Migration, Strategic Behavior and Children's Human Capital in Mexico☆

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Abstract

Migration introduces asymmetries of information that might trigger noncooperative behavior of spouses left behind. This paper studies noncooperative behavior in Mexican households and how this behavior affects children's human capital. I use the Mexican Family Life Survey (MXFLS), a longitudinal household survey that identifies migrants to the U.S. I find that migration causes noncooperative behavior in the spouse left behind, namely spouses reduce the time in doing chores and do not change their labor supply. At the same time, boys do more agricultural work and girls have to spend more time in taking care of other members. Migration positively affects school enrollment, but nonlinear effects suggest younger children are bearing most of the negative effect, as literature suggests lower school enrollment at early ages means lower cognitive achievement later on.

Keywords: Intrahousehold Allocation, Human Capital, Migration, Noncooperative Behavior, MXFLS
JEL: D13, F22, I1, I2, C7

1. Introduction

One of the main sources of economic growth and development for a country is human capital. At a micro level, human capital is represented by choices made in the household (and the subsequent outcomes) regarding cognitive development and health[1]. Microeconomic theory suggests that such choices are determined by income, prices and preferences.

Household choices are not made by an individual; instead, these are made by parents who have different preferences. This fact changes the rules governing allocation of household's resources (e.g. time or money) in two ways. First, each parent might change his/her behavior depending on what the other parent does (strategic behavior), making intrahousehold allocations the result of a game between parents. Second, the game might end up either in an allocation where both parents cooperate to achieve higher levels of welfare for the household, or in one where each of them decides not to cooperate in order to increase his/her own welfare at the cost of lower household welfare. Whether the cooperative or the noncooperative solution is achieved depends the ability to monitor each other's behavior (asymmetries of information): the easier it is to monitor how resources are allocated, the more likely is that parents cooperate.

The purpose of this paper is to study how allocations in Mexican households change in response to asymmetries of information, in particular allocations and outcomes related to children's human capital. Local or international migration is a source of asymmetric information, since the migrant cannot observe allocations or outcomes that have low degree of transparency[2]. This asymmetry of information provides an opportunity for noncooperative behavior for the spouse left behind[3], whose best strategy is to cooperate in allocations that are easily verifiable, and to behave in a noncooperative way in those allocations with a low degree of transparency.

For that purpose, I use the Mexican Family Life Survey (MXFLS), a longitudinal household survey that collects information of all individuals who were members of the household in the baseline year (2002) regardless of migration decisions[4]. I analyze individual and household behav-

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[1] In development economics, cognitive development and health are the main components of human capital (Mwabu, 2007).

[2] Transparency means how easy is to verify an allocation even when the person is away. For example, it is easy to verify school enrollment or Body Mass Index (BMI), but that is not the case for allocations or outcomes with low degree of transparency such as children's time allocation or calorie intake.

[3] I do not refer to parents as husband and wife or migrant and wife/husband, since these terms are defined based on gender. Some households in the data have the wife as the head and thus some migrants are women. To avoid misleading interpretations or gender bias, I refer to parents as head and spouse.

[4] The survey only keeps track of local migrants and migrants to the U.S. Migration of Mexicans to other countries is relatively uncommon. A more detailed description of the survey can be found in Rubalcava and Teruel (2006) and Farfan et al. (2012).

ior in the short-run[5] by estimating reduced-form equations for inputs and outcomes of children's human capital as well as spouses' time allocation and labor supply.

I find that migration induces spouses to reduce their time doing chores and do not change their labor supply. At the same time, boys do more agricultural work and girls spend more time taking care of other members. These results together are evidence of noncooperative behavior of spouses left behind. Regarding human capital, migration positively affects school enrollment, but nonlinear effects suggest younger children are bearing most of the negative effect, as it is widely recognized that lower school enrollment at early ages means lower cognitive achievement later on (Young, 2007).

The paper is structured as follows. Section 2 presents a theoretical framework for the model and Section 3 describes the strategies for identification of parameters and estimation of the model. Estimates are presented in Section 4, and Section 5 concludes.

2. Literature

At the micro level, the amount of inputs for production of human capital and subsequent outcomes is determined by how resources are allocated inside the household. There is an extensive literature looking at intrahousehold allocations (Behrman, 1997)[6]. In general, there are two approaches to analyze how these decisions are made: unitary and collective. The unitary approach is represented in consensus parental preference models (Becker, 1974; Becker and Tomes, 1976), where parents are assumed to have the same preferences. These models predict that resources in the household are pooled and therefore control over resources and asymmetries of information play no role in how resources are allocated. Unfortunately, the lack of empirical support for these predictions suggest a collective instead of a unitary approach is more appropriate (Mwabu, 2007).

The collective approach is represented in nonconsensus models (Bourguignon and Chiappori, 1992; Chiappori, 2009) where the main assumption is that parents have differences in preferences, which means decisions are the result of strategic behavior. Intrahousehold allocations are represented by the equilibrium of the game parents are playing, which can be either cooperative (McElroy and Horney, 1981; Apps and Rees, 2007) or noncooperative (Chen and Woolley, 2001).

I focus on games where parents are decision makers, strategies are intrahousehold allocations (related in some way to children's human capital) and there is variation on information sets caused by migration of the head of the household. In particular, the theoretical model I follow is the one by Lundberg and Pollak (1993), where parents make decisions in separate spheres[7] and the threat point is a noncooperative equilibrium[8]. Transaction costs to make binding agreements have the potential to move the equilibrium from being cooperative (Pareto optimal) to noncooperative. In this paper, transaction costs are represented by asymmetries of information, in particular, the inability the migrant has to verify how the spouse left behind is allocating resources as well as the outcomes obtained by children.

Having defined a model for how resources are allocated, now how human capital is produced within the household must be determined. The theory of human capital (Becker, 1962; Schultz, 1961) has an answer for that. The literature in development economics identifies education[9] (Schultz, 1960; Becker, 1975) and health (Mwabu, 2007; Strauss and Thomas, 2007) as the two main components of human capital. The standard theoretical approach has been to model both as a production function of the household (see Rosenzweig and Schultz (1983) for health and Todd and Wolpin (2003) for education).

Regarding health, the production function uses two types of goods as inputs: goods that affect both health and utility directly (e.g. alcohol, food) and those that only affect health (e.g. prevention, health care). Since health itself affects utility, this last group of inputs has an indirect effect on welfare through production of health. As for education, there are family and schooling inputs determining the cognitive achievement of the household member[10]. Both health and education take into account unobserved heterogeneity coming from unobserved variables such as genetic endowments or ability.

The way to derive individuals' choices follows the standard neoclassical approach: individual i maximizes utility subject to a budget constraint, time constraint and production/investment functions for education and health. By solving the utility maximization problem, it is possible to derive reduced-form demand functions for human capital inputs and outcomes, that are functions of prices, money income and health/ability endowments. These reduced forms and the production functions themselves con-

[5] Even though the MXFLS is scheduled to collect data for at least a 10-year span, to this date the only information available is for the first two rounds (2002 and 2005), which limits the analysis to a short-run perspective.

[6] A comprehensive review of theoretical models can be found in Browning et al. (2011) and of empirical studies for developing countries in Haddad et al. (1997).

[7] Separate spheres is a situation where "*husband and wife each bear the responsibility for a distinct, gender-specific set of household activities*". In that situation "*...minimal coordination is required because each spouse makes decisions within his or her own sphere, optimizing subject to the constraint of individual resources*" (Lundberg and Pollak, 1993, p.994)

[8] The noncooperative equilibrium is defined by traditional gender roles and gender role expectations (Lundberg and Pollak, 1993, p.990).

[9] In general, cognitive skills.

[10] For adults, experience in the labor market as well as the tradeoffs regarding investments in education are also inputs that must be accounted for. These are not relevant here since the paper focuses on children's human capital.

stitute the theoretical framework in which most of the empirical work in human capital is based on (Grossman, 1972a,b; Mocan et al., 2004; Cameron et al., 1988; Dow, 1999).

In order to introduce the collective approach regarding intrahousehold allocations in a model that explains human capital inputs and outcomes, I follow the model presented in Chen (2013). In this model, parents cooperate under perfect and symmetric information. Transaction costs represented in asymmetries of information create incentives to deviate toward noncooperative behavior, particularly in allocations that cannot be easily monitored. This lack of monitoring can easily emerge when one of the parents (decision-makers) migrates, since the migrant cannot observe how all the resources are being allocated, and not all allocations have the same degree of transparency.

