International Migrants and the Human Capital Formation of Their Left-Behind Children*

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November 14, 2022

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Abstract

International migration can disrupt families and affect the human capital investment of left-behind children. Using data from the Mexican Family Life Survey, I document that mothers with husbands in the United States invest less time and resources in the education of their children than those with husbands in Mexico. I develop a heterogeneous household model with endogenous migration and intergenerational linkages through investments in children's education. The model incorporates important features of the data. In particular, I allow for three features: the low returns of a Mexican education in the U.S. labor market, selection in the migration decision, and potential complementarity between fathers and mothers in the human capital formation of their children. I find that the differential returns of a Mexican education between the U.S. and Mexican labor markets is crucial to explain the educational investment disparities.

JEL Classifications: F24, G52, J22, D13

Keywords: Migration, education, intergenerational mobility

*I am very grateful for the guidance and helpful comments from Kei-Mu Yi, German Cubas, and Bent Sørensen. I thank Dirk Krueger, Federico Mandelman, Fan Wang, Karen Kopecky, Francisca Antman, Pedro Silos, Simon Fuchs, Salome Baslandze, Veronika Penciakova, Victor Zuluaga, Liu Mendoza, Nabila Biju, and participants at the Graduate Student Workshop at the University of Houston for their comments and suggestions. I also thank conference participants at the Federal Reserve Bank of Atlanta, the Texas Job Candidates Conference, and the University of Texas Rio Grande Valley. Part of this research was done under the auspices of the Americas Center Graduate Dissertation Internship from the Federal Reserve Bank of Atlanta; I am grateful to the Federal Reserve Bank of Atlanta for their hospitality. I acknowledge the statistical offices that provided the underlying data making this research possible: the Mexican National Institute of Statistics, Geography, and Informatics and the United States Census Bureau. All errors are mine.

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1 Introduction

Approximately 281 million people (3.6% of the global population) lived outside their countries of birth in 2020 (United Nations, 2021). International migration has a typical pattern: the first migrant of a household is usually the father, and children and mothers are left behind (Démurger, 2015). For example, in the case of Mexico, the probability of a husband migrating to the U.S. while the wife stays is 17 times higher than the reverse (Goerlach, 2022). A consequence of parental migration is that many left-behind children grow up without a parent; approximately 15% of Filipino children, 5% of Mexican children, and 2%-3% of Indonesian and Thai children have a parent overseas.[1] Parental migration is considered economically beneficial to left-behind household members because they receive remittances. However, this migration has family disruption costs for the left-behind members. For example, migrant fathers cannot dedicate time to their children, potentially affecting their human capital accumulation. When fathers are absent, the natural expectation is mothers' time and expenditure devoted to the education of their children will be greater.

In this paper, I study the relationship between parental migration and the human capital formation of left-behind children empirically and through the lens of a quantitative model. Using data from the Mexican Family Life Survey (MXFLS), I document that mothers with husbands in the U.S. invest less time and resources in the education of their children than those with husbands in Mexico. To explain this result, I develop a heterogeneous household model with endogenous migration and intergenerational linkages through investments in children's education. The model has three features that can potentially explain the documented investment disparities between households with and without a migrant father: selection in the migration decision, the low returns of a Mexican education in the U.S. labor market, and potential complementarity between fathers and mothers in the human capital formation of their children. The model is calibrated to be consistent with data moments related to human capital formation and migration. Results from the quantitative analysis of the model show that the possibility of migration of children to the U.S.—where the returns of Mexican education are low, and they can perceive relatively high earnings regardless of education—explains most of the documented educational investment disparities. These results help us better understand the intergenerational mobility of migrants, who do not necessarily need to improve their children's education to improve their future earnings.

[1] I calculate the percentage of Mexican children using data from the first two waves (2002 and 2005) of the Mexican Family Life Survey (MXFLS) as the percentage of individuals below 18 years old with a parent living outside of Mexico. The information about Filipinos, Indonesians, and Thais is from Bryant (2005).

The empirical analysis is mainly based on data from the MXFLS, a longitudinal study representative of the Mexican population at the national, urban-rural, and regional levels (Rubalcava and Teruel, 2013). The MXFLS has three waves; the first one was conducted in 2002 and collected information from 8,400 households. The next two waves, conducted during 2005-2006 and 2009-2012, reinterviewed almost 90% of the households initially sampled, including individuals who migrated within Mexico or emigrated to the U.S. The MXFLS contains information about migration histories, relationships with people living in the U.S., expenditure on education, and time investment in children's education by each parent. These features make the MXFLS a unique dataset for studying the migration dynamics between Mexico and the U.S.

Using cross-sectional data from the three waves of the MXFLS, I show that mothers with husbands in the U.S. spend less time helping their children study and do homework than those with husbands in Mexico (0.94 vs. 1.44 hours per week per child). They also spend less resources on their children's education. This result is counterintuitive because mothers with husbands in the U.S. have incentives to substitute the lost time from absent fathers and dedicate more time to their children's education. Also, households with fathers in the U.S. have considerably higher earnings, enabling the mothers to work less and dedicate more time to their children's education.

I then assess if the documented disparity in educational investments between the two groups is the result of selection based on observable characteristics in the migration status. The documented differences are robust to controlling for demographic variables and the parents' education. The results are also robust to using the placement of rail lines before the first wave of Mexican-U.S. migration during the 1920s (along with the distance to the border) as an instrument for the potentially endogenous migration status. This instrumental variables approach is standard in the Mexican-U.S. migration literature (Alcaraz et al., 2012; Demirgüç-Kunt et al., 2011; Woodruff and Zenteno, 2007). Lastly, I compare the two types of households in terms of non-educational expenditure and time dedicated to other activities. I find that mothers with husbands in the U.S. spend more time on leisure activities than those with husbands in Mexico and find no differences in working time (market and housework). Also, households with fathers in the U.S. spend more on clothes and non-food items than those with fathers in Mexico. In addition to motivating some of the model's assumptions, these results show that the relatively low investment in children's education of households with fathers in the U.S. is not explained because their mothers work more or their expenditures are smaller relative to non-migrant households.

The migration model has intergenerational linkages through children's education investment. The model has three main components. First, the economy is modeled using a partial equilibrium overlapping generations (OLG) model with endogenous migration from Mexico to the U.S. and heterogeneous households in terms of migration costs and human capital. Second, the choices of each parent affect the outcomes of the children. Parents' time investment in their children's education affects their human capital. Migrant parents cannot invest time in the education of their children left behind in Mexico. The third component is motivated by one of the facts documented in this paper. That is, the return of Mexican education in the U.S. labor market is smaller than that of Mexican education in the Mexican labor market. At the same time, U.S. earnings tend to be higher than Mexican earnings.

I also assume that fathers are the only potential migrants, and there is no return migration. I only consider time investments by each parent and abstract from investment via expenditure in children's education because the differences in educational expenditure between the two types of households are economically negligible ($10 per year); also, about 95% of Mexican children go to public schools. Given this setting, households choose whether or not to send the father to work in the U.S. and make other decisions such as investment in their children's education. The main distinctions between the two options are threefold: the earnings profiles in Mexico and the U.S. are different in terms of the level and returns to Mexican education, fathers working in the U.S. cannot dedicate time to the education of their left-behind children, and migration is costly.

The model calibration is mainly based on data from the MXFLS. The most relevant parameters for the quantitative analysis are those related to human capital production and those related to the migration decision. I calibrate these relevant parameters to match moments from the MXFLS and other data and take other parameters from the literature. One of the novel components of the model is that returns to Mexican education are smaller for people who work in the U.S. than for those who work in Mexico. Using data from the U.S. and Mexico censuses from Integrated Public Use Microdata Series (IPUMS) International (IPUMS, 2020), I estimate the returns of an additional year of Mexican education to work in each country following Bratsberg and Ragan (2002), but here I focus on the returns in levels. I find that an additional year of Mexican education increases the earnings of Mexicans in the U.S. by only 0.28% of the level increase they would receive if they worked in Mexico. Also, the earnings of Mexicans working in the U.S. are, on average, four times larger than the earnings in Mexico. Therefore, Mexican have fewer incentives to invest in their

children's education if they think their children will work in the U.S. Importantly, in addition to other relevant moments, the calibrated model predicts the fact that I established that children with fathers in the U.S. receive less time devoted to education investments from their mothers than those with fathers in Mexico.

Then, I use the calibrated model as a laboratory to study how potential migrants choose the educational investments of their children. Specifically, I assess the relative importance of the features that make potential migrants different from non-migrants by shutting down these features in counterfactual scenarios. I also analyze the substitutability between time investments from fathers and mothers for the human capital formation of their children.

In the first counterfactual, the children of migrants are not allowed to migrate, and I keep the fathers' migration decision of the benchmark economy. Under this counterfactual, mothers with husbands in the U.S. invest 3.35 hours a week on average in the education of each child, an investment three times larger than that of the benchmark economy. This increase in mothers' time investment is explained by the fact that their children will have to work in Mexico, where the returns to education are larger than in the U.S. As a result, in this case, mothers have more incentives to increase their time investments to compensate for the unavailable inputs from the absent father.

I also assess what happens if only children but not their fathers are allowed to migrate, and I restrict the sample to fathers who choose to migrate in the benchmark economy. Under this scenario, the time investment of the mothers reduces to only 15% of the time investment of the benchmark economy. Three main mechanisms explain this considerable investment reduction. First, children can have high earnings in the U.S. even with a low level of education. These are children of people who choose to migrate in the benchmark economy, so many of these children have low migration costs. Second, since the fathers work in Mexico, the mothers have to work more than in the benchmark economy and thus less time for their children's education. Third, children benefit from time investments from their fathers and now require fewer time investments from their mothers.

Finally, in another counterfactual, I shut down migration for all generations and focus on the sample of fathers who choose to migrate in the benchmark economy. The goal of this counterfactual is to assess how much of the differences in time investment between mothers with and without a husband in the U.S. in the benchmark economy is explained by differences in the parents' ed-

ucation. Under this counterfactual, mothers' investment increases drastically and represents 97% of the time investments of non-migrant mothers in the benchmark economy. This result shows that selection based on the fathers' education in the migration decision does not explain the documented disparities in education time investment between mothers with and without husbands in the U.S.

