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Distributive Implications of Fertility

Changes in Latin America*

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Abstract

Fertility rates significantly fell over the last decades in Latin America. In order to assess the extent to which these changes contributed to the observed reduction in income poverty and inequality we apply microeconomic decompositions to microdata from national household surveys from seven Latin American countries. We find that changes in fertility rates were associated to a non-negligible reduction in inequality and poverty in the region. The main channel was straightforward: lower fertility implied smaller families and hence larger per capita incomes. Lower fertility also fostered labor force participation, especially among women, which contributed to the reduction of poverty and inequality in most countries, although the size of this effect was smaller.

JEL codes: J2, J1

Keywords: fertility, Latin America, poverty, inequality

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1. Introduction

Fertility rates have been significantly falling during the last decades in Latin America. The average number of children decreased in families from all population groups, but the decline was sharper among poor households: the fertility gap between the most and the least vulnerable groups shrunk in the region. The distributive impact of these demographic changes could be sizeable. *Ceteris paribus*, a fall in the number of children in poor households and in those marginally above the poverty line, reduces income poverty; whereas heterogeneous changes in family size across income groups could reduce income inequality.

In this paper we assess the extent to which changes in fertility in seven Latin American countries (Argentina, Brazil, Chile, El Salvador, Mexico, Peru and Uruguay) contributed to the observed reduction in income poverty and inequality during the 1990s and 2000s. To that aim, we simulate the counterfactual household per capita income distribution if fertility outcomes in a given year would have been determined as in another different year.¹ Of course, actual changes in poverty and inequality are driven by various factors, including some of those affecting fertility. Estimating a general equilibrium model or complex structural equations that take into account all the interactions is not feasible, given lack of data, among other limitations. Instead, in this paper we follow a more modest but potentially useful methodology: we compute the first-round partial-equilibrium impact on the income distribution of changes in fertility. That impact could be taken as an approximation of the magnitude that fertility changes may have on poverty and inequality. In particular, we examine three effects: first, more children in the household imply a reduction in current per capita income, as a similar budget should be divided among more people; second higher fertility may affect the intensive and extensive margins of labor supply among adults in the household, and third, it may also affect the income transfers received through social programs targeted to families with children.

If we observe that family size declines for the poor more than for the rich, it is rather obvious that poverty and inequality measured over the distribution of household current income per capita will also decline. This paper makes two contributions to this intuition. First, it provides estimates of the magnitude of the direct distributive impact of the changes in fertility; that is the extent to which the actual decline in poverty and inequality can be accounted for by only

¹ The term *fertility* is used as a shortcut for the number of children in the household, which in most cases changes as the consequence of fertility decisions.

the change in the reproductive behavior. Second, the methodology allows tracing and measuring some not-so-obvious effects. The fall in the number of children in the bottom strata of the distribution may induce some low-income women to enter the labor market or to work more hours. In that case, the decline in poverty and inequality might be larger than expected if one only considers the direct impact of the decline in family size. In addition, a reduction in fertility may reduce the income transfers received by poor households in terms of social assistance directed to families with children.

In this paper we find that the changes in fertility that took place over the last decades in Latin America contributed to the reduction in income inequality as well as in poverty. The fall in fertility among the income-deprived helped to reduce the incidence of income poverty. Besides, since it was larger than the fall among the non-poor, it contributed to the reduction in income inequality, as well. The main channel was straightforward: lower fertility rates implied smaller families and hence larger per capita incomes. Lower fertility also fostered labor force participation, especially among women, which contributed to the reduction of poverty and inequality in most countries, although the size of this effect was small.

The rest of the paper is organized in a straightforward way. In the next section we document changes in fertility across income groups, and present trends in income inequality and poverty in Latin America. In section 3 we lay out the methodology, discuss its limitations, and introduce the data used in the estimations. Section 4 presents the main results of the paper, whereas section 5 closes with some concluding remarks.

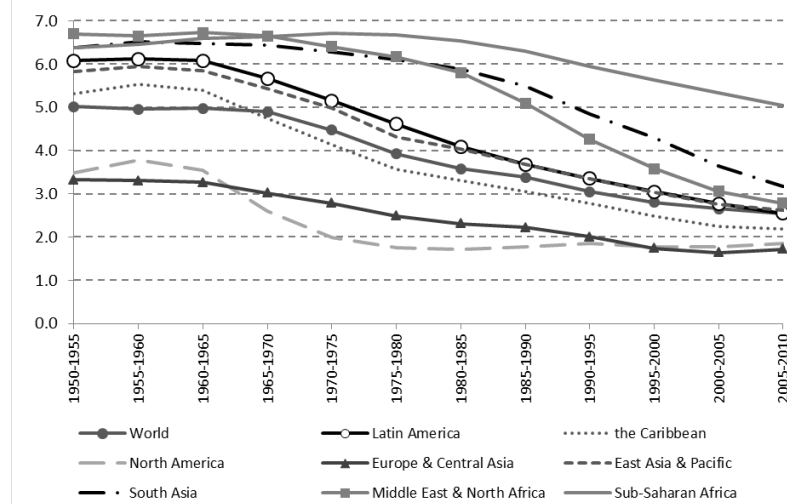
2. Fertility changes and distributive trends

In the early 1960s the total fertility rate (TFR) was around 6 children per woman in Latin America, higher than the world's average.² It was not until the mid-1960s that TFR began its downward trend, which eventually led to a clear convergence towards the levels of the most advanced regions of the world

² The Total Fertility Rate is the average number of children a hypothetical cohort of women would have at the end of their reproductive period if, during their whole lives, they were subject to the fertility rates of a given period and if they were not subject to mortality. It is expressed as children per woman (United Nations, World Population Prospects: The 2012 Revision, definition available at <http://esa.un.org/wpp/Excel-Data/fertility.htm>).

(Figure 1).^{3, 4} In particular, the TFR continued falling over the last two decades in Latin America, reaching an average of 2.5 children per woman in 2005-2010.