This paper contributes to the literature in the following ways. Firstly, I identify noncooperative behavior in a different setting. To my knowledge, this analysis has been done for China (Chen, 2006) and it is limited to internal migration. This study focuses on migration in Mexico, which is a good setting to study international migration because of the significant amount of nationals migrating to U.S. International migration is an interesting case because having to migrate to a different country exacerbates the asymmetry of information, making easier to identify emergence of noncooperative behavior. Other papers have used the MXFLS to analyze human capital in Mexican households (see Nopo and Winder (2008); Rubalcava et al. (2008); Arenas (2008); Powers (2011)). However, the role of asymmetries of information is missing in these studies.

A second contribution is to carry out this analysis with a broader set of allocations and outcomes. Previous studies only included allocation of time at the extensive margin, and health outcomes such as BMI or calorie intake (e.g. (Chen, 2006)). The MXFLS has additional information such as time allocation at the intensive margin and direct measurements of cognitive skills. Using this additional information might provide a more comprehensive and precise understanding of the effects of asymmetries of information on children's human capital.

3. Estimation, Identification and Data

The empirical counterpart of the model identifies noncooperative behavior by estimating reduced-form equations for inputs (spouse's and children's time allocation) and outcomes (child quality), and looks at the effect of migration on these variables. In particular, I estimate the following reduced form for the non-migrant spouse and children:

$$y_{ijkt} = \alpha + \phi \cdot c_{ijkt} + \beta \cdot h_{jkt} + \delta \cdot \text{away}_{jkt} + \rho \cdot f(\text{months}_{jkt}) + \xi_{ijkt} \quad (1)$$

where $\xi_{ijkt} \equiv \upsilon_{ijk} + \eta_{kt} + \varepsilon_{ijkt}$. In equation 1, y_{ijkt} represents the allocation or outcome of individual i in household j in location k at year t, c_{ikt} represents individual-level covariates, h_{jkt} represents household-level covariates, away_{jkt} is the direct effect of migration of the household's head and $f(\text{months away}_{jkt})$ is an indirect effect, coming from lower transparency of allocations as migrant's time away increases.

The error term ξ_{ijkt} has three components: individual fixed-effects υ_{ijk} to capture individual unobserved heterogeneity that is constant over time, location-year fixed effects η_{kt} to capture unobservable location-level determinants of migration, and an idiosyncratic error ε_{ijkt}. The next section describes the data, the necessary assumptions to identify the parameters, and the strategy to estimate the model.

3.1. Data

3.1.1. Survey and Sample

I use the Mexican Family Life Survey (MXFLS). This is a longitudinal dataset that collects information for a nationally representative sample of Mexican households in 2002. The survey monitors every household member who was interviewed in the baseline year (2002) and collects information from them in three more waves: 2005, 2009 and 2012. I work with the baseline (2002) and the first follow-up (2005) because these are the only waves that have been collected, processed and released. The survey collects information for individuals, households and locations. Locations are identified at three different spatial scales: states, municipalities (counties) and communities (cities)[11].

The MXFLS identifies and keeps track of migrants to the U.S.[12] as well as the ones who moved to a different location inside Mexico[13] (local migration). Composition of migrants by role is shown in Table 1.

Most migrants moved to the U.S., which means international migration is more important than local. Also, most migrants are sons/daughters (more than 50% in both cases). When looking at the reasons why they moved to a different location, most sons who migrated did it to meet their families, and only a few of them moved for economic reasons. This story is different for households' heads: most

[11] In order to protect confidentiality of individual information, the survey only has real codes for states, that is, it does not allow researchers to identify the real municipalities and communities corresponding to the codes in the dataset. That limits the possibility to add external information at municipality or community level in order to get better estimates.

[12] Information from migrants in the second wave was already collected. The survey team has only released a dataset that identifies which household members in 2002 were migrants to the U.S. in 2005, but they have not released the dataset with the migrants' answers to the questionnaires.

[13] The survey has an official dataset identifying migrants to the U.S. I identify local migrants based on the status the family reported for that member. Specifically, I define a local migrant as a household member who was reported by the family as not living in the household in 2005 and whose current location was in another community inside Mexico.

Table 1: Migrants in MXFLS by Role

	To the U.S.		In Mexico	
Role	# Migrants	%	# Migrants	%
Son/Daughter	416	62.46	234	52.47
Head	95	14.26	31	6.95
Grandson	68	10.21	59	13.23
Other	87	13.07	122	27.35
Total	666	100	446	100

of them moved because they were looking for employment. This is important for the analysis as it allows the assumption of a neutral role of migrant sons (or other household members) in provision and allocation of resources in the household. In addition, the survey shows that international migration is more common for households' heads, which means most of the variation of migration in the sample will come from migration to a different country.

Table 2: MXFLS vs. Sample

	Survey	+ Parents Panel	+ ≥ 1 Child Panel	+ No Farming
Households	8,440	5,291	2,584	1,933
Individuals	35,677	25,988	14,861	10,293
Children	11,909	5,829	5,110	3,846
Children in Panel	4,959	4,002	4,002	2,925
Migrants	1,139	781	411	263
Migrant Heads	132	109	67	49

Table 2 shows the number of observations in the MXFLS in 2002 for households, children and migrants. It also shows the number of observations for the sample of interest, which includes households with both parents and at least one child observed in both waves (in panel), with some variation in migration status. These two are the minimum requirements to identify noncooperative behavior.

The need for both parents each in panel comes from the fact that there are households whose parents divorced across waves, one of them died, or there is only one parent (e.g. single mothers). There are also new households coming from members in the first wave who married and/or started a new household between waves. In these cases, by definition, it is not possible to test for noncooperative behavior between parents.

The requirement of having at least one child in panel comes from the focus of this paper, that is human capital in children. I define children as household members between 5 and 14 years old[14]. This requirement also excludes kids who were children in the first wave but then grew up and became adults.

I further restrict the sample to exclude households who used land for farming for two reasons. The first one is that inclusion of agricultural production, as proposed in standard models of agricultural households[15], significantly complicates the identification of noncooperative behavior, as the acquisition of land after migration and subsequent increase of child labor might be part of the cooperative allocation agreed by the parents. The second reason is empirical. In the survey and the sample, the proportion of households who use land for agricultural production is small. When instruments are used to control for endogeneity of land in just a few observations, the noise they introduce is higher than their contribution to identify parameters[16].

The survey has 8,440 households (HHs) in the baseline year (2002). For the first follow-up in 2005, 924 HHs (10.9%) did not answered the survey (attrition). The reduction in the number of households between columns 2 and 3 in Table 2 is caused partially by this attrition, and partially by households who did not have each of both parents in panel. By adding the other two conditions, the sample I used to estimate the model has 1,933 households and 2,925 children in panel. These numbers can differ from the ones presented in regressions later on because some observations have missing values for some variables[17].

Even though these requirements exclude a large portion of households in the survey, this does not represent selection bias, since the sample was defined based on the model. In other words, the 1,933 households are a nationally representative sample of households with both parents and at least one child in panel, and the same applies to the 49 households where the head migrates.

3.1.2. Variables

Before going into details about statistics for each member, it is necessary to specify how the variables included in the model were calculated. For time at home, individuals were asked about the total number of hours they spent from Monday through Sunday in specific activities. In theory, a worker spends at home around 70 hours per week[18].

However, the data has much more variation and some numbers are inconsistent. This happens because the survey asks for the total number of hours in the week, which

[14]The reason for the lower bound is that human capital in babies (younger than 4) is hard to measure, specially the part regarding cognitive skills. As for health, there are plenty of measures but their stock of health has determinants that differ significantly from the ones for older children (e.g. mother's health status during pregnancy or breast feeding). For these reasons I exclude them from the sample. Regarding the upper bound, it corresponds to how children are defined in the MXFLS.

[15]Strauss (1986) and Singh et al. (1986) are examples of standard models for agricultural households.

[16]Three instruments for land were used: population, quality of roads and price of land. All of them turned out to be weak instruments.

[17]This happens because, once skip patterns are accounted for, there are still individuals who refused to answer either a whole book, a module of the book or a specific question. Also, some members were absent during the survey. The MXFLS has a proxy book where the household member who was present at the moment of the survey answers a summary of all the books for the member who was absent. However, even if that Proxy book is taken into account, there are still missing values for some individuals.

[18]Assuming he sleeps 8 hours per day (56 hours per week), and works 8 hours in weekdays (40 hours per week). For individuals who do not work, this number should be around 110.

requires respondents to do the arithmetic operation of getting the total per week based on the total per day[19].