I also investigate the hypothesis that a strong complementarity between mothers' and fathers' time for the human capital formation of the children explains why mothers with husbands in the U.S. invest less time in their children's education than those with husbands in Mexico. For that purpose, I calibrate the model by restricting the substitution parameter to negative values (complements). None of the combinations of parameters under this restriction can explain the differences in time investment observed in the data. In fact, with strong complementarity and the estimated wage profiles for U.S. and Mexico, migrant households would choose an extremely small level of investment in their children's education (with respect to that observed in the data). The lessons about the relationship between migration and educational investment decisions help us better understand the intergenerational mobility process of potential migrants, who do not necessarily need to improve their children's education to improve their future earnings.

Related Literature This paper relates to the existing literature that studies the effects of parental migration on left-behind children's education.[2] It also connects the empirical literature on the effects of parental migration on children's education with an emerging literature in quantitative macroeconomics that studies location choice and children's human capital formation.

The empirical literature on the effects of parental migration on the education outcomes of left-behind children has mixed results, ranging from net negative to net positive. The effect of parental migration on left-behind children can be either positive or negative, depending on individual circumstances, such as cumulative exposure to parental migration, gender, and country of origin (Démurger, 2015). The results can have more weight from the positive effects of migration on children's education (through remittances) or the negative effects (due to family disruption and low perceived returns to education because of children's migration expectations) depending on the dataset characteristics, empirical strategies, and population of interest.

McKenzie and Rapoport (2011) find evidence of a negative effect of migration on the educa-

[2]The empirical literature on the effects of family disruption due to migration goes beyond the education of left-behind children. Antman (2015) and Démurger (2015) review the literature on the effects of family disruption due to migration on health, labor supply response, and social status of family members who do not migrate.

tional attainment of left-behind children; most of the effect is explained by the future migration of boys and increased housework for girls. Antman (2012) finds a positive effect of paternal migration to the U.S. on girls' education, exploiting variations in siblings' ages at the time of parental migration as an instrument for parental migration. In contrast, she finds that domestic paternal migration has no effect on educational attainment for girls or boys. Antman (2011) addresses the endogeneity of paternal migration decisions using an instrumental variable based on U.S. city-level employment statistics in two industries popular with Mexican immigrants and finds that father's migration reduces children's study hours in the short run. There is also evidence of short-term positive effects of remittances on schooling in Mexico (Alcaraz et al., 2012) and the Philippines (Yang, 2008). These studies only capture the marginal effect of the transfers, not accounting for the adverse effects of parental migration. My empirical results are clearly on the side of those that find a negative effect of migration on the education of left-behind children. My paper complements the existing empirical work by studying migration and education in a unified model that accounts for the simultaneous nature of these household decisions. Modeling these household decisions jointly is important for understanding not only the consequences of migration but also its causes.

This paper also relates to the literature that studies differences in the quality of labor between poor and rich countries and the returns of migrants' foreign education in rich countries. Cubas et al. (2016) find that the quality of labor in rich countries is twice as high as that of poor countries using scores from the Programme for International Student Assessment (PISA) and argue that this finding explains part of the disparities in TFP between rich and poor countries. Hendricks and Schoellman (2017) show that the average immigrant from a middle-income or poor country increases their wage by a factor of two to three upon migration and that wage gains decline with education, consistent with imperfect substitution between skill types. Lagakos et al. (2018) document that returns to experience accumulated in their birth country are higher for workers from rich countries than those from poor countries. They argue that this result is explained because immigrants from poor countries accumulate relatively less human capital in their birth countries before migrating. Bratsberg and Ragan (2002) document low returns to foreign education in the U.S. labor market for migrants from poor countries and suggest that this finding is related to the low quality of education in poor countries, lack of transferability of skills, and language barriers. One of the novelties of my model is that I incorporate findings from this literature to explain the

migration decision of parents and the investment decision in their children's education. Allowing for different returns of Mexican education between the two countries is crucial in my quantitative model to explain the documented educational investment disparities between non-migrant and migrant households. In that respect, my model considers that the return of Mexican education in the U.S. labor market is smaller than that of Mexican education in the Mexican labor market. I estimate these returns following Bratsberg and Ragan (2002) closely.

Studies for Mexico have hinted that families with higher probabilities of migrating to the U.S. invest less in education because of the relatively low return to Mexican education in the U.S. labor market (McKenzie and Rapoport, 2011; Démurger, 2015). My paper is the first to incorporate the relatively low return of education from developing countries in the U.S. labor market in a migration model with human capital formation to analyze the quantitative importance of this mechanism. This paper is most closely related to Li (2021); he uses a quantitative model to study how paternal rural-to-urban migration affects the human capital formation of left-behind children in Indonesia, considering the cumulative exposure to parental migration. To my knowledge, Li (2021) and this paper are the only ones using a migration model with children's human capital formation that consider the negative effects of the absence of migrant fathers on left-behind children. His paper focuses on rural-urban migration within a country, whereas my paper focuses on international migration.

Finally, Liu et al. (2010), Fogli and Guerrieri (2019), Zheng and Graham (2022), Eckert and Kleineberg (2021), and Chyn and Daruich (2022) use spatial equilibrium models to study the relationship between location choices and child development and the implications on inequality and segregation in the U.S. These papers use richer models in other dimensions, such as general equilibrium framework, more spatial heterogeneity, or modeling the child development at different stages of childhood. My paper differs from that literature because I allow for family disruption due to migration, which is typical in international migration and migration within developing countries.[3]

The rest of this paper is organized as follows. Section 2 presents the motivating evidence. Section 3 presents the model, and Section 4 its calibration. Section 5 discusses the results. Last, Section 6 concludes.

[3]For example, 75% of left-behind children in Indonesia live with their mothers while the fathers are migrant workers (Li, 2021).

2 Motivating Evidence

In this section, I document differences in the educational investments received by children with migrant fathers and those whose fathers live in Mexico. I also highlight other stylized facts that shed light on the mechanisms that could explain the documented differences in time investment and motivate the model assumptions. In this empirical analysis, I do not make causal claims about the effects of migration on education. The migration and educational investment decisions are endogenous, and I model these decisions using a quantitative model described in Section 3.

2.1 Data

The primary dataset for this analysis is the Mexican Family Life Survey (MXFLS), with a representative sample of the Mexican population at the national, urban-rural, and regional levels (Rubalcava and Teruel, 2013). The MXFLS is a longitudinal study that tracks individuals regardless of changes in residence and new household formations (split-offs). The first round of the survey (MXFLS-1) was conducted in 2002 and collected information from 8,400 households (35,000 individuals). The second and third rounds (MXFLS-2 and MXFLS-3) were conducted during 2005-2006 and 2009-2012, respectively. The MXFLS-2 and MXFLS-3 relocated and reinterviewed almost 90% of the households initially sampled, including individuals who migrated within Mexico or emigrated to the U.S. In that sense, the MXFLS is convenient for studying migration dynamics between Mexico and the U.S.

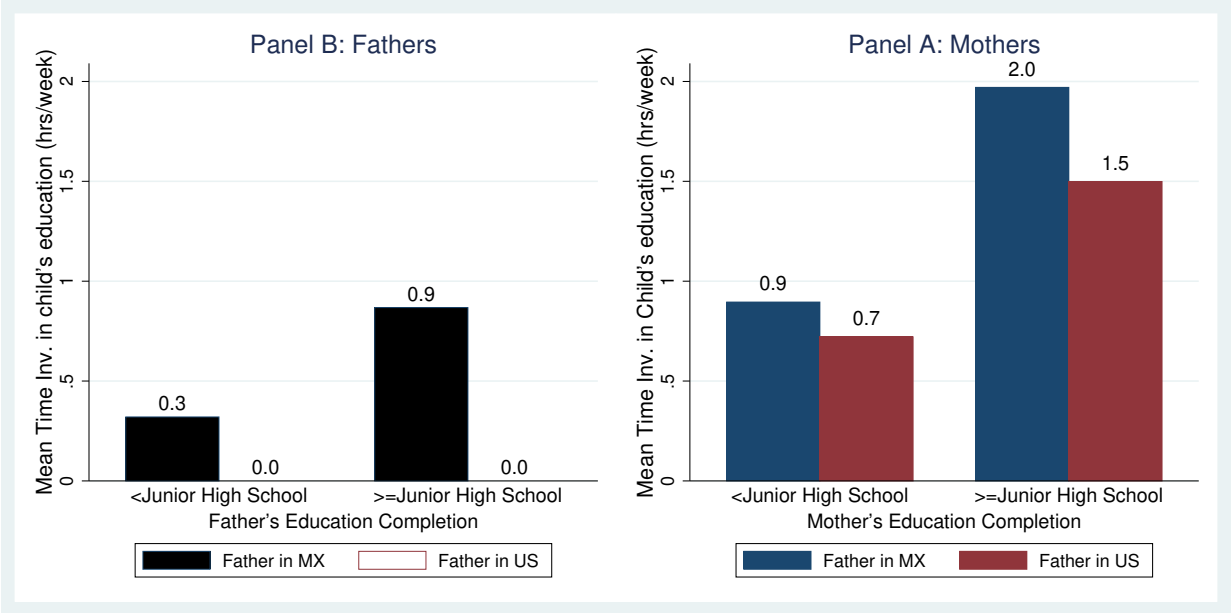
2.2 Relationship between Having a Father in the U.S. and Education Investments

Figure 1 shows the mean fathers' time investment in their children's education by the education and location of the father (panel A) and the mean mothers' time investment in their children's education (Panel B) by the education of the mother and the location of the father. The time investment in education (or time investment) is defined as the average weekly hours per child spent helping their children study or do homework. The location of the fathers can be the U.S. or Mexico, and I consider two levels of education completion: less than junior high school (< 9 years of schooling) and junior high school or more (≥ 9 years of schooling). The sample includes children between 4 and 12 years old with married parents from the three waves of the MXFLS.