Figure 1: Total Fertility Rate (children per woman)
Regions of the world, 1950-2010.



Source: Gasparini and Marchionni (2015), based on World Population Prospects: The 2012 Revision, DVD Edition.

Following a similar trend, the number of children per household – the proxy for fertility that can be implemented with household survey microdata – has been falling over the last two decades. In 1992, there were 2.3 children under age 16 per household – for households with a woman aged 25-45 – in a typical Latin American country; the figure was 1.8 in 2012 (Gasparini and Marchionni, 2015).

The average number of children decreased in households from all population groups, but the gap between the most and the least vulnerable groups shrank, owing to a sharper decline in the number of children living in poor households. Figure 2 takes a sample of seven Latin American countries to show the average number of children under 16 per household in the poorest 20% and richest 20% of the prime-age parents.⁵ In both groups, fertility went down over the two decades; the fall is somewhat more pronounced among the poorest couples. The

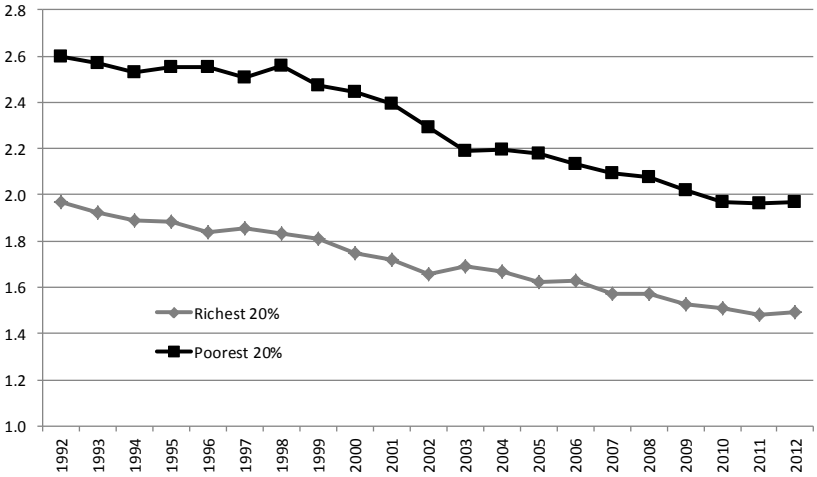
³ For an analysis of fertility dynamics in Latin America, see Chackiel (2004), ECLAC (2008, 2011).

⁴ This decreasing trend has been present in developed countries since the beginning of the past century (Guinnane, 2010; Jones and Tertilt, 2006).

⁵ The sample includes countries in which we implement the microsimulations that follow in the next section.

gap in the number of children per household shrank from 0.67 in 1992 to 0.47 in 2012.

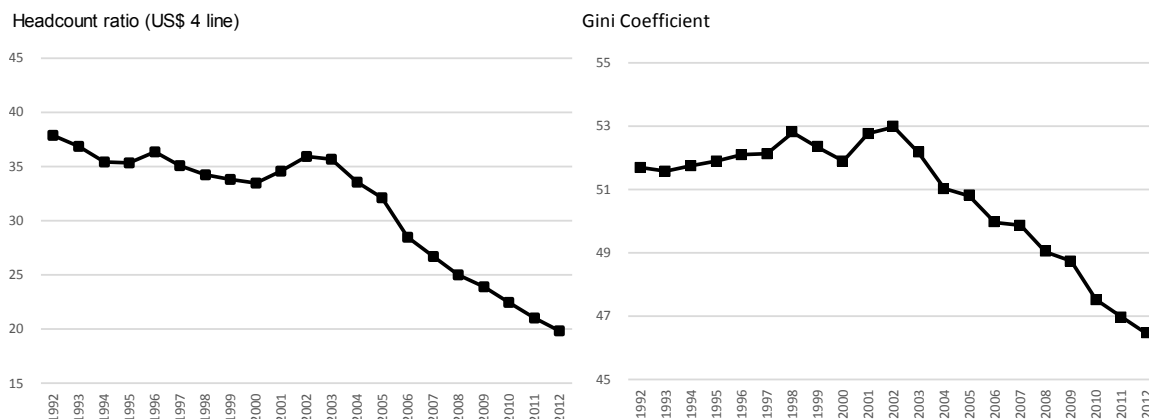
Figure 2: Number of children under 16 per household
 Bottom and top quintiles of parental income distribution, 1992-2012.



Source: own calculations based on microdata from national household surveys.
 Note: Average of seven Latin American countries: Argentina, Brazil, Chile, El Salvador, Mexico, Peru, and Uruguay. Households with head aged 25-45. Unweighted means.

With regard to the income distribution, Latin America experienced an increase in inequality during the 1990’s, while poverty slightly decreased (Gasparini and Lustig, 2011; Cornia, 2014; Alvaredo and Gasparini, 2015). In contrast, in the 2000’s there were strong reductions of both income inequality and poverty. Figure 3 shows the average income inequality and poverty trends of seven Latin America countries. Poverty is measured by the headcount ratio with a daily US\$4 line, while income inequality is measured by the Gini coefficient. Both indices are calculated over the household per capita income distribution. Income poverty slightly decreased during the 1990’s, and fell sharply during the 2000’s. Argentina, Uruguay and Mexico suffered an increase in poverty during the 1990’s, and then a continuous fall over the following decade (Figure 4). Meanwhile, Brazil, Chile, El Salvador and Peru experienced a decrease in poverty over the entire period, although steeper during the 2000’s.

Figure 3: Poverty and Income Inequality - Latin America



Source: own calculations based on microdata from national household surveys.

Note: Average of seven Latin American countries: Argentina, Brazil, Chile, El Salvador, Mexico, Peru, and Uruguay. Unweighted means. Poverty and inequality computed over the distribution of household per capita income.

