Childhood Migration Effects on Fertility

Evidence from the Mexican Family Life Survey

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Contents

Abstract

This article examines the relationship between childhood migration and the fertility decisions of adult women using the Mexican Family Life Survey. The analysis tests whether migration before the age of 12 has a causal effect on the total number of children and the age at first pregnancy. Migration before the age of 12 is a household decision rather than the decision of the individual herself; unlike adult migration, which prevents causal identification due to the simultaneity of the migration and fertility decisions. Additionally, given that fertility histories start at the age of 14, there is no risk of reverse causality because of the time lag between migration and the start of parity. Controlling for parental information, birth cohort, survey years, and location characteristics addresses self-selection and identifies the effect of migration. Results show that childhood migration has a statistically significant and positive effect on the extensive and intensive margin and that migrants' first pregnancy is at a younger age. Furthermore, women born in rural areas that migrated to urban areas have fewer children than rural-born non-migrants, and than rural-born migrants to rural destinations. This study highlights the importance of migration history - even in childhood - to study migration and fertility. The results are relevant for policies that influence fertility rates and population age distributions, as well as those that use fertility estimates to budget for public services. This is especially true in an increasingly migratory, aging, and urbanized world.

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This article highlights the relevance of migration history - even in childhood - to study migration and fertility. The relationship between migration and fertility is relevant for population estimations and the study of the determinants of fertility and migration. Moreover, childhood migration provides an avenue for identification since adult migration and fertility are jointly causal, and gives insights about how the age of migration affects fertility. Understanding the demographic composition across locations has implications for policies that influence fertility rates and population age distributions, or that use those estimates to budget for public services; especially in an increasingly migrant, aging, and urbanized world.

Policies that use migration as a strategy to influence the size of the population of an area or the age distribution of such population, need to consider the fertility determinants of migrants. Similarly, if local or national governments want to nudge individuals towards specific population size goals, it needs to understand both, their incentives to migrate and to have children, as well as the relationship between migration and fertility (Kondo 2018; Andersson 2004; Alam and Pörtner 2018). Additionally, the number of families relocating in developing countries are increasing [Croix and Gobbi (2017); united2019world]. This means that local governments need to understand the dynamics of a changing demographic distribution (Gerland et al. 2014) in order to effectively budget for the provision of goods and public services either for the young, such as education, or the elderly, such as health and pensions.

This article examines the effect of migration before the age of 12 on fertility outcomes number of children and the age of first pregnancy. It adds to the literature on determinants of fertility, and the relationship between migration and fertility. It concentrates on childhood migration to identify possible causal pathways through which migration affects individual women's decisions to have children, in the context of a developing country. A wealth of papers study migrations' effect on fertility outcomes, giving different hypotheses about how fertility rates compare. The majority of these papers analyze adult migration using households as the unit of analysis. In this sense, they cannot separate the migration from the fertility decision, or the effect on household incentives versus individual women incentives. To the best of my knowledge, no paper identifies the causal effect of childhood migration on adult fertility decisions of women.

The significance of childhood migration on adult fertility outcomes is twofold. First, childhood migration provides an opportunity for causal identification. There is a degree of exogeneity on the decision to migrate because of the age of the individual during migration and the time-lag between the migration events and fertility outcomes. Second, there can be particular processes through which childhood migration affects fertility differently than adult migration. For example, past research highlights that cultural norms' influence on preferences is stronger earlier in life. In this article, I focus on the utility maximization problem of a woman of child-bearing age, where she chooses her optimum number of children given her budget and child-rearing constraints, as well as her individual preferences. Preferences and constraints are influenced by birth and adult locations, as well as whether or not she migrated during her childhood.

One of the reasons for this gap in the literature in a developing country context is that such a study requires information about both, migration histories before the individual is a teenager, as well as fertility preferences once the individual is an adult. This article uses data from Mexico and estimates whether moving before the age of 12 out of an individual's metropolitan area has a causal effect on fertility outcomes of adult women. It uses all three rounds of the Mexican Family Life Survey (MxFLS), which ran from 2002 to 2013, and collected fertility histories as well as migration before the age of 12. The fertility outcomes examined are the total number of children (intensive margin), the decision to have children (extensive margin), and the age at first pregnancy.

For the identification strategy, the analysis leverages the dataset and compares results from different methods for count-data estimation. In addition to migration and fertility information, the Mexican Family Life Survey contains information on birth location, childhood migration, location at the age of 12, individual characteristics at the time of the interview, and parental characteristics. The benchmark model for the estimation includes household and location fixed effects and individual characteristics. Using all individuals interviewed from 2002 to 2013 ages from 15 to 49 at the last interview, a cross-sectional dataset was created that had over 11,000 observations. To address endogeneity due to self-selection and reverse causality, the model relies on the time lag between migration events and the start of parity, and controls for parental information, birth and survey years, and location characteristics. Different specifications confirm the robustness of the results to probability distribution assumptions and functional form of the control variables. For example, different functional forms to control for the age last surveyed are considered, and estimations on the full sample and on a sub-sample of individuals who never migrated as an adult, and I do multi-step addition of covariates and fixed effects.

The final identification step is to address censorship. The multi-cohort sample allows for precise estimation and identification of heterogeneous effects, but I need to consider the right censorship from incomplete fertility histories. I use a multi-dimensional empirical approach and control for time and age during the last interview and use different count models for estimation. To estimate the effect of childhood migration on the extensive and intensive margin of the total number of children, I use Poisson, zero-inflated, negative binomial, and hurdle models, as well as a logistic model for the extensive margin. Comparisons from the results of these different models reveal that over-dispersion is not a big concern, but the transition from 0 to 1, or from zero to the first count, requires differentiation from transition to higher counts. Results show that childhood migration has a statistically significant effect on the extensive margin, intensive margin, and age of first pregnancy. Furthermore, the effect of migration interacts with whether the woman is born in a rural or urban area and whether the destination is urban or rural.