In order to reduce this noise I calculated the time each individual spent in each activity at home relative to the total number of hours he/she reported in activities at home. The survey divides the time at home in eleven items, that I grouped in six categories. The first five are related to do chores, and include housework, care other members[20], carry firewood, carry water and agricultural work. The sixth one, called leisure, is the total time in cultural activities or sports, watching tv, helping other with studies, reading and using internet.

Other categories different from the ones I just mentioned, namely sleep, work[21] and study, do not have that kind of noise, and so these categories are measured in absolute units (# of hours per day). Time for work corresponds to the total number of hours per day spent in all the jobs the person has, since some individuals in the survey have more than one job. Time studying includes time commuting to school (round-trip), studying in school and studying outside school (e.g. at home)[22].

Cognitive skills are measured by the application of the Raven's Progressive matrices[23], which is a nonverbal test that measures reasoning ability. The survey provides the answer children picked as well as the correct answer. The measure of cognitive skills is the portion of correct answers (between 0 and 1).

Regarding BMI, it was calculated as weight divided by height squared. BMI is not a linear measure of health, since both low and high values indicate unhealthy weight, either caused by malnutrition or by excessive consumption of calories, respectively[24]. In order to be able to use BMI in linear regressions, I calculated deviations of BMI from cut-off values defining normal BMI[25]. These cut-off values discriminate by gender and age, in order to be able to use it for children.

Table 3: Characteristics of Spouse by Migrant Status

	Never Migrates		Head Migrates	
	2002	2005	2002	2005
Housework	0.442	0.495	0.409	0.463
	(0.21)	(0.22)	(0.21)	(0.23)
Care other members	0.265	0.172	0.31	0.148
	(0.24)	(0.22)	(0.27)	(0.21)
Carry firewood	0.006	0.005	0.013	0.007
	(0.03)	(0.03)	(0.03)	(0.03)
Carry water	0.005	0.003	0.006	0.007
	(0.03)	(0.02)	(0.03)	(0.03)
Agricultural work	0.003	0.002	0.004	0.015***
	(0.03)	(0.03)	(0.01)	(0.06)
Leisure	0.28	0.324	0.258	0.359
	(0.19)	(0.21)	(0.19)	(0.21)
Sleep	7.706	7.742	7.854	7.925
	(1.26)	(1.2)	(1.13)	(1.12)
Does work?	0.313	0.309	0.229	0.375
	(0.46)	(0.46)	(0.42)	(0.49)
Hours work	4.649	5.141	4.364	6.514*
	(2.85)	(2.92)	(2.62)	(2.85)
Study	0.015	0.01	0.012	0.021
	(0.19)	(0.14)	(0.08)	(0.14)
BMI	28.651	28.796	27.904	28.473
	(5.37)	(5.53)	(5.31)	(5.55)
# obs.	1780	1800	48	40

Notes: Standard deviations in parenthesis. (*) denotes significant difference between head migrates in 2005 and never migrates in 2005 at 10%, 5% (**) and 1% (***).

As for migration, I calculate the number of members away (total away) as well as the average of months they are away. These numbers are positive even for nonmigrant households because sons or other members different from the head of the households can also migrate.

Additional variables included to control for observable heterogeneity are individual's age, age squared, household size, assets (vehicles and appliances) and head and spouse's wages. In regressions for spouses I also included the total number of children and the proportion of male children. In regressions for children I included the age of the head and the spouse, the number of male and female siblings and a dummy variable for children that are sons/daugthers.

3.1.3. Descriptive statistics

Descriptive statistics at the individual and household level for spouses and children left behind are presented in Tables 3-6.

Spouses spend most of their time at home in housework (40-49% of the hours they reported), in taking care of other household members (14-26%) and in leisure (26-35%). The difference between both groups is significant for agricultural work[26] suggesting that spouses in migrant

[19] A way to collect data for time allocation that does not have this measurement error is to ask how many hours the person spent in each activity in a normal day. This can be asked separately for a normal weekday and for a normal weekend day, since allocation of time in these two usually differ. By asking in this way the person does not have to do arithmetic operations, reducing significantly the measurement error. Other surveys like the China Health and Nutrition Survey ask in this way; unfortunately that is not the case for the MXFLS.

[20] This refers specifically to elderly or sick person, and children.

[21] Unless otherwise specified, work refers to having a job outside home. It has nothing to do with agricultural work or housework, that are part of the time at home, and that usually are unpaid.

[22] This normalization reduces the noise in the variable. It is important to clarify that all the results presented in Section 4 hold when time allocation at home is included in the model in absolute values, so the transformation to relative values does not affect the conclusions derived from the model.

[23] Different versions of the test are applied to children and adults.

[24] It might be argued that BMI is not the best predictor for children's health, in particular for cardiovascular risk factors. Savva et al. (2000) find that waist circumference and the waist-to-height ratio are better predictors for these risk factors in children. Even though the MXFLS collected information on waist circumference, the significant amount of missing values does not allow to precisely estimate the effect of migration on this variable.

[25] Data for cut-off values was taken from the Center for Disease and Control Prevention - CDC.

[26] Even though these households do not use land for agricultural production, agricultural work here refers to agricultural activities related to taking care of the land/dwelling and/or livestock they own. For example, weeding, cleaning, sowing, shuck or degraining corn, pulling weeds/herbs, or taking care of animals.

households spend more time in this activity.

On average spouses sleep 7-8 hours per day and this is higher in migrant households, although the difference is not significant. Regarding work, in 31,3% of nonmigrant households the spouse had a job in 2002, and this did not change significantly for 2005 (30.9%). That is not the case for migrant households, where in 22.9% of households the spouse had a job in 2002 and for 2005 this proportion had almost a twofold increase (37.5%).

Table 4: Characteristics of Boys by Migrant Status

	Never Migrates		Head Migrates	
	2002	2005	2002	2005
Housework	0.05	0.06	0.03	0.09*
	(0.1)	(0.1)	(0.05)	(0.19)
Care other members	0.03	0.02	0.03	0.03
	(0.09)	(0.07)	(0.09)	(0.12)
Carry firewood	0	0.01	0	0
	(0.03)	(0.05)	(0.01)	(0.02)
Carry water	0	0.01	0	0
	(0.03)	(0.04)	(0.01)	(0.01)
Agricultural work	0	0.01	0.01	0.01
	(0.04)	(0.04)	(0.05)	(0.03)
Leisure	0.91	0.9	0.93	0.87
	(0.16)	(0.16)	(0.14)	(0.25)
Sleep	9.1	8.7	9.23	8.97
	(1.31)	(1.25)	(1.2)	(1.12)
Does Work?	0.02	0.06	0.05	0.06
	(0.15)	(0.24)	(0.22)	(0.24)
Hours work	5.68	5.67	4.21	12.5**
	(4.93)	(4.06)	(0.91)	(0.71)
School enrollment	0.95	0.96	0.9	0.91
	(0.22)	(0.2)	(0.31)	(0.29)
Study	4.94	6.71	4.88	6.03
	(3.04)	(2.39)	(3.26)	(2.22)
Age	8.00	11.21	7.79	11.08
	(1.96)	(1.97)	(1.98)	(1.97)
Cognitive skills	0.59	0.68	0.56	0.61*
	(0.21)	(0.2)	(0.23)	(0.21)
BMI	17.32	20.01	17.33	20.04
	(2.87)	(4.42)	(2.23)	(4.91)
# obs.	1414	1412	39	39

Notes: Standard deviations in parenthesis. (*) denotes significant difference between head migrates in 2005 and never migrates in 2005 at 10%, 5% (**) and 1% (***).

Spouses in nonmigrant households work around 4.6-5.1 hours per day[27], and in migrant households this went up from 4.3 to 6.5 hours per day after migration. There is a significant difference in this variable between control and treatment groups, suggesting that the spouse is working more hours in households where the head migrated. Thus, the data suggests migration increased spouses' labor supply at both the intensive and the extensive margin.

Finally, the average BMI is around 28. According to the CDC the standard weight categories for BMI in adults are 18.5-24.9 for normal weight, 25-29.9 for overweight and 30 and above for obese. This means spouses in the sample are overweight.

[27]This number is calculated excluding spouses that did not work (number of hours working is zero).

Tables 4 and 5 describe characteristics of boys and girls in the sample, respectively. I describe and estimate the model for boys and girls separately because their brain and body develop in different sequences (Reiss et al., 2000; Lenroot et al., 2007) and they play different roles in the household.