On average for our sample of seven countries income inequality increased during the first decade under analysis and then significantly decreased during the 2000's. The trend for the 1990's is driven by the sharp increase in income dispersion in Argentina and Uruguay (Figure 5), and the small changes in the rest of the countries. In contrast, during the 2000's the fall in inequality was strong and generalized to all economies.

3. Data and methodology

We focus on seven Latin American countries –Argentina, Brazil, Chile, El Salvador, Mexico, Peru and Uruguay– during the 1990s and 2000s. The analysis is based on microdata from national household surveys collected by the corresponding National Statistical Offices.⁶ Since surveys are not homogeneous, we have made all possible efforts to make variables comparable across countries and over time by using similar definitions of variables in each country/year, and by applying consistent methods of processing the data.

The ideal variable for capturing fertility would be the number of children, either living in the household or not. Unfortunately, this variable is usually not available in Latin American household surveys, with the exception of Brazil. As a proxy we use the number of children living in the household. Consequently,

⁶ Table 1 presents a brief description of these databases.

two main problems emerge. First, the measurement error of this proxy depends on the age of parents and children, *i.e.* on average, the older the parents, and the older the children, the more likely they leave the parental home. Therefore, the observed differences in the number of children across households are not only due to reproductive decisions, but also to the life cycle. To deal with this shortcoming we restrict our sample to households where the head of household is between 25 and 45 years old.⁷

Another problem arises since Latin American household surveys usually register family relationships among household members only in terms of the head of household, *i.e.* it is possible to match children with their parents only when they are the head of household or the spouse. Therefore, we further restrict the analysis to only consider fertility decisions of the head of household and the spouse.

Regarding the empirical specification and estimation methodology, we follow Marchionni and Gasparini (2007). The main inputs to carry out the microsimulations are the estimates of the parameters that govern fertility decisions/outcomes⁸ and the response of labor market participation to changes in family size. We assume that the number of children in a household follows a Poisson process, and that its parameters can be consistently estimated using a Poisson regression model. Hourly wages and hours of work are assumed to be simultaneously determined in an equilibrium model of the labor market.

After estimating the parameters, we carry out the simulations. That is, we simulate the counterfactual income distribution that arises in a given base year by assuming that the population in that year takes fertility decisions according to the parameters estimated for a different year. The resulting poverty and inequality measures over the simulated distribution are compared to those actually observed in the base year. The difference between the simulated value of an indicator of poverty or inequality and its actual value is interpreted as a measure of the direct impact of the change in fertility behavior, *i.e.* the impact that would take place in case all other covariates remained fixed.

The methodology requires keeping all other things constant when simulating the impact of changes in fertility decisions. Naturally, as it was stressed in

⁷ Many people younger than 25 years old may not have yet started childbearing. The average age at childbearing for the countries under analysis was 27.5 years old in 1993 and 27.6 in 2011. The dispersion across countries is also small, ranging from 26.5 in Mexico to 28.3 in Peru. The average age at marriage in the early 1990s was 22.9 and 25.6 years old for women and men, respectively; and about two years more in the early 2010s (25.0 and 27.5).

⁸ For simplicity we refer to fertility *decisions*, although fertility outcomes could be the result of free conscious choices, but also the consequence of various other circumstances.

previous sections, some of these factors may covariate with fertility. For instance, the structure of wages may respond to changes in the labor supply triggered by a change in fertility. Additionally, changes in reproductive behavior may have been induced by income changes, in which case the microsimulation only captures a single round of effects, from fertility to incomes, of a more complicated process.

In a given period, income poverty and inequality are affected by a host of factors, including economic shocks and social policies. The microsimulation methodology is useful as it allows approximating the size of the impact that a given factor would have, in case all others factors remained fixed. Although this is clearly an unrealistic scenario, the estimations are still useful as a first approximation of the impact, especially considering the fact that the more ambitious alternative of estimating a general equilibrium model is usually unfeasible.

3.1 Microsimulations

We carry out the simulation over the distribution of household per capita income, defined as

$$(1) \quad y_{it} = \frac{Y_{ht}^L + Y_{ht}^{NL}}{N_{ht}} \quad \forall i \in h \text{ at time } t$$

where i indexes individuals, h households and t time periods (years). Y_{ht}^L denotes total labor income of household h at time t , Y_{ht}^{NL} labels non-labor income, and N_{ht} is the family size, which is the sum of the number of children up to 16 years old H_{ht} and the rest of the household members R_{ht} .

$$(2) \quad N_{ht} = H_{ht} + R_{ht}$$

We need to specify how H_{ht} is determined in order simulate the counterfactual distributions. The literature argues that fertility outcomes are the result of a process affected by characteristics of each spouse and of the household, among other factors. This process can be formalized as

$$(3) \quad H_{ht} = H(Z_{ht}, e_{ht}; \eta_t)$$

where Z_{ht} is a vector of observable characteristics and e_{ht} includes all unobservable characteristics that influence family's reproductive behavior, while η_t is the set of parameters that govern fertility decisions.

We assume that labor income for individual i is given by

$$(4) \quad Y_{it}^L = w_{it} L_{it}$$

where w_{it} is the hourly wage rate and L_{it} the number of hours worked by individual i . Wages and hours of work are defined as $w_{it} = w(X_{1it}, \varepsilon_{it}^W; \beta_t)$ and $L_{it} = L(X_{2it}, H_{it}, \varepsilon_{it}^L; \gamma_t, \lambda_t)$, respectively. Where X_{1it} and X_{2it} are observable characteristics, ε_{it}^W and ε_{it}^L are unobservable characteristics, while β_t , γ_t and λ_t are parameters. In particular, λ_t is the parameter that relates the hours of work with the number of children.

Non-labor income is usually assumed to be exogenous in the microsimulation literature. However, as stated in previous sections, the expansion of social programs to families with children suggest a potential link between fertility decisions and non-labor income. Accordingly, we assume that non-labor income is given by

$$(5) \quad Y_{ht}^{NL} = m_{ht} + g(H_{ht})$$

where m_{ht} is exogenous and $g(H_{ht})$ represents the component of non-labor income that depends on the number of children.