The remainder of this article is organized as follows. The firsts section introduces the literature on the migration and fertility nexus from a theoretical and empirical perspective. It describes the three main theories that span across disciplines, the adaptation, selection, and self-selection hypotheses. It relates these hypotheses to theories and empirical approaches for estimation, and finishes with the contribution of this article to the literature. Section describes the data source and sample of the study, and the definition of the variables of interest, followed by the identification strategy. Section **??** describes the estimation process for each of the outcomes and the results. Section concludes with the implications of this study and some avenues for future research.

The Migration Fertility Nexus

The nexus between fertility and migration has been studied from a theoretical and an empirical perspective in economics and demography. First, I describe the four hypotheses: socialization, adaptation, selection, and disruption. Under this framework, previous research illustrates how either preferences or constraints relate to migration, but cannot identify the causal effect of migration on women's incentives since they focus on adult migration and decisions made by a unitary household. I introduce a model for the individual woman decision to have children and draw from empirical research to illustrate the mechanisms through which childhood migration can affect fertility, physical mechanisms or preference changes.

The four main hypothesis are socialization, adaptation, selection, and disruption (S. Goldstein and Goldstein 1981; Kulu 2005; Zarate and De Zárate 1975). The socialization hypothesis posits that fertility rates of migrants are dominated by the fertility preferences set on their childhood environments, while the adaptation hypothesis states that individuals adapt to the patterns at destination. The selection hypothesis refers to the self-selection of migrants to destinations that resemble their prefered fertility rates. The disruption hypothesis highlights the mechanical effects of the the trip itself either through separation of partners or negative biological impacts on fecundity (S. Goldstein and Goldstein 1981). To test these hypotheses, researchers consider fertility rates of migrants and stayers and compare different iterations of migrants with natives of origin or destination.

However, mixed results demonstrate the limitations for identification when examining adult migration, since it is likely that migration and fertility is decided at the same time. Consider testing the adaptation versus socialization hypotheses. Some studies use empirical evidence of converging fertility rates between migrants and populations at destination as support for the adaptation hypothesis; even if it takes some time for fertility rates to convergence, since this could be the interruption and adaptation hypothesis acting together(Kulu 2005; Andersson 2004; B. S. Lee and Pol 1993; K. S. Lee 1989; lee1984; S. Goldstein and Goldstein 1981). In this sense, migrants' behavior adapt to the cultural norms of the destination and their fertility rates resemble those of the destination the longer they stay in that place. Diverging fertility rates of migrants and natives at origin could also support the adaptation hypothesis, as migrants may adapt to the destination norms and bring them back home (Bertoli and Marchetta 2015; Beine, Docquier, and Schiff 2013).

If there is self-selection into migration, then converging (or diverging) fertility rates would support the socialization hypothesis instead. For example, Forste and Tienda (1996) considers that the level of connection to one's own ethnic group will affect how much an individual retains those preferences. Diverging fertility rates from immigrant parents to second-and higher- generation immigrants (Rosenwaike 1973; Kahn 1994) supports socialization because higher generation immigrants have lower connection to the place of origin of their parents, are not migrants themselves so preferences are affected not only by their ethnic group but also by their surrounding environment.

The two challenges for identification are endogeneity because of sel-selection and reverse causality. Strategies to control for selection are: controls for migrants' and natives' characteristics such as place of origin, controlling for migration trip characteristics such as duration at destination, simultaneous equations, and instrumental variables for migration. Carter (2000) use birth-history data to compare fertility rates of Mexican immigrants and American natives. Her results show that immigrants' fertility rate is somewhere in between that of the Mexican and the American rates. She provides explanations on how the three theoretical hypotheses may be working in conjunction. Kulu (2005) uses a simultaneous equation approach to control for self-selection, and uses data from Estonia to compare migrants with stayers. Beine, Docquier, and Schiff (2013) and Bertoli and Marchetta (2015) instrument for migration using the prices of oil and compare fertility rates among different migrants with those at destination.

It is important to isolate how women's incentives specifically relate to fertility because even if fertility outcomes are at the household level, household incentives are different than women incentives. The decision making agent of previous studies is largely a unitary household with adult, mostly married, women. In most studies the migrant or the decision to migrate is either the male partner or the household. Previous research has shown that the preferences of women and men may differ in relation to fertility and children's outcomes (Doepke and Kindermann 2019; Doepke and Tertilt 2018; Ashraf, Field, and Lee 2014), so the unitary household model does not hold. Similarly, migration effects at the household level are different than those at the individual level and even at the individual level, it matters who is the person that migrates (Ortensi 2015; Wang 2013; Chen 2013).

In order to understand how women's incentives change due to migration, it is necessary to isolate both, the unit of observation and the decision-making process. Even though we can study women's incentives separately from their partners, identifying the effect of adult migration on fertility decisions is challenging because both decisions are made simultaneously. However, childhood migration is a parents' decision and hence not jointly decided with fertility. We can then model the fertility decision of adult women and examine the effect that childhood migration had on either her preferences or constraints. This article fills a gap in the literature that identifies the causal effect of childhood migration of women on their fertility outcomes.

The Fertility Decision

To understand how childhood migration affects the individual fertility decisions of women once they are adults, consider the following utility maximization problem. Following the neoclassical theory of fertility (Becker and Lewis 1973), a woman maximizes utility, $maxU = U(x, n; \delta)$, subject to a location specific budget constraint defined as $w_j(T - t_n)\kappa = x + p_n n$, and a production function for children (Rosenzweig and Schultz 1985) given by $n = n(t_n; \mu)$[1]. Utility depends on the number of children n, consumption of a single composite good x, and the parameter δ, which represents individual specific characteristics such as preferences for children (Olsen 1994). A woman has total time endowement T, which she can use for either child-rearing activities, t_N, or working. If she decides to work, she gets location specific wages per unit of time, w_j, scaled by the individual specific technology parameter κ that represents efficiency wages or the quality of time used for childrearing. Income can be used on either a composite consumption good x with prices normalized to 1, or children expenses totalling number of children, n, times a minimum level of per-child expenses priced at p_n. Women are price takers for the costs of the composite good, the minimum level of expenses per child, and wages which differ by location. The children production function depends on child-rearing time availability and a technology parameter μ.