Children spend most of their time at home in leisure activities (80-90% of the time at home) and housework (3-14%). They sleep around 9 hours and migration slightly increases this number for boys and girls. School enrollment rates are around 90% and in both cases migration seems to induce a reduction in enrollment and study hours.

Table 5: Characteristics of Girls by Migrant Status

	Never Migrates		Head Migrates	
	2002	2005	2002	2005
Housework	0.08	0.14	0.09	0.13
	(0.11)	(0.16)	(0.11)	(0.14)
Care other members	0.04	0.04	0.07	0.02
	(0.1)	(0.1)	(0.15)	(0.06)
Carry firewood	0.00	0.00	0.00	0
	(0.02)	(0.03)	(0)	(0.02)
Carry water	0.00	0.01	0.00	0
	(0.02)	(0.03)	(0.01)	(0.01)
Agricultural work	0.00	0.00	0.00	0.03***
	(0.03)	(0.04)	(0)	(0.1)
Leisure	0.87	0.81	0.84	0.82
	(0.16)	(0.2)	(0.19)	(0.2)
Sleep	9.15	8.75	9.28	9
	(1.44)	(1.37)	(1.24)	(1.14)
Does Work?	0.02	0.03	0.05	0.06
	(0.12)	(0.17)	(0.22)	(0.24)
Hours work	4.71	3.33	4.07	4
	(4.54)	(2.88)	(0.71)	(5.45)
School enrollment	0.94	0.97	0.93	0.94
	(0.23)	(0.17)	(0.27)	(0.24)
Study	4.78	6.85	5.73	6.65
	(3.16)	(2.3)	(3.07)	(2.26)
Age	7.90	11.14	8.02	11.39
	(1.97)	(1.98)	(1.86)	(1.83)
BMI	17.38	20.00	16.39	19.06
	(3.15)	(4.23)	(1.92)	(3.43)
Cognitive skills	0.58	0.67	0.50	0.58***
	(0.21)	(0.2)	(0.19)	(0.22)
# obs.	1431	1433	41	41

Notes: Standard deviations in parenthesis. (*) denotes significant difference between head migrates in 2005 and never migrates in 2005 at 10%, 5% (**) and 1% (***).

There are three significant differences when comparing children in migrant vs. nonmigrant households. The time in doing housework is significantly higher for boys in migrant households, and same happens to girls regarding agricultural work. For both boys and girls, cognitive skills are lower in migrant households.

Table 6 describes the main variables at household-level. Households in the sample have around 5-6 members and migrant households are significantly bigger and have more children. Parents have significantly lower education in migrant households, and the difference is more significant for spouses than for heads.

Compared to migrant households, heads and spouses

in nonmigrant households have higher wages [28]. Households with migrants seem to have less assets (dwellings, savings and machinery) and migration might have induced increases in livestock.

Table 6: Characteristics of Households by Migrant Status

	Never Migrates		Head Migrates	
	2002	2005	2002	2005
Household size	5.31	5.54	5.9	6.35***
	(1.69)	(1.88)	(1.78)	(1.76)
# Children	1.98	1.93	2.33	2.2**
	(0.97)	(0.95)	(1.25)	(1)
% Male children	0.5	0.51	0.44	0.51
	(0.4)	(0.4)	(0.38)	(0.39)
Head's age	39.13	42.39	36.63	40.41
	(9.54)	(9.44)	(7.23)	(7.8)
Spouse's age	35.98	39.36	34.06	37.49
	(8.72)	(8.71)	(7)	(7.13)
Head's school	4.31	4.27	3.55	3.66*
	(2.12)	(2.15)	(1.51)	(1.58)
Spouse's School	3.94	3.97	3.35	3.32**
	(1.8)	(1.87)	(1.41)	(1.56)
Head's wage	24	31.11	26.76	15.67
	(59.44)	(71.14)	(64.25)	(3.95)
Spouse's wage	28.65	41.71	20.83	35.09
	(63.06)	(201.24)	(14.36)	(58.06)
Dwellings	282.71	191.33	116.33	153.96
	(5257.4)	(1000.89)	(228.57)	(311.25)
Savings	114.28	3.92	1.67	2.11
	(3320.45)	(23.55)	(8.98)	(10.8)
Machinery	2.91	0.22	0.2	0
	(85.63)	(5.04)	(1.43)	(0)
Livestock	1.1	0.83	1.27	2.84
	(14.86)	(12.88)	(8.18)	(13.27)
Total away		0.09		1.84
		(0.42)		(1.39)
Months away		1.04		17.66
		(5.16)		(11.69)
# obs.	1813	1837	49	41

Notes: Standard deviations in parenthesis. (*) denotes significant difference between head migrates in 2005 and head never migrates in 2005 at 10%, 5% (**) and 1% (***).

3.2. Identification

In general the decision to voluntarily[29] migrate is determined by differences in expected income between the two locations. The short time horizon between both waves of the MXFLS makes it feasible to assume that determinants of migration did not change across time. This assumption is also supported by the fact that the second wave of the survey was carried out before the escalation of violence in Mexico in 2006[30].

There might be aggregate determinants of migration, such as unemployment, that change over time. According to the IMF, the unemployment rate in Mexico increased from 2.97% in 2002 to 3.59% in 2005. I assume these aggregate determinants of migration are constant across individuals for some specific location. Under this assumption, I can control for these factors through the location-year fixed effect η_{kt}.

At the individual level there might be unobserved determinants of migration such as productivity or skills, as well as unobserved heterogeneity affecting human capital like ability or genetic endowments. I assume these determinants are constant over time and are captured by the individual fixed effect ξ_{ijkt}.

3.3. Estimation

I estimate the model by using individual and location-year fixed-effects. The first issue to consider is how to define location. The survey has 150 communities, 136 municipalities and 16 states. By definition, the optimal spatial scale is the most disaggregated (communities), since unobserved determinants of migration are local and might not be captured by aggregate scales such as states.

However, since local fixed effects are represented by dummy variables, higher disaggregation makes more likely for the local fixed effects (or a linear combination of them) to match other dummy variables in the model, the most important one being the dummy for whether the head of the household is away or not. Municipalities allow both to use location fixed effects and to estimate coefficients for all dummy variables included in the model. For this reason I define location as municipalities.

Another issue regarding estimation has to do with limited dependent variables. All the variables for time allocation and cognitive skills take values between zero and one. Also, in estimations at the extensive margin the dependent variable is binary. In both cases I use the linear probability model because fixed effects estimates of models with limited dependent variables are biased and have higher variance (Greene, 2004). Also, it is more relevant for the purpose of this paper to get rid of unobserved heterogeneity than to impose some boundary to the values for the endogenous variable.

4. Results

This section presents estimations of the reduced-form in equation 1 for the sample described before. I only show estimates for variables related to migration and for the outcome variables at the intensive margin[31]. Unless otherwise indicated, in all regressions White-consistent standard errors are shown in parenthesis below the estimates, and (*) denotes significance at 10%, 5% (**) and 1% (***).

[28] Since wages for migrants are not observable in 2005, I imputed wages for migrants based on age, education, type of job and location.

[29] Voluntarily means forced migration, caused by armed conflicts, is not taken into account.

[30] Violence between drug cartels increased significantly after 2006. This violence has become an important determinant of migration.

[31] Estimates at the extensive margin are presented in AppendixA.

4.1. Spouses

The first variable I consider is how spouses' time at home is affected by migration at both the intensive (Tables 7 and 9) and the extensive (Tables A.1 and A.3) margin. Regarding the intensive margin, it can be seen that migration has a direct[32] negative effect on the time in taking care of other members (Table 7, row 1).[33]. The effect on other chores is small and not significant.

Table 7: Spouses' Intensive margin: Hours doing chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	0.0153	-0.3039**	0.0042	-0.0115	0.0375
away	(0.1279)	(0.1388)	(0.0188)	(0.0117)	(0.0271)
Away*	-0.0031	0.0227	-0.0031*	0.0023**	-0.004
months	(0.0151)	(0.0156)	(0.0017)	(0.0011)	(0.0025)
Away*	0.0001	-0.0005	0.0001**	0**	0.0001
months^2	(0.0004)	(0.0004)	(0)	(0)	(0.0001)
Mgl.	0.0153	-0.3021**	0.004	-0.0113	0.0372
effect	(0.1269)	(0.1376)	(0.0187)	(0.0116)	(0.0268)
Mean	0.465	0.22	0.005	0.004	0.003
Obs.	3443	3443	3443	3443	3443

Since the variables are expressed as proportions of the total time at home, reduction in taking care of other members must be compensated by an increase in time doing other activities. Table 7 suggests this compensation does not happen in other chores; instead it happens in leisure activities, as it is shown in Table 8: spouses increase the time in cultural/sport activities and in reading.