We label the parameters of the fertility decisions at time t as η_t , and those at time t' as $\eta_{t'}$. A key step in the methodology is to estimate the counterfactual number of children in a given year t if fertility outcomes were determined as in an alternative year t' . Once this term, labeled as $H_{ht}(\eta_{t'})$, is estimated, three microsimulation exercises are carried out by replacing this estimate in the household per capita income equation.

The first exercise aims to capture the contribution of the change in fertility parameters η to the actual change in the income distribution through the denominator of equation (1). The simulated per capita income is given by

$$(6) \quad y_{it}^D = \frac{y_{ht}^L + y_{ht}^{NL}}{N_{ht}(\eta_{t'})}$$

where $N_{ht}(\eta_{t'}) = R_{ht} + H_{ht}(\eta_{t'})$. Superscript D in the simulated per capita income stands for the *direct-size effect*, i.e. the change in the income distribution due to changes in the number of household members among whom total household income should be distributed.

The second exercise involves simulating the labor income that a household would have in year t if parameters that govern fertility decisions were those of year t' . In other words, the exercise consists on replacing the simulated number of children $H_{ht}(\eta_{t'})$ in the equation of individual labor income (4), to obtain

$$(7) \quad y_{it}^H = \frac{y_{ht}^L(\eta_{t'}) + y_{ht}^{NL}}{N_{ht}}$$

Superscript H in the simulated per capita income stands for the *hours-size effect*, i.e. the contribution of the change in fertility parameters η to the actual change in the income distribution through the indirect channel of affecting the hours of work decisions.

We carry out a third exercise by simulating the counterfactual distribution arising from a change in non-labor income driven by changes in fertility decisions. We refer to the distributional impact of changes through this channel as the *non-labor income effect* and thus label the per capita income variable in equation (8) with the NL superscript.

$$(8) \quad y_{it}^{NL} = \frac{y_{ht}^L + y_{ht}^{NL}(\eta_{t'})}{N_{ht}}$$

Finally, equation (9) considers the three channels simultaneously to obtain the *total effect* –superscript T – of changes in the fertility parameters.

$$(9) \quad y_{it}^T = \frac{y_{ht}^L(\eta_{t'}) + y_{ht}^{NL}(\eta_{t'})}{N_{ht}(\eta_{t'})}$$

We denote the per capita income distribution among individuals in year t as $D_t(y_t) = (y_{1t}, y_{2t}, \dots, y_{nt})$, where n denotes the total number of individuals in the

population. Let $I(\cdot)$ be a distributive indicator, as the Gini coefficient or the poverty headcount ratio. Then, the contribution of the change in fertility parameters η to the actual change in the income distribution through the direct channel is given by equation (10). The contributions through the other channels are computed analogously.

$$(10) \quad I(D_t(y_t)) - I(D_t(y_t^D))$$

A shortcoming of the microsimulation methodology is that decompositions are path-dependent. This means that taking year t or year t' as the base year do not necessarily imply the same result. Accordingly, we perform the simulations alternating the base year and report the average effect for each exercise.

In the followings sub-sections we provide details concerning the specification and estimation of fertility, labor income and non-labor income equations.

3.2 Fertility decisions

We assume that the number of children in equation (3) follows a Poisson process with parameter μ_{ht} . Formally,

$$(11) \quad H_{ht} \sim \text{Poisson}(\mu_{ht}) \quad \text{with} \quad \mu_{ht} = E(H_{ht} | Z_{ht}) = \exp(Z'_{ht} \eta_t)$$

Then,

$$(12) \quad \text{Prob}(H_{ht} = H_o) = \frac{\exp(-\mu_{ht})(\mu_{ht})^{H_o}}{H_o!} \quad \text{with} \quad H_o = 0, 1, 2, \dots$$

Equation (12) is the Poisson regression model, from which it is possible to consistently estimate parameters η_t by maximum likelihood.⁹ We estimate separate models for two-parent household and single-parent households. For simplicity we denote the estimates as η .

⁹ It can be shown that consistency holds for the maximum likelihood estimators of η_t as long as the real distribution is any of the linear exponential family –to which the Poisson distribution belongs– provided that the conditional mean in (11) is correctly specified. See for instance Wooldridge (2002).

Once parameters η are estimates we proceed to simulate changes in the number of children. Since the objective is to simulate these changes as a consequence of changes only in the parameters η , it is necessary to keep unobservable factors fixed. Therefore, we characterize each household by the quantile it occupies in the distribution of children of year t . Let $F_{\eta_t|Z_{ht}}(\cdot)$ be the cumulative probability function of a random variable that follows a Poisson distribution with parameter equal to $\exp(Z'_{ht}\eta_t)$ and let q_{ht} be the quantile for household h at time t , that is, $F_{\eta_t|Z_{ht}}(H_{ht})=q_{ht}$. The simulated number of children in household h will be the one that places it in the q_{ht} quantile of the distribution of children with the relevant parameters of time t' ($\eta_{t'}$) conditional to the observable characteristics Z_{ht} . Formally, the simulated number of children in household h at year t using the estimated fertility parameters for year t' is given by equation (13).

$$(13) \quad H_{ht}(\eta_{t'}) = F_{\eta_{t'}|Z_{ht}}^{-1} \circ F_{\eta_t|Z_{ht}}(H_{ht})$$

3.3 Labor incomes

To estimate individual labor income in equation (4) we follow Gasparini, Marchionni and Sosa Escudero (2004) in assuming that both wages and hours worked are determined in a reduced-form model of the labor market equilibrium:

$$(14) \quad \ln w_{it}^* = X'_{1it}\beta_t + \varepsilon_{it}^W$$

$$(15) \quad L_{it}^* = X'_{2it}\gamma_t + H_{it}\lambda_t + \varepsilon_{it}^L$$

with $w_{it} = w_{it}^*$ and $L_{it} = L_{it}^*$ if $L_{it}^* > 0$
 $w_{it} = 0$ and $L_{it} = 0$ if $L_{it}^* \leq 0$
 $(\varepsilon_{it}^W, \varepsilon_{it}^L) \sim N(0, 0, \sigma_{W_t}^2, \sigma_{L_t}^2, \rho_t)$

where w_{it}^* and L_{it}^* are unobserved latent variables. Vectors X_{1it} and X_{2it} include observable factors affecting hourly wages and hours of work, respectively, while H_{it} stands for the number of children. β_t , γ_t (vectors) and λ_t , are parameters to be estimated, along with $\sigma_{W_t}^2$, $\sigma_{L_t}^2$ and ρ_t .