This problem focuses on the individual's decisions and illustrates some pathways through which childhood migration has an effect on adult fertility. Childhood migration affects fertility, n, through location-specific wages, and the parameters δ, κ and μ. The model separates the effect of childhood migration on childbearing into a preference component and a place

[1] For simplicity, I focus on the quantity of children as the choice variable, extracting away from the quantity quality trade-off. Furthermore, such tradeoff is implicitly represented by the parameters δ of individual preferences or the parameter κ of use of time with higher time for children implies higher quality.

component, rather than selection and a preferences[2] effect since adult women do not select into childhood migration. Of relevance fo this article is the exogeneity of childhood migration through which individual's physical constraints change, and the age at migration which identifies effect of migration on adult outcomes dependent on age of the trip. Wages affect the opportunity cost of time to rearing children, and parameters are influenced by the current location, as well as migration. Fertility preference, represented by the individual-specific parameter δ, depends on the location at birth as well as the location at age 12 and after, when the fertility decisions are made. Women may adapt their preferences to resemble those at destination, but the extent to which they adapt depends on their age at migration. Total income depends on the location specific wages, and the technology parameter κ. Income, therefore, affects women's shadow price of children through the opportunity cost of time. The opportunity cost of time depends on location through wages and on the interaction of migration and location through κ. Finally, the children production parameter μ is influenced by location specific characteristics (e.g. contraception and potential partners availability).

Location Component

Let's consider first how migration can influence fertility outcomes through the characteristics of a place. We consider only location characteristics relevant during the time of child-rearing, and later consider how migrants may adapt to these characteristics in comparison to natives. If an individual change locations, then it is the destination characteristics that determine her fertility rates rather than the constraints at the place of birth because she no longer faces them. Literature from regional and labor economics gives evidence of different mechanisms that affect fertility. Migrants adopt fertility rates similar to those at the destination because they face the same labor market characteristics and similar constraints. These include density, agglomeration, and ammenities and public services (Kondo 2018; Croix and Gobbi 2017; Bhattacharya and Innes 2008; Yakita 2019), and their respective effects on income, costs,

[2]Childhood migration also does not have mechanical impediments for child-rearning, interruption, since it happens before child-rearing ages

and prices (e.g. housing prices, childcare costs). These characteristics determine fertility either through the effects on the labor market, or costs of goods, whcih materialize through the budget constraint. Location characteristics will influence the shadow price of children through the wages or time constraints (e.g. higher transportation time due to higher density of the place).

Additionally, how long individuals are in a location can influence the parameters *kappa* and *mu* differently. If women in the same location at child-bearing age have the same fertility outcomes, then it is location characteristics that determine fertility rather than migration itself. Furthermore, the intensity of the effect of the location characteristis is stronger the longer an individual is in a location. Research about migration effects on different adult outcomes shows that it is not only characteristics of current location, but also duration at current location (Lemmermann and Riphahn 2018; Nakamura, Sigurdsson, and Steinsson 2016). Since natives have longer duration in a location, migrants will have different outcomes; however, the longer an individual is at a particular place, and the younger the individual arrived to the place, the more similar the parameters will be to those at the destination than to the place of birth. Depending on the duration since migration individuals resemble natives and hence they react to the location constraints the same way natives would. In conclusion, if migration happenned during childhood, migrants outcomes will be more similar to those of the natives rather than to those of origin population, but will not necessarily be exactly the same.

Preference Component

Duration at destination can influence socioeconomic characteristics (e.g. education) but also idiosyncratic preferences of the individual. Decisions depend on individual constraints and location constraints. Faced with the same location constraints migrants and natives would make the same decisions, but migrants characteristics differ to those of natives because of the duration of exposure to destination. Similarly, everything else equal, if exposed to the same social norms migrants and natives preferences should be the same; but since migrants and natives are not exposed to the same social norms for the same amount of time, age of migration is relevant for how social norms affect preferences for migrants. Similar to studies previously mentioned that exploit the duration at the destination to identify change of preferences of adult migrants, childhood migration can also entail change in preferences. This change is captured through the parameter δ; the model refrains from classifying this change as either a socialization effect or an adaptation effect.

The literature on the determinants of fertility identifies individual preferences as an important component of the children production function (Rosenzweig and Schultz 1985; Becker and Lewis 1973) , and literature on the determinants of preference highlight the rol of childhood in the development of such preferences (Postlewaite 2011). Ttherefore, δ is determined by place of birth, place of destination, and age of migration. These preferences may be directly related to fertility, like the prefered number of children; or indirectly, like marriage, age of sexual debut, contraception, partner involvement, pregnancy and post-partum, and human capital investments on self (Brauw and Harigaya 2007; Ndahindwa et al. 2014; Lindstrom 2003; Yount, Crandall, and Cheong 2018; Chapman 1978; Brockerhoff and Yang 1994; B. S. Lee and Pol 1993).

The socialization and adaptation hypothesis relate migration to fertility through a preference shift, with socialization emphasizing the critical role of the childhood environment and adaptation with the role of time spent abroad (Kulu 2005). Furthermore, both theories support the idea that how an individual is exposed to information will affect their fertility preferences, with an emphasis on age for the former and duration on the latter. Similarly, the literature on neighborhood effects (Chetty, Hendren, and Katz 2016) and research on the difussion of information from migrants (daudin_can_2018, Beine, Docquier, and Schiff 2013), identify information as the technology shifter for this preference parameter. The intensity through which an individual is exposed to this information, the more likely the information will affect her preferences; where intensity encompasses physical distance, duration at location, means of information transmission (e.g. parents and friends versus media, see for example Ferrara, Chong, and Duryea (2012)) or critical age of exposure to this information.