Table 8: Spouses' Intensive margin: Hours in leisure activities

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	0.0162*	0.1667	-0.0084	0.065*	0.0188
away	(0.0098)	(0.1073)	(0.0367)	(0.034)	(0.0226)
Away*	-0.0017	-0.0043	0.0029	-0.0096**	-0.0021
months	(0.001)	(0.0122)	(0.0038)	(0.0045)	(0.0022)
Away*	0	0	-0.0001	0.0003**	0
months^2	(0)	(0.0003)	(0.0001)	(0.0001)	(0)
Mgl.	0.0161*	0.166	-0.0083	0.0645*	0.0186
effect	(0.0097)	(0.1064)	(0.0365)	(0.0337)	(0.0224)
Mean	0.008	0.212	0.049	0.031	0.003
Obs.	3443	3443	3443	3443	3443

When categories of time at home are aggregated in two groups, chores and leisure, Table 9 shows that migration induces a reduction of 25% in the portion of time spouses spend doing chores[34]. This is accompanied with a significant increase in time sleeping (0.8 hours per day). At the same time, there is no evidence of increases in labor supply at the intensive margin, that is, spouses are not working more hours. Also, even though the proportion of spouses studying is very low, migration does not significantly affect the time studying.

Table 9: Spouses' Intensive margin: Work, Sleep and Study

	Chores Total	Hours Sleep	Hours Work	Hours Study
Head	-0.2584**	0.81*	1.2827	-0.0024
away	(0.1122)	(0.4742)	(1.7541)	(0.029)
Away*	0.0148	-0.0573	-0.0074	0.0004
months	(0.0131)	(0.0598)	(0.1841)	(0.0021)
Away*	-0.0002	0.0012	-0.0001	0
months^2	(0.0003)	(0.0013)	(0.004)	(0)
Mgl.	-0.2569**	0.8055*	1.281	-0.0024
effect	(0.1112)	(0.4699)	(1.7401)	(0.0288)
Mean	0.697	7.733	1.492	0.013
Obs.	3443	3473	3476	3476

Most indirect effects (rows 2 and 3 in Table 9) are not significant and not all of them share the same sign. Indeed, all of them are small in magnitude, suggesting that indirect effects are not important. This can be explained by the fact that most migrants in the sample moved to the U.S. to look for opportunities for employment, and legal as well as income constraints might limit the flexibility of coming back to Mexico. Thus, the marginal effect of being away is mostly dominated by the direct effect.

At the extensive margin (see Table A.1) migration seems to increase the proportion of spouses in the sample doing housework and agricultural work (extensive margin) and to reduce the time taking care of other members, carrying firewood and carrying water. However, none of these effects are significant, that is, the proportion of spouses doing each of these chores does not change with migration.

Regarding leisure (Table A.2), migration induces a significant increase in the proportion of spouses involved in cultural/sport activities, and this seems to be the driver behind the results obtained at the intensive margin. There is also a significant effect in the proportion of spouses who watch tv. Also, migration increases the proportion of spouses doing leisure but not the participation on doing chores (Table A.3), and the labor supply at the extensive margin does not increase.

All these results suggest there is evidence for noncooperative behavior of spouses left behind. They are not increasing their labor supply; instead, they spend less time doing chores, specifically in taking care of other members, and more time in leisure activities such as reading. At the same time, migration increases in almost one hour their sleeping time. Also, migration induces more spouses to get involved in cultural/sport activities and in watching tv.

[32]The direct effect is caused by whether the head migrates or not, and it is represented by the variable head away. The indirect effect comes from variations of the effect of migration depending on how long the migrant is away and children's age. These are represented by the variables away*months and away*age, respectively. Nonlinear interactions are presented by the squared terms away*months^2 and away*age^2.

[33]It could be argued that this effect comes from the fact that as children grow older, child rearing becomes less time consuming. Another possibility is that new household members (e.g. spouse's parents or siblings who become part of the household in the second wave) take care of children, so the spouse can reduce the time in this task. For the first case I included number of children in the household as a control variable, and household size controls for the second case. This means the effect shown here comes from migration.

[34]Since time at home adds up to 1, the results have exactly the same magnitudes but opposite signs for the total time in leisure activities.

4.2. Boys

Table 10 shows how boys' time at home changes with migration. In all categories except agricultural work, there is a reduction in time doing chores. For housework the indirect effects compensate the direct one, making the marginal effect positive. However, all these effects are not significant.

Table 10: Boys' Intensive margin: hours doing chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	-0.2374	-0.1901	-0.1232	-0.0492	0.1359
away	(0.3544)	(0.1985)	(0.0938)	(0.0515)	(0.1142)
Away*	-0.0001	0.0052	0.0014	-0.0004	-0.0088**
months	(0.0095)	(0.0057)	(0.0016)	(0.0016)	(0.0037)
Away*	0	-0.0002	0	0	0.0002**
months^2	(0.0002)	(0.0002)	(0)	(0)	(0.0001)
Away*	0.118	0.0711	0.0362	0.0157	-0.0313
age	(0.1196)	(0.0668)	(0.0293)	(0.0211)	(0.0377)
Away*	-0.0091	-0.0058	-0.003	-0.0013	0.0028
age^2	(0.0097)	(0.0052)	(0.0023)	(0.0018)	(0.003)
Mgl.	0.052	-0.0255	-0.0388	-0.0128	0.0693**
effect	(0.0818)	(0.0442)	(0.0264)	(0.0104)	(0.0326)
Mean	0.056	0.025	0.006	0.005	0.005
Obs.	2628	2628	2628	2628	2628

The effect on agricultural work is significant and positive: migration increases boys' time in agricultural work. Since these households do not use land for agricultural activities, this effect has nothing to do with increases in agricultural production or in agricultural assets. Instead, it captures reallocation of boys' time allocation by the spouse left behind. The effect is small, since the portion of time boys spend in this chore is small.

Table 11: Boys' Intensive margin: hours in leisure activities

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	0.5698	1.035	-0.2811	-0.4509	-0.2046
away	(0.3832)	(0.6596)	(0.1823)	(0.3197)	(0.1386)
Away*	-0.0014	0.0125	-0.0024	-0.0084	-0.0027
months	(0.0067)	(0.0179)	(0.0033)	(0.0087)	(0.0028)
Away*	-0.0001	-0.0003	0.0001	0.0003	0.0001
months^2	(0.0002)	(0.0004)	(0.0001)	(0.0002)	(0.0001)
Away*	-0.1854	-0.367	0.0875	0.1597	0.0861
age	(0.1372)	(0.2321)	(0.0633)	(0.1123)	(0.0532)
Away*	0.0146	0.0269	-0.0062	-0.0109	-0.0078*
age^2	(0.0114)	(0.0185)	(0.0051)	(0.0091)	(0.0045)
Mgl.	0.1221	0.0989	-0.0511	-0.0208	-0.0242
effect	(0.0804)	(0.1746)	(0.0439)	(0.0708)	(0.024)
Mean	0.044	0.393	0.011	0.043	0.009
Obs.	2628	2628	2628	2628	2628

When looking at leisure activities, Table 11 shows that migration has a positive effect on getting involved in cultural activities or sports and watch tv, and negative in helping other members in studies, read and internet. However, none of these effects are significant and therefore there were no significant effects on the time boys spend in leisure.

Regarding other activities in which boys spend time, Table 12 shows that migration did not change children's time in doing chores (or equivalently leisure activities). However, migration reduces in 1.74 hours per day the sleeping time for boys. At the same time, boys in migrant households study[35] 1.91 hours more per day[36], and this effect differs by the age of the child[37].