The black bars of Panel A show that more educated fathers dedicate more time to their chil-

dren's education (0.3 vs. 0.9 hrs/week) than less educated fathers. Also, Panel A highlights that fathers who live in the U.S. cannot invest time in their children's education. Panel B shows that mothers' time investment in children's education is also increasing with education when fathers are in Mexico (blue bar) and when fathers are in the U.S. (red bar). Surprisingly, this figure shows that children with fathers in the U.S. receive less time investment from their mothers relative to those with fathers in Mexico. This result holds within each educational group. In principle, we would expect that children with fathers in the U.S. would receive more time investments from their mothers to compensate for the time loss of the absent fathers.

Figure 1: Time Investments in Child Education by Fathers' Location and Education of Each Parent



Notes: This figure shows the mean fathers' time investment in their children's education by the education and location of the father (Panel A) and the mean mothers' time investment in their children's education (Panel B) by the mother's education and the location of the father. The time investment in children's education corresponds to the time the corresponding parent spends helping each child study or do homework. The sample is restricted to time investments in children between 4 and 12 years old with married parents using data from the MXFLS-1, MXFLS-2, and MXFLS-3. Mexican students must complete nine years of education to complete junior high school.

To analyze the differences in time investments presented in Figure 1, I estimate the relationship between having a father in the U.S. and their children's educational investments, controlling for observable characteristics. These observables include the mother's education, the child's age, the mother's age, the state where they live in Mexico, and whether they live in a rural or urban locality. Also, I examine if the smaller maternal time investment in children with fathers in the U.S. is related to substitution toward educational expenditure. The econometric specification for this analysis is the following:

$$y_{it}^{j} = c + \beta_1^{j} \cdot FUS_{it} + \beta_2^{j} \cdot ME2_{it} + \gamma^{j} \cdot x_{it} + \varepsilon_{it}^{j}, \tag{1}$$

where, y_{it}^{j} are the outcomes of interest—maternal time investment in education and expenditure on child education—FUS is a dummy equal to 1 if the child's father lives in the U.S. and 0 if he lives in Mexico, $ME2$ is a dummy equal to 1 if the completed level of education of the mother is equal to or greater than junior high school and 0 otherwise, and x_{it} includes the set of control variables described above. The main coefficient of interest is β_1, which captures differences between the educational investment received by children with fathers in the U.S. and those with fathers in Mexico. The coefficient β_2 captures the differences between the educational investment received by children of mothers with junior high school education and those with less educated mothers.

Table 1 shows the estimated coefficients of Equation (1). In line with the evidence presented in Figure 1, the first column of Table 1 shows that children with fathers in the U.S. receive less time investment from their mothers relative to those with fathers in Mexico. On average, children with fathers in the U.S. receive 0.16 fewer hours a week in educational time investment from their mothers relative to those with fathers in Mexico. The results presented in the second column show that children with fathers in Mexico also receive less expenditure for their education than children with fathers in the U.S. These results suggest that the lower time investment of households with fathers in the U.S. is not due to substitution toward educational expenditure and that they have fewer incentives to invest in their children's education.[4]

[4]The results presented in Table 1 are robust to different specifications–see Section 2.4.

Table 1: Relationship between Having a Father in the U.S. and Education Investments

	Dependent Variables	
	(1) Time Investment in Child's Education (Mothers)	(2) Expenditure on Child's Education
Father in U.S.		
Father in U.S.=1	-0.16**	-0.12***
	(0.08)	(0.03)
Mother's Education		
≥Junior High School	0.80***	0.53***
	(0.05)	(0.03)
Constant	-0.01	-3.68***
	(0.61)	(0.30)
Federal entity(states in MX)	Yes	Yes
Rural-urban dummy	Yes	Yes
Observations	12973	12126
R^2	0.084	0.116

Notes: The table reports estimated coefficients from the equation (1) $y^j_{it} = c + \beta^j_1 \cdot FUS_{it} + \beta^j_2 \cdot ME2_{it} + \gamma^j \cdot x_{it} + \varepsilon^j_{it}$, where the dependent variables are in the columns, FUS_{it} is a dummy equal to 1 if the child's father lives in the U.S. and 0 if he lives in Mexico, $ME2_{it}$ is a dummy equal to 1 if the completed level of education of the mother is equal to or greater than junior high school (9 years) and 0 otherwise, and x_{it} includes other control variables. Standard errors are in parentheses, and $^*p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$. Time variables are in hours per week. Education expenditure is in 1,000s of 2015 Mexican pesos (currency). Other controls not presented in the table include quadratic polynomials of child's age and mother's age. The sample includes children between 4 and 12 years old with married parents from the three waves of the MXFLS.

2.3 Relationship between Having a Father in the U.S. and Other Household Decisions

In this subsection, I analyze how the documented educational investment disparities are related to other household decisions. For example, higher work hours could explain the lack of mothers' time investment in migrant households. Similarly, the lack of educational expenditure could be related to low expenditure in other categories of goods and services.

Table 2 shows the relationship between having a father in the U.S. and the mothers' time dedicated to work and leisure activities. The analysis presented in this table is based on estimated coefficients of Equation (1) for a new set of dependent variables.

The first two columns of Table 2 show that households with fathers in the U.S. do not have significant differences in the mothers' time dedicated to working relative to those with fathers in Mexico. Columns 3 and 4 show that mothers of households with fathers in the U.S. dedicate more time to sleeping and watching TV, respectively. The higher maternal time in leisure activities of households with fathers in the U.S., relative to households with fathers in Mexico, suggests that part of the lack of time investment in education goes to leisure. These findings indicate that the low time investment cannot be explained by longer work hours associated with parental absence

but by other mechanisms of the intergenerational migration process.

Table 2: Relationship between Having a Husband in the U.S. and Time Uses

	Dep. Variables: Work Time		Dep. Variables: Leisure Time	
	(1) Market work (Mothers)	(2) Housework (Mothers)	(3) Sleeping (Mothers)	(4) Watching TV (Mothers)
Father in U.S.				
Father in U.S.=1	-0.59	-0.33	0.37***	3.01***
	(0.69)	(0.64)	(0.07)	(0.44)
Mother's Education				
≥Junior High School	3.49***	-0.63**	-0.47***	1.07***
	(0.36)	(0.31)	(0.04)	(0.19)
Constant	-23.10***	-13.79***	4.92***	24.66***
	(3.62)	(4.55)	(0.62)	(7.05)
Federal entity(states in MX)	Yes	Yes	Yes	Yes
Rural-urban dummy	Yes	Yes	Yes	Yes
Observations	13337	13318	13318	13318
R^2	0.042	0.026	0.033	0.085

Notes: The table reports estimated coefficients from the equation (1) $y^j_{it} = c + \beta^j_1 \cdot FUS_{it} + \beta^j_2 \cdot ME2_{it} + \gamma^j \cdot x_{it} + \varepsilon^j_{it}$, where the dependent variables are in the columns, FUS_{it} is a dummy equal to 1 if the child's father lives in the U.S. and 0 he if lives in Mexico, $ME2_{it}$ is a dummy equal to 1 if the completed level of education of the mother is equal to or greater than junior high school (9 years) and 0 otherwise, and x_{it} includes other control variables. Standard errors are in parentheses, and $^*p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$. Time variables are in hours per week. Other controls not presented in the table include quadratic polynomials of child's age and mother's age. The sample includes children between 4 and 12 years old with married parents from the three waves of the MXFLS.

Table 3 shows the relationship between having a father in the U.S. and different categories of household expenditure. The goal of this analysis is to assess if households with fathers in the U.S. spend less on their children's education than those with fathers in Mexico because they also have smaller expenditures on other types of goods and services. The expenditure variables are defined as the logarithms of the average expenditure per household member in Mexico. The first and fourth columns of Table 3 show no difference between the two types of households for expenditure on food and durable goods. Nonetheless, the second and third columns show that households with fathers in the U.S. spend more on non-food items and clothes than households with fathers in Mexico. These results suggest that the low expenditure on children's education of households with fathers in the U.S., relative to households with fathers in Mexico, is not related to smaller expenditure on other goods and services.

Table 3: Relationship between Having a Father in the U.S. and Household Expenditure

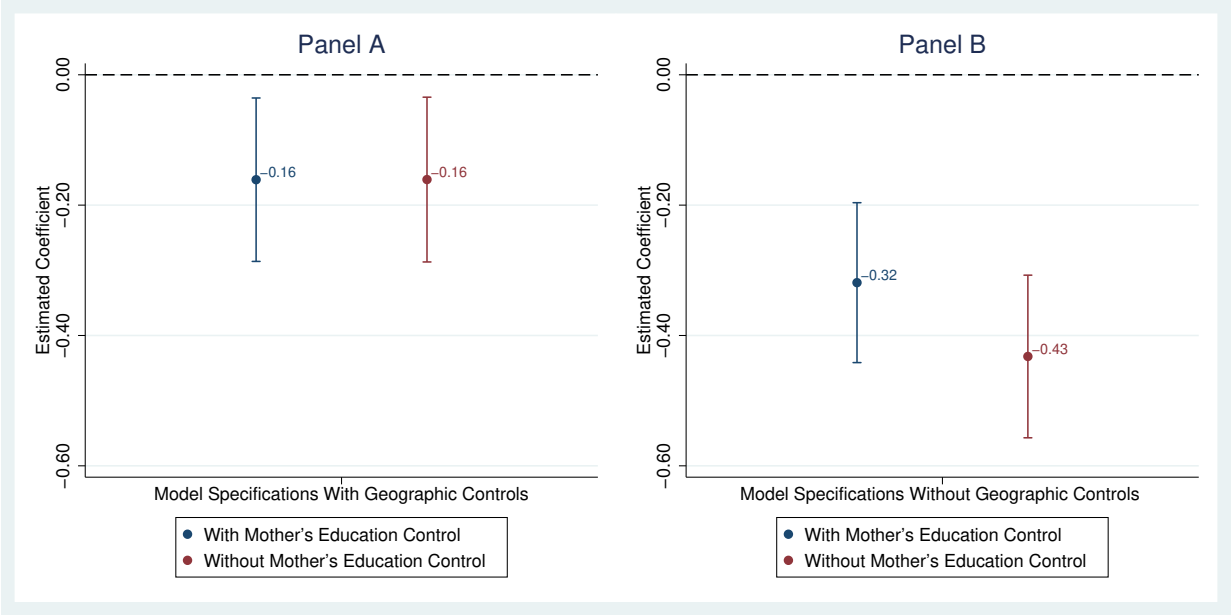
	Dep. Variables: ln(Expenditure categories)			
	(1) Food	(2) Non-food items	(3) Clothes	(4) Durables
Father in U.S.				
Father in U.S.=1	0.03	0.13***	0.27***	-0.01
	(0.03)	(0.04)	(0.06)	(0.11)
Mother's Education				
≥Junior High School	0.45***	0.50***	0.53***	0.53***
	(0.01)	(0.02)	(0.03)	(0.05)
Constant	3.86***	0.88***	-1.36***	-1.64
	(0.41)	(0.24)	(0.47)	(1.61)
Federal entity(states in MX)	Yes	Yes	Yes	Yes
Rural-urban dummy	Yes	Yes	Yes	Yes
Observations	13001	12901	10503	6621
R^2	0.238	0.230	0.102	0.073