Data

This research uses data from the Mexican Family Life Survey (Rubalcava and Teruel 2002–2013), MxFLS. The MxFLS is a longitudinal, multi-thematic survey, that collected household and individual data on three rounds spanning from 2002 to 2013. I used all rounds to build a dataset where each observation is an individual that was ever surveyed. This constitutes a total of 47525 individuals. The main variables of interest come from the fertility and migration module. The migration module covers all household members aged 15 or older, and the fertility module only females ages 14 to 49 at the time of survey. After removing incomplete observations, that is, individuals who do not have information on either the variables of interest or one of the covariates, the sample has 11335 individuals. Summary statistics are in table 1. An additional sample of study removes individuals who migrate as adults. I call this sample non adult migrants; it has 8663 observations.

Childhood migration is defined as a "no" answer to the following question: "when you were 12 years old, were you living in the same place you were living at when you were born?" The enumerator is instructed to "not consider changes of residence neither inside Mexico City, nor metropolitan area." 24.2% of the sample is a child migrant. I refer to these individuals as child migrants, child movers, or just movers. Adult migrants are those that moved for 1 year or more after turning 12. I refer to stayers for individuals who did not move before the age of 12, even if they are adult migrants. The MxFLS has two advantages for migration research. First, it collected detailed data about individuals' location and migration trips. In particular, it includes information about birth location, location at age 12, and adult migration histories. Data on the migration module is retrospective, which means the dataset includes the entire past migration history of the individual. Second, it has a very low attrition rate. Almost 90% of panel households were recontacted for at least one follow-up round.

The fertility outcomes are number of children ever born (CEB), with 0 children as a possible answer, and age at first pregnancy. The MxFLS asks females about their pregnancy history, pregnancy losses and still births, number of children alive, and number of children deceased. Questions are self-reported, and are either retrospective or current if applicable, e.g. a current pregnancy. If a woman is a panel member, questions are asked since the last visit. The total number of children are all boys and girls born alive. It goes from 0 to 18. Interrupted pregnancies and still births count as 0, while daughters or sons born alive but later deceased are added to the total sum of children. The average number of children of women in the sample is 1.75. If we exclude the women with no children, which accounts to excluding 33.8% of the sample, the average is 2.64 children. The questionnaire asks directly the age at first pregnancy, which may be younger than the age of first birth. If this variable is missing, I use the youngest age of the mother reported on the pregnancy histories. Low attrition is also beneficial for the measurement of fertility outcomes, although not required given my analytical approach, which does not assume that individuals have completed pregnancy histories.

The Mexican Family Life Survey includes many questions useful for controls in this study. I use information about the time and location at survey, household and family characteristics, and individual characteristics. When available, responses are taken from modules asked directly to the individual. It is relevant to mention that a household may be interviewed on several visits at different dates during the same survey round. Additionally, some questions are asked more than once. In particular, age and state at survey time is recorded on every book. I use the fertility module as the principal source of information. For example, if the age during survey reported on the migration module differs from the one on the fertility module, I take the one from the fertility module.

Next I will define the variables used for controls, and in later sections I explain how I used them in the analysis. The last time an individual is surveyed is defined as the last time she filled out the fertility module. This determines which data round I used for the age during last time surveyed, location during last time surveyed, and data round the person was last surveyed. Additionally, birth date, location at survey and age at survey is taken from the fertility module. If it is not available, I use the information from the migration module of the data round that the individual was last interviewed. With the birth year, I define cohorts based on the decade in which the individual was born. I create 5 different cohorts dummy variables, defined by decade born from 1950s to 1990s. The location at survey is defined as urban if it is a community with a population of more than 100000. The variables for location at birth are birth state and whether it is urban. They come from the migration module. Birth location is categorized as urban if it was a city. Education, for parents and respondent, is a categorical variable that goes from 1 to 8. 1 represents no instruction, and it increases with level of education as follows: preschool, elementary, secondary, high school, normal basic, college, and graduate. Finally, married is defined as 0 if at any interview the respondent reported being single and 1 if reported being either separated, married, divorced, widow, or on a free union. Summary statistics for these variables are in table 1 as well.

Identification Strategy

Studying childhood migration provides a tractable identification strategy, in addition to a relevant research question. The mechanisms through which adult migration affects fertility are difficult to establish because it is possible that the decisions are made simultaneously[3]. Additionally, several of the determinants of fertility are the same or interact with the determinants of adult migration. One way previous research identified causality is by studying the effect of adult migrants on fertility rates on origin or destination, comparisons

[3]For a brief illustration, consider a family that decides to have a large number of children, prompting them to move away from the central business district. Several years can pass between the move and the pregnancies, but in this case the decision to have children caused the move, not the other way around.

of migrant fertility rates against native-born, or the effect on the number of children if one of the household members migrate. [MISSING CITATIONS]. However, these studies do not study how women's individual incentives change if she changed locations. Even with a randomized controlled trial, it would be very difficult to encourage (adult) migration without affecting the fertility decision. E.g., a randomly assigned subsidy for migration could induce a delay in childbearing. Only an imaginary experiment where families are randomly assigned to change locations by force could separate the simultaneous decision-making processes of migration and fertility but it would not allow identifying whether the effect is from migration or a reaction to forced displacement.

The fact that it is childhood migration rather than adult migration has three advantages. First, there is a clear time sequence and a lag between the treatment and outcome. Second, given that it is migration before the age of 12, it is reasonable to assume that migration is a family decision rather than an individual decision, while fertility will remain an individual's decision after reaching adulthood. Third, even though the research strategy identifies the effect of migration on fertility specifically for child migrants, it also provides insights for adult migrants. Just as adult migration, child migrants are exposed to different groups and social norms upon arrival, they experience mobility, and there is a change in access to resources and opportunities such as public health resources and labor market opportunities.