Table 12: Boys' Intensive margin: hours sleeping, working and studying

	Chores Total	Hours Sleep	Hours Work	Hours Study
Head	-0.464	-7.5777**	-8.6518	11.178***
away	(0.4241)	(3.7874)	(6.1204)	(3.7695)
Away*	-0.0027	0.0616	0.2725*	-0.1172
months	(0.0128)	(0.0935)	(0.1486)	(0.0994)
Away*	-0.0001	0.0002	-0.0058*	0.0028
months^2	(0.0003)	(0.0021)	(0.0034)	(0.0025)
Away*	0.2098	2.5491*	2.8564	-3.936***
age	(0.1453)	(1.309)	(2.0354)	(1.3344)
Away*	-0.0163	-0.2122**	-0.2458	0.3182***
age^2	(0.0118)	(0.1043)	(0.1627)	(0.1086)
Mgl.	0.0443	-1.7441**	-2.3194*	1.9199**
effect	(0.1083)	(0.8575)	(1.4031)	(0.8143)
Mean	0.097	8.907	0.237	4.135
Obs.	2628	2661	2664	2664

Table 13: Boys: Outcomes

	BMI	Cognitive	School Enrollment
Head	-4.8165	-0.58	2.1791***
away	(5.0524)	(0.4329)	(0.6182)
Away*	-0.1356	0.006	-0.0186
months	(0.1826)	(0.013)	(0.0147)
Away*	0.004	-0.0002	0.0001
months^2	(0.0041)	(0.0003)	(0.0004)
Away*	1.8809	0.1636	-0.6845***
age	(1.7817)	(0.1616)	(0.2002)
Away*	-0.1448	-0.0117	0.0551***
age^2	(0.1388)	(0.0133)	(0.0157)
Mgl.	-0.1883	-0.1536	0.5604***
effect	(1.8562)	(0.1146)	(0.1634)
Mean	18.639	0.632	0.953
Obs.	2348	2645	2661

The results for time allocation at home at the extensive margin (Tables A.4 and A.5) suggest that after migration more boys are doing housework and watching tv, and these effects are significant at 10%. Comparing both effects, estimation suggest that the first one is higher, that is, the increase in the number of boys doing chores in response to migration exceeds the increase in number of boys watching tv.

For the total time spent in doing chores and in leisure activities (Table A.6), there are no significant changes in participation of boys doing any of these. There is, however,

[35] The average number of study hours per day for boys is 4.1, which might seem low. Children are asked for the total number of hours per day and then for the number of days per week. In order to express the variable in hours per day, I divided the calculated number of hours per week by 7 days per week. However, children may study just in weekdays (5 days); If that is the case then the hours per day studying is higher. Also this sample mean is reduced because of the children who do not attend school (# study hours is zero).

[36] The direct effect is huge and might seem unreasonable. However as the table shows, it comes from variations by age. Also, there is some noise in the magnitude of the parameters coming from estimating a linear probability model.

[37] Results for labor supply are not analyzed in detail since just a couple of children in the sample work. Results regarding hours of work are included only to provide a comprehensive view of time allocation in the household.

a positive and significant effect of migration on the proportion of boys spending hours studying, which is strictly related to the strong increase in school enrollment shown in Table 13.

It is important to point out that there is an implicit negative effect for young children because they face the highest reduction in hours of study as well as in school enrollment. This means young children are losing the opportunity to get enrolled in school and to develop cognitive skills earlier, which might have long-term effects as it will become more difficult for them to enroll and develop cognitive skills in subsequent years.

The last set of results has to do with outcomes (Table 13). There is a positive and significant effect of migration on school enrollment, that is, migration has a positive effect on education at the extensive margin. For BMI, migration seems to induce lower levels of BMI, which is beneficial for a population that is overweight; however, the effect is not significant. As for cognitive skills, the effect is negative and not significant.

Summarizing the effects on boys, migration increases their time in doing chores, specifically agricultural work and there are no changes in time spend in leisure activities. To compensate, they sleep less, but this does not seem to affect their cognitive skills. Together with the results for spouses, this is evidence for noncooperative behavior of the spouse left behind, as he/she shifts chores toward boys, does not increase labor supply and increases time in leisure activities. At the extensive margin, migration gets more boys doing housework, watching tv and enrolled in school. Differences in results by age suggest younger boys take the worst part, as they are more likely to be dropped out of school in response to migration[38].

4.3. Girls

Migration reduces girls' time in housework and increases time spend taking care of other members at the intensive margin (Table 14). These effects do not change by age of the girls or by the degree of transparency represented in the number of months the head is away. The effect is not that strong, since it level of significance is only 10%.

Regarding leisure activities (Table 15), migration induces an increase in the time girls spend helping other members in their studies as well as in reading and using internet[39]. The effect on helping other members in their studies changes by age because this kind of help requires having acquired the knowledge the other member needs help with. Thus, older girls will be better prepared to do this job.

[38] Since early child development makes the child more successful in later school (Young, 2007), lower school enrollment at early ages means lower cognitive achievement later on.

[39] Use of internet cannot be explained by improvements in access to the technology in the community; improvements in access were already controlled for in the community-year fixed-effect. It cannot be explained by higher income of the household, since I already controlled by wages.

Table 14: Girls' Intensive margin: hours doing chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	-0.1292	0.2916	0.0248	0.0005	-0.0266
away	(0.2945)	(0.2052)	(0.0282)	(0.0384)	(0.0232)
Away*	0.0022	-0.0151	-0.001	0.0006	0.0008
months	(0.0098)	(0.0095)	(0.0011)	(0.0015)	(0.0011)
Away*	0.0001	0.0003	0	0	0
$months^2$	(0.0002)	(0.0002)	(0)	(0)	(0)
Away*	-0.0225	-0.0548	-0.0086	-0.0046	0.0059
age	(0.1039)	(0.0781)	(0.0095)	(0.0118)	(0.0089)
Away*	0.0028	0.0044	0.0009	0.0005	-0.0003
age^2	(0.0086)	(0.0069)	(0.0008)	(0.001)	(0.0008)
Mgl.	-0.1553*	0.1617*	0.0092	-0.0068	-0.0091
effect	(0.0928)	(0.0945)	(0.0092)	(0.0147)	(0.0094)
Mean	0.11	0.037	0.003	0.004	0.003
Obs.	2647	2647	2647	2647	2647

Table 15: Girls' Intensive margin: hours in leisure activities

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	0.0703	-0.6982	0.3705***	0.2606	0.0591
away	(0.0781)	(0.5091)	(0.1355)	(0.2291)	(0.0441)
Away*	-0.0066	0.0038	-0.0205***	-0.018***	-0.002*
months	(0.0042)	(0.0214)	(0.0066)	(0.005)	(0.0012)
Away*	0.0002*	0	0.0005***	0.0005***	0
$months^2$	(0.0001)	(0.0005)	(0.0001)	(0.0001)	(0)
Away*	-0.0154	0.2601*	-0.0764**	-0.0635	-0.0141
age	(0.0249)	(0.1552)	(0.0385)	(0.0857)	(0.015)
Away*	0.0013	-0.0215*	0.0071**	0.006	0.0009
age^2	(0.0021)	(0.0125)	(0.0034)	(0.0074)	(0.0012)
Mgl.	0.0353	-0.1071	0.2153***	0.1347**	0.0188*
effect	(0.0378)	(0.1951)	(0.0728)	(0.0577)	(0.0109)
Mean	0.023	0.386	0.014	0.047	0.007
Obs.	2647	2647	2647	2647	2647

There is an important difference between boys and girls regarding hours of sleep. Table 16 shows that the number of hours girls sleep is not affected by migration, since the effect is not significant. In contrast, the number of hours girls spend studying is significantly increased by migration, and this effect does not seem to be caused by increases in the number of girls studying (Table A.9).

At the extensive margin (Tables A.7-A.9), migration seems to reduce the number of girls doing housework, reinforcing the effect at the intensive margin. For other categories related to doing chores, there are no significant effects.

Table 16: Girls' Intensive margin: hours sleeping, working and studying

	Chores Total	Hours Sleep	Hours Work	Hours Study
Head	0.1611	1.1559	0.9027	13.7948***
away	(0.2918)	(3.7958)	(1.7658)	(3.7266)
Away*	-0.0125	-0.1532	-0.0257	-0.1198
months	(0.0113)	(0.1012)	(0.0433)	(0.1438)
Away*	0.0004*	0.004*	0.0013	0.0028
$months^2$	(0.0003)	(0.0024)	(0.0012)	(0.0032)
Away*	-0.0845	0.4599	-0.4731	-4.5968***
age	(0.1099)	(1.2046)	(0.6122)	(1.1989)
Away*	0.0082	-0.0608	0.0363	0.3744***
age^2	(0.0096)	(0.0919)	(0.0487)	(0.0976)
Mgl.	-0.0002	1.5929	-0.2458	3.1757**
effect	(0.1086)	(1.0614)	(0.4337)	(1.4226)
Mean	0.157	8.962	0.083	4.143
Obs.	2647	2668	2668	2668

Regarding leisure, migration induces a significant in-

crease in the proportion of girls who help other members in their studies, also reinforcing the effect found at the intensive margin. There are no significant changes in other categories related to leisure.