We estimate equation (14) by Heckman's maximum likelihood method, where a censored version of (15) is used as a selection equation replacing hours of work

by a binary variable that indicates whether the individual works. For estimation of equation (15) we use a Tobit model.¹⁰ We estimate separate models for head of households and spouses.

To simulate changes in individual labor incomes we replace the observed number of children of individual i at year t in equation (15) by the simulated number of children $H_{th}(\eta_{t'})$, while assigning her a wage based on equation (14), and an error term drawn from the bivariate distribution implicit in the model.

3.4 Non-labor incomes

We simulate non-labor incomes in an *ad-hoc* manner, taking into account the characteristics of each country's social program. In those cases where it is not possible to identify the recipients in the household survey, we identify potential beneficiaries and estimate the amount of the transfers based on the design of each program. The general framework is as follows: non-labor income of household h at year t is given by equation (5), where $g(H_{ht})$ represents the part of non-labor income that depends on the number of children.¹¹ Typically, cash transfers in poverty-alleviation programs vary with the number of children in the family. For example if the program has a fixed amount θ_t per child, the non-labor income becomes:

$$(16) \quad Y_{ht}^{NL} = m_{ht} + \theta_t H_{ht}$$

The simulated non-labor income is calculated using the counterfactual number of children in a given year t if fertility outcomes were determined as in an alternative year t' .

$$(17) \quad Y_{ht}^{NL}(\eta_{t'}) = m_{ht} + \theta_{ht} H_{ht}(\eta_{t'})$$

¹⁰ Although this estimation strategy is not fully efficient, efficiency loss is not necessarily significant for a given sample size and this alternative has certain computational advantages over a full information procedure. For more details, see Gasparini *et. al* (2004).

¹¹ The measure of non-labor income includes pensions, capital income (profits and benefits, rents, interests, dividends) and transfers (private and from government as well). Conditional cash transfers are included as government transfers. We assume that the number of children affect non-labor income only through the latter component (i.e. $g(H_{ht})$), while the remaining non-labor income, m_{ht} , is presumed to be exogenous.

Even though all programs have a similar setting as the one described, they differ in some aspects –maximum number of children, age, and in some cases how to identify the program’s recipients. The details are given in the Appendix. We simulate non-labor incomes for Argentina, Brazil, Mexico and Uruguay. Even though the programs in Chile, El Salvador and Peru have similar characteristics, it is not possible to estimate how the amount of transfers varies with the number of children given the information in the household surveys. For these countries we assume that non-labor income is completely exogenous.

4. The results

The results of the microsimulations regarding poverty are presented in Table 2. Column (i) displays the observed change in the headcount ratio, while the rest of the columns present the impact of the changes in fertility on poverty. Column (v) shows the sum of all effects explored. In order to better understand the information in the table, take the case of Brazil. Column (i) informs that between 1990 and 2012 the poverty headcount ratio in that country (using the line of US\$ 4 a day) fell around 25 points. The value in the last column has the following interpretation: if fertility had been the only factor that changed during that period, then the poverty headcount ratio in Brazil would have fallen 3.92 points. This change is statistically significant, although not very big compared to the actual fall in poverty in that period. The overall effect is the result of a significant *direct* effect (-3.74), and two smaller effects that go in different directions. On the one hand, the differential reduction in fertility implied a greater increase in hours of work among more disadvantaged households, which in turn contributed, although very slightly, to a further reduction in income poverty. On the other hand, the falling patterns in fertility among the poor ameliorated the poverty-decreasing impact of the conditional cash transfer programs that are targeted to families with children (mainly the *Bolsa Familia* in the 2000s). However, this effect was quantitatively almost insignificant.

Table 2: Impact of fertility changes on poverty
Changes in the poverty headcount ratio (US\$ 4 line)

Country	Period	Observed change (i)	Effects			
			Direct (ii)	Hours (iii)	NLI (iv)	Total (v)
Argentina	1992-2012	-11.22 (0.08)	-1.39 (0.02)	0.04 (0.01)	0.39 (0.01)	-0.80 (0.02)
Brazil	1990-2012	-25.16 (0.03)	-3.74 (0.01)	-0.17 (0.00)	0.14 (0.00)	-3.92 (0.01)
Chile	1990-2011	-33.24 (0.05)	-1.56 (0.01)	0.18 (0.00)	- (-)	-1.43 (0.01)
El Salvador	1991-2010	-14.12 (0.06)	-4.98 (0.04)	-0.34 (0.01)	- (-)	-5.31 (0.05)
Mexico	1992-2012	-3.50 (0.10)	-4.35 (0.04)	-0.30 (0.02)	0.25 (0.01)	-4.43 (0.04)
Peru	1997-2012	-23.20 (0.09)	-3.83 (0.03)	-0.19 (0.01)	- (-)	-3.94 (0.03)
Uruguay	1995-2012	-1.56 (0.03)	-0.08 (0.02)	0.00 (0.00)	0.02 (0.00)	-0.05 (0.02)

Source: own calculations based on microdata from national household surveys.

Note: All effects are significant at the 1% level. The standard errors were calculated using bootstrap with 200 replications. The values of each effect are averages that result from taking alternatively each year in the comparison as the base year. The sample includes only households in which the head is between 25 and 45 years old. NLI= non-labor income.