Notes: The table reports estimated coefficients from the equation (1) $y^j_{it} = c + \beta^j_1 \cdot FUS_{it} + \beta^j_2 \cdot ME2_{it} + \gamma^j \cdot x_{it} + \varepsilon^j_{it}$, where the dependent variables are in the columns, FUS_{it} is a dummy equal to 1 if the child's father lives in the U.S. and 0 if he lives in Mexico, $ME2_{it}$ is a dummy equal to 1 if the completed level of education of the mother is equal to or greater than junior high school (9 years) and 0 otherwise, and x_{it} includes other control variables. Standard errors are in parentheses, and $^*p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$. Time variables are in hours per week. Expenditures are in 1,000s of 2015 Mexican pesos (currency). Other controls not presented in the table include quadratic polynomials of child's age and mother's age. The sample includes children between 4 and 12 years old with married parents from the three waves of the MXFLS.

2.4 The Role of Selection

In this subsection, I analyze the role of selection to explain the documented education investment disparities between households with the fathers in U.S. and households with fathers in Mexico. Recall that Figure 1 shows that more educated parents invest more in the education of their children. In that sense, I assess if mothers with husbands in the U.S. invest less in their children's education than those with husbands in Mexico because the former are less educated and would have invested less even if their husbands lived in Mexico. Specifically, I analyze if the results presented in Table 1 are robust to controlling for the mothers' education, using the mothers' education as a proxy for the human capital of both parents.

Figure 2: Difference in Educational Time Investment for Children with Fathers in the U.S. and Mexico by Model Specifications



Notes: The figure shows the estimated coefficients, $\hat{\beta_1}$, of the difference in time investments in children's education between mothers with husband in the U.S. and those with husband in Mexico, from different specifications of (1) $y_{it} = c + \beta_1 \cdot FUS_{it} + \beta_2 \cdot ME2_{it} + \gamma \cdot x_{it} + \varepsilon_{it}$, where the dependent variables are in the columns, FUS_{it} is a dummy equal to 1 if the child's father lives in the U.S. and 0 if he lives in Mexico, $ME2_{it}$ is a dummy equal to 1 if the completed level of education of the mother is equal to or greater than junior high school (9 years) and 0 otherwise, and x_{it} includes geographic controls (federal entity and a rural-urban dummy) and quadratic polynomials of child's age and mother's age. The sample includes children between 4 and 12 years old with married parents from the 3 waves of the MXFLS. The circles present the point estimates of $\hat{\beta_1}$, and the bands the 90% confidence interval.

Figure 2 show the estimated coefficients $\hat{\beta}_1$ of the difference between the educational time investment received by children with fathers in the U.S. and those with fathers in Mexico from different specifications of Equation (1). Panel A shows estimates of β_1 from the full specification presented in Table 1 (in blue) and from the full model without controlling for the mother's education (in red). The estimates of β_1 from both specifications are equal to –0.16. This result suggests that the negative magnitude of the coefficient of interest is not explained by differences in the level of education of the mothers.

Panel B shows estimates of β_1 from less controlled specifications where I do not control for the geographic variables: federal entity (Mexican states) and a rural-urban dummy. As in Panel A, the blue dot shows the estimate of β_1 when controlling for the mother's education, and the red dot shows when I do not control for the mother's education. First, notice that the coefficients of both specifications are negative, in line with the previous results. Second, notice that these coefficients are not statistically different. Lastly, the coefficient from the specification without geographic controls is smaller than that from the specification with geographic controls. The last result suggests that the locations of the households are not enough to fully explain why mothers with husbands

in the U.S. invest less time in their children's education than mothers with husbands in Mexico. The geographic variables may capture differences in the labor markets not explained by mothers' education level and can also be related to migration costs. In that sense, the migration model presented in Section 3 considers the distribution of earnings from the data and allows for different migration costs.

Other potential sources of selection into migration are related to differences in unobservables between households with fathers in the U.S. and households with fathers in Mexico, which may explain their educational investment disparities. For example, if migrant households care less about their children's education or if they have a lower discount factor, they would have invested less than non-migrant households even if they stayed in Mexico. The quantitative migration model presented in Section 3 does not consider selection into migration based on heterogeneous preferences toward children's education. However, I provide empirical evidence below suggesting that mothers with husbands in the U.S. invest less in their children's education than those with husbands in Mexico even when I deal with the possible endogeneity of migration.

To deal with the possible endogeneity of migration, I use a standard instrumental variables (IV) approach in the Mexican-U.S. migration literature (Alcaraz et al., 2012; Demirgüç-Kunt et al., 2011; Woodruff and Zenteno, 2007). Following Alcaraz et al. (2012), I use the placement of rail lines before the first wave of Mexican-U.S. migration during the 1920s (along with the distance to the border) as an instrument for the migration status of household fathers. The results of the IV estimations are consistent with the maternal time investment disparities previously discussed and are presented in Table 9 of Appendix A.2.

2.5 Returns to Education of Children of Migrants and Their Probability of Migration

In this section, I show that children with fathers in the U.S. have smaller returns to Mexican education than children with fathers in Mexico. Three critical mechanisms should be considered. First, children of migrants are more likely to migrate than children of non-migrants. As a result, children of migrants give a high weight to the possibility of working in the U.S. Second, earnings in the U.S. are considerably higher than Mexican earnings. Third, an additional year of Mexican schooling has low returns for people who work in the U.S. relative to the returns for people who work in Mexico. The low returns to Mexican education in the U.S. labor market have been related to language barriers, the relatively low quality of Mexican education, and the low transferability

of skills to the U.S. labor market (Bratsberg and Ragan, 2002).

Table 4 presents the share of people that moved to the U.S. between 2002 and 2005, conditional on having parents or no relatives in the U.S., using data from the first and second waves of the MXFLS. The first column shows that 13.1% of Mexicans with parents in the U.S. moved to the U.S. In contrast, the second column shows that only 2.3% of Mexicans without relatives in the U.S. moved to the U.S. In other words, people with parents in the U.S. are around six times more likely to migrate than those without relatives in the U.S.

Table 4: Share of Mexicans that Moved to the U.S. between 2002 to 2005, Depending on Having Parents or No Relatives in the U.S. (ages 15 to 45 in 2002)

	Parents in U.S.	No relatives in U.S.
Moved to U.S.?	%	%
No	86.88	97.70
Yes	13.12	2.30
Total	100.00	100.00

Notes: Moved to U.S.=Yes if individuals resided in Mexico in 2002 and resided in the U.S. in 2005. Moved to U.S.=No if individuals resided in Mexico in 2002 and 2005. Moved to U.S.=No include individuals that moved to the U.S. between 2002 and 2005 and resided in Mexico in 2005.

Using data from the U.S. and Mexico censuses from IPUMS international (IPUMS, 2020), I estimate the returns of an additional year of Mexican education in each country's labor market. I follow Bratsberg and Ragan (2002) closely, but I am interested in the level of earnings, whereas they focus on log earnings. People care about earnings levels when they make migration and educational investment decisions.

For this analysis, I restrict the samples to males between 25 and 65 years old who worked positive hours in 2015. In addition, the sample from the U.S. census is restricted to people born in Mexico who moved to the U.S. after turning 25. The last restriction ensures that the Mexicans working in the U.S. acquired their education (or most of it) in Mexico. The results of this analysis are presented in Appendix A.3. I summarize the main results below.

I find that an additional year of Mexican education increases the earnings of Mexicans in the U.S. by only 28% of the level increase they would receive if they worked in Mexico. For example, an additional year of Mexican education for a Mexican who does not speak English would not increase their U.S. earnings as a construction worker.[5] However, the earnings of Mexicans working in the U.S. are, on average, four times larger than the earnings in Mexico. That means that even if

[5]These results are in line with Bratsberg and Ragan (2002), who find that the returns of a Mexican education in the U.S. labor market are low compared to the returns of a U.S. education received by young migrants.

the returns of a Mexican education in the U.S. labor market are low, Mexicans have incentives to work in the U.S., and they have fewer incentives to invest in their education or the education of their children if they think they can work in the U.S.