Table 17: Girls: Outcomes

	BMI	Cognitive	School Enrollment
Head	3.3174	-0.4375	1.5248***
away	(4.2195)	(0.4967)	(0.4579)
Away*	-0.1044	-0.0431**	0.0449**
months	(0.2169)	(0.0207)	(0.022)
Away*	0.0027	0.0008*	-0.001*
$months^2$	(0.0049)	(0.0004)	(0.0005)
Away*	-0.5932	0.2826*	-0.5818***
age	(1.5068)	(0.1543)	(0.1496)
Away*	0.0119	-0.0222*	0.0436***
age^2	(0.1319)	(0.0125)	(0.0115)
Mgl.	0.9527	0.231	0.086
effect	(2.1476)	(0.2094)	(0.1727)
Mean	18.631	0.619	0.956
Obs.	2382	2654	2668

Compared to boys, the marginal effect of migration on girls' school enrollment (Table 17) is not significant. There is a strong positive direct effect that is ameliorated by the age of the girl. Results suggest that there is a quadratic interaction with age, which means the direct effect only prevails at very early ages. For girls between 4 and 9 years old the effect on school enrollment is negative, and it becomes positive for girls older than 9. That contrasts with the results for boys, that for all ranges of age is positive, even though it is almost zero in ages around 7. As for the other outcomes, there are no significant effects of migration on BMI or cognitive skills.

Summarizing results for girls, migration increases their time in taking care of other members, in helping them in their studies and in reading, while it decreases the time in housework. In contrast to boys, girls spend more hours studying, but school enrollment is not significantly improved.

Results shown in Tables 13 and 17 represent the effect of migration on health as a linear relationship with BMI. However, a linear relation does not capture the correct interpretation of BMI. For example, for a child whose weight is excessive, an increase in BMI means a loss in health, but for a child with severe thinness it represents a gain in health. Thus, BMI must be interpreted based on standard cut-off values[40] that determine whether the person is underweight, overweight or obese.

Accounting for deviations from ideal values is particularly relevant for children because their BMI changes according to age and gender. I define the ideal value as the mean value of the boundaries defining BMI in normal weight, by age and gender. Then I calculate the deviation of child's BMI from his/her corresponding ideal value. I used two measures of deviation: absolute deviation (absolute value) and squared deviation, in order to have more precise estimates at the intensive margin. Under this definition, negative effects on deviations of BMI are desirable for children's health since they mean to be closer to the ideal BMI (zero deviation)[41]. Estimates for the effect of migration on deviations from ideal BMI are shown in Table 18.

Table 18: BMI: Deviation from cut-off Values

	Boys		Girls	
	Absolute Deviation	Squared Deviation	Absolute Deviation	Squared Deviation
Head	-0.375	-9.4045	-0.8303	-15.9116
away	(5.2921)	(59.1532)	(2.9559)	(25.3921)
Away*	-0.1275	-2.4477	-0.2751	-2.21
months	(0.1581)	(2.79)	(0.1711)	(1.5738)
Away*	0.0024	0.0484	0.0072*	0.0556
$months^2$	(0.0039)	(0.0618)	(0.0037)	(0.0361)
Away*	0.4803	14.9113	0.9729	9.667
age	(1.7264)	(21.4018)	(0.8798)	(8.852)
Away*	-0.0273	-1.1804	-0.0937	-0.8686
age^2	(0.1334)	(1.6572)	(0.0749)	(0.7539)
Mgl.	1.0583	26.2436	1.0264	4.2407
effect	(1.7942)	(27.6084)	(1.7129)	(13.3671)
Mean	2.647	15.218	2.592	14.211
Obs.	2348	2348	2382	2382

Results are very similar between boys and girls at the intensive margin. In general, there are no significant effects of migration on how close children are to the ideal BMI. The only exception is duration of migration in girls: the longer the migrant stays away, the less healthy the girl becomes. However, this is not a robust result, as it is significant only at 10% and it does not hold with quadratic deviations from ideal BMI.

In general migration does not affect the nutritional structure of the population. The signs of the estimates suggest migration directly increases the proportion of overweight children and decreases the proportion of children in severe thinness. However the effects in both categories are not significant.

5. Conclusion

Theory suggests that noncooperative behavior might have negative results in children's human capital. I found evidence of noncooperative behavior in migrant households in Mexico. When the head migrates, spouses left behind spend less time doing chores, specifically taking care of other members, and more time in leisure activities such as reading. They also sleep more and do not increase their labor supply. At the same time, children increase the time doing chores: boys spend more time doing agricultural work and girls spend more time taking care of other members and helping other members in their studies.

In regard to human capital, migration does not affect children's health. However, it increases school enrollment and this effect is stronger for boys. There is also evidence

[40] These values are defined by the World Health Organization - WHO for both children between 5 and 19 years and adults.

[41] At the extensive margin, I estimate the effect of migration on the probability of becoming underweight, overweight or obese. Estimates at the extensive margin are shown in AppendixA.

of nonlinear effects in school enrollment, which implies negative effects of migration on younger children, specially for girls.

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AppendixA. Estimations at the Extensive Margin

Table A.1: Spouses' Extensive margin: participation in chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	0.1459	-0.1821	-0.0484	-0.2089	0.158
away	(0.1237)	(0.2651)	(0.3104)	(0.1707)	(0.1532)
Away*	-0.0152	0.0126	-0.0307	0.0312*	-0.0226
months	(0.0117)	(0.0353)	(0.03)	(0.0165)	(0.0172)
Away*	0.0003	-0.0003	0.0009	-0.0007*	0.0005
$months^2$	(0.0002)	(0.0008)	(0.0006)	(0.0003)	(0.0004)
Mgl.	0.1448	-0.1812	-0.0499	-0.2064	0.1564
effect	(0.1227)	(0.2628)	(0.308)	(0.1694)	(0.152)
Mean	0.974	0.557	0.06	0.041	0.022
Obs.	3476	3476	3476	3476	3476

Table A.2: Spouses' Extensive margin: participation in leisure

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	0.2025*	0.3686**	0.06	0.2966	0.0526
away	(0.1134)	(0.176)	(0.219)	(0.2723)	(0.0439)
Away*	-0.0196	-0.0321*	0.016	-0.0291	-0.0048
months	(0.012)	(0.0186)	(0.0229)	(0.0323)	(0.0057)
Away*	0.0003	0.0007*	-0.0005	0.0005	0
$months^2$	(0.0003)	(0.0004)	(0.0005)	(0.0008)	(0.0001)
Mgl.	0.2004*	0.366**	0.0604	0.2937	0.0517
effect	(0.1124)	(0.1745)	(0.2174)	(0.27)	(0.0434)
Mean	0.077	0.896	0.473	0.342	0.026
Obs.	3476	3476	3476	3476	3476

Table A.3: Spouses' Extensive margin: participation in work and study

	Do Chores?	Do leisure?	Do Work?	Do Study?
Head	0.1489	0.4877***	0.1139	0.0063
away	(0.1224)	(0.1832)	(0.256)	(0.0154)
Away*	-0.016	-0.0509***	-0.0023	-0.0008
months	(0.0115)	(0.0188)	(0.0278)	(0.0013)
Away*	0.0004	0.001***	0	0
$months^2$	(0.0002)	(0.0004)	(0.0006)	(0)
Mgl.	0.1477	0.4836***	0.1134	0.0062
effect	(0.1214)	(0.1818)	(0.2539)	(0.0152)
Mean	0.978	0.94	0.302	0.009
Obs.	3476	3476	3476	3476

Table A.4: Boys' Extensive margin: participation in chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	-0.887	-1.6734	0.4738	-1.3208	0.2035
away	(1.2994)	(1.0812)	(0.4846)	(0.8731)	(0.7343)
Away*	-0.0838***	0.0104	0.0076	-0.0271	-0.0444***
months	(0.0306)	(0.0248)	(0.012)	(0.0198)	(0.0163)
Away*	0.0018**	-0.0005	-0.0002	0.0009	0.0009**
$months^2$	(0.0008)	(0.0007)	(0.0003)	(0.0006)	(0.0004)
Away*	0.573	0.6095	-0.1489	0.5044	-0.0293
age	(0.4648)	(0.4013)	(0.1557)	(0.3381)	(0.2373)
Away*	-0.045	-0.0524	0.0094	-0.0424	0.0056
age^2	(0.0379)	(0.0341)	(0.0115)	(0.0291)	(0.0184)
Mgl.	0.4892*	-0.326	0.0536	-0.1805	0.2178
effect	(0.2792)	(0.2139)	(0.1222)	(0.1454)	(0.1767)
Mean	0.41	0.131	0.047	0.041	0.026
Obs.	2664	2664	2664	2664	2664