Changes in fertility patterns over the last two decades in Latin America have implied a reduction in income poverty. The impact is statistically significant and in some cases economically large. For instance, the estimated poverty-reduction effect was more than 4 points in Mexico and El Salvador. Most of the effect comes through the *direct* effect: a reduction in fertility rates among the most disadvantaged groups reduced family size and increased per capita income. The *hours-of-work* effect is in most cases poverty reducing and the *non-labor-income* effect is poverty increasing, but in both cases the estimated sizes are small.

Table 3 shows the results of the simulations on income inequality, measured by the Gini coefficient. Inequality in Brazil, as measured by the Gini coefficient, fell 7.18 points between 1990 and 2012. If fertility had been the only factor that changed in that period, then the Gini coefficient would have fallen 1.32 points (column v). This change is statistically significant, representing around 18% of the actual reduction in inequality during that period. The differential reduction in fertility across socioeconomic groups in Brazil contributed to the observed decline in inequality in the last two decades. The overall effect of -1.32 points in column (v) is the result of a significant *direct* effect (-1.30), and two smaller effects going in different directions.

Table 3: Impact of fertility changes on inequality
Changes in the Gini coefficient

Country	Period	Observed change (i)	Effects			
			Direct (ii)	Hours (iii)	NLI (iv)	Total (v)
Argentina	1992-2012	-5.44 (0.10)	-1.04 (0.01)	-0.01 (0.00)	0.13 (0.00)	-0.95 (0.02)
Brazil	1990-2012	-7.18 (0.04)	-1.30 (0.00)	-0.06 (0.00)	0.06 (0.00)	-1.32 (0.00)
Chile	1990-2011	-1.78 (0.08)	-0.75 (0.01)	0.04 (0.00)	- -	-0.73 (0.01)
El Salvador	1991-2010	-7.68 (0.06)	-1.30 (0.02)	-0.07 (0.00)	- -	-1.40 (0.02)
Mexico	1992-2012	-0.86 (0.19)	-1.68 (0.02)	-0.11 (0.00)	0.12 (0.00)	-1.69 (0.02)
Peru	1997-2012	-7.32 (0.13)	-1.92 (0.01)	-0.06 (0.00)	- -	-1.99 (0.01)
Uruguay	1995-2012	-2.03 (0.04)	-0.12 (0.01)	-0.01 (0.00)	0.02 (0.00)	-0.13 (0.01)

Source: own calculations based on microdata from national household surveys.

Note: All effects are significant at the 1% level. The standard errors were calculated using bootstrap with 200 replications. The values of each effect are averages that result from taking alternatively each year in the comparison as the base year. The sample includes only households in which the head is between 25 and 45 years old. NLI= non-labor income.

Some interesting general results emerge from Table 3. First, changes in fertility have implied a decline in income inequality. The differential pattern in fertility across groups experienced in most Latin American countries over the last decades translated into an equalizing impact on the income distribution. Second, this effect is small, although not negligible. To be sure, demographic changes are not the central reason behind changes in income inequality but they are statistically significant and economically relevant. On average, fertility changes account for a fall of around one point in the Gini coefficient.

Third, most of the impact comes from the *direct* effect. The differential fall in fertility rates among socioeconomic groups had a larger impact on the family size of poorer families, implying a proportionally larger increasing effect on their per capita incomes.

Fourth, the effect of fertility changes on hours of work and, in turn, on incomes, is smaller and has different signs across countries. It is important to notice that a more intense reduction in fertility among the poor may be consistent with a positive sign (inequality-increasing) for this effect. This could happen if the elasticity of hours of work with respect to the number of children is higher among the non-poor, and if the extra-hours worked triggered by the fall in

fertility imply a household income increase proportionally larger for the non-poor. Anyway, with one exception the hours-of-work effect has a negative sign, implying that the asymmetric reduction in fertility contributed to a reduction in income inequality by fostering a higher participation in the labor market among poor parents (mostly mothers).

Finally, the effect through non-labor incomes is always inequality-increasing, but small. The fall in fertility among the poor implied a lower inequality-reducing impact of the conditional cash transfer programs that were introduced and expanded in the region, mainly during the 2000s. The effect, however, is in most cases very small.

5. Concluding remarks

Poverty and inequality fell in Latin America over the last decades, driven by a large number of factors. In this paper we highlight one factor that is usually overlooked in the economic literature: the impact of changes in fertility. The average number of children fell in households from all groups, but especially among the more vulnerable, a fact that could have distributive implications. We quantify the consequences of this demographic pattern by applying microsimulation techniques. The results suggest that changes in fertility that took place over the last decades in Latin America contributed to the reduction in income inequality as well as in poverty. The impacts found were in general statistically significant and economically relevant, although not very large. Although surely there are more important determinants behind the observed patterns in the income distributions of the Latin American countries, demographic factors should not be overlooked.

The paper has focused on three simple yet central channels: (i) the change in the number of children enlarges the family size and reduces per capita income, (ii) affects the labor supply decisions, and (iii) modifies the income support from social programs. Certainly, there are other potentially relevant channels that are ignored in the paper. For instance, a reduction in the number of children per family could imply higher inheritances and higher family spending on education and health per child, and hence, better income perspectives. Also, smaller families may be better positioned to take advantage of labor market opportunities, for instance, through migration. Moreover, lower fertility rates may be associated with a reduction in the relative supply of unskilled labor and hence, an increase in its relative wage.

Although in the short and medium-run, lower fertility in more disadvantaged households may contribute to reducing poverty and inequality, in the long run

the implications are more nuanced. When children become adults they may contribute to their parents' incomes: a fall in fertility may reduce incomes for the elderly, especially in countries where the pension system is weak, and ultimately contribute to higher poverty through that intertemporal channel.