3 Model

This section describes a household migration model with intergenerational linkages through children's education investment. The model has three main components. First, the economy is modeled using a partial equilibrium overlapping generations (OLG) model with endogenous migration from Mexico to the U.S. and heterogeneous households in terms of migration costs and human capital. Second, the choices of each parent affect the outcomes of the children. Parents' time investment in their children's education affects their human capital. Migrant parents cannot invest time in the education of their children left behind in Mexico. Third, the return of a Mexican education in the U.S. labor market is smaller than that of a Mexican education in the Mexican labor market. At the same time, U.S. earnings tend to be higher than Mexican earnings. In addition, consumption is more expensive in the U.S. consumption than in Mexico.[6]

3.1 Timing, Household State Variables, and Decisions

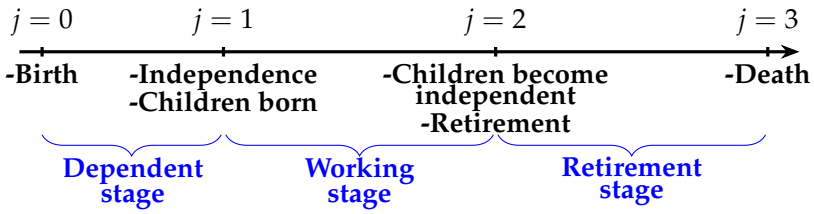
The model assumes an OLG framework with three stages: dependent (or childhood), working, and retirement. Each household has two married adults—a husband and a wife—and two children during a particular stage of the household life cycle. Figure 3 shows the life cycle of a household. Let j denote the periods of the life cycle of the households. From $j = 0$ to $j = 1$, children live with their parents, receive educational investments from them, and do not make any decisions.

Children become independent adults at the beginning of period $j = 1$. At $j = 1$, the newly independent adults also become parents. Their human capital ε (from the educational investments of their parents during their childhood) and their migration cost k are the state variables of their households. Households make several decisions during the working stage that begins at independence. First, households make a migration decision consisting of deciding whether or not to send the father to work in the U.S.; mothers and children stay in Mexico. Households also decide how much time each parent invests in their children's education. Fathers working in the U.S. cannot

[6]The consumption price difference between these two countries does not offset the higher earnings in the U.S. relative to Mexico.

dedicate time to their children's education. In addition, households decide their consumption expenditure, labor supply, and savings for retirement. Parents retire at the beginning of $j = 2$, and their children become independent adults. When their children become independent adults, they must solve the same problem solved by their parents. During the retirement stage, the parents consume their retirement savings until death at period $j = 3$.

Figure 3: Model Timeline: OLG with Three Stages



Notes: This figure shows the timeline of the life cycle of a household.

3.2 Working-Stage Decisions

Households start the working stage with parents' human capital ε and migration cost k; then, they make several decisions. Households choose the location of the father (U.S. or Mexico), labor supply of the mother h_2, time investments in the education of the children s_1 and s_2, weighted average consumption per household member $\bar{c}$, and savings for retirement a'. Households start their working period in Mexico, and their first decision is whether to send the father to work in the U.S. or have him stay in Mexico. Then, they make decisions on consumption, work, and educational investment in their children.

The value function for the migration decision of the father is given by

$$\hat{v}_1(\varepsilon, \kappa) = max \left\{ \underbrace{v_1^{MX}(\varepsilon, \kappa)}_{Mexico}, \underbrace{v_1^{US}(\varepsilon, \kappa)}_{U.S.} \right\}, \tag{2}$$

where $v_1^{MX}(\varepsilon, \kappa)$ is the value to the household of the father staying in Mexico (migrant household) and $v_1^{US}(\varepsilon, \kappa)$ is the value to the household of the father moving to the U.S (non-migrant household). The main distinctions between the two options are threefold: the earnings profiles in Mexico and the U.S. are different in terms of the level and returns to Mexican education, fathers working in the U.S. cannot dedicate time to the education of their left-behind children, and migration is costly. Below I provide specific details about each option.

3.2.1 Non-Migrant Households' Decisions

The value function of non-migrant households that keep the father in Mexico is given by

$$
\begin{aligned}
v_1^{MX}(\varepsilon,\kappa) = \quad & \max_{\{\bar{c},h_2,s_2,a'\}} \left\{ u(\bar{c},h_1,s_1,h_2,s_2) + \beta \cdot v_2^{MX}(a',\varepsilon'_{ch},\kappa) \right\}, \\
& v_2^{MX}(a',\varepsilon'_{ch},\kappa) \equiv v_2^{R,MX}(a') + \beta_{ch} \cdot \hat{v}_1(\varepsilon'_{ch},\kappa) \\
& c + a' \leq w_{mx}(\varepsilon) \cdot h_1 + \theta_f w_{mx}(\varepsilon) \cdot h_2 \\
& \varepsilon'_{ch} = \left[\alpha_1 \varepsilon^{\rho} + (1-\alpha_1) I^{\rho}\right]^{1/\rho}, \; I = \bar{A}\left[s_1^{\gamma} \cdot \mathbf{1}_{\{m=MX\}} + s_2^{\gamma}\right]^{1/\gamma}.
\end{aligned}
\tag{3}
$$

These households receive a flow utility, $u(.)$, from the weighted average consumption per household member $\bar{c}$, hours worked by fathers and mothers h_1 and h_2, respectively, and time investment in children's education by each parent s_1 and s_2. Households spend their labor earnings on household consumption expenditure c and savings for retirement a'.[7] Households are not allowed to borrow during the working stage because they do not work during the retirement stage. Also, $\theta_f < 1$ captures the female-to-male wage ratio observed in the Mexican data.

The continuation value of these households $v_2^{MX}(a',\varepsilon'_{ch},\kappa)$ has two parts. The first part is the value of the retirement of parents $v_2^{R,MX}(a')$. The second is the value function of their children $\hat{v}_1(\varepsilon'_{ch},\kappa)$, who must solve the same problem solved by their parents. In that sense, parents are altruistic toward their children and affect the continuation value of their children through time investment in their human capital ε'_{ch}.

I assume that the human capital of the children depends on the human capital of their parents and time investments received from their fathers and mothers. I model human capital using a nested constant elasticity of substitution (CES) function. The outer CES combines the human capital of the parents ε and an index of time investments by each parent I. The inner CES combines the time investments by fathers s_1 and mothers s_2 into the time investments index I. Human capital is increasing in earnings, but the earnings returns to Mexican human capital in the U.S. and Mexican labor markets are different and represented by the earning functions $w_{us}(\varepsilon)$ and $w_{mx}(\varepsilon)$, respectively. These different earning functions capture the documented smaller return of a Mexican education in the U.S. labor market relative to Mexico and that the average earnings of Mexicans working in the U.S. are higher than the average Mexican earnings. I assume that the children's migration cost is the same as that of their fathers. This simplifying assumption captures

[7] The consumption expenditure of a household is defined as the expenditure on each member, the two adults and the two children: $c \equiv c_1 + c_2 + 2c_{ch}$.

the intergenerational persistence of migration.[8]

3.2.2 Migrant Households' Decisions

The value function of households that send their fathers to work in the U.S. is given by

$$
\begin{aligned}
v_1^{US}(\varepsilon,\kappa) = \quad & \max_{\{\bar{c},h_2,s_2,a'\}} \left\{ u(\bar{c},h_1,s_1,h_2,s_2) + \beta \cdot v_2^{US}(a',\varepsilon'_{ch},\kappa) \right\}, \\
& v_2^{US}(a',\varepsilon'_{ch},\kappa) \equiv v_2^{R,US}(a') + \beta_{ch} \cdot \hat{v}_1(\varepsilon'_{ch},\kappa) \\
& c + a' \leq w_{us}(\varepsilon) \cdot h_1 + \theta_f w_{mx}(\varepsilon) \cdot h_2 - k \\
& \varepsilon'_{ch} = \left[\alpha_1 \varepsilon^{\rho} + (1-\alpha_1) I^{\rho}\right]^{1/\rho}, \; I = \bar{A}\left[s_1^{\gamma} \cdot \mathbf{1}_{\{m=MX\}} + s_2^{\gamma}\right]^{1/\gamma}.
\end{aligned}
\tag{4}
$$

This problem is identical to the one solved by non-migrants in terms of preferences; the distinctions are in the budget constraint and the human capital production function. First, notice that migrant fathers receive earnings based on the U.S. wage profile for Mexican workers $w_{us}(\varepsilon) \cdot h_1$. Second, migrant households have to pay a migration cost k. Third, migrant fathers cannot invest time in the human capital formation of their children. Fourth, consumption goods are more expensive in the U.S. than in Mexico, and the expenditure is adjusted by a parameter p; the expenditure on consumption of these households is $c \equiv c_1 p + c_2 + 2c_{ch}$.

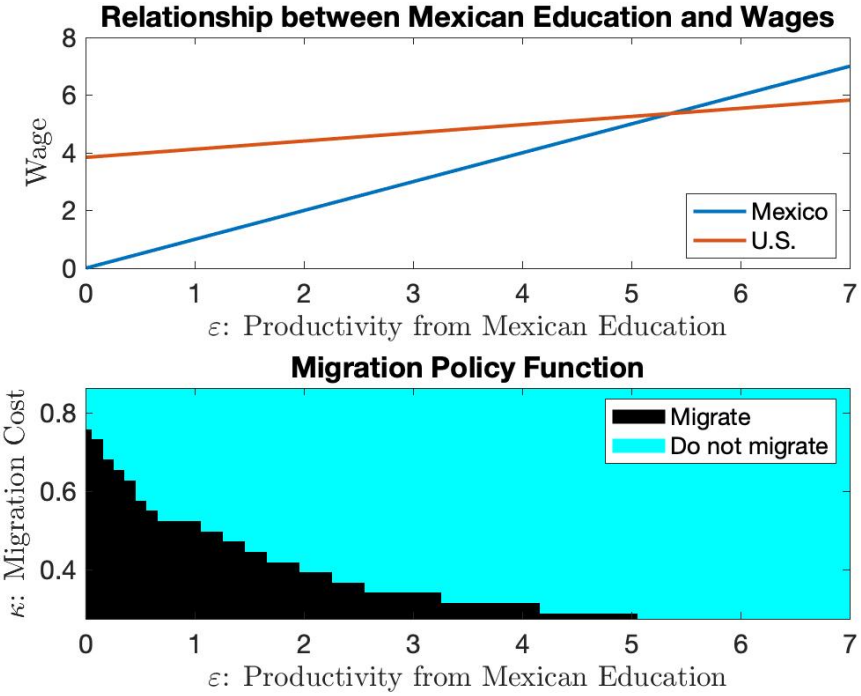
3.3 Mechanisms

In this subsection, I use the role of the different wage profiles of the U.S. and Mexico with respect to a Mexican education to explain the migration decisions. The top panel of Figure 4 shows the relationship between wages and productivity from a Mexican education for Mexicans who work in Mexico (blue) and the U.S. (red). This figure shows that U.S wages are higher than Mexican wages for less educated Mexicans. This difference shrinks with the level of education, as shown by the slope of the red line (U.S.), which is smaller than that of the blue line (Mexico). In other words, the relatively low returns of a Mexican education in the U.S. labor market makes the migration option less attractive to more educated Mexicans. The bottom panel shows the optimal migration choice for different combinations of parents' productivity and migration costs. This figure shows that households with low productivity choose to migrate even if their migration costs are high. In contrast, as the productivity of households increases, households require a lower migration cost to find the migration option attractive.