Table A.5: Boys' Extensive margin: participation in leisure

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	1.0799	1.6766**	-0.8029	1.0602	-0.9375
away	(0.8683)	(0.7368)	(0.7801)	(1.3965)	(0.6555)
Away*	0.0129	-0.0106	-0.0478**	0.0102	-0.0128
months	(0.026)	(0.0129)	(0.0222)	(0.0312)	(0.0153)
Away*	-0.0007	0.0002	0.0013**	-0.0006	0.0004
$months^2$	(0.0006)	(0.0003)	(0.0005)	(0.0008)	(0.0004)
Away*	-0.2815	-0.5648**	0.2615	-0.4219	0.4222*
age	(0.2986)	(0.2387)	(0.3022)	(0.4875)	(0.2565)
Away*	0.0152	0.0436**	-0.0113	0.0474	-0.0378*
age^2	(0.0232)	(0.0187)	(0.0246)	(0.039)	(0.0217)
Mgl.	0.2139	0.2924*	0.0749	0.4254	-0.0451
effect	(0.2106)	(0.1746)	(0.157)	(0.3057)	(0.1315)
Mean	0.273	0.926	0.101	0.334	0.06
Obs.	2664	2664	2664	2664	2664

Table A.6: Boys' Extensive margin: participation in work and study

	Do Chores?	Do Leisure?	Do work?	Do Study?
Head	-0.4971	0.3863	-0.7383	1.7258***
away	(1.6313)	(0.3182)	(0.659)	(0.571)
Away*	-0.0822**	-0.0156	0.0292	-0.0163
months	(0.0319)	(0.0103)	(0.0215)	(0.0162)
Away*	0.0016*	0.0004	-0.0006	0.0005
$months^2$	(0.0008)	(0.0003)	(0.0005)	(0.0004)
Away*	0.3969	-0.129	0.242	-0.6432***
age	(0.5544)	(0.1051)	(0.2229)	(0.1971)
Away*	-0.0277	0.0107	-0.0234	0.0544***
age^2	(0.0439)	(0.0083)	(0.0172)	(0.0157)
Mgl.	0.5464	0.0905	-0.2713	0.2787**
effect	(0.3643)	(0.0801)	(0.1827)	(0.1262)
Mean	0.479	0.983	0.039	0.849
Obs.	2664	2664	2664	2664

Table A.7: Girls' Extensive margin: participation in chores

	House-work	Care members	Carry firewood	Carry water	Agric. work
Head	-1.2739	0.7449	0.0738	0.1442	-0.2302
away	(1.0221)	(0.8401)	(0.1479)	(0.237)	(0.1679)
Away*	0.0487	-0.0278	-0.0031	0.0017	0.0118
months	(0.0385)	(0.0351)	(0.0062)	(0.0117)	(0.0104)
Away*	-0.0005	0.0009	0	-0.0001	-0.0002
$months^2$	(0.001)	(0.0009)	(0.0002)	(0.0003)	(0.0002)
Away*	0.0764	-0.3125	-0.0292	-0.0877	0.0273
age	(0.3749)	(0.3356)	(0.0499)	(0.083)	(0.0591)
Away*	-0.0001	0.0302	0.0031	0.0084	-0.0003
age^2	(0.0326)	(0.0293)	(0.004)	(0.0072)	(0.0057)
Mgl.	-0.9282***	0.1483	0.0236	-0.0244	-0.1149
effect	(0.2973)	(0.2847)	(0.0476)	(0.1012)	(0.0986)
Mean	0.629	0.183	0.028	0.033	0.011
Obs.	2668	2668	2668	2668	2668

Table A.8: Girls' Extensive margin: participation in leisure

	Cultural/ Sports	Watch TV	Help studies	Read	Internet
Head	0.4861	-0.3152	1.9526**	0.9712	0.0684
away	(0.65)	(0.3895)	(0.7917)	(1.3105)	(0.3609)
Away*	-0.051	-0.0356***	-0.0819***	-0.065	-0.0119
months	(0.0359)	(0.0129)	(0.0309)	(0.0404)	(0.0107)
Away*	0.0014	0.0012***	0.002***	0.0014	0.0002
$months^2$	(0.0009)	(0.0003)	(0.0007)	(0.0009)	(0.0003)
Away*	-0.0808	0.1808	-0.5293**	-0.2212	-0.0017
age	(0.225)	(0.1275)	(0.2574)	(0.4377)	(0.1226)
Away*	0.0059	-0.0143	0.0514**	0.0206	0
age^2	(0.0189)	(0.0107)	(0.0217)	(0.0393)	(0.0089)
Mgl.	0.2786	0.1126	0.9428***	0.5224	0.0587
effect	(0.295)	(0.1269)	(0.3156)	(0.4702)	(0.0721)
Mean	0.18	0.928	0.14	0.393	0.049
Obs.	2668	2668	2668	2668	2668

Table A.9: Girls' Extensive margin: participation in work and study

	Do Chores?	Do Leisure?	Do work?	Do Study?
Head	-0.8609	0.1101	0.1398	2.421***
away	(0.954)	(0.0905)	(0.4889)	(0.4475)
Away*	0.057	-0.0059	0.0041	0.0121
months	(0.0354)	(0.0051)	(0.0183)	(0.0224)
Away*	-0.0008	0.0001	0.0001	-0.0002
$months^2$	(0.0008)	(0.0001)	(0.0004)	(0.0005)
Away*	-0.0725	-0.0204	-0.1401	-0.9122***
age	(0.3549)	(0.0189)	(0.1626)	(0.1392)
Away*	0.0113	0.0016	0.0125	0.0747***
age^2	(0.031)	(0.0015)	(0.0131)	(0.0112)
Mgl.	-0.8782***	0.0609	-0.1523	0.3289
effect	(0.3006)	(0.0552)	(0.1664)	(0.2063)
Mean	0.668	0.989	0.019	0.84
Obs.	2668	2668	2668	2668

Table A.10: Boys: BMI in Extensive Margin

	Severe Thinness	Thinness	Normal	Over-weight	Obese
Head	-0.375	-9.4045	-0.1049	0.0327	0.5089
away	(5.2921)	(59.1532)	(0.0646)	(0.0481)	(0.9198)
Away*	-0.1275	-2.4477	-0.0009	0.0018	0.0114
months	(0.1581)	(2.79)	(0.0014)	(0.0016)	(0.0292)
Away*	0.0024	0.0484	0	-0.0001	0
$months^2$	(0.0039)	(0.0618)	(0)	(0)	(0.0007)
Away*	0.4803	14.9113	0.0375*	-0.0156	-0.1035
age	(1.7264)	(21.4018)	(0.0221)	(0.017)	(0.3129)
Away*	-0.0273	-1.1804	-0.0028	0.0013	-0.0016
age^2	(0.1334)	(1.6572)	(0.0017)	(0.0014)	(0.0249)
Mgl.	1.0583	26.2436	-0.0119	-0.0022	-0.0028
effect	(1.7942)	(27.6084)	(0.0121)	(0.0109)	(0.2668)
Mean	2.647	15.218	0.008	0.012	0.541
Obs.	2348	2348	2737	2737	2737

Table A.11: Girls: BMI in Extensive Margin

	Severe Thinness	Thinness	Normal	Over-weight	Obese
Head	-0.0666	0.1134	-0.2632	1.1265	-0.9101
away	(0.072)	(0.1391)	(0.8489)	(0.6885)	(0.6923)
Away*	0.0029	-0.0053	0.0333	-0.0019	-0.0289
months	(0.0026)	(0.0058)	(0.0296)	(0.0281)	(0.0243)
Away*	-0.0001	0.0001	-0.0007	0.0003	0.0004
$months^2$	(0.0001)	(0.0002)	(0.0007)	(0.0006)	(0.0006)
Away*	0.0158	-0.0325	-0.039	-0.3527	0.4084*
age	(0.0233)	(0.044)	(0.2902)	(0.2448)	(0.2303)
Away*	-0.0012	0.003	0.0041	0.0216	-0.0274
age^2	(0.0017)	(0.0037)	(0.024)	(0.02)	(0.019)
Mgl.	-0.0287	0.046	-0.3256	0.1255	0.1828
effect	(0.0184)	(0.0476)	(0.3312)	(0.2915)	(0.2463)
Mean	0.007	0.021	0.586	0.177	0.209
Obs.	2740	2740	2740	2740	2740