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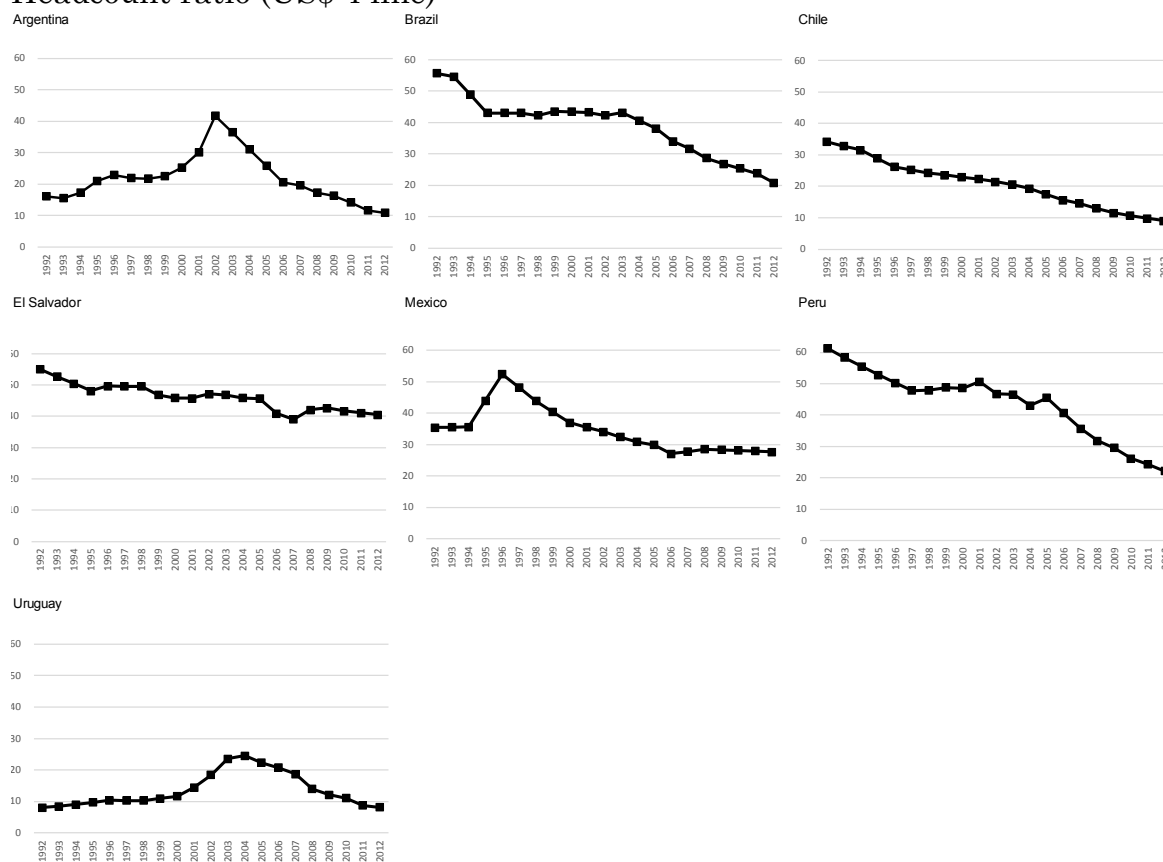
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Table 1: Household Surveys

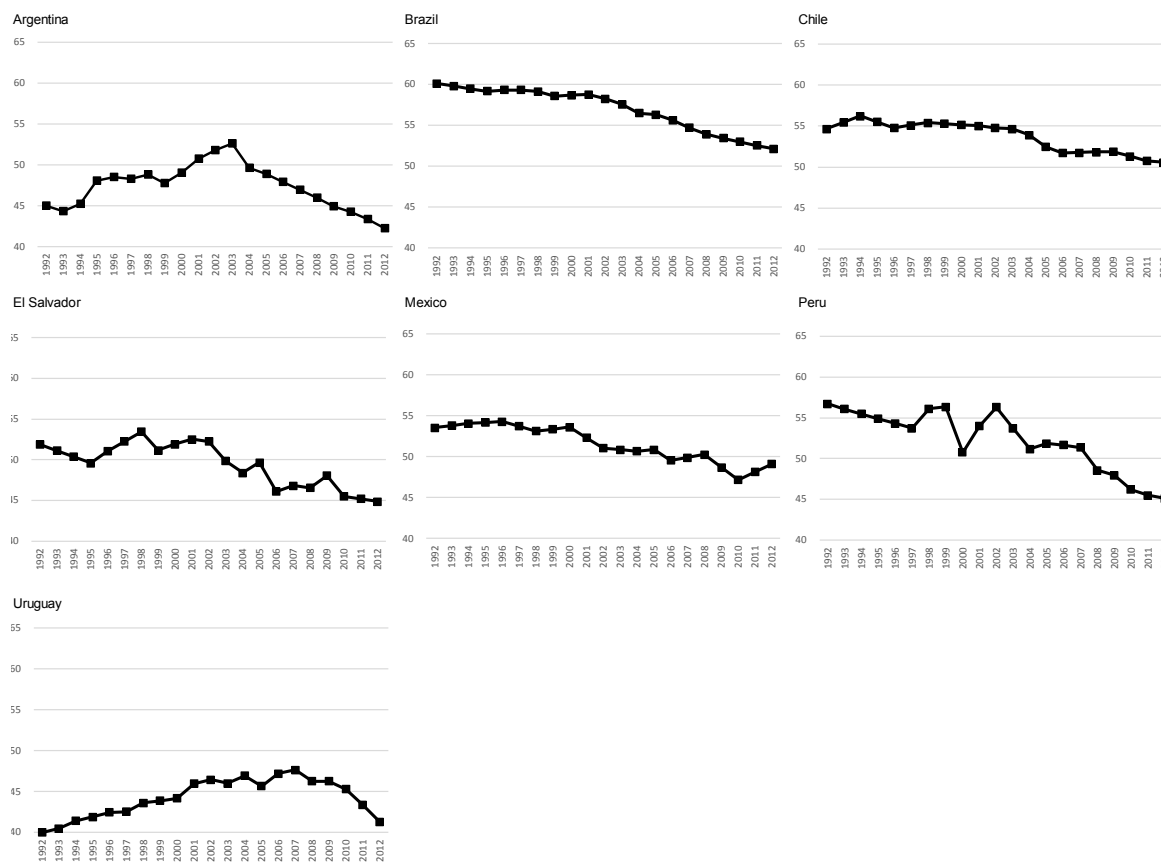
Country	Survey	Acronym	Years
Argentina	Encuesta Permanente de Hogares	EPH	1992-2012
Brazil	Pesquisa Nacional por Amostra de Domicílios	PNAD	1990-2012
Chile	Encuesta de Caracterización Socioeconómica Nacional	CASEN	1990-2011
El Salvador	Encuesta de Hogares de Propósitos Múltiples	EHPM	1991-2010
Mexico	Encuesta Nacional de Ingresos y Gasto de los Hogares	ENIGH	1992-2012
Peru	Encuesta Nacional de Hogares	ENAHO	1997-2012
Uruguay	Encuesta Continua de Hogares	ECH	1995-2012