[8] This assumption can be relaxed to better match the intergenerational persistence of migration observed in the data.

Importantly, when households make their migration and educational investment decisions, they know that once their children become independent, they will also have to make their own migration decision. As a result, parents of children with low migration costs have fewer incentives to invest time in their education because their children can do very well in the U.S., even with low levels of education. On the other hand, mothers of migrant households have incentives to substitute the lost time from absent fathers and dedicate more time to their children's education. Also, households with fathers in the U.S. have considerably higher earnings, enabling the mothers to work less and dedicate more time to their children's education. Evaluating the importance of these three forces is one of the goals of the quantitative model.

Figure 4: Migration Decision and Its Relationship with the U.S. and Mexican Wage Profiles with Respect to Mexican Education



Notes: The top panel is based on the results presented in Section 2.5. The bottom panel is based on a version of the actual calibrated model with a finer migration cost grid. The mean productivity is equal to 1.

4 Calibration

In this section, I describe how I calibrate the model. The main parameters of interest are calibrated "internally" along with the solution of the model to match relevant moments from the data and summarized in Table 6. The rest of the parameters are calibrated "externally" to match the

data or borrowed from the literature and summarized in Table 5. The primary data source is the MXFLS described in Section 2.1. I start presenting the preferences and explaining the choice of its externally calibrated parameters. Then, I explain the choice of the rest of the externally calibrated parameters. Next, I describe the calibration strategy of internally calibrated parameters and discuss the data targets.

Table 5: Externally Calibrated Parameters

Parameters	Interpretation	Value	Source
Preferences			
σ	Inverse of elast. of intertemporal subst.	2	(Chyn and Daruich, 2022)
ψ	Inverse of Frisch elasticity	3	(Chyn and Daruich, 2022)
ζ	Child's fraction of adult consumption	0.5	Own assumption
p	Price of goods in the U.S. relative to MX	1.5	Penn World Table
β	Discount factor	0.9	Own assumption
Other			
θ_1^{us}	Relative return of MX education in U.S.	28%	Based on data from IPUMS
σ_ε	Std. dev. parental human capital	0.52	Based on data from MXFLS
h_1	Average work time of fathers in MX	19.18%	Based on data from MXFLS
s_1	Average time inv. of fathers in Mexico	0.7%	Based on data from MXFLS
θ_f	Gender wage gap	0.6	Based on data from MXFLS

Notes: Parameters calibrated exogenously based on own calculations and taken from other studies.

4.1 Preferences

During the working stage, the period utility function of consumption, labor, and educational investment is specified as

$$u(\bar{c}, h_1 + s_1, h_2 + s_2) = \frac{(\bar{c})^{1-\sigma}}{1-\sigma} - \mu \left[\frac{(h_1 + \iota \cdot s_1)^{1+\psi}}{1+\psi} + \frac{(h_2 + \iota \cdot s_2)^{1+\psi}}{1+\psi} \right], \tag{5}$$

where $\bar{c}$ is the weighted average real consumption of the household. I assume that both adults have the same level of consumption and that each child consumes a fraction $\zeta = 0.5$ of the consumption of an adult. Therefore, $c \equiv c_1 + c_2 + 2c_{ch} = 3 \cdot \bar{c}$ and $c \equiv c_1 p + c_2 + 2c_{ch} = (p+2) \cdot \bar{c}$ are the consumption expenditures of non-migrant and migrant households, respectively. The weighted average consumption of the former can be expressed as $\bar{c} = c/3$ and of the latter as $\bar{c} = c/(p+2)$. I set the price of consumption goods in the U.S. relative to Mexico to $p = 1.5$, based on data from the Penn World Table from 2002 to 2009 (Feenstra et al., 2015). Following a standard convention assumption in the literature, I set the inverse of the elasticity of substitution and the inverse of the Frisch elasticity to $\sigma = 2$ and $\psi = 3$, respectively. Based on data from the MXFLS, I

set the average work time of fathers in Mexico to $h_1 = 19.18\%$. Similarly, I set the average fathers' time investment per child's education in Mexico to $s_1 = 0.7\%$. Lastly, I calibrate μ and ι internally to match the average maternal time investment per child's education and the average work time of mothers with husbands in Mexico, respectively. The parameter μ captures disutility of work and time investments in children's education. The parameter ι captures a differential utility cost between working time and time devoted to children's education.

4.2 Initial Distribution of Parents Human Capital

For the calibration, the initial state of the parental generation is exogenous and informed by the MXFLS data. That is, I do not solve for the stationary equilibrium of the model. Instead, I simulate moments from the optimal decisions in the model, given the cross-sectional distribution of parental human capital in the data. Then, I try to match the equivalent moments observed in the data, which result from the optimal decisions of households. In that sense, I first estimate the cross-sectional distribution of parental human capital and then discretize it following Rouwenhorst (1995).

To estimate the cross-sectional distribution of the parental human capital, I residualize their log earnings on gender, a quadratic polynomial of their age, and an urban-rural dummy. Then, I discretize the cross-sectional distribution of the earnings residual into a 50 point grid using the Rowenhorst method with the estimated standard deviation of the residual log earnings of the parents $\sigma_\varepsilon = 0.52$ from the MXFLS. I also normalize the average human capital of the parental generation to unity, dividing the initial discretized distribution by the initial average.

4.3 Other Externally Calibrated Parameters

I use wages in Mexico as the measure of human capital from Mexican education; $w_{mx}(\varepsilon) \equiv \varepsilon$. In that sense, the human capital production function is disciplined so that their inputs are consistent with earnings data. For the relationship between Mexican education and U.S. earnings, I consider $w_{us}(\varepsilon) \equiv \theta_0^{us} + \theta_1^{us} \cdot \varepsilon$. The parameter $\theta_1^{us} = 28\%$ captures the lower return to Mexican education in the U.S. labor market relative to the Mexican labor market documented in Section A.3. The parameter θ_0^{us} is calibrated internally to match the difference earnings levels between the U.S. and Mexico. $\theta_f = 0.6$ captures the gender wage gap observed in the MXFLS data. Since the intergenerational dynamics of the models happen via educational investment, I normalize β_{ch} to

unity, and let ι govern the altruism toward children.

4.4 Internally Calibrated Parameters

Although all parameters are calibrated along with the model solution, I describe each parameter and discuss its most related moment.

Table 6: Calibration Parameters

Parameters	Interpretation	Value
Human capital: $\varepsilon'_{ch} = [\alpha_1 \varepsilon^\rho + (1-\alpha_1) I^\rho]^{1/\rho}$, $I = \bar{A}\left[s_1^\gamma \cdot \mathbf{1}_{\{m=MX\}} + s_2^\gamma\right]^{1/\gamma}$		
α_1	Parents' human capital share	0.28
ρ	Time investments and parents' human capital substitutability	0.37
γ	Fathers and mothers' time substitutability	0.50
$\bar{A}$	Time investments scale	33.78
θ_0^{us}	Earnings shift if work in U.S.	0.28
Migration		
$k_2 \in k \equiv \{k_1, k_2, k_3\}$	Second migration cost. $k_1 \equiv 0 < k_2 < k_3 \equiv \infty$	0.44
$p(k = k_2)$	Probability of $k = k_2$	8.0%
$p(k = k_3)$	Probability of $k = k_3 \equiv \infty$	88.0%
Preferences		
ι	Disutility of education time	22.4
μ	Disutility of work	1,555.6

Notes: Parameters calibrated endogenously by targeting selected data moments.

The top panel of Table 6 show the parameters that are related to the human capital production function. In the outer CES of the human capital production function, α_1 is the weight parameter between the human capital of the parents and the index of time investment. I calibrate α_1 to match the inter-generational persistence in earnings, β_f^w, from the following auxiliary model

$$lw^{ch} = \beta_0 + \beta_f^w lw^{pa} + \epsilon, \tag{6}$$

where lw^{ch} is the log earnings of children's generation when they become adult and lw^{pa} is their parents' log earnings at a comparable age. The implementation of such a comparison is not straightforward because of limitations in the data that I explain and address in Appendix B. Table 10 in Appendix B shows a robust inter-generational persistence in earnings coefficient $\beta_f^w = 0.24$.

I calibrate the substitution parameter between parents' human capital and educational investments to match the partial correlation between earnings and mothers' time investments of non-migrant households. The target of interest is set to $\beta_{s_2}^w = 0.12$ and results from regressing log earnings on the log of maternal time investment received in childhood and on a quadratic polyno-

mial of the age. The substitution parameter, between parents' time in the inner CES of the human capital production function is calibrated to match the mean mothers' time in child education if the father is in the U.S. Recall that the paternal time investment is fixed in the model and only changes to zero when a father migrate. Therefore, the difference in time investments between mothers with husbands in the U.S. and in Mexico can be informative about γ. I use the scale parameter, $\bar{A}$, to make sure that the mean earnings of the children's generation is not too far from that of the parents' generation.