I estimate the effect of childhood migration on the fertility outcomes of individual i at location j and time t with the following reduced-form model

$$F_{ijt} = \alpha + \beta M_i + \delta X_i + \theta H_i + \delta Z_{ijt} + \nu_j + \gamma_t + \epsilon_{ijt} \tag{1}$$

where F_{ijt} stands for the fertility outcome[4] of individual i observed at location j at the time of survey t. Fertility outcomes are the total number of children ever born and age at first

[4]Even though the data source is a longitudinal survey, the analysis is cross-sectional with one observation per individual, fertility outcome defined only once per individual, and childhood migration not varying over time. Controlling for individual fixed effects would eliminate the variation in the childhood migration variable.

pregnancy. Using data on CEB, I also consider the extensive margin, a 1/0 dummy with 1 if the woman has any children. M_i is a childhood migration dummy, 1 if the individual migrated before the age of 12 and 0 otherwise. The parameter of interest, β, represents the effect of migration on the outcome analyzed. X_i represents time-invariant individual characteristics, H_i stands for childhood household characteristics of individual i, Z_{ijt} are other individual characteristics that change by time or location, and ν_j and γ_t are location and time fixed effects.

Even if the migration decision is made by the parents, β may be biased because of self-selection or heterogeneous effects (McKenzie and Yang 2010). Individual,X_i, and household, H_i, characteristics control for self-selection bias and heterogeneous effects. Location and time fixed effects to control for period or location trends. There may be characteristics common to those families that migrate, which affect the decision to move as well as underlying fertility preferences. I use parents' education to proxy for household characteristics H_i[5] Other factors that may affect childhood migration and fertility decisions are accounted for by controlling for generational trends, and time or location-driven preferences. I include cohort controls, survey round as time fixed effects, state of birth as location fixed effects, and whether the birth location is urban or rural. I use whether the location at age 12 is urban with whether the location at birth is urban, and interact them with migration to identify the type of trip; where the type of trip is one of 4, rural to rural, rural to urban, urban to rural, and urban to urban. Additional controls may bias the estimated parameters if those variables affect the coefficients for childhood migration as well as fertility. Including them may, in effect, be over-controlling by attributing differences in fertility to secondary factors affected by childhood migration, rather than to the migration experience itself.

To study the effect of migration on the fertility preferences of all women of childbearing age and to focus on the women's decisions rather than on household effects, I do not limit the

[5]There is additional information for parents, as long as they are also part of the panel. Limiting the sample in this way would be problematic because using only those observations significantly reduces sample size.

sample to married women or to women above a certain age threshold. Additionally, the larger number of observations can give more precise estimates and potentially reveal mechanisms that would be missed otherwise. For example, the inclusion of younger women from different cohorts can help identify ways in which childhood migration affects some generations but not others. Similarly, it also allows a deeper study of certain mechanisms through which childhood migration affects the fertility of all cohorts or age groups. For example, differing effects by cohort would not be revealed in the analysis focused only on older women. Finally, a larger sample lets us control for different covariates to identify mechanisms more precisely, such as birth locations, interactions between childhood migration and other explanatory variables, and marriage itself.

This approach, however, can increase the risk of bias from incomplete fertility histories. There are two strategies found in the literature to account for incomplete fertility histories when studying fertility determinants or the effects of migration. The first one is to divide the sample into subgroups by age groups (Andersson 2004) [MISSING CITATIONS]. INCLUDE MORE CITATIONS!!! The second one is to estimate a censored model at the individual level (Caudill and Mixon (1995)) by controlling for the censorship through an age functional form in the regression. Age variables refer to both, age of the individuals as well as duration since migration. Common age variables are the age of the woman at the time of the survey, the age of the woman and the age of the husband at the time of marriage, and the duration of the woman in the destination location. I account for this by including a flexible spline functional specification for the age during the survey.

Estimation and Results

I estimate the parameters of the explanatory variables through maximum likelihood and I assume three different probability distributions for the outcome, Poisson, negative binomial, and zero-inflated. Additionally, I consider different processes for the extensive and intensive margin using evidence from the data, compare estimates from the zero-inflated model and a hurdle model, and consider the specifications of the extensive margin independently. Finally, I estimate the model for only mothers, examining their number of children and the age of first pregnancy. For the age at first pregnancy, I use ordinary least squares to evaluate the effect of childhood migration on the log of the age at first pregnancy. Throughout the analysis, I consider different specifications examining the urban/rural dimension, controlling for parents' education, and the different controls described in section **??**. My results give insights into the endogeneity corrections, and the different mechanisms through which childhood migration affects fertility.

Consider the fertility outcome F_{ijt} defined as the total number of children a woman has up to the time of interview t. Because the dependent variable is a count, ordinary least squares is inefficient and standard errors are inconsistent (Winkelmann 2008). Additionally, estimation could lead to negative predictions. I estimate equation 1 using a count probability model, common in the literature for estimating the effect of determinants of the number of children. See for example Caudill and Mixon (1995) for general determinants of the number of children, and Bertoli and Marchetta (2015) for an application to migration and fertility. To estimate the effect of childhood migration on the total number of children, assume a Poisson distribution of the outcome. Let F_i follow a Poisson random process, with $i \in [1, n]$, then its probability function is defined by

$$f(F_i) = \frac{e^{-\mu_i}\mu_i^{F_i}}{F_i!} \tag{2}$$

where

$$\mu_i = e^{\alpha+\beta M_i+\delta X_i+\varepsilon_i} \tag{3}$$

M_i represents a dichotomous variable with 1 for migrants and zero for non-migrants, F_i is the total number of children including 0 children, and X_i is a vector of covariates. On equation 2 the outcome of each individual is assumed to be a random draw out of the probability distribution of F. The covariates described in equation 1 come to the estimation process of equation 2 through μ. Table 2 shows the results of the regression assuming a poisson distribution. The results of this specification are shown in table 2, all estimates are marginal effects. Testing for overdispersion shows no concern; however, I use robust standard errors to allow flexibility on the Poisson assumption that the mean and the variance are the same. [CITATION ABDOUL PAPER].