Figure 4: Poverty
Headcount ratio (US\$ 4 line)



Source: own calculations based on microdata from national household surveys.
Note: Poverty computed over the distribution of household per capita income.

Figure 5: Income Inequality
Gini coefficient



Source: own calculations based on microdata from national household surveys.
Note: Inequality computed over the distribution of household per capita income.

Appendix

In this appendix we describe the issues regarding the simulations of the non-labor incomes for each country.

Argentina - Asignación Universal por Hijo (AUH)

Argentina launched the conditional cash transfer program AUH in 2009. The beneficiaries are children under the age of 18 in households whose members are unemployed or informal workers. The program provides a monthly cash subsidy per child, up to 5 children. Since the Argentina's household survey (EPH) does not include a question to identify recipients of this program, we follow Garganta and Gasparini (2015), assuming full take up among those who qualify. The simulation is made according to the following rule:

$$(A1) \quad Y_{ht}^{NL}(\eta_{t'}) = \begin{cases} Y_{ht}^{NL} + \theta_t (H_{ht}(\eta_{t'}) - H_{ht}) & \text{if } H_{ht}(\eta_{t'}) + Q_{ht} \leq 5 \text{ and } H_{ht} + Q_{ht} \leq 5 \\ Y_{ht}^{NL} + \theta_t (5 - H_{ht} - Q_{ht}) & \text{if } H_{ht}(\eta_{t'}) + Q_{ht} > 5 \text{ and } H_{ht} + Q_{ht} \leq 5 \\ Y_{ht}^{NL} + \theta_t (H_{ht}(\eta_{t'}) + Q_{ht} - 5) & \text{if } H_{ht}(\eta_{t'}) + Q_{ht} \leq 5 \text{ and } H_{ht} + Q_{ht} > 5 \\ Y_{ht}^{NL} & \text{if } H_{ht}(\eta_{t'}) + Q_{ht} > 5 \text{ and } H_{ht} + Q_{ht} > 5 \end{cases}$$

where Q_{ht} is the number of children aged 17 or 18 (recall we carry the simulations for children aged 16 or younger), and θ_t is equal to AR\$270 for the third trimester of 2012 and AR\$340 for the fourth trimester.

Brasil - Bolsa Familia program (BFP)

The *Bolsa Familia*, implemented in 2003, is the flagship conditional cash transfer program in Brazil, aimed at poor households. The estimated non-labor incomes in this case are calculated as:

$$(A2) \quad Y_{th}^{NL}(\eta_{t'}) = \begin{cases} Y_{th}^{NL} + M_{th} \left(\frac{H_{th}(\eta_{t'})}{H_{th}} - 1 \right) & \text{if } H_{th} > 0 \text{ and beneficiary} \\ Y_{th}^{NL} + \bar{M}_{th}^k - l_{th} & \text{if } H_{th} = 0, H_{th}(\eta_{t'}) = k \\ & \text{and beneficiary} \end{cases}$$

with $k = 1, 2, 3, \dots$, M_{th} the amount of the transfer, \bar{M}_{th}^k the average benefit of households with k children, and l_{th} the standard benefit of recipients without children.

Mexico - Oportunidades

Oportunidades is the main anti-poverty program of the Mexican government. The size of the transfer depends on the number of children, among other characteristics of the household. Mexico's ENIGH identifies the beneficiaries of the program and the amount of the subsidy that each household receives. The simulation is made as follows:

$$(A3) \quad Y_{ht}^{NL}(\eta_{t'}) = Y_{th}^{NL} + \bar{M}_{th}^k - M_{th} \quad \text{if } H_{th}(\eta_{t'}) = k, H_{th} \neq k \text{ and beneficiary}$$

where \bar{M}_{th}^k is the average transfer of a beneficiary household with k children, and M_{th} is the original household transfer.

Uruguay - Asignaciones Familiares

The *Asignaciones Familiares* program in Uruguay is targeted to the children of workers. The amount of the transfer varies with the household's income. Since the size of the transfer depends on characteristics of the child, such as her age, the simulation is carried out as follows:

$$(A4) \quad Y_{ht}^{NL}(\eta_{t'}) = \begin{cases} Y_{th}^{NL} + M_{th} \left(\frac{H_{th}(\eta_{t'})}{H_{th}} - 1 \right) & \text{if } H_{th} > 0 \text{ and beneficiary} \\ Y_{th}^{NL} + \bar{M}_{th}^k & \text{if } H_{th} = 0, H_{th}(\eta_{t'}) = k \text{ and beneficiary} \end{cases}$$

with $k = 1, 2, 3 \dots$, M_{th} the total amount of the transfer, \bar{M}_{th}^k the average transfer of a household with k children.