The second panel of Table 6 shows the parameters related to the distribution of the migration costs. I consider a discrete distribution with 3 points such that $k_1 \equiv 0 < k_2 < k_3 \equiv \infty$ and $p(k = k_1) < p(k = k_2) < p(k = k_3)$. Under these two restrictions the distribution is characterized by 3 parameters: k_2, $p(k = k_2)$, and $p(k = k_3)$. The latter restriction captures the fact that most Mexicans do not migrate to the U.S. and reduces the number of combinations of these parameters to be evaluated in the calibration. The targets most closely related to the distribution of migration costs are the probability of migration, the probability of migration of children of migrants, and the relative probability of migration between the top and bottom quintiles. I approximate the probability of lifetime migration to the U.S. as the percentage of Mexican-born migrants living in the U.S. to 10% from Genoni et al. (2017). I construct the probability of lifetime migration to the U.S. conditional on having a parent in the U.S. using the results presented in Table 4. In that sense, I take the three-years migration rate of individuals with parents in the U.S. and those with no relatives in the U.S. from Table 4. Then, using the corresponding weight of each group, I find the migration rates that are consistent with the 10% migration rate of the entire population during their lifetimes. The implied probability of successful lifetime migration to the U.S. conditional on having a parent in the U.S. is 50.7%. I take the relative probability of migration between the top and bottom quintiles from Kaestner and Malamud (2014), which also uses data from the MXFLS.

4.5 Model Fit

This section analyzes how well the model matches the data. Table 7 presents the targeted data moments and the moments from the calibrated model. The first two rows of Table 7 show that the model can account for the puzzling fact that children with fathers in the U.S. receive less time devoted to education investments from their mothers than those with fathers in Mexico.

Table 7: Targeted Moments

Moments	Data	Model
Human Capital and Earnings		
$\overline{s_2}^{MX}$: Mean mothers' time in child education if father in MX (%)	0.83%	0.86%
$\overline{s_2}^{US}$: Mean mothers' time in child education if father in U.S.	0.50%	0.56%
β_f^w: Father's earnings persistence in MX	0.24	0.25
$\beta_{s_2}^w$: Relationship between earnings and mothers' time in MX	0.12	0.12
Mean(child earnings in MX)/mean(fathers earnings in MX)	1.05	1.01
Mean(earnings of Mexicans in US)/mean(earnings in MX)	4.07	4.08
$\overline{h_2}^{MX}$: Mothers work time in MX	5.87%	17.32%
Migration		
Migration probability	10.0%	10.4%
Migration probability of migrants' children	50.7%	100.0%
Relative prob of migration top vs bottom quintiles	-42.0%	-66.7%

Notes: This table reports the observed and simulated moments. See text for definitions and data sources.

The model also performs well in terms of matching most of the targets. However, there are two targets for which the model performs very poorly. First, the probability of migration of children of migrants is 100% in the model, higher than the 50.7% observed in the data. This result is directly related to the simplifying assumption that the migration cost of a household is unchanged across generations. A possible way to improve the model's performance in terms of this target is to decrease the persistence of the migration cost and allow for some uncertainty. Although the model overestimates the probability of migration of children of migrants, it endogenously generates a higher probability of migration of that group relative to that of children of non-migrants, which is an important feature. Second, the model implies a higher labor supply of mothers with husbands in the U.S. than observed in the data.[9] To avoid extremely low consumption levels, mothers with low human capital optimally choose to work long hours because I assume that the labor supply of males is fixed to the average observed in the data.[10] Missing these targets is not consequential for the main results of the model.

5 Results: Intergenerational Migration and Education Investments

This section assesses the role of intergenerational migration in explaining the educational time investment decisions of migrants. For this purpose, I compare the results of the benchmark cal-

[9] This moment is challenging for the model to imply while also performing well in the other moments. For this reason, I assigned a low weight to this moment relative to the weights used for the rest of the moments.

[10] The incorporation of endogenous labor supply of fathers can improve the model's performance to predict mothers' labor supply in Mexico.

ibrated economy to four counterfactual economies. In doing so, I quantify the importance of different mechanisms that motivate household members to migrate. In this analysis, I quantify the relative importance of the possibility of migration of children and parents. Table 8 compares the results from the benchmark calibration of the economy to results from the four counterfactual economies. The first panel shows the assumptions of the different economies, shown in the columns. The second panel presents the results of interest for each economy.

In the first counterfactual, children of migrants are not allowed to migrate, and I keep the fathers' migration decision of the benchmark economy. This counterfactual can be thought of as a case in which, after moving to the U.S., households learn that their children will not be allowed to migrate and must work in Mexico when they become adults. Under this counterfactual, mothers with husbands in the U.S. invest 3.35 hours a week on average in the education of each child. This time investment is more than three times larger than the investment under the benchmark economy. Also, the time investment of these mothers is more than two times larger than that of mothers with husbands in Mexico. This increase in mothers' time investment is explained by the fact that their children will have to work in Mexico, where the returns to Mexican education are higher than in the U.S. As a result, in this case, mothers have more incentive to increase their time investments to compensate for the unavailable inputs from the absent father.

The second counterfactual is similar to the first one: children are not allowed to migrate, but now fathers have that information before making their migration decision. The increase in maternal time investment is similar to the one presented for the first counterfactual. However, the last row shows that under this counterfactual, the average productivity of migrants decreases. Because fathers know that their children are not allowed to migrate, they have fewer incentives to migrate because they want to help their children improve their human capital, which has relatively high returns in the Mexican labor market. As a result, the most educated fathers who decide to migrate in the benchmark economy choose to stay in Mexico and dedicate time to their children's education.

Table 8: Role of Intergenerational Migration

Panel 1. Assumptions	**Benchmark**	**Counterfactuals**			
		1	2	3	4
Fathers can migrate	✓	✓	✓	$\mathcal{X}$	$\mathcal{X}$
Children can migrate	✓	$\mathcal{X}$	$\mathcal{X}$	✓	$\mathcal{X}$
Use fathers' migration decision from benchmark	✓	✓	$\mathcal{X}$	$\mathcal{X}$	$\mathcal{X}$
Sample where fathers choose to migrate in benchmark	✓	✓	$\mathcal{X}$	✓	✓
Panel 2. Results					
Mean mothers' time in child education non-migrants (hrs/week)	1.44				
Mean mothers' time in child education if father in U.S. (hrs/week)	0.94	3.35	3.15	0.14	1.39
Mean MX productivity of migrants' children	0.30	0.70	0.61	0.49	0.95
Wage of migrants' average children if work in U.S.	3.93	4.04	4.01	3.98	4.11
Mean productivity of Migrant fathers	0.83	0.83	0.57	0.83	0.83

Notes: This table presents results from the calibrated benchmark economy and four counterfactual economies.

In the third counterfactual, children, but not fathers, are allowed to migrate, and I restrict the sample to households in which fathers migrated in the benchmark economy. Under this scenario, the time investment of the mothers falls to 0.14 hours per week, compared to 0.94 in the benchmark economy. Three main mechanisms explain this educational investment reduction. First, children can have high earnings in the U.S. even with a low level of education. These are children of people who choose to migrate in the benchmark economy, so many of these children have low migration costs. Second, since fathers work in Mexico, mothers have to work more than in the benchmark and have less time for their children's education. Third, children benefit from education time investment from their fathers and now require less time investment from their mothers.

Finally, in the fourth counterfactual, I shut down migration for all generations and focus on the sample of households in which fathers migrated in the benchmark economy. The goal of this counterfactual is to assess how much of the differences in time investment between mothers with and without a husband in the U.S. in the benchmark economy is explained by differences in the parents' education. The last column of Table 8 shows that under this counterfactual, mothers would invest 1.39 hours per week in each child's education, which is similar to the 1.44 hours per week invested by non-migrant mothers in the benchmark economy. That is, the selection based on the fathers' education in the migration decision does not explain the documented disparities in maternal education time investment between mothers with and without husbands in the U.S.

I also investigate the hypothesis that a strong complementarity between mothers' and fathers' time investment for the human capital formation of the children explains why mothers with husbands in the U.S. invest less time in their children's education relative to those with husbands in

Mexico. For that purpose, I calibrate the model by restricting the substitution parameter to negative values (complements). None of the combinations of parameters under this restriction can explain the differences in time investment observed in the data. In fact, with strong complementarity and the estimated wage profiles for the U.S. and Mexico, migrant households would choose a very small level of investment in their children's education. Hence, from the lens of my model, a strong complementarity between mothers' and fathers' time investment for the human capital formation of the children cannot explain the main puzzling fact.

In summary, the results from the quantitative analysis of the model show that the possibility of migration of children to the U.S.—where the returns of Mexican education are low, and they can perceive relatively high earnings regardless of education—explains most of the documented educational investment disparities. The hypotheses about selection in the migration decision based on the parents' human capital only explain a minimal part of the time disparities. Finally, a strong complementarity between mothers' and fathers' time investment for the human capital formation of the children cannot predict the investment disparities observed in the data. These results help us better understand the intergenerational mobility of migrants, who do not necessarily need to improve their children's education to improve their future earnings.

6 Conclusions

This paper studies the relationship between parental migration and the human capital formation of left-behind children empirically and through the lens of a quantitative model. I documented that mothers with husbands in the U.S. invest less time and resources in the education of their children than those with husbands in Mexico. To explain this result, I developed a heterogeneous household model with endogenous migration and intergenerational linkages through investments in children's education. I calibrated the model to match several facts related to human capital formation and migration. Results from the quantitative analysis of the model show that the possibility of migration of children to the U.S.—where the returns of Mexican education are low, and they can perceive relatively high earnings regardless of education—explains most of the documented educational investment disparities. The lessons about the relationship between migration and educational investment decisions help us better understand the intergenerational mobility process of potential migrants, who do not necessarily need to improve their children's education to improve

their future earnings.

I plan to explore further the role of differences in the returns to Mexican education and earnings levels between Mexico and the U.S. In that sense, I will link my work with studies that find that improving English in Mexican education promotes the future migration of Children. Also, I want to assess how improvements in earnings in Mexico affect migration decisions and investment in children's education. There are exciting avenues for future research that include the following options. First, allowing for a richer life-cycle, where the timing of the migration decision can matter because the paternal absence can affect younger and older children differently. Second and related to the first, allowing children to get an education in the U.S. would create higher incentives for migration. If parents migrate when their children are young, their children can get an education in the U.S. and overcome the obstacle of the low returns of Mexican education in the U.S. labor market. Last, extending the analysis to allow for internal and international migration jointly can be more informative about the parameters of the human capital production function.