Column 1 shows the results with no covariates but including all fixed effects from birth cohort, state of birth, and survey round. It also includes the age at the last survey, to control for right censorship (Caudill and Mixon (1995)). Columns 2 and 3 include controls for parents' education and urban at birth respectively. Column 4, the preferred specification, also includes the type of trip. Types of trip is an interaction of childhood migration times iterations of urban at birth and urban at age 12. The interaction uses the variable values if the trip is from (to) an urban area, or 1 minus the variable value if the trip is from (to) a rural area. In this sense, there are 6 categories of individuals: rural stayers, urban stayers, rural-rural migrants, rural-urban migrants, and urban-urban migrants. For illustrations, consider trip rural-urban = child migrant X (1- urban at birth) X urban at age 12. If an individual migrated from a rural to an urban area, the value of the interaction will be 1 but the values of child migrant, urban at birth, and urban at age 12 will be 1, 0, and 1 respectively.

The estimates show that the coefficient on childhood migration is statistically significant from zero. The coefficients of parents' education are significant and in the expected direction, showing evidence that they control for self-selection bias of the households. There is a significant and important effect from being born in an urban area, driving down the number of children a woman has. Child migrants have more children than nonmigrants and this result hold for both urban and rural areas. In other words, rural stayers have fewer children than migrants that move from a rural area to another rural area; and urban stayers have fewer children than urban migrants that move from an urban area to another urban area. The coefficients form the trip rural-urban and trip urban-rural indicate that migrants approximate the fertility rates of the stayers at the destination with rural-urban migrants having more children than urban stayers because of the positive effect of migration, but urban-rural migrants having fewer children than rural stayers due to the size of the effect from being born in urban areas.

To allow flexibility in the variance, robust standard errors are reported in parenthesis. To verify the robustness of the Poisson distribution assumption, the specification on column 4 of table 2, the preferred specification, is replicated using a negative binomial distribution. Results are reported on column 1 of table 5. Coefficients for both distributions are very similar and changing the probability distribution assumption did not change the statistical significance of the results.

It is relevant to consider the difference between the decision making the process at the extensive and intensive margin, or the decision to have children at all versus the number of children a woman has. This accounts for two aspects. First, some women may decide not to have children at all because of the effect of migration. Second, there is more friction towards having the first children than to have additional children. To consider these variations, the outcome variable under study is a dummy variable with 1 if a woman has children, and 0 otherwise. Results are reported on column 1 of table 3 and show childhood migration increases the probability of becoming a mother, similar to the previous results that indicate that migration increases the number of children. Unlike results on table 2, there is not a significant difference among the type of migration or between rural and urban dwellers. This indicates that it is migration itself affects the decision to become a mother or to have the first child.

It

could be that the decision-making processes are different and therefore follow different probability distributions. Therefore, it is relevant to analyze the results for only mothers. Column 2 of table 3 shows the estimates for the intensive margin only for those women that have children. In this case, the coefficients for the types of trips and urban are significant and the effect on the number of children being the same as for the full sample. Column 3 of the same table also shows results for only mothers, but the outcome variable is the log of the age of the first pregnancy. The estimates are significant only for migration and show that migration decreases the age of the first pregnancy. Since these results are for different samples, to allow comparisons of the regressions the model is run using a zero-inflated and hurdle model, which accounts for different probability distribution functions of the extensive and intensive margin, but uses the entire sample for the analysis. The results of the count component are shown in columns 2 and 3 of table 5 and show that the conclusions are the same.

Many mechanisms may be at play through migration or through the effect of being in an urban area. Table 4 shows the estimation of the model using as outcome variables education, adult migration, and marriage, instead of fertility. Column 1 indicates shows that the coefficient of childhood migration is not significant, but the coefficients on urban at birth and types of trips are. Similarly to the results on fertility, rural-urban and urban-rural migrants education levels approximate those of the destination, with higher education if the move is to an urban area and lower education if the move is to a rural area. But there is still some effect from the place of origin, in other words, the positive effect of moving to an urban area is not as high as being born in an urban area, and the negative effect from moving to an urban area does not decrease education to the level of being born in a rural area. Considering previous research that connects education with labor market participation and access to contraception information, this result is consistent with the fertility results on the intensive margin. Another possible pathway that migration may affect fertility is through its effect on adult migration. Column 2 shows that a childhood migrant is more likely to migrate again as an adult, and even more so if as a child the migration was from an urban to a rural area. Because of this additional effect, and to identify the effect of childhood migration from adult migration, all previous estimations are also run with a sample that does not include adult migrants. Columns 4, 5, and 6 of the other tables show these results, which are similar to the ones for the full sample. Finally, column 3 of table 4 examines the effect of marriage. Results indicate that migration increases the probability of being married and being in an urban area decreases it. Examining the sizes of the coefficient reveals that a move towards an urban area is a net decrease in the probability of being married.

In conclusion, the results show that childhood migration increases fertility rates through the extensive margin, and at the intensive margin urban moves decrease the number of children. Childhood migration increases the probability of becoming a mother, and child migrants start parity younger, conditional on covariates. Parents' education is an important component of fertility decisions, but in this context, it is more important because of identification. It helps control for endogeneity due to self-selection. Urbanization, or access to resources due to being in a city, is the more likely mechanism through which childhood migration affects fertility. Considering additional outcomes such as education, marriage, and adult migration gives some insights into the mechanisms at play.

