally. These results underscore the critical role of child-rearing for mothers to engage in formal employment, and highlight how improvements in school enrollment, as evident in the empirical data, can effectively promote women's participation in formal labor markets.

The implications of these findings extend beyond individual households, carrying significance for broader socio-economic development and gender equality initiatives within developing countries. Recognizing and understanding the multifaceted connections between female labor force participation, educational opportunities for children, and the dynamics of formal and informal labor markets are crucial for shaping effective policies and interventions that can positively impact the lives of women and contribute to sustainable development. Therefore, policies aiming to increase children's enrollment, such as conditional cash transfers, vouchers or scholarships, community awareness campaigns, and flexible and extended school schedules, may have significant effects on women's labor force participation and the formalization of women in the workforce.

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