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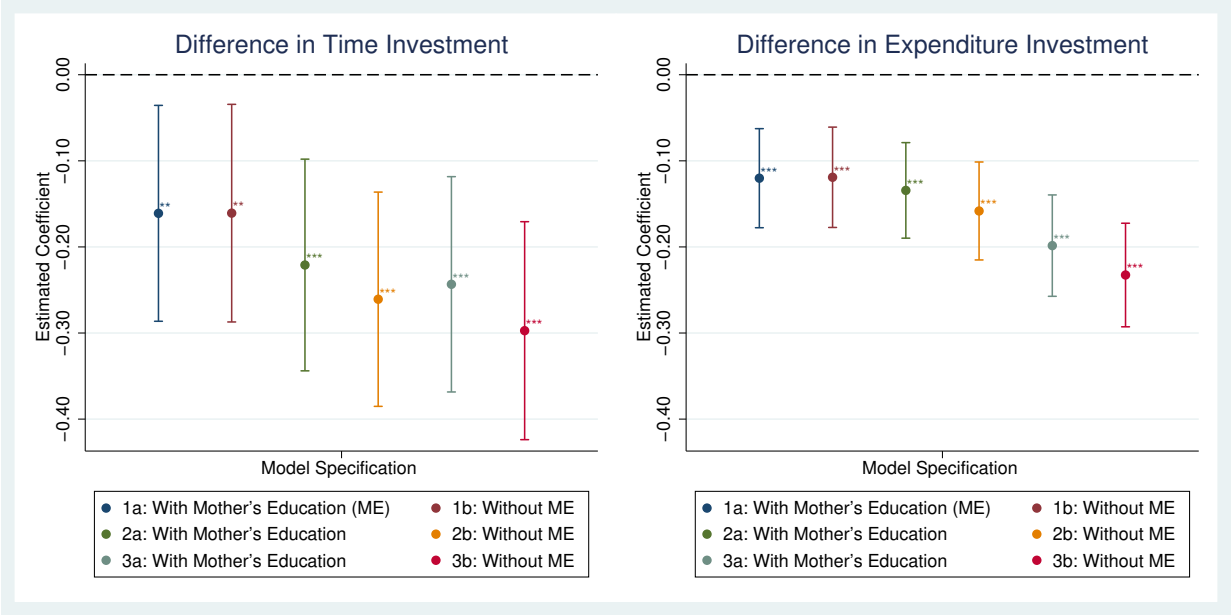
A Appendix: Data

A.1 Selection Other Specifications

Figure 5: Differences in Education Investments of Children of Migrants and Non-migrants by Model Specifications



Notes: The circles present the point estimates and the bands the 90% confidence interval.

A.2 Selection IV

Table 9: Relationship Between Having a Father in the US and Education Investments Using IV

	Dep. Variable: Mother Time Invt. in Child's Education					
	(1)	(2)	(3)	(4)	(5)	(6)
Father in US						
Father in US	-10.79**	-11.91**	-10.26***	-13.39***	1.83	-2.14
	(4.88)	(5.13)	(2.62)	(2.88)	(3.94)	(3.77)
Mother's Education						
≥Junior High School	0.81***		0.80***		0.88***	
	(0.06)		(0.06)		(0.06)	
Constant	-0.27	0.06	-0.25	0.01	0.56	0.97*
	(0.74)	(0.82)	(0.72)	(0.85)	(0.52)	(0.52)
Federal entity(states in MX)	Yes	Yes	Yes	Yes	No	No
Rural-urban dummy	Yes	Yes	No	No	Yes	Yes
Observations	12972	13016	12972	13016	12972	13016
F-statistic: First-stage	11.513					

Notes: The table reports the IV estimated coefficients from the equation (1) $y_{it}^j = c + \beta_1^j \cdot FUS_{it} + \beta_2^j \cdot ME2_{it} + \gamma^j \cdot x_{it} + \varepsilon_{it}^j$, where the dependent variables are in the columns, FUS_{it} is a dummy equal to 1 if the child's father lives in the US and 0 if lives in Mexico, $ME2_{it}$ is a dummy equal to 1 if the completed level of education of the mother is equal or greater than junior high school (9 years) and 0 otherwise, and x_{it} includes other control variables. Standard errors in parentheses and $^*p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$. Time variables are in hours per week. Other controls not presented in the table include quadratic polynomials of child's age and mother's age. The sample includes children between 4 and 12 years old with married parents from the 3 waves of the MXFLS.

A.3 Returns to Mexican Education

B Calibration Appendix

B.1 Educational Investments During Childhood and Outcomes During Adulthood

The goal of this sections is to analyze the relationship between educational investments received during childhood and their adulthood earnings. To simplify the explanation I focus on the relationship between mothers' time investment, s_2, into their children education and the earnings, w, of their children when they become adults; later I discuss other variables such as the father's time investments and father's earnings (as a measure of intergenerational persistence).

$$ln(w_{it+h}) = \beta_1 + \beta_2 s_{2it} + \beta_3 age_{it} + \beta_4 age_{it}^2 + \beta_6 X_{it} + u_{it+h} \tag{7}$$

where h is the number of periods after the children educational investment when we observe earnings, and X is a vector of controls that include a rural/urban dummy.

Unfortunately, the data has the limitation that we do not observe educational investments during childhood and earnings after $h = 7$ periods for many individuals. This happens because

many of them are still studying and dropping them from the regression would bias the results. Remember that the data is a panel with 3 waves, the first conducted in 2002, the second in 2005, and the third in 2009. I focus on educational investments received between 12 and 15 years old.

To solve the above-mentioned data limitations I take advantage of the fact that years of education do not change much (for most of the people) after 22 years old. In that sense, I estimate the relationship between years of education and earnings and then I use the estimated coefficients to project earnings. Then, I link the educational investments received during childhood to the projected earnings (from the previous estimation) which rely on the years of education $h = 7$ periods after receiving the educational investments and also adjusting for the age of interest. Below I explain these steps in more detail—in this explanation I assume that there are no selection issues for the observed wages. I also try to control for selection into work based on a Heckman-selection estimator and the results are similar.[11]

First step

1. Regress earnings on **years of education**, age and other observables. I restrict the sample to married individuals between 25 and 60 years old because of a higher participation at that ages. I also restrict the sample to the first two waves because during 2009 the share of people receiving earnings is significantly smaller due to the great recession (70% vs 84% for males).

$$ln(w_{it}) = \alpha_1 + \alpha_2 ln(educ_{it}) + \alpha_3 ln(educ_{it})^2 + \alpha_4 age_{it} + \alpha_5 age_{it}^2 + \alpha_6 X_{it} + \mu_t + \epsilon_{it} \quad (8)$$

2. Predict earnings, using (8). I predict earnings for individuals who where between 12 and 15 in the first wave (19 to 22 in the third wave) and add 16 years to their age, so that we get their predicted earnings at their ages between 35 and 38. The assumption is that years of schooling do not have important changes after 22 years old. I focus on predicted earnings between 35 and 38 because the mean average age of Mexican workers is around 37 and I take this age as a representative age of their entire working part of their life cycle; my model only has on period for the working stage.

[11] To control for selection I follow Chyn and Daruich (2022), and construct Inverse Mills ratios by estimating the participating equation using number of children as well as federal entity fixed effects.

Second step

$$ln(\hat{w}_{it+7}|age+16 \in [36,38]) = \beta_1 + \beta_2 s_{2it} + \beta_3(age_{it}+16) + \beta_4(age_{it}^2+16) + \beta_6 X_{it} + u_{it+7} \quad (9)$$

where $t = 2002$ is the period of the first wave and $t+7 = 2009$ is the period of the third wave. I restrict the sample to children of married couples aged between 12 and 15 years old in the first wave (19 to 22 in the third wave).

Results

The third column of Table 10 shows the results for the previous equation. I also present other specification that are encompassed in the following specification:

$$ln(\hat{w}_{it+7}|age+16 \in [36,38]) = \beta_0 + \beta_2 s_{2it} + \beta_3 s_{1it} + \beta_4 ln(\hat{w}_{it+7}^{father}|age^{father} = age+16) + \beta_5(age_{it}+16) + \beta_6(age_{it}^2+16) + \beta_7 X_{it} + u_{it+7} \quad (10)$$

where s_1 is the time investment by the father, $ln(\hat{w}_{it+7}^{father}|age^{father} = age+16)$ is the predicted earnings of the father at the same age of the predicted earnings of the children (the main difference is their years of education).

Table 10: Time investments during childhood and earnings

	Dependent Variables: ln(earnings)				
	(1)	(2)	(3)	(4)	(5)
L2.Mother Time investment	0.02***	0.04***	0.04***	0.02***	
	(0.01)	(0.01)	(0.01)	(0.01)	
L2.Father Time investment	0.01	0.03**			
	(0.01)	(0.01)			
L2.ln($earnings^{father}$)	0.24***			0.24***	0.24***
	(0.01)			(0.01)	(0.01)
sex=1	0.49***	0.47***	0.47***	0.49***	0.49***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
L2.Child's Age	0.18	0.15	0.13	0.18	0.14
	(0.18)	(0.19)	(0.19)	(0.18)	(0.18)
L2.Child's Age × L2.Child's Age	-0.01	-0.00	-0.00	-0.01	-0.00
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.88	1.81	1.99	0.92	1.21
	(1.21)	(1.26)	(1.26)	(1.21)	(1.18)
Rural-urban dummy	Yes	Yes	Yes	Yes	Yes
Observations	1824	1992	1992	1824	1935
R^2	0.658	0.596	0.593	0.658	0.652

Standard errors in parentheses

Mother time investement as percentage of total available time.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 shows that the coefficient of intergenerational persistence is robust.