Conclusions

Understanding fertility can inform policies on the availability and targeting of planning services, as well as population targets and public services in particular areas. Population size targets help plan for policies in the short, medium, and long term for social services, especially for the young, like education plans; elders, like retirement and public services; and women of childbearing age, like job market participation, childcare subsidies, contraception, and children nutrition. Characterizing the incentives of women for fertility, related to migration, can help make better population estimates and even individual-level policies. Even though this article studies childhood migration and not adult migration, it helps identify mechanisms through which migration affects fertility either through a location specific component or a preference component. In particular, the location components mechanisms will not change dramatically if the treatment is adult migration, but causal identification would not be possible.

In economics, and in the study of determinants of fertility, self-selection is one of the main challenges to identify the causal effect of a treatment, in this case, migration. Furthermore, fertility and migration outcomes are endogenous because population size affects the same determinants that made a person either move or to reproduce. With this in mind, it is important to recognize that even if we just examine the determinants of migration or the determinants of fertility separately, we need to consider endogeneity. The relationship between migration and fertility can be synthesized in a similar way as the literature of migration, both literatures evaluate characteristics of the place and characteristics of the individual. It is precisely this challenge that leads researchers to attempt different approaches to measure the relationship of fertility and migration.

This article focuses on childhood migration, which means the migration event and the fertility outcomes are not happening at the same time. Specifically, I use the Mexican Family Life Survey to study the effect of migration before the age of 12 on fertility decisions after the age of 14. If there is an effect of migration on fertility, there is at least a three-year gap between the "treatment" and the "outcome". This is important for identifying causality. Additionally, I use different strategies to account for self-selection, reverse causality, censored fertility histories, excess zeros, and allow flexibility in terms of different data-generating processes for the extensive and the intensive margins (having any children and the number of children). The results indicate that childhood migration net effect on fertility rate is complex. Conditional on covariates, childhood migration increases the probability of becoming a mother, and child migrants start parity younger, but the number of children will depend on whether the destination is urban, compared to a rural or urban place of birth. Parents' education is an important component of fertility decisions, but in this context, even more so because of identification. Parents' education helps control for endogeneity due to self-selection into migration.

Childhood migration has the potential to increase fertility rates since there are more mothers and they start childbearing younger. However, migration towards urban areas has a strong effect towards fewer children, and even if a woman migrates to a rural area, results show she will still have fewer children than the rural native and she might move again towards urban areas as an adult. The implications of the results for a location's fertility rate will then depend on the initial level of the population size and the distribution among rural and urban locations. Urbanization, or access to resources due to being in a city, is the more likely mechanism through which childhood migration affects fertility. Furthermore, controlling for currently living in an urban area, child migration increases fertility by decreasing the age of first pregnancy. Lower probability of marriage and higher education in the cities are also at play when women decide their opportunity cost of time, which lends them as likely candidates of the mechanisms at play for the effect of migration and urbanization into fertility decisions.

Table 1: **Summary Statistics**

Statistic	Mean	St. Dev.	Min	Max	N
Migrated before age 12	0.242	0.428	0	1	11,335
Age last time surveyed	31.434	10.776	14	49	11,335
Total No. of Children Born	1.748	1.978	0	18	11,335
Total No. of Children Born >0	2.641	1.885	1	18	7,504
1 if any children	0.662	0.473	0	1	11,335
Age during first pregnancy	20.364	4.355	14	48	7,729
Respondent's education level	4.173	1.462	1	8	11,335
Father's education level	2.856	1.542	1	8	11,335
Mother's education level	2.724	1.406	1	8	11,335
1 if born in urban area	0.386	0.487	0	1	11,335
1 if at 12 in urban area	0.373	0.484	0	1	11,335
Migrated as an adult	0.236	0.424	0	1	11,335
1 if ever married	0.690	0.463	0	1	11,335
1 if born in 1960s Cohort	0.205	0.403	0	1	11,335
1 if born in 1970s Cohort	0.229	0.420	0	1	11,335
1 if born in 1980s Cohort	0.332	0.471	0	1	11,335
1 if born in 1990s Cohort	0.139	0.346	0	1	11,335
Last surveyed round 2002	0.109	0.311	0	1	11,335
Last surveyed round 2005	0.160	0.366	0	1	11,335
Last surveyed round 2009	0.732	0.443	0	1	11,335

Note: Child Migrant is 1 if location at age 12 is a different metropolitan area than birth location. Total children are children ever born. Education is a categorical variable from 1 to 8; higher category represents higher educational attainment. Urban area at birth is 1 if a city. Urban area at survey is 1 if location's population greater than 100,000. Adult migrant is 1 if moved for at least one year.

Table 2: **Effect of Childhood Migration on Fertility, Total Children**

	Dependent variable:				
	Total No. of Children Evern Born (CEB)				
	Poisson				
	Full Sample				Non Adult Migrants
	(1)	(2)	(3)	(4)	(5)
Child Migrant	0.001	0.015	0.017	0.052**	0.055
	(0.018)	(0.018)	(0.017)	(0.026)	(0.034)
Father Education		−0.073***	−0.067***	−0.066***	−0.071***
		(0.007)	(0.007)	(0.007)	(0.009)
Mother Education		−0.070***	−0.064***	−0.062***	−0.068***
		(0.008)	(0.008)	(0.008)	(0.010)
Urban at Birth			−0.123***	−0.146***	−0.150***
			(0.017)	(0.019)	(0.023)
Trip rural-urban				−0.179***	−0.217***
				(0.039)	(0.050)
Trip urban-rural				0.078*	0.105*
				(0.044)	(0.059)
Trip urban-urban				−0.030	−0.030
				(0.046)	(0.057)
Observations	11,335	11,335	11,335	11,335	8,663

Note: *p<0.1; **p<0.05; ***p<0.01
Child migrant = 1 if location at age 12 different than birth location. Different location defined as a different metropolitan area or farther. All specifications include birth state fixed effects, survey year controls, spline function of age at survey, and cohort based on birth decade. Robust standard errors in parentheses. Constant is not reported.

Table 3: **Effect of Childhood Migration on Fertility, Separate Extensive and Intensive Margin**

	Dependent variable:					
	1 if Mother	CEB	Log of Age	1 if Mother	CEB	Log of Age
	logistic	*Poisson*	*OLS*	*logistic*	*Poisson*	*OLS*
		Full Sample			Non Adult Migrants	
	(1)	(2)	(3)	(4)	(5)	(6)
Child Migrant	0.273***	0.016	−0.016**	0.222**	0.005	−0.015
	(0.096)	(0.023)	(0.008)	(0.112)	(0.030)	(0.010)
Father Education	−0.133***	−0.051***	0.013***	−0.136***	−0.052***	0.012***
	(0.021)	(0.006)	(0.002)	(0.023)	(0.007)	(0.002)
Mother Education	−0.130***	−0.041***	0.015***	−0.131***	−0.039***	0.016***
	(0.024)	(0.007)	(0.002)	(0.027)	(0.008)	(0.003)
Urban at Birth	−0.040	−0.141***	0.008	0.003	−0.164***	0.012*
	(0.065)	(0.016)	(0.006)	(0.072)	(0.019)	(0.006)
Trip rural-urban	−0.235	−0.154***	0.024*	−0.281	−0.177***	0.032**
	(0.158)	(0.034)	(0.012)	(0.184)	(0.043)	(0.015)
Trip urban-rural	−0.132	0.079**	−0.007	−0.069	0.109**	−0.013
	(0.147)	(0.038)	(0.012)	(0.170)	(0.050)	(0.015)
Trip urban-urban	−0.253*	0.037	0.002	−0.281*	0.060	0.007
	(0.150)	(0.038)	(0.013)	(0.170)	(0.046)	(0.016)
Observations	11,335	7,729	7,729	8,663	5,441	5,441

Note: *p<0.1; **p<0.05; ***p<0.01
Child migrant = 1 if location at age 12 different than birth location. Different location defined as a different metropolitan area or farther. All specifications include birth state fixed effects, survey year controls, spline function of age at survey, and cohort based on birth decade. Robust standard errors in parentheses. Constant is not reported.

Table 4: **Effect of Childhood Migration on Other Outcomes**

	Dependent variable:		
	Education	Migration	Married
	OLS	*logistic*	*logistic*
	(1)	(2)	(3)
Child Migrant	0.023	0.277^{***}	0.283^{***}
	(0.040)	(0.085)	(0.096)
Father Education	0.232^{***}	0.007	-0.127^{***}
	(0.011)	(0.021)	(0.020)
Mother Education	0.258^{***}	0.009	-0.122^{***}
	(0.012)	(0.024)	(0.023)
Urban at Birth	0.405^{***}	-0.584^{***}	-0.138^{**}
	(0.030)	(0.066)	(0.063)
Trip rural-urban	0.314^{***}	-0.218	-0.335^{**}
	(0.072)	(0.135)	(0.155)
Trip urban-rural	-0.211^{***}	0.636^{***}	0.060
	(0.068)	(0.136)	(0.148)
Trip urban-urban	-0.089	0.177	-0.254^{*}
	(0.069)	(0.146)	(0.147)
Observations	11,335	11,335	11,335

Note: *p<0.1; **p<0.05; ***p<0.01
Child migrant = 1 if location at age 12 different than birth location. Different location defined as a different metropolitan area or farther. All specifications include birth state fixed effects, survey year controls, spline function of age at survey, and cohort based on birth decade. Robust standard errors in parentheses. Constant is not reported.

Table 5: **Effect of Childhood Migration on Fertility, Alternative Distributions**

	Dependent variable:					
	Total No. of Children Ever Born (CEB)					
	negative binomial	*zero-inflated count data*	*hurdle*	*negative binomial*	*zero-inflated count data*	*hurdle*
	(1)	(2)	(3)	(4)	(5)	(6)
Child Migrant	0.052^{**}	0.006	-0.008	0.056^{*}	-0.010	-0.022
	(0.025)	(0.025)	(0.027)	(0.033)	(0.033)	(0.035)
Father Education	-0.066^{***}	-0.075^{***}	-0.073^{***}	-0.072^{***}	-0.076^{***}	-0.076^{***}
	(0.007)	(0.007)	(0.008)	(0.009)	(0.009)	(0.010)
Mother Education	-0.062^{***}	-0.060^{***}	-0.064^{***}	-0.068^{***}	-0.067^{***}	-0.070^{***}
	(0.008)	(0.008)	(0.009)	(0.010)	(0.010)	(0.011)
Urban at Birth	-0.145^{***}	-0.191^{***}	-0.224^{***}	-0.146^{***}	-0.229^{***}	-0.268^{***}
	(0.019)	(0.020)	(0.023)	(0.023)	(0.025)	(0.027)
Trip rural-urban	-0.176^{***}	-0.185^{***}	-0.177^{***}	-0.214^{***}	-0.235^{***}	-0.208^{***}
	(0.038)	(0.040)	(0.044)	(0.050)	(0.051)	(0.057)
Trip urban-rural	0.076^{*}	0.094^{**}	0.109^{*}	0.101^{*}	0.160^{***}	0.153^{**}
	(0.044)	(0.047)	(0.055)	(0.058)	(0.062)	(0.072)
Trip urban-urban	-0.030	0.015	0.039	-0.033	0.011	0.073
	(0.046)	(0.049)	(0.056)	(0.056)	(0.059)	(0.067)
State Fixed Effects	Yes	No	No	Yes	No	No
Observations	11,335	11,335	11,335	8,663	8,663	8,663

Note: *p<0.1; **p<0.05; ***p<0.01
Child migrant = 1 if location at age 12 different than birth location. Different location defined as a different metropolitan area or farther. All specifications include birth state fixed effects, survey year controls, spline function of age at survey, and cohort based on birth decade. Standard errors in parentheses. Robust standard errors for negative binomial specification and clustered standard errors at the state level for the zero-inflated and hurdle specifications. Constant is not reported.

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